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Effect of Multi-Sensory Intervention Programmes on Fluid Reading Abilities of Dyslexic Children in Primary Schools in Anambra State

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Abstract

This study investigated effects of multi-sensory intervention programme on fluid reading abilities of dyslexic children in primary schools in Anambra State. Specifically, it determined; the mean pretest and posttest achievement of dyslexic children taught reading using LAPH Reading Intervention programme and those taught using the conventional reading method, the mean pretest and posttest achievement of male and female dyslexic children, and the interaction effect of gender and LAPH Reading Intervention programme on their reading achievement**.** Three null hypothesis were tested at (P≤ 0.05) level of significance. Quasi-experimental Design was adopted. The population of the study was 58,187 pupils from 2,877 public primary schools in Anambra State. Four intact classes were used with one sixty seven children (87 for experimental and 80 for control group). Instruments for data collection were two standardized tests (WIAT-III and WISC-V) and LAPH Reading Intervention Programme. The intervention programme was validated by three experts and in pilot studies. Data was analysed using mean, standard and Analysis of Covariance (ANCOVA).The findings of the study revealed that the two groups had almost the same pretest achievement baseline mean before the reading intervention strategy (Experimental 17.24 ± 5.08 and Control 16.83 ± 3.10), children in Experimental Group had higher mean gain (37.09 ± 4.99) than the control Group (28.64 ± 5.01). Female and male children in the experimental group achieved almost the same with little mean difference 0.82.The Intervention programme and gender have positive interaction in the children's ability in Reading. In conclusion LAPH reading intervention programme improved dyslexic children's reading ability.

Keywords: Multi-Sensory, Intervention, Fluid, Reading, Ability, Dyslexia, Children.

Introduction

Reading is a process of communication from the writer to the reader involving the recognition of letters, words, phrases, clauses and a process of negotiating between the reader and the writer (Paris and Hamilton, 2009). Knowledge (including knowledge of language) experience and a particular purpose of reading influence the meaning a reader derives from a text (Rice, 2013). Reading enlightens the mind, makes the intellect sharper and makes an individual travel far without motion (Pearson, 2010). One of the most important factors in education is the ability to read, understand and critically comprehend the text. In the context of this study, reading is the ability of primary school pupils to read and understand a passage of instruction.

Reading is an essential skill towards literacy development, and should be provided so that children can master the skill at their early ages. Among the four basic skills in the context of English language, reading is the most vital skill because reading gives meaning and understanding of written texts (Berninger *et al*., 2013). Fakeye and Fakeye (2016) maintained that reading is one of the skills that should be mastered by learners of a foreign language and that without the ability to read, a child cannot fully access his or her democratic rights. Non-readers and poor readers cannot fully consider political or socio-economic, health and technological positions and issues; they cannot take complete advantage of available societal or governmental institutions for themselves or thoroughly access their rights and responsibilities as citizens. One aspect of reading skills is reading fluency, which is defined as "the ability to read text quickly, accurately, and with appropriate expression (Banfi *et al*., 2021).Children therefore, require reading skills for functionality in the society. Children who are encouraged to read and develop their reading skills will eventually pave a path towards effective understanding, grasping, thinking, and communication abilities. Studies have shown that children who are avid readers and who know the purpose of reading are more likely to have successful careers and a healthy lifestyle (Leverage Education, 2023).

At present in the Nigerian primary schools, reading, the core skill required for academic advancement is taught as part of language lesson. Pupils are made to read repeatedly from printed text in all their lessons. This does not allow adequate focus on the reading problems children face in schools coupled with the limited time allocated to it. As a result, progress in learning to read is severely limited; the average Nigerian primary school children are about three years behind their American or British counterparts in reading age (Abe, 1991). However, it seems that most children in primary schools including Anambra State find it difficult to read fluently because of reading difficulties. Nevertheless, the development of the skills to read and understand a text can be most difficult for dyslexic children.

Dyslexia is a language-based learning disability that is neurobiological in origin. It is characterized by difficulties with accurate or fluent word recognition and poor spelling and decoding abilities. Individual with dyslexia faces challenges in reading, spelling, writing, and pronouncing words. They often struggle with processing and understanding written text as the brain's neural pathways for language processing function differently for them. According to British Dyslexia Association (BDA) (2020), dyslexia is the inability of school aged children to read fluently and understand the reading text. One of the common difficulties experienced by all the dyslexic children is the inability to have a grasp on the letter shapes and then linking those shapes to the sounds symbolized by the letters (Elshazly, 2019). According to Mahmoud and Samir (2021), neurologically-based learning disability manifests as severe difficulties in reading, spelling, and writing words and sometimes in arithmetic. Dyslexia has several forms; according to Cicerchia (2016), more than 70% of students with Dyslexia have a phonological awareness disability that affects the ability to break down words into their component sounds. The acquisition of these skills is impaired in children with developmental dyslexia (Mahmoud and Samir (2021). It may affect any aspect of the reading process, difficulty in recognition of words fluently and accurately, decoding words, and difficulties in reading comprehension (Sedaghati, 2010). In children with reading difficulties and dyslexia, the difficulty of accurately and fluently interpreting the words during reading is not due to any cognitive impairment but mainly due to the deficiency in the language's phonological processing (National Institutes of Health, 2020). The development of reading skills in children with dyslexia is delayed, and they read at levels lower than the expected reading level for their age (Berninger et al., 2013). Children with dyslexia process and interpret the information differently from normal children who do not have reading difficulties (Palfiova *et al.,* 2016).

The difficulty in reading fluency for them has been known for decades and acknowledged by relevant organizations such as International Dyslexia Association [IDA] (Mascheretti *et al*., 2017). According to BDA (2020), dyslexia among school-going children is prevalent globally and was identified more than a hundred years ago. Dyslexia and Literacy International reported that "dyslexia is the most common form of learning difficulty with a prevalence of 7% or more of any given population". It affects about 15% to 20% of the world population (IDA, 2019). The prevalence of dyslexia varies in each country, and the number of cases ranges from 5–20% of the school-age child population (Lopes et al., 2020; Banfi et al., 2021; Gran Ekstrand et al., 2021). In China the prevalence was about 8%, Malaysia 7% of the entire population. A Study conducted by the National

Institute of Neurological Disorders and Stroke indicated that approximately 17% of children in the United States and 16% in Australia were affected by dyslexia (Lee and Tong, 2020; Peter et al., 2021b). Idoko (2018) estimated that one out of six primary school pupils in Nigeria show signs and symptoms of dyslexia which usually manifests from the age of five and above within the primary school age. Dyslexia affects the reading, spelling and writing abilities of an individual which are core skills required for academic achievement. Dyslexic children often struggle with these core skills and are labeled 'lazy, dull or dumb' by peers, parents and teachers as a result of lack of early diagnosis and intervention(Idoko, 2018). This may lead to loss of self-esteem, depression and sometimes, school dropout. Ogundare (2018) noted that although dyslexia is a lifelong disability, it can be managed with adequate facilities, carefully planned programs and specially trained teachers.

Support has been given in many ways to dyslexic children to teach them reading through using various multi-sensory methods and using computer-based applications that include animated characters and text-to-speech (TTS) technology. In such applications, although stimulating, it requires the children to call for help by clicking on the custom-made buttons on the computer screen, often, such an application requires the dyslexic children to be aware of their mistakes and be able to judge when help is needed. They are just reluctant to ask the computer for help. Hence, such technology does not provide immediate intervention to correct any reading failure.

Multi-sensory approaches that are explicit and systematic, however, have been recognized by educational researchers, as well as National Reading Organizations such as IDA, as an effective intervention to develop and strengthen the reading skills of children with learning impediments (Mostafa and Ghani, 2016). Multisensory reading instruction is an educational approach that engages more than one sense at a time, such as sight, hearing, movement, and touch. This method helps students, particularly those with dyslexia, connect and understand concepts more effectively. Multisensory techniques aim at providing a variety of ways for learners to access, engage, and retain knowledge. Teachers might integrate visual, auditory, kinesthetic, and tactile activities in a multisensory classroom to enhance learning and memory.

There seems to be limited research on the efficacy of multi-sensory, explicit, and systematic language instruction on the fluid reading ability of primary school children with disabilities particularly in Anambra State. It is therefore worth to look at effect of an indigenous multi-sensory LAPH Reading Intervention Programme on fluid reading. LAPH programme is a multisensory programme targeted at enhancing visual processing, phonological awareness, working memory and fine motor skills which are important for

acquisition and enhancement of reading and writing abilities.

Purpose of the Study

The main purpose of the study was to investigate effect of Multi-Sensory LAPH Intervention programmes on fluid reading abilities of dyslexic children in primary schools in Anambra State. Specifically, the study determined:

1. mean pretest and posttest achievement of dyslexic children taught reading using LAPH Reading Intervention programme and those taught using the conventional reading method;
2. mean pretest and post test achievement of male and female dyslexic children taught reading using LAPH Reading Intervention programme and those taught using conventional reading method;
3. interaction effect of gender and LAPH Reading Intervention programme on primary schools' dyslexic children's achievement in reading.

Hypotheses

The following null hypotheses were tested by the study at 0.05 level of significance:

H_{O1}: There is no significant difference in the mean pretest and posttest achievement of dyslexic children taught reading using LAPH Reading Intervention programme and those taught using the conventional reading strategy;

H_{O2}: There is no significant difference in the mean pretest and post test achievement of male and female dyslexic children taught reading using LAPH Reading Intervention programme and those taught using the conventional reading strategy;

H_{O3}: There is no interaction effect of gender and LAPH Reading Intervention programme on primary schools dyslexic children's achievement in reading.

Methodology

***Design of the Study*:** The study adopted a quasi-experimental research design. The specific design for the study was Pretest Posttest Non-Equivalent Control Group Design. This design according to Shona (2019) is a special type of design that allows for the comparison of groups that are similar to each other in terms of baseline.

Area of the Study: The Area o**f** the study was Anambra State, south eastern Nigeria. It has 21 local government areas (LGAs).

***Population for the Study*:** The population of the study was 58,187 primary school pupils from 2,877 public primary schools in Anambra State. The pupils were males and females of 6 to 12 years.

***Sample for the Study*:** This was made up of 167 primary II pupils. These include 87 children (41 males and 46 females) for the experimental group, and 80 children (37 males and 43 females) for the control group. Multi-stage sampling technique was

adopted. Purposive sample method was used to select two education zones, two LGAs, and two primary schools. Primary schools were selected because the pupils and their teachers could communicate in English language. This decision was to rule out lack of familiarity with English language used in the instruments. Primary two pupils were also purposively selected from the schools. Primary two pupils were selected because they were at the early stage of primary education, and were expected to benefit more from early intervention.

***Instruments for Data Collection*:** The instruments for data collection were Weschler's Individual Achievement Test third edition (WIAT III), Weschler's Intelligence Scale for Children 5th edition (WISC V) and the LAPH Reading Intervention Programme. The two standardized instruments (WIAT III) and (WISC V) were adopted and used for the pretest and posttest determination of the reading abilities of the subjects, while the researchers developed LAPH Reading Intervention Programme was used for intervention in the experimental classes.

The LAPH intervention programme was validated by three experts each from Dyslexia foundation Lagos, Nigeria, and university experts in child development. The reliability of the test instruments (WIAT III), (WISC V) and the LAPH intervention programme was conducted in pilot studies three public primary schools in Nsukka local government area, Enugu State.

***Method of Data Collection*:** Before commencement of the study a pre-test was administered to all the children on their reading abilities using WIAT III and WISC V. They were divided into experimental and control groups. The LAPH intervention programme was administered to the experimental group in each school every school day for a period of eight weeks with help of two trained research assistants and class teachers during the 70 minutes allotted for English language every day for the experimental groups, while the control group did their English language using the conventional method. Routine effective monitoring of the study was also carried out. At the end of the eight weeks posttest was administered on all the children in both experimental and control groups with the same WIAT III and WISCV.

***Data Analysis Techniques*:** Mean and standard deviation were used to answer the research questions. Analysis of covariance (ANCOVA) was used to test the null hypotheses stated at 0.05 level of significance.

RESULTS

Table 1: Mean and Standard Deviation of the Pretest and Posttest achievement of Dyslexic Children taught Reading using LAPH Reading Intervention Programme and Those Taught Using Conventional Reading Strategy

Groups	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_d$
Experimental Group (N=87)	17.24	5.08	37.09	4.99	19.86
Control Group (N=80)	16.83	3.10	28.64	5.01	11.81

$\bar{X}_1$ = Pretest Mean; SD_1 = Pretest Standard Deviation; $\bar{X}_2$ = Posttest Mean; SD_2 = Posttest Standard Deviation; $\bar{X}_d$ = Mean Difference.

Table 1 shows the pretest mean and standard deviation achievement of the Experimental Group (17.24 ± 5.08), and that of the Control Group (16.83 ± 3.10). This means that the two groups have almost the same achievement baseline before the reading intervention strategy. The posttest mean and standard deviation achievement of the Experimental Group was (37.09 ± 4.99), and Control Group was (28.63 ± 5.01). It also showed the mean difference of children in pretest and posttest for the Experimental and control Group are 19.86 and 11.81 respectively. It indicates that children in Experimental Group had higher mean gain than those in control Group. Therefore, children with dyslexia taught reading with LAPH Reading Intervention programme in primary schools in Anambra State had higher mean achievement than those taught with conventional reading strategy.

Table 2: Mean and Standard Deviation Pretest and Posttest Achievements of Male and Female Dyslexic Children taught Reading using LAPH Reading Intervention Programme and those taught using Conventional Reading Strategy

Method	Gender	N	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_d$
Experimental Group	Males	41	16.43	3.27	36.69	5.47	20.27
	Females	46	18.03	3.36	37.47	4.48	19.45
Control Group	Males	37	16.30	3.31	28.47	5.91	12.17
	Female	43	17.33	2.80	28.80	4.00	11.46

N = Number of respondents; $\bar{X}_1$ = Pretest Mean; SD_1 = Pretest Standard Deviation; $\bar{X}_2$ = Posttest Mean; SD_2 = Posttest Standard Deviation; $\bar{X}_d$ = Mean Difference.

Table 2 shows that the pretest achievement means and standard deviation of male children in Experimental Group was (16.43 ± 3.27), and that of females in the same group were (18.03 ± 3.36). It also showed the pretest mean achievement and standard deviation of males in the Control Group (16.30 ± 3.31), and that of females (17.33± 2.80). It could be seen that female children in the entire group achieved a little higher in the

same achievement baseline before intervention treatment. It equally showed the posttest mean and standard deviation scores of male children in Experimental Group (36.70 ± 5.47), and that of female children (37.48 ± 4.48). The table finally showed the mean and standard deviation achievement of male children in the Control Group (28.47 ± 5.91), and that of female children (28.80 ± 4.00). It shows from the result that after the intervention treatment, female children in experimental group achieved almost the same with that of male children with just little mean difference 0.82 an insignificant number, showing that the differences that exist between male and female children in reading passages were not much. This shows that male and female children taught reading with LAPH Reading Intervention programme performed better than those taught using conventional reading strategy in primary schools in Anambra State.

Table 3: Mean ($\bar{X}$) and Standard Deviation (SD) Scores on the Interaction Effect of Gender and LAPH Reading Intervention Programme on Primary Schools' Dyslexic Children's Achievement in Reading Ability.

Method	Gender	N	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2
Experimental Group	Males	41	16.43	3.27	36.70	5.47
	Females	46	18.03	3.36	37.48	4.48
Control Group	Males	37	16.30	3.31	28.47	5.91
	Female	43	17.34	2.80	28.80	4.00

N = Number of respondents; $\bar{X}_1$ = Pretest Mean; SD_1 = Pretest Standard Deviation; $\bar{X}_2$ = Posttest Mean; SD_2 = Posttest Standard Deviation;

Table 3 shows pretest mean achievement and standard deviation scores of male children in Experimental Group (16.43 ± 3.27),and that of females in the same group are (18.03 ± 3.36). It also showed the pretest mean and standard deviation of males in the Control Group (16.30 ± 3.31), and females (17.34 ± 2.80). It could be seen that female children in the entire group achieved a little higher in the same achievement baseline before instructional treatment but the mean differences are insignificant. The table equally showed the mean achievement and standard deviation scores of male children in Experimental Group (36.70 ± 5.47), and that of female children (37.47 ± 0.48). The table further showed the mean achievement and standard deviation scores of male children in the Control Group was (28.46 ±5.91), and that of female children (28.80 ±4.00). This result indicates that both male and female children operate in the same achievement baseline after instructional treatment, indicating that both LAPH Reading Intervention programme and gender have positive interaction in the Primary Schools' Dyslexic Children's ability in Reading.

Table 4: Summary of Analysis of Covariance on the Significant Difference in Mean Achievement Scores of Dyslexic Children taught Reading Using

LAPH Reading Intervention Programme and those taught using Conventional Reading Strategy (HO_1)

Dependent Variable: Posttest					
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	7358.872[a]	2	3679.436	152.072	.000
Intercept	10730.242	1	10730.242	243.483	.000
Pretest	261.798	1	261.798	14.953	.000
Method	6775.821	1	6775.821	140.046	.000
Error	9436.202	165	24.195		
Total	447681.000	167			
Corrected Total	16795.074	166			

a. R Squared = .338 (Adjusted R Squared = .335)

Table 4, shows that F (1,165)= 140.05, P<.000. This leads to the rejection of the null hypothesis (HO_1) and the acceptance of the alternative hypothesis. This means that there is a significant (P<0.05) difference between the Mean Achievement Scores of Dyslexic Children taught reading using LAPH Reading Intervention programme and those taught using conventional Reading Strategy.

Table 5: Summary of Analysis of Covariance on the Significant Difference in the Mean Achievement Scores of Male and Female Dyslexia Children Taught Reading Books Using LAPH Reading Intervention Programme and those taught using conventional Reading Strategy (HO_2)

Dependent Variable: Posttest					
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	7363.926[a]	4	1840.982	75.738	.000
Intercept	10370.965	1	10370.965	326.664	.000
Pretest	230.313	1	230.313	13.589	.000
Method	6773.573	1	6773.573	178.667	.000
Gender	2.882	1	2.882	.119	.731
Method * Gender	1.931	1	1.931	.079	.778
Error	9431.148	155	24.307		
Total	447681.000	167			
Corrected Total	16795.074	166			

a. R Squared = .338 (Adjusted R Squared = .333)

Table 5 shows that F (1,155)= 0.08, P>0.78. Therefore the null hypothesis (HO_2) which stated that there is no significant difference in the mean achievement scores of male and female dyslexic children taught reading using LAPH Reading Intervention programme and those taught using conventional reading strategy was accepted.

Table 5, also shows that the F-calculated 0.08 under method and

gender is not significant at 0.78 which is greater than 0.05 level of significance (P>0). The null hypothesis (HO_3) which stated that there is no interaction effect of gender and LAPH Reading Intervention programme on primary schools' dyslexic children's achievement in reading was not rejected.

Discussion

The study investigated the effect of LAPH Reading Intervention multi-sensory programme on the fluid reading abilities of dyslexic children in primary schools in Anambra State. The finding shows that the children in the experimental and control groups have almost the same achievement baseline pretest mean achievement before the reading intervention strategy. Hence, the dyslexic children were of the same reading ability level. This supports the finding by Idoko (2018) that one out of six primary school pupils in Nigeria show signs and symptoms of dyslexia. After the intervention period result indicated that children in the Experimental Group had higher mean gain than those in control Group. This could be so since the intervention programme engaged multiple senses at a time, such as sight, hearing, movement, and touch, which helps students, particularly those with dyslexia, connect and understand concepts more effectively. This finding collaborates with the finding of Mostafa and Ghani (2016) that pupils with Dyslexia tend to have a better performance when teachers use multi-sensory activities to teach them. On a similar note children with reading disabilities and dyslexia are characterized by decreased phonological awareness and are likely to use the non-phonological approach to memorize words (Miller and Kupfermann, 2009). Another important factor that may have improved children's reading skills is that the tool allows children to play their recorded sound of the word pronunciation and can be repeated until the children match the pronunciation with the words and correctly spell them. This way, the children are able to identify their shortcomings in pronouncing the words and prompt them to correct the words by repeating them. Based on this, Katai and Toth (2010) suggested that the phoneme-grapheme association by making connections between the spoken and written words is an effective teaching strategy in children with reading disabilities and dyslexia. The finding also agrees with Mostafa and Ghani (2016) and Seidenberg (2013) who opined that Multi-sensory approaches that are explicit and systematic, however, have been recognized by educational researchers, as well as National Reading Organizations such as IDA, as an effective intervention to develop and strengthen the reading skills of children with learning impediments.

There is a significant (P<0.05) difference between the Mean Achievement Scores of Dyslexic Children taught reading using LAPH Reading Intervention programme and those taught using conventional Reading Strategy.

The findings showed that the female children in the entire group

achieved a little higher in the same achievement baseline before instructional treatment. It shows from the result that after the instructional treatment, female children in experimental group achieved almost the same with that of male children with just little mean difference an insignificant number, showing that the differences that exist between male and female children in reading passages were not much. This shows that male and female children taught reading with LAPH Reading Intervention programme performed better than those taught using conventional reading strategy in primary schools in Anambra State. The LAPH Reading Intervention programme used in this study is an educational approach that engages more than one sense at a time, such as sight, hearing, movement, and touch. This method helps students, particularly those with dyslexia, connect and understand concepts more effectively, bringing in playfulness as a tool, which increases learner-system interactions irrespective of their gender differences in line with the views of (Mostafa and Ghani, 2016). Lin et al. (2017) noted that playfulness in such social environment has been proved to enhance learner-system interactions based on gender in children with Dyslexia. The findings also agree with the findings by Ashbaugh (2016), who concluded that multisensory teaching methods and strategies inspire learners by involving and motivating them to use more of their senses. The null hypothesis which stated that is no significant difference in the mean achievement scores of male and female dyslexic children taught reading using LAPH Reading Intervention programme and those taught using conventional reading strategy was accepted.

The result equally indicated that both male and female children operate in the same achievement baseline after instructional treatment, indicating that both LAPH Reading Intervention programme and gender have positive interaction in the primary schools' dyslexic children's ability in reading. The null hypothesis which stated that there is no interaction effect of gender and LAPH Reading Intervention programme on primary schools' dyslexic children's achievement in reading books was not rejected

Conclusion

The findings of this study revealed that many primary school children had reading difficulties with dyslexia symptoms in the state. Using a multi-sensory LAPH reading intervention strategy to teach dyslexic children reading in primary schools improved their reading ability than conventional methods. That LAPH Multi-sensory reading intervention strategy had positive interaction in teaching male and female dyslexic children reading in public primary schools in Anambra State. It is evident that if multi-sensory strategy LAPH Reading Intervention programme is adapted in reading, there will be visible change and improvement in the reading, spelling and writing ability of dyslexics thereby changing the view that they are lazy and unintelligent and ensure brighter future literacy wellbeing.

Recommendations

The following recommendations were made based on these findings:

1. Stakeholders in primary education should ensure that enabling environments are created in primary schools to make multi-sensory reading intervention strategy attainable for developing reading skills in Anambra State.
2. The teachers' training curriculum for National Certificate in Education (NCE) and First Degree (B. Ed.) should include a basic program that should prepare teacher to identify and handle children with dyslexics to improve their performance.
3. The State and Federal ministries of Education should provide teachers of primary schools in-service training programmes to learn the application of multi-sensory programmes in teaching reading for male and female children with dyslexia in Nigeria.
4. Ministries of primary education should intensify efforts to adjust or alter completely, the method or strategy of teaching reading to multi-sensory approaches to primary school children at foundation levels to help their difficulties and set them on a higher academic level.

Ethical Clearance

Ethical clearance was obtained from the ethics committee at the University of Nigeria Teaching Hospital (UNTH), Ituku-Ozalla, Enugu (No. NHREC/05/01/2008B-FWA00002458-IRB00002323).

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Mobile Phone Applications (Apps) Usage Issues among Rice (*Oryza sativa*) Farmers in Obafemi Owode Local Government Area, Ogun State

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Abstract

The study focused on mobile phone Apps usage among rice farmers in Obafemi Owode Local Government Area (LGA),Ogun State. Specifically, it determined; frequency of usage of phone Apps; agricultural purposes for which mobile phones Apps were used; benefits of using mobile phone Apps; and constraints to use of mobile phone Apps among rice farmers in the study area. Population for the study comprised of all rice farmers in Obafemi Owode LGA, Ogun State. Random technique was used to select 120 respondents. Questionnaire was used to collect data. Data were analyzed using frequency, percentage and mean. Findings reveal eight Apps being used by farmers, including phone book (x =2.85), radio (x =2.64), calculator (x =2.55), SMS (x =2.52) were highly utilized while calendar (x =2.30), WhatsApp (x =1.57), Facebook (x =1.33) and Twitter (x =0.54) were poorly utilized mobile phone Apps by rice farmers in the study area. Other findings are nine purposes for using phone Apps. These are for calculation of expenses on input e.g. fertilizer, rice seed (94.2%), access market information (90.8%), for purchase of fertilizer (86.7%), listening to radio programs related to rice farming (82.5%) were the leading agricultural purposes of using phone Apps. Also nine benefits from use of Apps were identified. These include; utilization of mobile phone Apps has improved rice production (98.3%), helped them to determine amount of profit and loss on rice sales (97.5%), helped to access extension information on rice production (95.8%). Seven constraints were identified. These include; high tariff deduction from telecommunication companies (68.3%), and unstable power supply (61.7%) among others. It is recommended that rice farmers associations should help members to procure solar facilities to power their mobile phone.

Keywords: Phone, Book, Radio, Calculator, Market, Information, Farm, Productivity

Introduction

Globally, farmers have utilized mobile phone features and Apps for agricultural purposes. Mobile phones are multifunctional devices with several features and applications

(Apps). Common features of the mobile phones is voice call, short message service (SMS), video camera, calendar, calculator, torch, voice recorder, reminder, radio, Multimedia messages, internet browser, etc. Apps usable by mobile smart phones are social media Apps for sharing information and social interaction, agro-related Apps for accessing production, harvesting, market, and distribution of agricultural produce (Krell et al., 2020). The use of phone Apps could be of tremendous help to farmers as they could decrease some of the challenges faced by farmers by increasing their knowledge of planning, decision making and the execution of programmes (Michels et al., 2020). Mobile phones could be used, not only for person-to-person voice communication, but also, as a means of access to information through services like multi-media, Bluetooth, and text message among others (Komolafe et al., 2018).

Studies across the world have shown that the utilization of mobile phone Apps have increased farmers' financial household performance in Vietnam (Do et al., 2023), improved farmers' capacity to use of agricultural inputs and increased productivity in Pakistan (Khan et al., 2022), and improved well-being of farmers in rural China (Nie, Ma and Sousa-Poza, 2021).Farmers could use mobile phones to acquire information especially on price, products, transport, and weather forecast which would assist them on decision making especially on seasons to plant, breed new species, and harvest farm products (Aparo et al., 2022; Kabbiri et al., 2017). The use of mobile phones by farmers saves costs by providing access to agricultural information through communicating with traders and other partners involved in agricultural processes. Additionally, the use of mobile phones is essential for the acquisition of agricultural information which would aid agricultural activities to have formidable impact in countries (Anadozie et al., 2021), higher farm productivity for farmers in Tanzania (Quandt et al., 2020), as well as technical efficiency of rice (*Oryza sativa*) farming in Indonesia (Kusumaningsih, 2021).

Rice is one of the major staple foods in Nigeria (Komolafe et al., 2019). Due to several challenges facing in accessing relevant extension information for rice cultivation, rice farmers in the country have taken the advantage of mobile phone Apps including Rice Advice and the Nigeria Institute of Soil Science (NISS) AGRO Mobil App, social media Apps and smart phone features to connect with experts, fellow farmers and agricultural extension agents for professional advices in order to solve common challenges in rice farming and access market information (Ogunsola et al., 2022; Alhassan et al., 2022).

Despite the enormous potential benefits of mobile phone features and Apps usage for rice production, rice farmers in Nigeria have not maximally benefited due to series of challenges. A study by Abdullahi, Oladele and Akinyemi (2021) have found that poor power supply, cost of phones, poor network, complexity in operating

phones and high cost of airtime were the main constraints to the use of mobile phone applications among farmers in Nigeria. According to Coggins et al. (2022), mobile cellular subscription is an issue which affects the usage of mobile phones by everyone, mostly among farmers. Mobile users in area where data is limited or expensive are very cost-conscious; users frequently adopt a change of non-trival strategies in an attempt to optimize their mobile phone usage, most users switched off cellular data connections or postpone mobile usage until connected with Wi-Fi (Coggins et al., 2022). Umar et al., (2020) further found that agro-App developers for rice farming mostly do not take into consideration the demographic information about farmers such as their educational level and income level, given that most farmers are uneducated and do not have the knowledge about how to operate the internet in Nigeria (Umar et al., 2020).

The aforementioned challenges of rice farmers make it difficult to understand the usage pattern of mobile phone Apps in Obafemi Owode LGA of Ogun State Nigeria. There is knowledge gap that is yet to be covered in the literature. Therefore, empirical investigation into the level of usage, benefits and constraints of the rice farmers in the use of mobile phone applications in Obafemi Owode LGA is necessary. The findings could among other things, promote favourable policies and programmes for widespread adoption of mobile phone features and Apps that will boost rice production in the study area.

Objectives of the study

The broad objective of this study was to assess issues related to phone Apps utilization among rice farmers in Obafemi Owode LGA, Ogun State, Nigeria. Specifically, the study determined:

(1) phone Apps utilized by rice farmers in Obafemi Owode LGA,
(2) agricultural purposes for which phones Apps are used by rice farmers in the LGA,
(3) benefits of phone Apps usage among rice farmers in the LGA,
(4) constraints to the use of phone Apps by the rice farmers in the LGA,

Methodology

***Design of the Study*:** The study adopted descriptive quantitative research design.

***Area of the Study*:** The study was conducted in Obafemi Owode LGA, Ogun State, Nigeria. The LGA is located on the latitudes 03^0 6' and 07^0 3', and longitudes 03^0 2' and 03^0 8' east of Greenwich Meridia. Obafemi Owode LGA is politically divided into 12. The area is particularly regarded as the "Home of *Ofada* Rice" because of the extensive cultivation of the rice variety among others (Sangotegbe et al., 2013).

***Population for the Study*:** This is made up of all registered rice farmers in Obafemi Owode LGA. Population considered were registered rice farmers retrieved from Ogun State Agricultural Development Project Office in three wards namely Obafemi,

Owode and Ofada where rice is widely cultivated in Obafemi Owode LGA. The registered rice farmers were 600, 420 and 180 respectively.

***Sample for the Study*:** Sampling involved a random selection of 10 percent rice farmers in each wards, giving a total of 120 rice farmers as respondents.

***Instrument for Data Collection*:** A questionnaire was used for data. The same instrument was used as interview schedule to elicit data from illiterate respondents. Utilization of phone features and Apps were measured using a 4-points scale of frequently (3), sometimes (2), rarely (1), never (0). Benefits derived from the use of phone Apps were measured the 2-points scale as: benefitted (1), no benefit (0). Constraint to the use of phone Apps were measured by using a 4-points scale of very severe (3), severe (2), not severe (1), not constraints (0). The instrument was validated by five experts in agricultural extension and economics. Reliability of the instrument was established using test-re-test method. This was conducted on 10 rice farmers outside Owode LGA. Cronbach's alpha value of 0.71 was obtained, indicating that the instrument was reliable.

Data Collection Methods: One hundred and twenty copies of the questionnaire were administered to respondents. A comprehensive explanation of the main objective of the study was provided to the respondents. Illiterate respondents were guided as the questionnaire served as interview schedule for them. All the 120 copies of the questionnaire were retrieved. This represent 100 percent return.

***Data Analysis Techniques*:** Data collected was analyzed using frequency count, percentage, mean, and standard deviation to achieve objective 1 to 4. Benchmark score of decision were determined using scale of instrument. Both utilization and constraints to use of mobile phone apps were similarly measured with the numerals 0, 1, 2, and 3. Summation of these scores number (6) and divided by the number of scales (4) giving 1.5. Therefore, mean value of 1.5 was used as benchmark for decision on utilization and constraints to the use of mobile phone in the study area.

RESULTS

Data analysis shows that 67.5 percent of the respondents were men. 47.9 percent were within the age of 51 to 60years, 48.8 percent had 6 to 10 years of farming experience, only 13.3 percent had no formal education while others had one form of formal education, 55.8 percent earned between ₦51,000 to ₦100,000 monthly, and 72.5 percent cultivate between 2 to 6 acre of rice farm.

Mobile Phone Apps Utilization

Table I: Mean Responses on Mobile Phone Apps Utilization among Rice Farmers in Owode LGA

S/N	Phone Apps	Mean	Std. Dev.	Rank	Decision
1.	Phone book	2.85	0.51	1st	High usage
2.	Radio	2.64	0.63	2nd	High usage
3.	Calculator	2.55	0.72	3rd	High usage

4.	Short Message Service (SMS)	2.52	0.94	4th	High usage
5.	Calendar	2.30	0.51	5th	High usage
6.	WhatsApp	1.57	0.79	6th	High usage
7.	Facebook	1.33	0.91	7th	Low usage
8.	Twitter	0.54	0.55	8th	Low usage

Table 1 shows that shows phone book (x =2.85), radio (x =2.64), calculator (x =2.55), SMS (x =2.52), Calendar (x =2.30) and WhatsApp (x =1.57) were ranked first, second, third, fourth, fifth and sixth position respectively with mean scores greater than the cut-off point of 1.5 and were there therefore considered as highly utilized phone Apps by rice farmers in the study area. On the other hand, the utilization of Facebook (x =1.33) and Twitter (x =0.54) were ranked seventh and eighth position respectively with mean score less than the cut-off point of 2.5 and were there therefore considered as low utilized mobile phone Apps by rice farmers in the study area.

Purposes for Using Mobile Phone Apps

Table 2: Frequency and Percentage Responses on Agricultural Purposes for Using Mobile Phone Apps by Rice Farmers in Owode LGA

S/N	Agricultural purposes	Frequency(%)
1.	Interaction with family	118(98.3%)
2.	Access market information	109(90.8%)
3.	Monitor transaction on rice production and sales	79(65.8%)
4.	Listening to radio programs related to rice farming	99(82.5%)
5.	Solve agricultural problems	51(42.5%)
6.	Reduce travelling	94(78.3%)
7.	Calculation of expenses on input e.g. fertilizer, rice seed	113(94.2%)
8.	For purchase of fertilizer	104(86.7%)
9.	Marketing agricultural produce	78(65.0%)

Table 2 reveals that majority of the rice farmers used mobile phone to interact with family (98.3%), calculation of expenses on input e.g. fertilizer, rice seed (94.2%), access market information (90.8%), for purchase of fertilizer (86.7%), listening to radio programs related to rice farming (82.5%), reduce of traveling (78.3%), monitor transaction on rice production and sales (65.8%), and marketing agricultural produce (65.0%) while appreciable percentage use mobile phone Apps to solve agricultural problems (42.5%).

Benefits Derived from the Use of Mobile Phone Applications

Table 3: Percentage Responses on Benefits Derived from Utilization of Phone Apps by Rice Farmers in Owode LGA

S/N	Benefits of mobile phone apps utilization	Freq.(%)
1.	Improved my productivity on rice sales	118 (98.3%)
2.	Improved income generated	114 (95.0%)

3.	Reduced the stress of travelling from one place to another to get information	103 (85.8%)
4.	Helped to make and receive payments of rice sales faster	105 (87.5%)
5.	Assisted in accessing rice market locations	109 (90.8%)
6.	Helped me calculate my profit or loss on rice sales	117 (97.5%)
7.	Improved access to and use of information on rice production	115 (95.8%)
8.	Helped to get update related with agricultural information on rice production	111 (92.5%)
9.	Helped to update knowledge on changes in weather and climate	82 (68.3%)

Table 3 shows that majority of the respondents indicated that utilization of mobile phone Apps has improve rice productivity (98.3%),helped to determine amount of profit and loss on rice sales (97.5%), helped to access extension information on rice production (95.8%), helped farmers to access agricultural information on rice production inputs (92.5%), and helped farmers to access rice markets locations (90.8%). Other majorities further indicated that utilization of mobile phone Apps has reduced the stress of travelling from one place to another to get rice production/sales information (85.8%), helped to make and receive payments of rice sales faster (87.5%) and helped to update knowledge on changes in weather and climate (68.3%).

Constraints to Utilization of Phone Apps by Rice Farmers

Table 4: Mean Distribution of Responses on Constraints to Utilization of Phone Apps by Rice Farmers in Owode LGA

S/N	Constraints to Utilization of Phone Apps	Mean	Std. Dev.	Rank
1.	Unstable power supply	2.45	0.76	1st
2.	Poor network services	2.38	1.04	3rd
3.	Difficulty in the use of the phone applications	1.56	0.46	5th
4.	Cost of recharging mobile phone	2.19	0.66	4th
5.	Lack of training on the use of phone applications	1.46	0.10	6th
6.	High tariff deduction from telecommunication companies	2.39	0.84	2nd
7.	Educational background	1.20	0.84	7th

Table 4 shows constraint with mean value at 1.5 and above which were considered as severe constraints were unstable power supply (x =2.45), high tariff deduction from telecommunication companies (x =2.39),poor network services (x =) which were ranked first, second and third respectively. On the other hand, Lack of training on the use of phone applications (x =1.46), and educational background (x =1.20) were ranked sixth and seventh position respectively and were considered as less severe constraints to utilization of mobile phone apps among rice farmers in Owode LGA.

Discussion

On the usage of mobile phone Apps, phone book, radio, calculator, and SMS were highly utilized by rice farmers. This indicates that phone book, phone radio, phone calculator and SMS were

the most relevant phone apps to rice production activities in the study area. High usage of these apps is expected as rice farming is a day-to-day activity that require recording of events in phone book. This will help farmers to track progress of farm activities and next action to take for each day on schedule of activities. In this case, errors will be minimized while accuracy of task performance, efficiency and improved productivity will be ascertained. Phone radio is a unique app to assess information and update of knowledge on rice farming through radio agricultural broadcast stations. Most radio stations give update on weather forecast expected to assisted farmers to take daily decision and planning for mitigation and adaptation strategies towards the effects of climate change. Other agricultural programme for best agronomic practices in rice farming can also be heard through radio broadcast. The result is in line with reports of studies that indicate that independently indicated phone book (Idiku et al., 2022), phone radio (Anadozie et al., 2021), phone calculator (Aparo et al., 2022), and SMS (Abdullahi et al., 2021; Emeana et al., 2020) were mainly utilized by farmers for agricultural purpose.

The purposes for which the majority of the farmers used phone Apps were to interact with family, access market information, purchase of fertilizer, listening to radio programs related to rice farming, reduction of traveling, marketing of agricultural produce. These purposes are reflection of the commonly used phone apps and are critical to successful farming business. This shows that fertilizer is an important rice farming input. Fertilization is a means to improve soil fertility which helps rice germination and bountiful fruiting. The practice of applying fertilizers at least twice during the growing season (split application), either using basal at planting or top-dressed during vegetative growth increases rice yields (Liu et al., 2019). Thus, rice farmers will always want to have access to fertilizer is a perquisite for rice farming (Iwuchukwu et al. 2022; Umar et al., 2022). In support of this finding, Kijima (2022) report the high use of phone application in accessing fertilizer among rice farmers in Nigeria. After harvesting, the main aimed of commercial rice farmers are to sell the paddy or processed rice for profit. Therefore, it is important for rice farmers to have current and reliable access to market information on the sales of rice. This will help the farmers in selling rice produce while reducing selling at farm gate to middlemen which often reduce farmers' profits. Information on fertilizer accessibility and rice marketing can be access through radio agricultural broadcasts, making phone radio an important app for rice farmers in the study area. The results from this study collaborate with the findings that mobile phones could be used, not only for person-to-person voice communication, but also, as a means of access to information on agricultural production and marketing (Quandt et al., 2020; Rahman et al., 2020; Komolafe et al., 2018).

The main benefits derived from the use of mobile phone applications include increase access to market and increase sales, increase income, reduced traveling, update related with agricultural information on rice production as well as changes in weather and climate. In line with commonly used apps and purposes of using them, mobile phone apps have increased farmers access to market information. When farmers have access to market information, there would be increase rate of sales and income. Information that may require farmers to travel long distant to access can be accessed through phone calls or the use of SMS. Also, rice farming inputs can also be ordered via phone calls and SMS, thereby reducing traveling cost of traveling. Traveling cost entails the time to travel and be absent at farm as well as addition cost to transport fare (to and fro). Reduction in cost of traveling implies a reduction in expenditure while profit increases. On the update related with agricultural information on rice production, radio broadcasts that organize agricultural extension programmes are avenue through which the rice farmers could update their knowledge. The result is in line with findings of studies that indicated that use of phone applications provide direct access to radio programmes through which farmers can access agricultural extension information (Adeyeye et al., 2021; Ifabiyi et al., 2022).

Furthermore, high tariff deduction from telecommunication companies and unstable power supply were the leading constraints indicated by rice farmers. These constraints must have limited and frustrated the desire extent of mobile phone Apps utilization by the rice farmers. For farmers that want to be consistent in the phone Apps, the issues of high tariff deduction from telecommunication companies have the tendency to increase farmers' expenditure as well as decreased profit. In addition, this study suggests that high tariff deduction may be attributed low utilization of phone Apps that requires internets tariff/data bundle charges such as Facebook, Twitter and WhatsApp in order to reduce cost of production. This finding is in line with report of study by Ajayi et al. (2022) who found high charges on services as one of the main constraints limiting farmers the use of phones Apps for agricultural purposes in Nigeria.

Conclusion

Based on findings of the study, it is concluded that phonebook, phone radio, phone calculator, SMS were highly utilized while phone calendar WhatsApp, Facebook and Twitter were less utilized by rice farmers in the study area. Rice production purposes achieved by the farmers through phone Apps utilization were calculation of expenses on inputs, market information, purchase of fertilizer, listened to radio programs related to rice farming, monitor transaction on rice production and sales as well as marketing agricultural produce. Achieving these purposes has further earned the farmers the benefits of improved rice productivity. The farmers were mainly limited in the utilization of phone Apps by high tariff

deduction from telecommunication companies and unstable power supply. These constraints must have limited and frustrated the desire extent of mobile phone Apps utilization by the rice farmers.

Recommendations

The following recommendations will help in the usage of mobile phone applications:

1. Agricultural extension agents should organize trainings on use and benefits of underutilized of phone Apps for the rice farmers in the study area.
2. Government should make policy to control tariff deduction placed by telecommunication companies.
3. Telecommunication should provide adequate network service in the rural areas.
4. On the issue of irregular power supply, rice farmers in their various groups can pool resources together to assist members in accessing solar facilities at moderate price with the capacity that can recharge mobile phone.

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Evaluation of Amino Acid Profile, Protein Quality and Pasting Properties of Pap Made From Fermented Maize Starch and Red Kidney Beans

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Abstract

The study investigated amino acid profile, protein quality and pasting properties of pap made from fermented maize starch and red kidney bean. The samples were processed and made into five portions. One portion was used as the control while the remaining four portions of fermented maize starch were enriched with processed red kidney bean at the ratio of 90:10, 80:20, 70:30 and 60:40 percent respectively. Results of amino acid profile showed that the values were significantly different ($P < 0.05$). Fermented maize starch enriched at a ratio of 60: 40 showed the highest content of leucine (7.655g/100g), lysine (6.665g/100g), tryptophan (4.875), histidine (3.355g/100g), is oleucine (4.433g/100g), Phenylalanine (5.765g/100g) and valine (5.045g/100g) respectively. The results also showed that increasing the red kidney bean flour in the blends increased the amino acid quality. The biological value and nutritional index ranged from 76.0 to 81.6 and 5.1 to 6.1 % respectively and were significantly improved by increasing the red kidney bean flour. The control sample had the best breakdown viscosity (57.22 Rapid Visco Unit), setback viscosity (61. 15 Rapid Visco Unit), pasting time (5.56 min) and pasting temperature (91.85). The pasting properties of the samples was significantly ($P < 0.05$) affected by the blending ratio at each level of flour concentration. However, it is recommended that red kidney beans should be incorporated into fermented maize to enhance the amino acid profile, protein quality and quantity of pap.

Keywords: Amino Acid, Profile, Protein, Quality, Pasting, Properties, Maize, Red Kidney Bean

Introduction

Pap also known as *Akamu in Igbo, Ogi* in Yoruba and *Koko* in Hausa is produced from fermented maize, sorghum, or millet or a combination of the grains. The major reason why cereals grains are usually utilized in pap making is due to their high gelling capacity, availability, affordability and ease of Processing (James *et al*., 2015).It is consumed by both adults and children. Pap is transformed into ready to serve diet by dissolving and diluting the fermented starch sediment in little amount of water, after which boiled water is added to form a semi liquid gruel. The gruel is usually sweetened with sugar, milk, ginger. The properties of the fermented starch, type of cereals and the manufacturing process give rise to varieties of Pap. Pap is made by steeping cereal grain in water for three days, the water drained, milled, filtered, bagged, dewatered with poor storage shelf life due to its high moisture content which of great concern as it reduces the quality of the food. Pap is produced mainly from maize because of its functional and sensory attributes (Bristone *et al*., 2016).

Maize is high in carbohydrate, magnesium, and potassium but very low in lysine, tryptophan, small in oil and B-vitamins (Makanjuola and Olakunle, 2017).Several researchers have reported that pap is poor in protein quantity and quality (Bolaji *et al*., 2015; Bristone *et al.,* 2016). The quality of dietary protein is measured from the amino acid profile, protein efficiency ratio, net protein ratio, nitrogen balance index, net protein utilization and biological value. The major purpose of dietary protein is to provide amino acids for protein synthesis which should meet the physiological needs of the consumer. Amino acid is necessary for human but human can synthesis only ten out of the twenty naturally occurring amino acid. The remaining ten are called essential amino acid because they must be obtained from dietary sources (Aremu*et al.,* 2017). The absence of these essential amino acids can lead to disease such as morbidity, mortality, stunting and mental retardation (Aremu *et al*., 2011).

However, most of the consumers are not aware of the low quality of pap since most consumers assess the quality of food based on having good or sweet taste in the mouth which is always not true as food that is sweet may have low nutritional quality. It is because of these limitations that pap made from fermented maize need to be enriched with other rich protein sources such as red kidney beans.

Food enrichment refers to the addition of vital nutrients to a particular food to correct specific nutritional deficiencies such as minerals and vitamins (Okafor *et al*., 2017).Several authors have enriched *ogi* with legumes like cowpea (Ashaye et al., 2000),pawpaw (Ajanaku et al., 2010), soybean (Adeleke and Oyewole, 2010), groundnut seed (Ajanaku *et al.,* 2012), crayfish (Ajanaku et al., 2013), okra seed meal (Aminigo and Akingbola, 2004), kersting's groundnut (Kerstingiellageocarpah) flour (Aremu*et al*., 2011),among others. In their different studies, it was reported that one cheap method of enhancing the nutritive value of pap is by adding legumes to it.

Legumes are cheap sources of protein-rich foods that have been used in solving the problem protein malnutrition in Africa (Okafor *et al*., 2017). Legumes which include mung bean (*Vigna radiata*), soybean (*Glycine max*), pigeon pea (*Cajanus cajan*), (*Cicer arietinum*), lab lab bean (*Lab labpurpureus*) and red kidney bean (*Phaseolus vulgaris*) are good sources of protein, energy, vitamins, dietary fibre, minerals, and oil (Arawande and Borokini, 2010). Maize is deficient in lysine and tryptophan but high in methionine and cysteine while red kidney bean is rich in methionine, cysteine, and lysine which when combined will complement each other.

Red kidney bean (*Phaseolus vulgaris*) is an excellent source of both quality and quantity protein, starch, soluble and insoluble fiber, water soluble vitamins and minerals especially potassium, iron, zinc, magnesium, and manganese (Auduand Aremu, 2011) and very low in fat (Eknayake*etal*., 1999). Red kidney bean can be a potential ingredient in

nutraceutical and functional foods (Shehzad *et al., 2015)*. Despite its industrial and nutritional potentials, it is widely underutilized. Loggerenberg (2004) observed that red Kidney beans are excellent source of lysine and can be used for the fortification of cereal-based products. In order to solve the problem of low nutritional quality of pap and deficiencies associated with it, it is important to enrich to meet the nutritional need of the people.

Objectives of the study

The general objective of the study was to evaluate the amino acid profile, protein quality and pasting properties of pap made from fermented maize starch enriched with red kidney beans. Specifically, the study determined:

1. amino acid profile of pap made from fermented maize starch enriched with red kidney beans.
2. protein quality of pap made from Fermented Maize Starch enriched with red kidney beans.
3. Pasting properties of pap made from fermented maize starch enriched with red kidney beans.

Materials and Methods

***Design of study*:** Experimental method was used for this research. Yellow maize and red kidney beans were purchased and separately sorted, washed, soaked, boiled, dehulled, washed, dried, and divided into four portions. The different portions were mixed separately.

***Procurement of materials*:** The materials used in this study were yellow maize variety and red kidney beans grains purchased from Abakaliki main market, Ebonyi State, Nigeria.

***Preparation of the materials*:** materials were prepared as follows:

Maize grains: These were sorted, washed, with potable water and steeped in clean water for three days. The grains were milled into slurry with an attrition mill. Water was poured into the slurry in excess and the floating germs were skimmed off. The slurry was manually sieved with cheese cloth. The starch which settled at the bottom of container was washed several times with clean water. The corn starch was sundried using Dehyra tray to moisture content of 10 percent using moisture meter.

Red kidney: These were cleaned, soaked for six hours, then boiled for 30 minutes and manually dehulled, washed and sundried to reduce moisture content below 10 percent. It was milled into flour using attrition mill and was sieved using cheese cloth.

Formulation of Composite Blends: The fermented maize starch and red kidney beans flour were blended to produce the following composite blends:

Code	Corn starch	Red kidney beans
Control	100	0
M: KB1	90	10
M: KB2	80	20
M: KB3	70	30
M: KB4	60	40

Where M = Maize, KB = Red kidney bean

***Amino Acid Determination*:** The method of Nwosu *et al.* (2008) was used. Exactly thirty milligrams (30mg) of the sample were dried to a constant weight, defatted with Soxhlet extractor

for 15mins. The defatted sample was transferred into a glass ampoule and hydrolyzed using 7ml of 6N Hydrochloric. The glass ampoule was sealed using import sealer and place inside an oven set at 105^0C for 22hrs to affect hydrolysis. The sample was cooked and filtered. The filtrate was evaporated to dryness at 40^0C under vacuum in a rotary evaporator. The residue was liquefied with 5ml f acetic buffer and analyzed using multi-sample amino acid analyzer (TSM). Tryptophan content was determined calorimetrically after subjecting to alkaline hydrolysis as outlined by Miller, (1967).

***Protein Quality Determination*:** Protein quality was determined based on the amino acid profile, because protein quality is largely dependent on amino acid composition of the protein mixture. The content of the different acids was expressed as g/100g protein and was compared with FAO/WHO (2007) reference pattern.

***Determination of Essential Amino Acid Index*:** The essential amino acid index (EAAI) was calculated using the method of Labuda *et al.,* (1982).

Nutritional Index: The nutritional index was calculated using the formular below.

$$\text{Nut Index (\%)} = \text{EAAI} \times \frac{\text{\% Protein}}{100}$$

Where: EAAI= Essential Amino Acid Index.

Protein Efficiency Ratio: The protein efficiency ratio (PER) was estimated according to the regression equation developed by Alsmyer *et al.*, (1974) cited by Mune-Mune*et al.,* (2011).

Protein efficiency ratio (PER) = -0.468+0.454 (Leu) – 0.105 (Tyr).

Biological Value: The biological value was calculated from EAAI using the equation by Mune-Mune*et al.*, (2011)BV = (1.09 x essential amino acid index) – 11.7

Determination of Pasting Property: A Rapid Visco Analyzer (RVA) was used to determine the pasting property (Newport Scientific RVA Super 3, 1998). A portion of the sample (3g) was weighed into a vessel, and 25 ml of distilled water was poured into a new test canister. The sample was then transferred into the canister's water surface. The paddle was inserted into the canister, and the blade was vigorously jogged up and down ten times through the sample. The test went on for a while and then ended on its own. The slurry was heated to 95°C and then cooled to 50°C in 12 minutes while rotating the can at 160 rpm and stirring the contents continuously with a plastic paddle. Peak viscosity, setback viscosity, final viscosity, trough, breakdown value, pasting temperature, and time to reach peak viscosity were among the parameters estimated.

***Data Analysis*:** Data generated was analyzed using SPSS version 20. Data were presented as mean ± standard deviation. Analysis of variance (ANOVA) was used to compare means. Mean was separated using Turkey test ($P< 0.05$) to determine significant level.

RESULTS

Amino acid Profile of Fermented Maize Starch - Red Kidney Bean Pap

Table 1: Amino Acid Profile of Fermented Maize Starch Enriched with Red Kidney Bean

Amino Acid (g/100g)	Control	MKB1	MKB2	MKB3	MKB4	FAO/WHO (1991) (g/100g)FC
Arginine	0.778^{e}	0.843^{d}	0.878^{c}	0.909^{b}	0.911^{a}	5.20
Cysteine	0.322^{a}	0.311^{b}	0.305^{c}	0.304^{d}	0.0303^{e}	3.00
Methionine	0.868^{a}	0.843^{b}	0.823^{c}	0.810^{d}	0.808^{e}	2.50
Histidine	2.985^{e}	3.175^{d}	3.190^{c}	3.240^{d}	3.355^{a}	1.9
Isoleucine	4.250^{e}	4.275^{d}	4.280^{c}	4.430^{d}	4.435^{a}	3.1
Leucine	7.265^{e}	7.385^{d}	7.440^{c}	7.555^{b}	7.655^{a}	6.3
Lysine	6.355^{e}	6.375^{d}	6.445^{c}	6.545^{b}	6.665^{a}	5.2
Tyrosine	1.275^{e}	1.355^{d}	1.450^{c}	1.455^{b}	1.680^{a}	1.10
Phenylalanine	5.270^{e}	5.365^{d}	5.370^{c}	5.435^{b}	5. 765^{a}	6.30
Threonine	3.170^{e}	3.255^{d}	3.275^{c}	3.385^{b}	3.450^{a}	2.7
Tryptophan	3.765 ^{e}	4.055 ^{d}	4.545 ^{c}	4.560^{b}	4.875^{a}	0.7
Valine	4.225^{e}	4.375^{d}	4.655^{c}	4.460^{b}	5.045^{a}	5.00
Glycine	3.360^{e}	3.490^{d}	3.555^{c}	3.675^{b}	3.975^{a}	2.20

Control = 100% maize pap, MKB1 = 90% maize: 10% KB, MKB2 = 80% maize: 20% KB, MKB3 = 70% maize: 30% KB, MKB4 = 60% maize: 40% KB, FC = For children.

Table 1 shows that there were significant differences (P< 0.05) in the amino acid contents of the sample except in tryptophan were no significant difference (P > 0.05) existed among the sample. The variation in amino acid profile may be attributed to blending cereal and legumes. The most abundant amino acid in the samples was leucine (7.655 -7.265 g/100g) with 60% fermented maize and 40% red kidney beans having the highest value. Tryptophan an essential amino acid ranged from 3.765 to 4.875 mg/100g. The Arginine ranged from 0.778 to 0.911mg/100g. Histidine ranged from 2.985 to 3.355 mg/100g.

Amino acid quality of Fermented Maize Starch Enriched with Red Kidney Bean

Table 2: Amino Acid Quality of Fermented Maize Starch Enriched with Red Kidney Bean

Parameter	Control	MKB1	MKB2	MKB3	MKB4	Mean	SD	CV%
TAA	45.01	45.71	45.79	46.45	48.36	46.26	1.28	2.8
TNEA	5.99	6.02	6.10	6.21	6.80	6.23	0.33	5.4
%TNEA	13.10	13.13	13.38	13.57	14.07	13.45	0.39	2.9
TEAA with His	38.99	39.57	39.72	40.35	41.56	40.04	0.98	2.4
%TEAA (with HIS)	85.93	86.43	86.62	86.87	86.90	86.55	0.39	0.5
TEAA (without His)	35.63	36.33	36.53	37.37	38.38	36.85	1.06	2.9

%TEAA (WOH)	79.16	79.36	79.37	79.92	80.44	79.65	0.53	0.7
TArAA	10.81	10.88	11.19	10.36	11.99	11.24	0.47	4.2
TSAA	1.11	1.11	1.13	1.15	1.19	1.14	0.03	2.8
%TSAA	2.37	2.43	2.47	2.48	2.56	2.46	0.07	2.8
%CYSinTSAA	26.52	27.09	27.26	27.44	27.44	27.15	0.38	1.4
TAAA	-	-	-	-	-	-	-	-
TBAA	10.31	10.49	10.55	10.62	10.68	10.53	0.14	1.4
%TBAA	22.09	22.19	22.92	23.07	23.59	22.77	0.63	2.8
TNAA	34.39	35.16	35.29	36.14	37.68	35.73	1.25	3.5
%TNAA	76.41	76.93	77.08	77.81	77.91	77.23	0.63	0.8

TTA = Total amino acid, TNEA = Total non-essential amino acid, TEAA = Total essential amino acid, TArAA =Total aromatic amino acid, TSAA = Total Sulphur amino acid, TAAA = Total acidic amino acid, TBAA = Total basic amino acid, TNAA = Total neutral amino acid, Where Control = 100% maize pap, MKB1 = 90% maize: 10% KB, MKB2 = 80% maize: 20% KB, MKB3 = 70% maize: 30% KB, MKB4 = 60% maize: 40% KB., WHO = without, Coefficient of variation

Table 2 shows the total amino acids (TAA), total non-essential amino acid (TNEA), total essential amino acid (TEAA), total aromatic amino acid (TArAA), total Sulphur amino acid (TSAA), total acidic amino acid (TAAA), total basic amino acid (TBAA) and total neutral amino acid (TNAA) of samples. The results showed that most of the amino acids are essential. The total essential amino acids range between 35.63 – 38.38g/100g while the total non-essential amino acids range between 34.39 – 37.68 g/100g. The total essential amino acids were above the total non-essential amino acids (5.99 - 6.80g/100g). It was observed that essential amino acid with histidine which are known to be essential amino acid in children are lower than the total non-essential amino acid with histidine. Percentage of TEAA ranged from 85.63 – 86.55%. This is an indication that *ogi* produced from fermented maize and red kidney beans are rich sources of essential amino acids.

On further classification of the amino acids, it was found that TArAA was highest in the 60%M40%KB and lowest in the control, TNAA was highest in the 60%M40%KB and lowest in the control. The mean percentages of these amino acids in the samples were in the following order: %TNAA> %TArAA> %TBAA > %TSAA > %TAAA. The recommended TSAA value for infants is 5.8g/100g (FAO/WHO/UNU, 1991). None of the samples met this requirement and this could be explained by the fact that cysteine, a component of the TSAA was the limiting amino acid in all the samples.

Protein quality of Fermented Maize Starch Enriched with Red Kidney Bean.

Table 3: Protein Quality of Fermented Maize Starch Enriched with Red Kidney Bean

Parameter	100%M	90M10KB	80M20KB	70M30KB	60M40KB	Mean	SD	CV%
EAAI	80.5	81.3	81.4	82.9	85.6	82.3	2.02	2.5

BV (%)	76.0	77.0	77.0	78.7	81.6	78.1	2.23	2.9
PER(%)	2.7	2.8	2.8	2.8	2.8	2.8	0.06	2.1
NI (%)	5.1	5.3	6.0	6.1	6.1	5.7	0.46	8.0

EAAI = Essential amino acid index, BV = biological value, PER = protein efficiency ratio, NI = nutritional index, Where: Control = 100% maize ogi, MKB1 = 90% maize: 10% KB, MKB2 = 80% maize: 20% KB, MKB3 = 70% maize: 30% KB, MKB4 = 60% maize: 40% KB. CV= coefficient of variation.

Table 3 shows the results of the essential amino acid indices, biological value, protein efficiency ratio and nutritional index are shown in Table 3. The values ranged from 80.5 to 85.6 % with the 60%M40%KB blend recording the highest value, followed by 70%M30%KB and the least value was observed in the control. This indicates that blending fermented maize with 40 % red kidney bean produced pap of higher EAAI. The protein efficiency ratio is similar to 2.88 in whole hen egg, (Achidi*et al*., 2016), higher than 2.50 in reference casein (Oyarekua and Eleyinmi, 2004) as reported by Achidi*et al*. (2016). The biological value ranged from 76.0 – 81.6 with 60%M40%KB having the highest value. It was observed that inclusion of red kidney bean improved the biological value of the developed pap.

Essential Amino Acid Scores of White Maize-Red Kidney Bean Pap Based on FAO/WHO 2007 Reference Pattern.

Table 4: Essential Amino Acid Scores of White Maize-Red Kidney Bean Pap Based on FAO/WHO 2007 Reference Pattern.

Amino acid	FAO/WHO	Control	MKB1	MKB2	MKB3	MKB4	Mean	SD	CV %
Isoleucin	3.1	1.37	1.38	1.38	1.43	1.43	1.4	0.08	5.9
Leucine	6.3	1.15	1.17	1.18	1.20	1.22	1.2	0.02	2.0
Lysine	5.2	1.22	1.23	1.24	1.26	1.28	1.2	0.02	2.0
Meth+Cys	2.5	0.45	0.45	0.45	0.46	0.48	0.5	0.01	2.8
Phe+Tyr	4.6	1.44	1.48	1.48	1.53	1.55	1.5	0.04	2.9
Threonine	2.7	1.17	1.21	1.21	1.25	1.28		1.2	3.3
Tryptophan	0.7	5.38	5.790	6.49	6.51	6.96	6.2	0.63	10.2
Valine	4.1	1.03	1.07	1.09	1.14	1.23	1.1	0.08	7.0
Histidine	1.8	1.66	1.76	1.77	1.80	1.86	1.8	0.07	4.2

Control = 100% maize pap, MKB1 = 90% maize: 10% KB, MKB2 = 80% maize: 20% KB, MKB3 = 70% maize: 30% KB, MKB4 = 60% maize: 40% KB. CV = Coefficient of variation

Table 4reveals that is oleucine of the enriched samples was higher than the control (1.37 -1.43). The tryptophan content increased with increase in red kidney bean when compared with the control (5.38 -6.96). Histidine increased with increase in red kidney bean (1.66 - 1.86). the amino acids in all the samples except for Tryptophan and histidine were lower than the amino acids in the reference pattern as indicated by essential amino acid scores (EAAS).The low value recorded for meth+Cys in all the samples shows that the first limiting amino acids in the samples were meth+Cys.

Pasting Properties of Fermented Maize Starch Enriched with Red Kidney Bean

Table5: Pasting Properties of Fermented Maize Starch Enriched with Red Kidney Bean.

Properties	Control	MKB1	MKB2	MKB3	MKB4
PV(RVU)	164.92^{e}	165.3^{d}	169.42^{c}	190.08^{b}	268.17^{a}
Trough	100.33^{e}	108.08^{d}	109.08^{c}	131.33^{b}	205.83^{a}
Breakdown	57.22^{e}	58.75^{d}	60.34^{c}	62.33^{b}	64.59^{a}
Final viscosity	198.67^{e}	227.33^{d}	230.57^{c}	236.42^{b}	338.92^{a}
Setback	61.15^{e}	62.41^{d}	67.34^{c}	71.12^{b}	133.03^{a}
Peak time(min)	5.56^{e}	6.28^{d}	6.35^{c}	6.48^{b}	6.28^{a}
Pasting temp	91.85^{e}	92.44^{d}	93.65^{c}	93.75^{b}	93.11^{a}

Control = 100% maize pap, MKB1 = 90% maize: 10% KB, MKB2 = 80% maize: 20% KB, MKB3 = 70% maize: 30% KB, MKB4 = 60% maize: 40% KB

Table 5 shows the result of the pasting characteristics of enrich
ed samples. The peak viscosity ranged from 164.92 to 268.17 RVU. Significant difference exists ($P < 0.05$) between samples. The trough viscosity ranged between 100.33 and 205.83 RVU with 60%M40%KB possessing the highest trough viscosity (205.83 RVU). The break down viscosity ranged from 57.22 to 64.59 RVU. Final viscosity ranged from 198.67 to 338.92 RVU. Pasting time ranged from 5.56 to 6.28 RVU. Setback viscosity ranged from 61.15 to 133.03 RVU. Pasting temperature ranged from 91.85 to 93.75 RVU. The sample differ significantly ($P<0.05$).

Discussion

Amino acids are important components for healing and protein synthesis process, any deficiency in these important components will hinder the recovery process. Leucine remained the highest amino acid in all the samples and met the recommended requirement for infant (6.3). This was followed by lysine, phenylalanine, and valine. Lysine is essential as it is crucial for bone formation, lowers serum triglyceride levels and involved in hormone production. This result agrees with the report of other researchers (Aremu*et al.,* 2017)for amino acid composition of some leguminous seeds grown in Nigeria; Oluwole, (2022)macronutrient composition, amino acid profiles and acceptability of maize-based complementary foods enriched with defatted white melon seed and *moringa oleifera* leaf powder and Okafor *et al.* (2017) for nutritional composition and antinutritional properties of maize pap cofermented with pigeon pea. The result revealed that the essential amino acid in the samples were higher than the FAO/WHO (1991) reference pattern except for arginine, cysteine, and methionine. This shows that the samples are good sources of essential amino acids which are important in the nutrition of children and adults. Furthermore, the result revealed that cysteine was the least concentrated amino acid in the samples. This was expected as legumes are known to be

low in sulphur-containing amino acid *(*Amarakoon, *2012;* Adeyeye, 2010;Ijarotimi and Keshinro, 2013*)*. This implies that red kidney bean cannot serve as cysteine supplement in food formulation.

The arginine is lower than the value recommended by FAO/WHO (1991) which is 5.20g/day for infant. The histidine is higher than the recommended value by FAO/WHO (1991) which is 1.9for infant. Histidine and arginine are essential amino acid for infants because the gut of infants cannot synthesize this amino acid. The histidine value increased as the red kidney beans flour content increased. This because red kidney beans have more protein than maize.

It was observed that red kidney bean is rich in essential amino acids than non-essential amino acid. The increase in amino acid quality was observed with increase in red kidney bean. The results suggest that the pap blends can meet the essential amino acid requirement of people of all age groups since the value is greater than 39 % considered to be ideal protein food for infants, 26 % for children and 11 % for adults (FAO/WHO 1991).

Generally, a protein is said to be of good nutritional quality when its essential amino acid indices is above 90 % and to be useful as food when the values are around 80 % and inadequate for food material when the value is below 70 percent (Ijarotimi and Keshinro, 2012)for amino acid, fatty acid, mineral and nutritional quality of raw, germinated and fermented African locust bean (*Parkia biglobosa*) flour. In this present study, it was observed that EAAI for all the formulations were above 80 percent considered useful and adequate for food. Biological value (BV) is an index for the measurement of the proportion of the absorbed protein from a food which becomes incorporated into the proteins of the organism's body (Abiola, 2018). This implies that the enriched samples protein can be absorbed when consumed. The protein efficiency ratio was higher in pap produced from enriched flour than the control and was within the recommended value of 2.7g/100g (Ijarotimi and Keshinro, 2012). The greater the essential amino acid indices, the more balanced amino acid composition and the higher quality and efficiency of the protein (Fang *et al.,* 2018).

The pasting properties are essential in predicting the performance of food during and after cooking. The peak viscosity value increased with increase in red kidney bean. The highest value was recorded in enriched samples while the least value was observed in control sample. Breakdown viscosity is the ability of starch or mixture to withstand heating and shear stress during cooking (Adebowale *et al*., 2005). The higher breakdown viscosity recorded in the enriched sample implies that it will be less stable to withstand heating and shear stress. The trough is the minimum viscosity value in the constant temperature phase of the RVA profile and measures the ability of paste to withstand breakdown during cooling. The final viscosity shows the ability of the sample to form a viscous paste or gel

after cooking and cooling (Maziya-Dixon *et al*., 2007). The final viscosity value of enriched sample indicated the ability to form a firm visco-elastic paste or gel after cooking and cooling. The setback shows that the unsubstituted sample will be more susceptible to retrogradation after cooking and cooling but will be desirable in a system where enzyme hydrolysis is undesirable. Peak time is the minimum time taken to cook food product and it was observed that unsubstituted sample will require more time to cook. Pasting temperature is the minimum temperature needed to cook a given food sample and the time required for gelatinization to occur during food processing. It was observed that enrichment increased the pasting temperature which implies that the enriched sample will take longer time to cook.

Conclusion

This study has shown that inclusion of red kidney beans improved the amino acid profile, amino acid quality, essential amino acid score, protein quality and pasting properties of fermented maize starch. It was observed that enriched pap samples were nutritionally superior when compared with the traditional pap and would produce a more nutritionally balanced and acceptable food products which will be cheaper and readily available. Hence, it can be concluded that inclusion of red kidney bean to fermented maize starch enhanced the nutritional quality of the developed pap.

Recommendation

Based on the results of the study, it is therefore recommended that:

1. Red kidney bean is a good of amino acid profile and should be incorporated into diets.
2. Pap should be blended with processed red kidney bean as an alternative protein and energy sources for infant and adults since animal protein is now very expensive.

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Assessment of Food Expenditure Pattern and Nutritional Status among Adults in Agro-Ecological Zones of Nigeria

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Abstract

This study examined the pattern of food expenditure and nutritional status among adults in agro-ecological zones of Nigeria. Specifically, the study determined socioeconomic characteristics of the respondents, food expenditure patterns and nutritional status. Survey design was adopted for the study. The population composed of all male and female adults aged 18 years and above in the household across the six agro-ecological zones in Nigeria. Data were collected using questionnaire. Nutritional status was determined using Body Mass Index (BMI) which was calculated from anthropometric measurements. Food expenditure was measured through per capita monthly expenditure on food. Data were analyzed using frequencies, percentages and chi-square. Findings show that more than two-third (67.3%) were male while 32.7 percent were female. Nutritional status revealed that overweight condition was greater (18.1%) among male than female (9.8%) while obesity was higher (13.8%) among female than male (6.9%) across all the zones. Age group of 31- 60 years were overweight (20.5%) and obese (16.5%) than others. Food expenditure patterns revealed higher *percapita* monthly food expenditure on meat (₦3,000.00), dairy products (₦2, 200.28), refined grains (₦2,000.00) and fat and oil (₦1,880.90) whereas lower expenditure was recorded on fruit and vegetables (₦290.57) for obese adults than underweight, normal weight and overweight adults. Normal weight adults spend more money on diet rich in fruit and vegetable than overweight or obese adults, therefore, nutrition education with focus on fruit and vegetable consumption is advocated.

Keywords: Adults, Assessment, Body Mass Index, Expenditure Pattern, Food, Nutritional, Status

Introduction

Food consumption in households does arise from purchases, thus, to ascertain the variations in the pattern of food consumption and nutritional status, there is a need to understand the

pattern of food spending. However, identifying the aspect of food intake that drives this among the adult population is arduous because information that influences food choices is often unavailable.

Nutritional status refers to an individual's health condition as a result of the ingestion, absorption, and utilisation of food nutrients (Todhunter, 1970). Its assessment in adults is done in various ways, however, the most commonly used in nutrition research include anthropometry, which is measured via body mass index, classifying adults as underweight, normal weight, overweight or obese (Caputo *et al.,* 2003). Unhealthy food consumption pattern has been identified as a significant cause of over-nutrition, which brings about overweight and obesity. These conditions develop when there is an imbalance between calories consumed and calories expended, mostly due to inadequate consumption of unhealthy foods high in fat and physical inactivity that cut across all age groups (Oke *et al.* 2019). In Nigeria, the rising incidence in the shift of nutritional status of adults from underweight to overweight has been linked to numerous factors, which include consumption of highly processed foods / unhealthy food consumption patterns, declining physical activity, rising income and urbanisation (Kayode and Alabi, 2020).

In Nigeria, food expenditure differentials among household members existed due to variations in several factors like availability of food items and food prices, preferences, cultural differences and lack of resources, as documented by Romling and Qaim (2011). In addition, cultural differences exist in the ethnic distribution of the population in terms of the type of food eaten and the kind of physical activities they engage in. For example, the Northern agro-ecological zone is primarily composed of the Hausas-Fulanis, which had a dietary composition with higher rice and maize consumption. At the same time, the South-east population meal is primarily made up of yam and cassava (Akarolo-Anthony *et al.* 2013). Furthermore, people in the Northern zone also engage in more physically tasking agricultural activities than their Southern counterparts. Thus, these variations across the country have implications for within-country variations in nutritional status distribution among adults in Nigeria.

Examining food expenditure patterns at the household level serves as an instrument for assessing adult household members' food consumption patterns as well as nutritional status. Household food expenditure and consumption data measures dietary intake by combining data on food consumption from three different sources, namely, (food items purchased from the market, food items given as gifts and food items taken from personal production or stocks) and the duration extends beyond 24 hours. The household consumption and expenditure surveys (HCES) are important information sources on household and individual food choices. Earlier studies by Romling and Qaim (2011) have transformed HCES data

into estimates of dietary intake to make recommendations on nutritional policy and planning.

In addition, food expenditure data show how much is being spent by an individual or a household on different types of foods that can used to describe dietary patterns and quality, which in turn inform the nutritional status categories measured by body mass index. Furthermore, the relationship between expenditure pattern on specific food and nutritional status have been documented. For example, Sari *et al.* (2010) found that higher household expenditure on foods from animal sources and non-grain reduced stunting risk among children ages 0–59 months in Indonesia. In these studies, expenditure information on particular food groups and food group combinations documented in the literature to contribute to overweight and obesity were employed. Several studies, including Ozughalu (2016), have linked the HCES data to food security and poverty. However, few studies, except for Romling and Qaim (2011), exist in the literature that linked household food consumption and expenditure data to adults' nutritional status, particularly in low-income countries like Nigeria. Additionally, earlier studies on the subject in Nigeria have used state and local government case studies for micro-level research (Raimi et al. 2015). This study on food expenditure patterns and nutritional status determinants in Nigeria departs from earlier studies on food consumption and nutritional status by utilising the primary data collected through a structured questionnaire from 1,480 adults in households across the agro-ecological zones of Nigeria. The Partnership for Aflatoxin Control in Africa (PACA) of the Africa Union Commission (AUC) funded the data collection. This study proxied individual consumption levels with per capita food expenditure data adapted from Romling and Qaim (2011). To know the dietary composition of adults of different nutritional status categories, that is, the different kinds of food purchased and consumed by underweight, normal weight, overweight and obese adults, their *per capita* monthly food expenditure was used.

Purpose of the study

The major objective of this study was to assess the food expenditure pattern and nutritional status of adults (18 years and above) across agro-ecological zones of Nigeria. Specifically, the study:

1. described the socioeconomic characteristics of respondents in the study area;
2. determined the nutritional status of respondents in the study area
3. compared expenditure pattern on foods among different nutritional status categories of respondents in the study area,

Methodology

***Design of the Study*:** Survey design was adopted for the study. Food expenditure data were collected from the respondents by asking them to provide information on how much was spent on the different food items listed in the questionnaire every week. This was repeated over a period of one

month. Nutritional status was assessed using Body Mass Index.

Area of the Study: The study area was made up of six agro-ecological zones of Nigeria. Nigeria is grouped into six agro-ecological zones, comprising of 36 States and a Federal Capital Territory. A projection of the census figures posits that Nigeria's population is currently 193.3 million people (National Bureau of Statistics, NBS, 2017). A survey by Statistia (2021) has it that Nigeria has over 70% of its labour force engaged in agriculture. Other agricultural enterprises in the country are livestock such as poultry, piggery, sheep and goat and fish farming. Its water bodies are also suitable for fishing, irrigation and transportation. The shift in the nutritional status towards obesity has increased recently due to factors including widespread rural-urban migration, technological advancement, mechanisation of farming activities and changes in food consumption patterns across different regions of Nigeria (Olayiwola et al. 2010). This has a negative impact on Nigerians' nutritional status and wellbeing. Nigerians' lifestyle patterns have undergone significant change as a result of technological advancement, including an increase in the middle class' consumption of calorie-dense foods and beverages, a rise in the trend of fast food consumption due to work pressure, and a lack of access to regular exercise.

Population for the Study: This study covered adults (male and female aged 18 years upward) from the six agro-ecological zones of Nigeria. They are the population because the decision on monthly expenditure on different food items in the household lies with them and also, they constitute the economically active population with engagements in different livelihood activities. Furthermore, the literature also established that this group consume energy-dense foods and exhibits a sedentary lifestyle that promotes overweight and obesity as a result of work pressure, which often deprives them of access to regular exercise. Adult population in Nigeria was put at an estimate of 109,810,327 persons (World Population Review, 2023).

***Sample for the Study*:** A multistage sampling procedure was employed in selecting the respondents. In stage one, a random selection of two states each from the six agro-ecological zone was done to give 12 states as indicated above. Following the Agricultural Development Programme (ADP) grouping, five blocks were randomly selected per State, giving a total of 60 agricultural blocks in stage two. In stage three, 3 cells were randomly selected per block, which gave a total of 180 cells. In the last stage, proportionate sampling to size was done to give 1,480 households from which data were collected through personal interviews of the adults. The states that were selected from the agro-ecological zones are: Katsina and Kano (Sahel Savanna agro-ecological zone); Sokoto and Jigawa (Sudan Savanna agro-ecological zone); Niger and Taraba (Southern Guinea Savanna agro-ecological zone); Kaduna and Bauchi (Northern Guinea Savanna

agro-ecological zone); Oyo and Nasarawa (Derived Savannah agro-ecological zone) and Cross-River and Lagos (Humid Forest agro-ecological zone).

Instrument for Data Collection: Data were collected through the use of a structured questionnaire that was divided into three sections. Section A consists of questions on the socioeconomic characteristics (age, sex, occupation, income level, educational qualification and so on) of the respondents. Section B consists of the anthropometry measurements of the respondents. Section C was on monthly food expenditure.

***Nutritional Status*:** This was assessed using Body mass index (BMI**).** Their weights were measured in kilograms using a portable bathroom scale. Respondents' height (in meters) were obtained using a vertically calibrated metre rule.

The body mass index (BMI) of the respondents was determined by dividing the weight (kg) of each respondent by the square of their height in metres. The values obtained were compared with the World Health Organization reference values in order to classify them into different nutritional status categories.

$$\text{Body Mass Index, BMI} = \frac{\textit{weight in kiogramme}}{\textit{height in metre squared}}$$

An adult is underweight if BMI (< 18.5kg/m2), normal weight (18.5 - 24.99 kg/m2), overweight (25 - 29.99 kg/m2) and obese (≥30 kg/m2).

Per Capita Food Consumption and Expenditure: Food consumption (expenditure) data were collected from each household every week during the survey period of one month. There are 14 food commodities in all, which were further compressed into nine food groups based on nutrient similarities. Expenditure on food in Naira was expressed in terms of the total amount of money spent on different food items consumed in the household over one month.

As used in this study, per capita expenditure on food refers to individual food consumption or intake level. *Per capita* food expenditure on each food item was obtained by dividing the total monthly expenditure on each food item by the household size.

$$\textit{Per capita food expenditure} = \frac{\textit{household total food expenditure}}{\textit{household size}}$$

The third objective was to know the dietary composition of adults of different nutritional status categories, that is, the kinds of food mainly purchased and consumed by underweight, normal weight, overweight and obese adults. This was achieved through *per capita* monthly food expenditure on different food groups. The nine food groups considered include cereals (rice), root and tuber crops (cassava and yam), legumes (beans), animal products (meat and fish), dairy products (milk), fat and oil, vegetables, fruits and processed foods (refined grains, e.g. spaghetti, noodles, custard and bread). Earlier studies as documented by Romling and Qaim (2011) reported higher *per capita* expenditure on processed foods and refined grains,

meat, fat and oil and dairy products but a lower *per capita* expenditure on fruits, vegetables and unprocessed staples like rice, millet, maize, and root and tuber crops among overweight and obese adults.

Data Collection Method: One thousand four hundred and eighty (1,480) copies of the questionnaire were administered to the respondents by hand. The entire 1,480 copies were correctly filled and collected back. This implies 100 percent return.

***Data Analysis*:** Data on the adults' socioeconomic characteristics, anthropometrics and food expenditure were collected with the aid of a questionnaire. These were coded (in an Excel spreadsheet) and analysed using descriptive statistics (frequencies, percentages). To test whether a significant relationship exists between food expenditure patterns and nutritional status measured through body mass index, chi-square test was used.

RESULTS

Socioeconomic characteristics of respondents

Data analysis on the distribution of respondents according to sex reveals that majority (67.3%) were male while 32.7% were female. Majority (90.8%) were less than sixty years old while very few (9.2%) were above sixty years old. A cumulative of 77.5% had formal education out of which 28.0% had tertiary form of education. Also, 22.4% had non-formal education. This suggests a high literacy rate among the respondents. Farming and Trading (44.1% and 33.9%) respectively constituted dominant occupation category with very few (12.4%) into civil service. Majority (89.5%) of the respondents earned less than ₦ 100,000 monthly as income (low income group) with very few (2.7%) earning above ₦ 200,000 monthly. The average monthly income was ₦50, 984.35.

Table 1: Frequency and Percentage Distribution of Respondents according to Body Mass Index

Variables	F (%) (N = 1480)
<18.5 kg/m^2 (Underweight)	99 (6.7)
18.5-24.99 kg/m^2 (Normal weight)	660 (44.6)
25-29.99 kg/m^2 (Overweight)	414 (27.9)
≥30 kg/m^2 (Obese)	307 (20.7)
Mean BMI + Std. Dev. (kg/m^2)	25.73 + 1.2

Table 1 shows the respondents' body mass index distribution. More than one-quarter (27.9%) of the respondents were overweight while 20.7% were obese. Also, a large number (44.6%) of the adults were of normal weight while very few (6.7%) were underweight. The mean body mass index across the geopolitical zones was 25.73kg/m^2 implying that an average adult is at risk of being overweight which has a lot of nutritional and economic implications if not curtailed.

Body Mass Index of Respondents

Table 2: Frequency and Percentage Distribution of Respondents' Body Mass Index by Socioeconomic Characteristics

Socioeconomic characteristics	UW (F %)	NW (F %)	OW (F %)	OB (F %)
Sex				
Male	69 (4.6)	555 (37.5)	269 (18.1)	103 (6.9)
Female	30 (2.0)	105 (7.1)	145 (9.8)	204 (13.8)
Age in years				
18-30	36 (2.4)	171 (11.5)	71 (4.8)	41 (2.8)
31-60	57 (3.8)	420 (28.4)	304 (20.5)	244 (16.5)
61 and above	6 (0.4)	69 (4.7)	39 (2.6)	22 (1.5)
Marital status				
Single	7 (0.4)	34 (2.3)	21 (1.4)	19 (1.3)
Married	92 (6.2)	626 (42.3)	393 (26.5)	288 (19.5)
Education				
Non-formal	30 (2.0)	153 (10.3)	86 (5.8)	63 (4.2)
Primary	22 (1.5)	141 (9.5)	70 (4.7)	63 (4.2)
Secondary	28 (1.9)	205 (13.9)	122 (8.2)	82 (5.5)
Tertiary	19 (1.3)	161 (10.9)	136 (9.2)	99 (6.7)
Occupation				
Farming	37 (2.5)	333 (22.5)	167 (11.3)	116 (7.8)
Trading	36 (2.4)	175 (11.8)	169 (11.4)	121 (8.2)
Civil servant	11 (0.7)	63 (4.3)	57 (3.9)	53 (3.6)
Artisan	6 (0.4)	52 (3.5)	8 (0.5)	3 (0.2)
Full housewife	6 (0.4)	7 (0.5)	3 (0.2)	2 (0.1)
Others	3 (0.2)	30 (2.0)	10 (0.6)	12 (0.8)
Income (Naira/month)				
<100,000	99 (6.7)	560 (37.8)	398 (26.9)	268 (18.1)
100,000-200,000	-	100 (6.7)	6 (0.4)	9 (0.6)
>200,000	-	-	10 (0.6)	30 (2.0)

UW = Underweight (n = 99); NW = Normal weight (n = 660); OW = Overweight (n = 414); OB = Obese (n = 307)

Table 2 shows the body mass index distribution of the respondents according to their socio-economic characteristics. The prevalence of overweight was higher in male than female (18.1% as against 9.8%) whereas obesity was higher (13.8%) among female than male (6.9%). The highest prevalence of obesity (16.5%) was seen among the age group 31- 60 years compared to other age group, this also applies to overweight respondents. According to marital status, married respondents were prone to obesity (19.5%) than the singles (1.3%). Respondents with the highest level of education were more overweight (9.2%) and also obese (6.7%) than others. Considering occupation, the traders were more overweight (11.4%) and obese (8.2%) than those in other occupation category. The prevalence of overweight and obesity reduces with income. Highest occurrence was seen among respondents that earn less than N100, 000 monthly as 26.9% and 18.1% were overweight and obese respectively in this income group.

Table 3: Per Capita Monthly Expenditure on Food in Naira (₦) according to Body Mass Index

Food items	Underweight	Normal weight	Overweight	Obese
Rice	₦903.33	₦ 1,963.13	₦ 1,071. 83	₦ 1,600.00
Cassava	₦ 376.03	₦ 714.49	₦ 217.73	₦ 608.56
Yam	₦ 548.49	₦ 565.02	₦ 1,867.00	₦ 1,423.78
Beans	₦ 374.24	₦ 1,155.52	₦ 520.62	₦ 1,080.66
Meat	₦ 1,082.67	₦ 1,462.03	₦ 2,400.00	₦ 3,000.00
Fish	₦ 650.97	₦ 1,400.00	₦ 702.61	₦ 564.40
Milk	₦ 297.12	₦ 520.31	₦ 1,319.85	₦ 2,200.28
Fat and oil	₦ 220.32	₦ 730.48	₦ 1,334.05	₦ 1,880.92
Vegetables	₦ 62.34	₦ 450.88	₦ 112.19	₦ 100.79
Fruits	₦ 112.26	₦ 601.70	₦ 197.44	₦ 148.47
Spaghetti	₦ 250.00	₦ 385.28	₦ 1,300.00	₦ 2,000.00
Noodles	₦ 368.67	₦ 550.00	₦ 1,320.00	₦ 1,650.35
Custard	₦ 180.00	₦ 240.00	₦ 1,400.00	₦ 1,700.00
Bread	₦ 450.00	₦ 830.00	₦ 1,600.00	₦ 2,500.00

Table 3 shows that food expenditure patterns differ across respondents of different weight categories. Nine food groups that were considered include cereals (rice), root and tuber crops (cassava and yam), legumes (beans), animal products (meat and fish), dairy products (milk), fat and oil, vegetables, fruits and processed foods (refined grains e.g. spaghetti, noodles, custard and bread). Overweight and obese respondents consume more fat rich diets than their counterparts as *per capita* monthly expenditure on these food groups was higher for them than their counterparts. Furthermore, it can be deduced from the table that obese respondents purchase larger quantities of certain food categories (fat and oil, dairy products and refined foods) that promote weight gain but spent less on healthy foods like fruits and vegetables.

Figure 1: Per capita monthly food expenditure and body mass index of respondents

Figure 1 shows the graphical illustration of the per capita monthly food expenditure on the different food items by the respondents. On the y-axis lies the per capita monthly expenditure in naira while the x-axis shows the different food items. The height of each bar shows the per capita monthly expenditure. It can be seen in the above figure that obese and overweight adults had highest expenditure on food items like meat, bread, fat and oil, spaghetti and noodles that had been identified in the literature as contributors to weight gain compared to normal weight or underweight adults. Also, overweight and obese adults had lower expenditure on fruits and vegetables compared to normal weight adults.

Discussion

Findings from the study showed that the mean age of the respondents across the six agro-ecological zone was 43 years. This implies that the respondents are still physically active and young. This also supports the age distribution of the population in the country where the young dominates the population and the aged constituted the least percentage as documented by the National Bureau of Statistics (NBS, 2017). The highest prevalence of obesity (16.5%) was seen among those in the 31- 60 age group compared to others, this also applies to overweight respondents as well. This conforms to the earlier findings of Hughes *et al.* (2002) where physical activity tends to reduce as age increases. Obesity is more prevalent among women than men. Kassie *et al.* (2020) documented a higher (15%) obesity prevalence rate in Nigeria among adults women aged 18 years and above than men (11%). This may be due to the cultural belief that obesity is a sign of affluence and also as a result of lower level of physically tasking activities among women. However, according to Magemba and Sebastian (2020), marriage and the use of hormonal contraceptives were identified as the major risk factors for overweight and obesity among Zimbabwean women. Married respondents were prone to obesity (19.5%) than the singles (1.3%). This corroborates the findings of Oladapo *et al.* (2010). Adult household members with the highest level of education were more overweight (9.2%) and also obese (6.7%) than others. This is also consistent with earlier findings by Ojofeitimi *et al.* (2007).Considering occupation, the traders were more overweight (11.4%) and obese (8.2%) than those in other occupations. This may be due to the sedentary nature (low physical activity) of their work which has been reported in the literature to be associated with overweight. Studies which documented such findings include (Ogunbode *et al.* 2011). The prevalence of overweight and obesity reduces with income as highest occurrence was seen among respondents that earn less than ₦100,000 monthly. This is in contrast with the findings of Abdulai (2010) where obesity increases with income particularly among women in Nigeria.

Food expenditure pattern shows that obese and overweight adults

consume dairy products (milk) than their counterparts as their *per capita* monthly expenditure was higher. This conforms to the earlier findings of Berkey *et al*. (2005) who reported high consumption of milk and cheese among overweight adults.Additionally, Chukwuonye et al. (2015) reported that sedentary lifestyles, high levels of refined sugar and saturated fats (fast food) and increased dietary consumption of energy-dense foods are some of the primary contributors to the growing incidence of obesity in Nigeria. The chi-square result from the study on the relationship between food expenditure pattern and nutritional status measured through body mass index showed that there is no significant relationship between body mass index and expenditure on rice (χ^2 = 12.000 and p-value = 0.213). This result agrees with the earlier submission of Romling and Qaim (2011) of no relationship between expenditure on cereal products and nutritional status. In addition, the result also showed that there is a significant relationship between body mass index and expenditure on oil and fat foods (χ^2 = 9.316 and p-value = 0.000). This result agrees with the earlier submission of Omage and Omuemu (2018) that found that there exist a relationship between excessive consumption energy-dense food items and overweight. Expenditure on fruit and body mass index was also significant (χ^2 = 7.019 and p-value = 0.001). The above result agrees with that of Amira *et al.* (2011) where diets high in fats and oil were associated with overweight and obesity among adults. Also, Van den Berg *et al.* (2013) reported that consumption of high energy foods at the expense of low energy foods, fruits and vegetables could promote overweight among adults which can further predisposes them to the risk of non-communicable diseases.

Conclusion

The study revealed that body mass index differs significantly among respondents across the agro-ecological zones of Nigeria. The mean body mass index value of 27.17kg/m^2 implies that an average adult is overweight. Overweight and obesity condition increases with age and income, and also more prevalent among female that were mostly into trading as a form of occupation. Specifically, overweight condition is more prevalent among male than female.

The *per capita* spending demonstrates how the monthly food expenditure patterns vary among adults of various nutritional status categories. Furthermore, overweight and obese respondents spend more on animal products, fat and oil and dairy foods that promote weight gain and less on healthy foods (fruits and vegetables) than their counterparts.

Recommendation

Based on the findings from this study, the following recommendations are made:

1. Given the propensity of some social group to be overweight or obese, policy measures should focus on this consumer segment to improve their diet and health awareness.

2. Public awareness should be created among the populace on the implication of being overweight or obese.
3. Government should implement regulations that encourage the consumption of good and healthy foods, perhaps by imposing a fee on unhealthy food items that encourage overweight and obesity.
4. Adults in the household should develop a healthy diet pattern and engaging in regular physical activity.
5. Relevant organisations and non-governmental organisations could help by promoting the sale and supply of fresh food products and also by strengthening the regulations on the use of additives and artificial sweeteners in processed foods.

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Grassland Management Employment Opportunities in Kogi State, Nigeria

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Abstract

The study focused on grassland management employment opportunities in Kogi State, Nigeria. Specifically, it determined employment opportunities in grassland management, challenges that could hinder employment in various grassland management opportunities, and ways of ameliorating the challenges that could hinder employment in various grassland management opportunities the state. Survey research design was used. Population was made up of 81 respondents consisting of 42 Agricultural Extension lecturers and 39 Extension agents. Questionnaire was utilized for data collection. It was validated by three experts. Cronbach Alpha reliability coefficient of 0.82 was obtained for the instrument. Data were analyzed using mean and standard deviation and t-test. Finding include 12 employment opportunities available in grassland management such as Grassland Manager ($\overline{X}$= 3.32) and Grazing assistant ($\overline{X}$= 3.62). Also 10 challenges that could hinder employment opportunities in various grassland management opportunities were identified such as climate-related challenges such as droughts ($\overline{X}$= 3.72) and low reputation of various grassland management opportunities ($\overline{X}$= 3.72) 13 ways of ameliorating challenges that could hinder employment opportunities were identified. These include building synergies with NGOs that already provide skills for grassland management ($\overline{X}$= 3.46) and improving access to resources and infrastructure needed in grassland management ($\overline{X}$ = 3.24). Further, there was no significant differences between the mean responses of Agricultural Extension lecturers and Extension Agents on employment opportunities available in grassland management, challenges that could hinder employment opportunities and ways of ameliorating the challenges, all at 0.05 level of significance.

Keywords: Grassland, Management, Employment, Opportunities, Challenges, Extension, Agents

Introduction

Grassland refers to an area in which vegetation is dominated by nearly continuous cover of grasses. According to Derner and Briske (2013), grasslands are characterized by the dominance of grasses and herbaceous plants. They are extensive ecosystems that play a critical role in supporting biodiversity, providing ecosystem services, and contributing to the global carbon cycle. Grasslands occur in environments conducive to the growth of plant-cover, but not that of taller plants, particularly trees and shrubs (Veldman, *et al*, 2015). Grasslands exhibit unique characteristics shaped by environmental factors such as climate, soil conditions, and grazing patterns(Ogbonna & Mshelia, 2018). They demonstrate remarkable adaptability and resilience, supporting a wide range of plant and animal species (Grace, et, al 2016). Grasslands provide essential ecological functions, including soil stabilization, water filtration, carbon sequestration, and forage production for livestock (Milchunas, *et al*, 2017). Grassland provides feed for livestock especially ruminants, reduces the cost of feeding animals especially ruminants and increases infiltration and percolation of water, thereby reducing run off and soil erosion (Iwena, 2012). According to Ejiofor, et al, (2017), grassland also provides adequate nutrients to the soil through legumes which fix nitrogen in the soil as well as source of income to the person managing the grassland. Human activities have however disrupted the natural equilibrium of grasslands, threatening their sustainability. Overgrazing, land conversion for agriculture or urban development, and inadequate land management practices have contributed to grassland degradation (Milchunas *et al.,* 2017). To ensure the long-term viability of grasslands, effective management strategies must be implemented.

Grassland management involves a range of operations aimed at restoring and maintaining the ecological integrity of these ecosystems. It encompasses practices such as grazing management, restoration of degraded areas, control of invasive species, monitoring of biodiversity, and the development of sustainable land management plans (Food and Agricultural Organization (FAO), 2019).Grassland management refers to the manipulation of natural vegetation in order to achieve some predetermined goals(Grassland Conservation Council of British Columbia, 2012). Grassland management keeps grass stands healthy so that they continue to provide long term conservation benefits (Minnesota Department of Agriculture, 2016). Due to the importance of grassland, it is fast becoming a viable area for employment in developed countries (Nwakile, *et al*, 2020).

The management of grasslands presents numerous employment opportunities. Skilled professionals are required to carry out critical tasks in grassland management, including land assessment, monitoring and evaluation,

implementation of management plans, community engagement, research, and policy development (Griffith, *et al*, 2017). These professionals play a vital role in ensuring the sustainable use and conservation of grasslands. According to Zhang, Lü, Isbell and Han (2019), job opportunities in grassland management includes: range manager, grassland conservation officer, restoration scientist, wildlife biologist and agricultural extension agents. Furthermore, controlled burning is often employed as a management tool in grassland ecosystems (DeLonge, *et al*, 2019). It helps control invasive species, rejuvenate grasses, and maintain habitat diversity (Milchunas, *et al*, 2017). Fire management activities include prescribed burning planning, monitoring weather conditions, implementing safe and controlled burns, and assessing post-fire vegetation responses (Nelson, *et al*, 2017).In undertaking a career in grassland management, certain practices are involved. The practices involved in grassland management help to ensure that grassland management is carried out efficiently.

Activities involved in grassland management are crucial for maintaining the health, productivity, and ecological integrity of these ecosystems (Derner, *et al*, 2018). According to Collins, et al (2018), the activities involved in grassland management includes determining appropriate stocking rates, implementing rotational grazing systems, monitoring grazing intensity, and managing livestock distribution. Lacey, *et al* (2021) posited that activities involved in grassland management includes identifying and monitoring invasive species, implementing targeted control methods (such as herbicide application, mechanical removal, or biological control), and implementing restoration activities to promote the recovery of native vegetation. Globally, there is an increasing demand for grassland management professionals, reflecting the growing recognition of the importance of sustainable land management practices (Zhang *et al.*, 2019). The Food and Agriculture Organization (FAO) highlights that grasslands cover approximately 26% of the world's land surface and provide livelihoods for millions of people globally (FAO, 2019). This underscores the significant role that grassland management employment plays in supporting local economies and promoting sustainable development in countries including Nigeria (Ogbonna & Mshelia, 2018).

In Nigeria, grasslands cover substantial portions of the country's land, including Kogi state (Ogbonna & Mshelia, 2018). This shows that Kogi State has the potentials to grassland management employment opportunities. These opportunities are however not explored and investigated through research. This is sad considering that Amedu (2018) reported that the state has one of the highest unemployment and poverty rates in Nigeria. To survive, many individuals have resorted to negative vices such as stealing, kidnapping and prostitution amongst others as a means

of survival (Amedu, 2018). It is therefore necessary to investigate issues relating to the promotion of grassland management employment opportunities in Kogi State.

Employment opportunities that can be generated through grassland management are numerous. Ogbonna and Mshelia (2018), identified job opportunities in grassland management which include; grassland restoration labourer, grazing assistant, pasture maintenance worker, invasive species control crew, livestock herder, wildlife habitat monitor and land rehabilitation labourer. Despite these opportunities, there is need for empirical studies to ascertain if they fit into the characteristics of inhabitants of the area. Furthermore, despite these opportunities in grassland management, certain challenges could hinder individuals in Kogi State from engaging in opportunities in grassland management. According to Sheley, *et, al.,* (2020), factors that could inhibit the utilization of grassland management opportunities include: general lack of extension agents to teach the skills and low reputation of grassland management. Others include inadequate provision of labour market information to students about grassland management and inadequate policy coordination favoring grassland management (Pywell, *et al*, 2020). In spite of the potentials of grassland management employment opportunities in Kogi state, there appears to be no available research findings on the potentials. This is a gap that needs to be closed, hence this study

Purpose of the Study

The study focused on ascertaining grassland management employment opportunities in Kogi state, Nigeria. Specifically, the study determined:

1. Employment opportunities available in grassland management in Kogi State, Nigeria.
2. challenges that could hinder employment in various grassland management opportunities in Kogi State, Nigeria.
3. ways of ameliorating challenges that could hinder employment in grassland management employment opportunities in Kogi State, Nigeria.

Hypotheses (HOs)

There is no significant difference between the mean opinions of Agricultural Extension Lecturers and Extension agents on HO_1 employment opportunities available in grassland management in Kogi State, Nigeria

HO_2 challenges that could hinder employment in various grassland management employment opportunities in Kogi State, Nigeria

HO_3 ways of ameliorating the challenges that could hinder employment in grassland management employment opportunities in Kogi State, Nigeria.

Methodology

***Design of the Study*:** The study adopted a survey research design.

Area of the Study: The study was carried out in Kogi State. Kogi is a state in the North central region of Nigeria.

It is popularly called the Confluence state because of the confluence of River Niger and River Benue at its capital, Lokoja. Kogi state was chosen because of the high level of poverty among families in the area despite having numerous grasslands in the area which would create employment (Amedu, 2018).

Population for the Study: The population for the study was 81respondents consisting of 42Agricultural Extension lecturers and 39 Extension agents in the area. Source of information: (Personnel Office of the various tertiary institutions, 2022) and (Kogi State Ministry of Agriculture, 2022). Agricultural extension lecturers are involved in the training of extension agents while extension agents take information that is needed to farmers and rural areas. No sampling or sampling was carried out due to the manageable size of the population.

Instrument for Data Collection: The instrument for data collection was questionnaire. The questionnaire contained 35 items which were generated based on literature review. It was validated by five experts. The internal consistency of the instrument was determined using Cronbach Alpha reliability coefficient which yielded a coefficient index of 0.82. The items on the questionnaire were divided into clusters I, II and III based on the research questions. Cluster I had 4-point response options of Very Available (VA), Occasionally Available (OA), Rarely Agree (RA), and Not Available (NA) with weights of 4, 3, 2 and 1 respectively. Cluster II had 4-point response options of Very Strong Challenge (VSC), Strong Challenge (SC), Mild Challenge (MC), and Not a Challenge (NC) with weights of 4, 3, 2 and 1 respectively. Cluster III had 4-point response options of Very Strong Way (VSW), Strong Way (SW), Mild Way (MC), and Not a Way (NW) with weights of 4, 3, 2 and 1 respectively.

Data Collection Technique: A total of 81 copies of questionnaire were distributed to respondents. Only 73 copies were properly filled and retrieved from 36 agricultural extension lecturers and 37 extension agents. This gave a return rate of approximately 90.1 percent.

Data Analysis Technique: The data collected were analyzed using mean ($\overline{X}$) and standard deviation (SD) to answer the research questions. Null hypotheses were tested using t-test at 0.05 level of significance. A cut-off mean of 2.50 was used for decision making based on the 4-point scales and the specific purposes of the study. Items that had mean values of 2.50 and above ($\overline{X}$ = ≥ 2.50) were categorized as Available (A), Challenge (C) and Way (W) for clusters I, II and III respectively while items with mean less than 2.50 were categorized as Not Available (NA), Not a Challenge (NC) and Not a Way (NW) for clusters I, II and III respectively.

RESULTS

Table 1: Mean, Standard Deviation and t-test of Responses on employment Opportunities Available in Grassland Management in Kogi State, Nigeria

S/N	Employment Opportunities	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_g$	SD_g	Df	t-cal	Remarks	
1	Grassland manager	3.38	0.70	3.26	0.76	3.32	0.73	71	0.37	A	NS
2	Grassland restoration labourer	3.20	0.80	3.36	0.68	3.28	0.74	71	0.78	A	NS
3	Restoration scientist	3.30	0.55	3.50	0.57	3.40	0.56	71	0.65	A	NS
4	Grazing assistant	3.62	0.60	3.58	0.68	3.60	0.64	71	0.94	A	NS
5	Agricultural Extension agents	3.16	0.63	3.28	0.57	3.22	0.60	71	0.66	A	NS
6	Pasture maintenance worker	3.40	0.82	3.30	0.86	3.35	0.84	71	0.27	A	NS
7	Land rehabilitation labourer	3.19	0.78	3.13	0.70	3.16	0.74	71	0.74	A	NS
8	Invasive species control crew	3.42	0.60	3.62	0.64	3.52	0.62	71	0.12	A	NS
9	Livestock herder	3.16	0.70	3.12	0.90	3.14	0.80	71	0.80	A	NS
10	Wildlife habitat monitor	3.01	0.83	3.03	0.89	3.02	0.86	71	0.81	A	NS
11	Agroforestry specialist	3.61	0.89	3.68	0.95	3.65	0.92	71	0.72	A	NS
12	Community engagement coordinator	3.40	0.72	3.56	0.80	3.48	0.76	71	0.76	A	NS

Population = 73; $\bar{X}_1$ = Mean of 36 Extension lecturers; $\bar{X}_2$ = Mean of 37 Extension agents $\bar{X}_G$ = Grand Mean; SD_G = Grand standard deviation; A = Available; NA = Not Available; S= Significant; NA = Not Significant; Df = Degree of freedom; t-cal = t-calculated

Table 1 shows that all the 12 items has means ranging from 3.02 – 3.65 ($\bar{X}$ = ≥ 2.50). This implies that the 12 items are available opportunities for employment in grassland management in Kogi State, Nigeria. The standard deviation of all the 12 items ranged from 0.56 – 0.92. Each of the values was below 1.96 indicating that the respondents were near to the mean and to each other in their responses. The Table also shows that all the 12 items had their t-cal values ranging from 0.12 – 0.94 which were greater than 0.05 level of significance. Therefore the null hypothesis of no significant differences was upheld for all the 12 items. This shows that the mean responses of the respondents do not differ significantly in their opinions on the employment opportunities available in grassland management in Kogi State, Nigeria.

Table 2: Mean Ratings, Standard Deviation and t-test of the Responses on Challenges that Could Hinder Employment in Various Grassland Management Opportunities in Kogi State, Nigeria

S/N	Challenges	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_g$	SD_g	Df	t-cal	Remarks	
1	Low reputation of various grassland management opportunities	3.18	0.58	3.26	0.66	3.22	0.62	71	0.19	C	NS
2	Grassland management training for interested people on various jobs is sometimes only theoretical	3.34	0.60	3.42	0.62	3.38	0.58	71	0.46	C	NS
3	Extension agents are sometimes lacking in practical knowledge of grassland management needed to train those seeking job opportunities in grassland management	3.10	0.50	3.18	0.58	3.14	0.54	71	0.10	C	NS
4	Lack of knowledge among people about grassland management	3.09	0.62	3.11	0.66	3.10	0.64	71	0.59	C	NS
5	Limited resources and infrastructure such as fencing materials, watering systems, and machinery for mowing which poor families may not be able to afford.	3.15	0.72	3.25	0.72	3.20	0.72	71	0.57	C	NS
6	Inadequate access to land and land tenure issues	3.22	0.80	3.28	0.92	3.25	0.86	71	0.81	C	NS
7	Climate-related challenges such as droughts, floods, and extreme weather events can hinder grass production	3.70	0.81	3.74	0.85	3.72	0.83	71	0.68	C	NS
8	Difficulty in accessing markets and establishing value chains	3.08	0.96	3.20	0.92	3.14	0.94	71	0.58	C	NS
9	Inadequate policy coordination favoring grassland management	3.05	0.46	3.15	0.50	3.10	0.48	71	0.39	C	NS

10	Limited extension services hinder the effective implementation of grassland management initiatives among families	2.96	0.70	3.00	0.74	2.98	0.72	71	0.75	C	NS

Population = 73; $\overline{X}_1$ = Mean of 36 Extension lecturers; $\overline{X}_2$ = Mean of 37 Extension agents $\overline{X}_G$ = Grand Mean; SD_G = Grand standard deviation; C = Challenge; NC = Not a Challenge; S= Significant; NA = Not Significant; Df = Degree of freedom; t-cal = t-calculated

Table 2 shows that of all 10 items ranged from 2.98 – 3.74 ($\overline{X}$ = ≥ 2.50). This implies that the 10 items are the challenges that could hinder employment in various grassland management opportunities in Kogi State, Nigeria. The standard deviation of all the 10 items ranged from 0.48 – 0.94. Each of the values was below 1.96 indicating that the respondents were near to the mean and to each other in their responses. The Table also shows that all the items had t-cal values ranging between 0.10 – 0.81. All the items had t-cal values greater than 0.05 indicating that there were no significant differences between the opinions of Agricultural Extension Lecturers and Extension agents on the challenges that could hinder employment in various grassland management employment opportunities in Kogi State, Nigeria.

Table 3: Mean, Standard Deviation and t-test of Responses on the Ways Ameliorating the Challenges that Could Hinder Employment in Various Grassland Management Employment Opportunities in Kogi State, Nigeria

S/N	Possible solutions	$\overline{X}_1$	SD_1	$\overline{X}_2$	SD_2	$\overline{X}_g$	SD_g	Df	t-cal	Remarks
1	Government has to make well informed policy decisions favouring grassland management	3.68	0.66	3.76	0.70	3.72	0.68	71	0.66	W NS
2	Providing labour market information to household about grassland management opportunities	3.35	0.80	3.45	0.90	3.40	0.70	71	0.43	W NS
3	providing education and training on grassland management techniques	3.12	0.68	3.16	0.60	3.14	0.64	71	0.71	W NS
4	Continuous business coaching to enable households establish businesses such as grasslands	3.14	0.56	3.22	0.52	3.18	0.54	71	0.78	W NS
5	Grassland management skill training among individuals should be done in work places rather than in classrooms.	3.26	0.51	3.18	0.53	3.22	0.52	71	0.49	W NS

6	Building synergies with NGOs that already provide skills for grassland management	3.40	0.70	3.52	0.84	3.46	0.76	71	0.97	W	NS
7	Provision of funds by government and donors for training/retraining of extension agents in grassland management	3.18	0.84	3.26	0.92	3.22	0.88	71	0.94	W	NS
8	Embedding grassland management practice and teaching within the regulatory framework and within the curriculum.	3.05	0.66	3.15	0.58	3.10	0.62	71	0.71	W	NS
9	Skilling Vocational Education and Training trainers and other teachers to deliver skills in grassland management	3.55	0.86	3.60	0.98	3.50	0.92	71	0.620	W	NS
10	Developing strategies to up skill and retrain household members in skills in grassland management	3.45	0.86	3.35	0.94	3.40	0.90	71	0.29	W	NS
11	Encouraging more research in skills for grassland management	3.18	0.70	3.30	0.78	3.24	0.74	71	0.41	W	NS
12	Improving access to resources and infrastructure needed in grassland management	3.23	0.52	3.25	0.60	3.24	0.56	71	0.78	W	NS
13	Addressing land tenure issues	2.94	0.68	2.98	0.76	2.96	0.72	71	0.16	W	NS

Population = 73; $\overline{X}_1$ = Mean of 36 Extension lecturers; $\overline{X}_2$ = Mean of 37 Extension agents $\overline{X}_G$ = Grand Mean; SD_G = Grand standard deviation; W = Way; NW = Not a Way; S= Significant; NA = Not Significant; Df = Degree of freedom; t-cal = t-calculated

Table 3 reveals that the mean of all 13 items ranged from 2.96 – 3.72 ($\overline{X}$ = ≥ 2.50). This implies that the 13 items were the ways of ameliorating the challenges that could hinder employment in various grassland management opportunities in Kogi State, Nigeria. The standard deviation of all the 13 items ranged from 0.52 – 0.92. Each of the values was below 1.96 indicating that the respondents were near to the mean and to each other in their responses. The Table also shows that all the items had t-cal values ranged 0.16 – 0.94. The t-cal values of all the items were greater than 0.05 indicating that there was no significant differences between the opinions of Agricultural Extension Lecturers and Extension agents on the the ways of ameliorating the challenges that could hinder employment in various grassland management employment opportunities in Kogi State, Nigeria

Discussion of the Findings

The findings of the study reveal 12 employment opportunities available in

grassland management in Kogi State, Nigeria. These includes: grassland Manager ($\overline{X}$ = ≥ 2.50)., Grassland restoration labourer, Restoration Scientist, Grazing assistant, Agricultural Extension Agents, among others. The findings are also in line with Ogbonna and Mshelia (2018) who made similar findings. The findings are in line with Zhang, Lü, Isbell and Han (2019) who found that job opportunities in grassland management includes: range manager, grassland conservation officer, restoration scientist, wildlife biologist and agricultural extension agents. The findings are also in agreement with DeLonge, et al, (2019) who found that opportunities in grassland management includes Environmental Consultant, Policy Analyst, Soil Conservationist The findings also support that of Milchunas, et al, (2017) who found out that job opportunities in grassland management include Agroforestry Specialist and Community Engagement Coordinator. Hence, it implies that the identified items are opportunities for employment in grassland management in Kogi State, Nigeria. The findings also revealed that there was no significant differences between the opinions of Agricultural Extension Lecturers and Extension agents on the employment opportunities available in grassland management in Kogi State, Nigeria. No difference in opinion could be because the respondents have similar educational backgrounds.

The findings of the study on the challenges that could hinder employment in various grassland management opportunities in Kogi State, Nigeria revealed that the challenges are as follows: low reputation of various grassland management opportunities, grassland management training for interested people on various jobs is sometimes only theoretical, extension agents are sometimes lacking in practical knowledge of grassland management needed to train those seeking job opportunities in grassland management, lack of knowledge among people about grassland management, limited resources and infrastructure such as fencing materials, watering systems, and machinery for mowing which poor families may not be able to afford. Others include inadequate access to land and land tenure issues, climate-related challenges such as droughts, floods, and extreme weather events can hinder grass production, difficulty in accessing markets and establishing value chains, inadequate policy coordination favoring grassland management and limited extension services hinder the effective implementation of grassland management initiatives among families. The findings are in agreement with Lacey, et al, (2021) who found that grassland management as a means of employment is hindered by inadequate policy coordination by the government favoring grassland management, extension agents are sometimes lacking in practical knowledge of grassland management needed to train those seeking job opportunities in grassland management and lack of knowledge among people about grassland

management. The findings are in agreement with Ogbonna and Mshelia (2018) who found that the challenges to grassland management include: teachers are sometimes lacking in practical knowledge of grassland management and lack of knowledge and awareness among families about grassland management. The findings are also in agreement with Pywell, et al, (2020) who found out that grassland management doesn't thrive as a means of poverty reduction due to limited resources and infrastructure needed to start the business such as fencing materials and watering systems, amongst others which poor families may not be able to afford. The findings also revealed that there was no significant differences between the opinions of Agricultural Extension Lecturers and Extension agents on the challenges that could hinder employment in various grassland management employment opportunities in Kogi State, Nigeria. No difference in opinion could be because the respondents have similar educational backgrounds.

The findings on ways of ameliorating the challenges militating against the adoption of grassland management among families for poverty reduction in Kogi State revealed that the ways include: Government has to make well informed policy decisions favouring grassland management; providing labour market information to household about grassland management opportunities; providing education and training on grassland management techniques; continuous business coaching to enable households establish green businesses such as grasslands; green skill training among children should be done in work places rather than in classrooms; building synergies with NGOS that already provide skills for grassland management; provision of funds by government and donors for training/retraining of extension agents in grassland management; embedding grassland management practice and teaching within the regulatory framework and within the curriculum; skilling vocational education and training trainers and other teachers to deliver green skills in grassland management; developing strategies to up skill and retrain household members in green skills in grassland management; encouraging more research in green skills for grassland management; improving access to resources and infrastructure; and addressing land tenure issues. The findings are also in line with Derner and Briske(2013) who found that grassland management can reduce poverty levels by building synergies with NGOS that already provide skills for grassland management. The findings are also in agreement with Collins, et al, (2018) who found that Government making informed policy decisions favouring grassland management and providing labour market information to household about grassland management opportunities can mitigate the challenges that hinders employment in grassland management opportunities. The findings are also in agreement with Nelson, et al, (2017) who found that

developing strategies to up skill and retrain household members in skills in grassland management; and encouraging more research in skills for grassland management helps to ensure grassland management is efficiently utilized as a means of job creation. The findings further revealed that there was no significant differences between the opinions of Agricultural Extension Lecturers and Extension agents on the the ways of ameliorating the challenges that could hinder employment in various grassland management employment opportunities in Kogi State, Nigeria. No difference in opinion could be because the respondents have similar educational backgrounds.

Conclusion

Reducing poverty is a challenge faced by many governments due to many families experiencing high level of poverty. To curtail the increasing levels of poverty, job opportunities in grassland management have been found to help reduce unemployment and consequently poverty but there was need to ascertain the grassland management employment opportunities in Kogi state, Nigeria. The study identified 12 opportunities for employment in grassland management, 10 challenges that could hinder employment in various grassland management opportunities and 13 ways of ameliorating the ways of ameliorating the challenges that could hinder employment in various grassland management opportunities in Kogi State, Nigeria. It is concluded that if the ways are adhered to, there would be increase in the number of people employed in various opportunities in grassland management consequently leading to poverty reduction among individuals and families.

Recommendations

Based on the findings of the study, the following recommendations were made;

1. Adequate funds should be provided by the Government for financing research institutions focused on promoting grassland management among families
2. Extension agents should avail themselves to workshop for training/retraining on grassland management/skill requirements to make them more competent in impacting such skills to families.
3. Training in various grassland management opportunities should be practical to ensure skill acquisition among those seeking various opportunities in grassland management.

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Utilization of Digital Technologies in Promoting Research Skills of Postgraduate Students: A Case Study of Ebonyi State University, Abakaliki

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Abstract

The study focused on issues relating to digital technologies and research skills of postgraduate students in Ebonyi State University, Abakaliki. Specifically, it determined; digital technologies necessary and available for developing research skills among postgraduate students in EBSU, factors that militate against the utilization of digital technologies for promoting research skills among postgraduate students in EBSU and ways of ameliorating challenges of utilization of digital technologies for promoting research skills among postgraduate students in EBSU. A survey research design was adopted. Population was 1,189; comprising of 565 lecturers and 624 postgraduate students of three academic years (2020/2021, 2021/2022 and 2022/2023 sessions) in Ebonyi State University, Abakaliki. Data were analyzed using mean and standard deviation. Findings of the study include 13 digital technologies (DT) necessary for developing research skills among postgraduate students in EBSU. These include, among others, projectors ($\overline{X}$ = 3.26), laptops ($\overline{X}$ = 3.53), desktop computers ($\overline{X}$ = 3.79), printer machines ($\overline{X}$ = 3.70). Only four of the DTs are availability, desktop computers ($\overline{X}$ = 3.79), printer machines ($\overline{X}$ = 3.70), photocopier machines ($\overline{X}$ = 3.44) and scanners ($\overline{X}$ = 3.37). Also nine challenges were identified, including inadequate number of computers to access digital information ($\overline{X}$ = 3.31), lack of skills to access digital information resources among students ($\overline{X}$ = 3.20), inadequate hardware and software ($\overline{X}$ = 3.11) and others. Furthermore, nine ways of ameliorating the challenges, including promoting internet connectivity and requisite subscription to address the challenges of inadequate computers to increase access to digital information ($\overline{X}$ = 2.92) promoting environmental friendliness for critical thinking in the university ($\overline{X}$ = 3.12) and others. Three recommendations were made for utilization of DT in promoting research skills of postgraduate students in EBSU.

Keywords: Digital, Technologies, Availability, Utilization, Research, Skills, Creativity, Innovation, funding, Universities, Postgraduate, Students.

Introduction

Digital technologies are an integral part of the debate on teaching and learning especially in higher education today. Digital technology according to Selwyn, et al, (2016) can include but not limited to: computers, tablets, smart phones, FaceBook, Moodle, online library services, Google, YouTube, writing essays on Microsoft Word, etc. Digital technology enables people to access the internet not just from home but in any location through portable devices. Institutions' and people's life have been greatly influenced by technological developments such as computers, portable devices and the internet, influencing their relation with information, knowledge and ways of working (Onyema, 2019). Global educational growth and competitiveness rest significantly on application of digital technologies, driven by a well-planned vibrant research skills acquisition system to integrate the research prowess of higher education with the demands of industry and larger society. Tertiary institutions all over the world are usually the key drivers of research and development activities.

Higher education institutions are expected to offer technology based computer infrastructures that support virtual organization and management of teaching and learning. Thus digital technologies in higher education have blurred the traditional borders between learning spaces and time, between formal and informal learning environments, between the use of specific tools for learning and personal use.

The introduction of new technology-assisted learning tools such as mobile devices, smart boards, tablets, laptops, simulations, dynamic visualizations, and virtual laboratories have altered education in institutions. The Social media as a learning tool is an integral part of digital technology which has come a long way towards making teaching and learning more interesting and participatory (Ankrah & Al-Tabbaa, 2015).

Digital tools has made it possible for online platforms that are currently available for conducting classes, sharing resources, doing assessment and managing the day to day activities of academic institutions (Jakobsen, et al, 2019). University graduates represent a huge potential for stimulating innovation and entrepreneurship, either by directly establishing their own firms or through their employment after graduation; therefore they need adequate knowledge on the application of digital tools to adapt in the present internet driven society. They need research skills which could be facilitated through digital technologies (Wilson, 2012; Geng 2014).

The task of preparing university graduate for careers in increasingly innovation-intensive working environments and helping them to acquire skills that enhance their entrepreneurial abilities, are amongst the mandates of universities that appeared not to be fully recognized (Robert, 2018). Digital technologies if

properly applied in the university would go a long way to developing research skills and associated potentials amongst postgraduate students in particular to facilitate new discoveries and innovations in the ever changing society (Agyei and Voogt 2011). It is practically impossible to imagine effective education without optimal use of ever-changing digital technologies in this hyper connected era. This argument is in line with the view of Nwajioha and Chukwu (2021) who stated that both teachers and students are currently passing through technology use and digital transition in education with its associated challenges.

Agyei and Voogt (2011) noted that lack of knowledge about integrating digital technologies in the classroom, lack of training opportunities related to technology integration, shortage of ICT-based facilities and school plants, and lack of internet connectivity in schools, among others, are barriers to the application of digital technologies in teaching and learning. Incidentally, the world is changing as a result of technological and economic advancement, which create peculiar problems and challenges to most Nigerian graduates. There is an increased search for skilled workers and specialists in various fields, just as there is a declining job market for university products that mostly lack necessary skills or ability to utilize the knowledge acquired from the university to solve immediate problems. Sadly too, the few self-employed graduates are mostly in quandary, as scant infrastructural facilities make it impossible for them to effectively ply their trade. It is on the bases of the above that this study sought to investigate the issues relating to digital technologies in promoting research skills amongst students with particular reference to Ebonyi State University, Abakaliki.

Objectives of the Study

This study focused on issues relating to utilization of digital technologies in promoting research skills of postgraduate students of Ebonyi State University (EBSU), Abakaliki. Specifically, the study determined

1. digital technologies necessary and available for developing research skills among postgraduate students in EBSU.
2. factors that militate against the utilization of digital technologies for promoting research skills among postgraduate students in EBSU.
3. ways of ameliorating challenges of utilization of digital technologies for promoting research skills among postgraduate students in EBSU.

Methodology

***Design of the Study*:** This study adopted a descriptive survey research design.

***Area of the Study*:** The study was conducted in Ebonyi State University, EBSU, Abakaliki. It was established in 2000, EBSU offers courses and programs leading to many recognized higher education degrees in several areas of study. EBSU operates under a multi-campus structure, with efforts still ongoing to unify the campuses in her permanent site. The school is

seriously in need of basic ICT and digital tools as most of the campuses, like faculty of education lack function internet connectivity for effective e-learning and research development

***Population for the Study*:** The population of the study was made up of both lecturers and postgraduate students of Ebonyi State University, Abakaliki; numbering 1,189. A breakdown of the population showed that there exist a total of 565 lecturers in EBSU; while the number of students admitted for postgraduate studies for all the programmes in 2020/2021, 2021/2022 and 2022/2023 sessions stood for 211, 196 and 217 respectively. The population of lecturers as presented in this study is comprised of 274 females and 291 males from the rank of Lecturer I and above who are involved in teaching postgraduate programmes in different Department and Faculty of the University. Similarly, the total number of 624 postgraduate students in this study comprised 351 females and 273 males in all postgraduate programmes of the University for the three Sessions as indicated in this study. (Sources: Personnel Unit of EBSU and Admission Office of the School of Postgraduate Studies, EBSU).

***Sample for the Study*:** A stratified random sampling technique was used to draw a sample size of 253 respondents from the population. Ten lecturers who are involved in the teaching and supervision of Postgraduate programmes were drawn from each of the eleven Faculties in the university, making a total of 110 lecturers of 57 female and 53 male. The sample was also made up of 13 postgraduate students from each of the 11 Faculties, which amounted to 143 (53 female and 50 male) from various faculties of the University as research participant in this study.

***Instrument for Data Collection*:** The instrument for data collection was a structured questionnaire. It was developed through literature review based on the objectives of the study. The instrument was made up of 32 items, which were grouped in three clusters in line with the specific objectives of the study. It was a 4-point scale instrument. The instrument was validated by three university experts in digital technology. It was subjected to a test of reliability using Cronbach Alpha procedure. This yielded the reliability coefficient of 0.67.

***Data Collection Method*:** A total of 253 copies of the instrument were administered as follows: 110 copies to lecturers and 143 copies to postgraduate students. All the 253 copies were properly completed and retrieved. This represents 100 percent return. This arrangement ensured a hundred percent return rate of the administered copies of the instrument.

***Data Analysis Techniques*:** The collected data was analyzed using mean and standard deviation. A mean score of 2.50 constitute a benchmark for an item as affirmative opinion of respondents and interpreted as "agreed". This implies that items with mean scores of 2.49 and below were considered as negative responses of the respondents and interpreted as "disagreed".

RESULTS

Table 1: Mean Responses of Lecturers and Postgraduate Students on the Digital Technologies Needed for the Development of Research Skills among Postgraduate Students in EBSU,

S/N	Digital Technologies (DT)	Necessary			Availability		
		$\overline{X}_{1n}$	$\overline{X}_{2n}$	$\overline{X}_{gn}$	$\overline{X}_{1a}$	$\overline{X}_{2a}$	$\overline{X}_{ga}$
1	Projectors	3.41	3.11	3.26	2.24	2.23	2.24
2	Laptops	3.05	4.00	3.53	2.02	2.21	2.12
3	Computer application software	3.11	3.32	3.22	2.31	2.11	2.21
4	Modem for internet connectivity	3.22	3.23	3.23	2.41	2.41	2.41
5	Desktop computers	3.72	3.84	3.79	2.75	2.62	2.69
6	Printing machines	3.69	3.71	3.70	2.62	2.59	2.61
7	Photocopier	3.87	3.01	3.44	2.61	2.58	2.60
8	Scanners	3.62	3.11	3.37	2.53	2.59	2.56
9	Google Classroom	3.10	3.12	3.11	2.24	2.28	2.36
10	Google Drive	3.21	3.09	3.15	1.58	1.74	1.66
11	Haiku Deck	3.65	3.13	3.39	1.65	1.83	1.74
12	e-library	3.11	3.21	3.16	2.13	2.22	2.18
13	e-resources	3.23	3.08	3.16	2.23	2.34	2.29
	Grand Mean	**3.38**	**3.30**	**3.35**	**2.26**	**2.29**	**2.27**

$\overline{X}_{1n}$ = Mean of lecturers on necessary DT; $\overline{X}_{2n}$= Mean of students on Necessary DT; $\overline{X}_{gn}$ = Grand mean of lecturers and students on necessary DT; $\overline{X}_{1a}$ = Mean of lecturers on availability DT; $\overline{X}_{2a}$ = Mean of students on availability DT; $\overline{X}_{ga}$ = Grand mean of lecturers and students on availability DT.

Table 1 shows that the grand mean ($\overline{X}_{gn}$) for all the 13 items on **necessary DT** for the development of research skills among postgraduate students are all more than the criterion mean of 2.50 ($\overline{X}$ ≥2.50). On the contrary, for availability it is only 4 items of serial numbers 5, 6, 7 and 8 that have grand mean scores that are greater than the criterion mean of 2.50 indicating the only digital technology which are available for the development of research skills among postgraduate students in Ebonyi State University and perhaps, other public universities in Nigeria.

Table 2: Mean Responses of Lecturers and Postgraduate Students on Factors that Militate Against Utilization Digital Technologies for Promoting Research Skills among Postgraduate Students in EBSU.

S/N	Ways of Ameliorating Challenges	$\overline{X}_1$	SD_1	$\overline{X}_2$	SD_2	$\overline{X}_g$	SD_g	RMks
1	Inadequate hardware and software	3.10	0.52	3.11	0.51	3.11	0.52	A
2	Paucity of finance to procure the	3.09	0.41	3.01	0.76	3.05	0.59	A

	needed ICT resources							
3	Lack of expertise and human resources to maintain the technologies effectively	3.02	0.60	3.11	0.65	3.07	0.63	A
4	Epileptic nature of power supply	3.30	0.65	3.04	0.72	3.17	.69	A
5	Inadequate number of computers to access digital information	3.41	0.48	3.21	0.64	3.31	0.56	A
6	Lack of proper maintenance culture	3.13	0.54	3.13	0.57	3.13	0.56	A
7	Lack of skills to access digital information resources among students	3.19	0.43	3.21	0.54	3.20	0.49	A
8	Poor attitude of some lecturers towards embracing Internet use and digital tools	3.21	0.54	3.01	0.61	3.11	0.58	A
9	Frequent breakdown and vandalization of facilities in the university.	3.31	0.49	3.04	0.53	3.18	0.51	A
	Grand Mean/Std Dev	**3.20**	**0.52**	**3.10**	**0.61**	**3.15**	**0.57**	**A**

$\overline{X}_1$ = Mean of lecturers; SD_1= standard derivation of lecturers; $\overline{X}_2$ = Mean of students; SD_1= standard derivation of students; $\overline{X}_g$ = Grand mean of lecturers and students; SDg =Grand standard derivation of lecturer and students..

Table 2 shows that the mean ($\overline{X}$) for all the nine items therein for both lecturers and postgraduate students are all greater than the criterion mean of 2.50 ($\overline{X}$≥2.50). The grand mean ($\overline{X}_{gn}$) of 3.15 is also greater than the criterion mean of 2.50 indicating that all the items therein constitute factors that militate against the utilization of Digital Technologies for promoting research skills among postgraduate students in Ebonyi State University.

Table 3: Mean Responses of Lecturers and Postgraduate Students on Ways of Ameliorating Challenges of Utilizing Digital Technologies for Promoting Research Skills among Postgraduate Students in EBSU.

S/N	Challenges	$\overline{X}_1$	SD_1	$\overline{X}_2$	SD_2	$\overline{X}_g$	SD_g	Rmks
1	Training lectures and resource person in up- to-date 21st century skills of ICTs usage.	3.01	0.67	3.11	0.49	3.06	.0.58	A
2	Voting a reasonable amount of fund to education during the appropriation of annual budget by governments at all levels.	3.03	0.61	3.01	0.63	3.02	0.62	A
3	Ensuring infrastructural overhaul to guide against epileptic nature of power supply.	3.02	0.63	3.11	0.65	3.07	0.64	A
4	Promoting internet connectivity and requisite subscription to address the challenges of inadequate or slow band	2.80	0.59	3.04	0.58	2.92	0.59	A
5	Provision of adequate computers to	3.11	0.49	3.21	0.51			

	increase access to digital information					3.16	0.50	A
6	Providing functional security network to safeguard university facilities from vandals	2.97	0.51	3.13	0.47	3.05	0.49	A
7	Motivating lecturers through enhanced pay packages to minimize brain drain and attrition rate.	3.58	0.52	3.21	0.54	3.40	0.53	A
8	Ensuring easy access of students to research grants	3.35	0.50	3.01	0.65	3.18	0.58	A
9	Promoting environmental friendliness for critical thinking in the university.	3.43	0.69	3.04	0.48	3.24	0.59	A
	Grand Mean/Std Dev	**3.14**	**0.58**	**3.10**	**0.56**	**3.12**	**0.57**	**A**

$\overline{X}_1$ = Mean of lecturers; SD_1= standard derivation of lecturers; $\overline{X}_2$ = Mean of students; SD_1= standard derivation of students; $\overline{X}_g$ = Grand mean of lecturers and students; SDg =Grand standard derivation of lecturer and students.

Table 3 shows that the mean ($\overline{X}$) for all the nine items therein for both lecturers and postgraduate students are all greater than the criterion mean of 2.50. The grand mean ($\overline{X}_{gn}$) of 3.12 is also greater than the criterion mean of 2.50 indicating that all the items therein constitute ways of ameliorating the challenges of utilizing digital technologies to promote research skills among postgraduate students in Ebonyi State University.

Discussion of Finding

The result of data analysis as presented on Table 1 of this study revealed that the necessary digital technology (DT) for the development of research skills among postgraduate students included but not limited to: projectors, laptops, computer application software, modem for internet connectivity, desktop computers, printing machines, photocopying machines, scanners, Google classroom, haiku deck and Google drive etc. Unfortunately, the result showed also that most of the necessary digital tools as highlighted therein are not usually available for the development of research skills among postgraduate students in Ebonyi State University and perhaps, other public universities in Nigeria. The findings showed specifically that Google Classroom is not available to provide self-directed spaces, such as blogs and forums that satisfy researchers' curiosity for problem solving; while Google Drive is also mostly not available to allow lecturers and students to use Google Docs, Google Forms and other Google services to create, store, share and retrieve useful information for quality research.

This finding is in line with Villani, et al, (2017) who argued that digital technologies that are highly required in tertiary institution for research development and innovation are mostly insufficient and in some cases not even available at all in most public institutions. These scholars stated that digital technologies posses huge potential to transform teaching and learning practices in schools and open up new horizons that can facilitate:

innovative pedagogic models, improve higher-order thinking skills, conceptual understanding and enhance students' creativity, imagination and problem-solving skills for quality research. The findings also corroborated with the view of Biagi & Lio (2013) who maintained that digital technologies provide opportunities for simulations such as remote or virtual online laboratories which provide relatively low-cost, flexible access to experiential learning and build research skills on the learners.

It was seen on Table 2 that the mean ($\overline{X}$) for all the 9 items therein for both lecturers and postgraduate students are all greater than the criterion mean of 2.50. The grand mean ($\overline{X}_{gn}$) of 3.15 is also greater than the criterion mean of 2.50 indicating that inadequate hardware and software, paucity of finance to procure the needed ICT resources, lack of expertise and human resources to maintain the technologies effectively, epileptic nature of power supply and poor attitude of some lecturers towards embracing Internet use and digital tools among others are the factors that militate against the utilization of Digital Technologies for promoting research skills among postgraduate students in Ebonyi State University and perhaps, other public universities in Nigeria.

These findings are in line with Haleem, et al, (2022) who stated that some students, even at postgraduate level are still having some difficulties in absorbing digital tools as a result of many factors relating to lack of funds facilities and motivation. Some students according to them come from low-income families and do not have money to procure any of the digital tools to enhance their adaptability to the new order. Millions of young- stars simply do not have access to the internet at home and in some cases in school too (Agwu, 2021). Teachers are also having difficulty since some are utterly inexperienced with digital technologies. Nonetheless, it was noted that inculcation of digital skills for innovative research would be efforts in futility without proper information and communication technology equipment, internet/mobile network connectivity, instructional resources, and teacher motivation/training and students' awareness drive.

Result of data analysis on Table 3 showed that the mean ($\overline{X}$) for all the 9 items therein for both lecturers and postgraduate students are all greater than the criterion mean of 2.50. The grand mean ($\overline{X}_{gn}$) of 3.12 was also greater than the criterion mean of 2.50 indicating that all the items therein constitute ways of ameliorating the challenges of utilizing digital technologies to promote research skills among postgraduate students in Ebonyi State University and perhaps, other public universities in Nigeria. The findings specifically showed among others that the challenges of utilizing DT can be ameliorated by training lectures and resource person in up- to-date 21st century skills of ICTs usage, voting a reasonable amount of fund to education during the appropriation of annual budget by governments at all levels, ensuring infrastructural overhaul to guide

against epileptic nature of power supply, promoting internet connectivity and requisite subscription to address the challenges of inadequate or slow band etc

These findings are in line with Villani, et al, (2017) who argued that the application of digital technology in the university can be facilitated through the provision of adequate computers, upgrading infrastructural facilities, internet connectivity, security and by promoting environmental friendliness for critical thinking in the university. Therefore, it could be noted that students will become more interested in research if the application of digital tools are promoted in the universities. This is because youngsters of nowadays are pretty accustomed to the usage of electronic gadgets; incorporating them into schooling would undoubtedly assist in piquing their interest and enhancing their involvement levels (Cheok & Wong., 2016). Promoting the application of digital technology into education will provide students at all levels with an engaging learning experience, allowing them to remain more interested and participatory. The utilization of projectors, computers, and other cutting-edge technical gear in the classroom may make studying fascinating and entertaining for students. Thus, student learning can become more dynamic and engaging; resulting to creative thing, curiosity and other innovative research skills.

Conclusion

University in Nigeria is faced with lots of challenges which continually threaten university effectiveness in keeping pace with the technological advancement and innovation in the society. It has been identified that the possession of a university degrees is not just enough for the holder to contribute positively to the development of the society in which he/she is a member. University education should be properly repositioned to equip graduates with the requisite innovative competences and entrepreneurial skills that would enable individuals to find their fittings in the continually dynamic and technology-driven society that is characterized by unemployment. Promoting the application of digital technology in the university, especially at postgraduate level will go a long way to facilitate creative thing, curiosity and other innovative research skills among postgraduate students.

Digital technology as highlighted in this study promotes computer-based creative thinking and enhances divergent thinking abilities of postgraduate students for job creation and enhances creativity-stimulating conditions which create opportunities to examine problems from new perspectives. It was pointed out also that digital technologies enhances creative tourism of students and increases their understanding of innovative trends of the jet age.

Recommendations

1. Government should improve funding to university to guarantee the provision of necessary facilities including digital technology.

2. University management should show more commitment in the application of digital technologies by providing functional digital resources for postgraduate students.
3. Technological capabilities of lecturers should be enhanced through appropriate training, workshops and seminars.

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Comparative Analysis of Antioxidant Vitamins, Minerals and Bioactive Compounds of Black Pepper (*Piper guineense)* Seed, Turmeric (*Curcuma longa)* and Ginger (*Zingiber officinale)*Rhizomes Spices

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Abstract

The study compared antioxidant vitamins, minerals and bioactive compounds of three selected local spices (turmeric, African black pepper and ginger) consumed in Nigeria. Specifically, the study analysed the antioxidant vitamin (pro vitamin A, C, E), mineral (iron, copper, sodium potassium, manganese, zinc, magnesium) and phytochemical (steroid, tannin, glycoside) compositions. The samples were prepared for chemical analysis using reference standard methods. Data were analysed using mean and standard deviation. Analysis of variance was also used to test for differences. Results on antioxidant vitamins showed that pro vitamin A content of turmeric was significantly higher (322.24 µg /100g) compared to ginger (177.16µg/100g) and black pepper (75.43µg/10g). Vitamin C content of ginger was significantly higher (27.73mg/100g) compared to black pepper (20.69mg/100g) and turmeric (20.62mg/100g). Magnesium content of black pepper was significantly higher (303.61mg/100g) than that of turmeric (241.0 mg/100g) and ginger (194.73 mg/100g). Calcium concentration of black pepper was significantly higher (357.67 mg/100g) compared to turmeric (167.67mg/100g) and ginger (162.00mg/100g). The iron content of the ginger was significantly higher (0.51mg/100g) compared to black pepper (0.34mg/100g) and turmeric (0.29mg/100g). Phytochemical analysis showed that steroid concentration in black pepper was significantly higher (1.80mg/100g) compared to turmeric (0.99mg/100g) and ginger (0.35mg/100g). The value of tannin in black pepper was significantly higher (6.27mg/100g) compared to turmeric (4.67mg/100g) and ginger (3.50mg/100g).

Keywords: Antioxidant, Vitamins, Minerals, Phytochemicals, Ginger, Black pepper, Turmeric

Introduction

Spices refer to the dried part of a plant that contains volatile oils or aromatic flavours. They are food adjuncts commonly added to foods to improve their sensory properties. They can come in various forms; whole, ground, or as extract depending on the

processing method. They are used in small quantities to flavor dishes and tend to add few calories to food. Spices contribute a wide range of nutrients and bioactive components to foods (De La Torre et al., 2015). These major constituents of food have some nutritional, antioxidant and therapeutic potentials. Each has a special purpose and thus meets a specific need in the body.

Antioxidants vitamins, minerals and phytochemicals are vital substances needed by the body to perform daily functions properly. These essential substances in spices are crucial in boosting the immune system and assist in the metabolic processes of the body. Numerous epidemiological, preclinical, and clinical studies have shown that spices and herbs are excellent sources of antioxidants with their high content of phenolic compounds which are therapeutically useful in the management of diseases (Okoye & Ebeledike, 2013; De La Torre et al., 2015).

Antioxidant vitamins are organic substances needed in small amounts by humans which can help protect cells from oxidative damage. These molecules can scavenge free radicals, thus would keep the balance between oxidation and anti-oxidation (Zhou et al., 2016). Dietary antioxidants such as carotenoids, vitamins A, C and E play important roles in the body's antioxidant defense, disease management, prevent or slow damage to cells caused by free radicals and are widely used to ameliorate excessive oxidative stress (Jomova & Valko, 2013; Jiang & Xiong, 2016). Research has shown that carotenoids, vitamins A, C and E can be effective antioxidants for inhibiting the development of certain diseases (Nimse & Pal, 2015).

Spices contain minerals which are inorganic substances needed in small amounts by humans for normal growth and development (De La Torre et al., 2015). Mineral elements contained in medicinal plants are very important in human nutrition in alleviating micronutrient deficiencies (Gropper, Smith & Carr, 2018). There are two kinds of minerals: macro minerals and trace minerals. Macro minerals are required in larger amount. They include calcium, phosphorus, magnesium, sodium, potassium, chloride and sulfur. Trace minerals are required in small amounts. They include iron, manganese, copper, iodine, zinc, cobalt, fluoride and selenium. The presence of mineral elements in diet is vital for the human's metabolic processes (Gropper, Smith & Carr, 2018).

Medicinal spices contain some bioactive compounds which are chemicals produced by the plants. These bioactive components are known as phytochemicals. Phytochemicals can be seen in various parts of the plants such as the rhizome, bark, leaves, stems, fruits and seed. Phytochemicals are non-nutritive plant chemicals that have protective or disease preventive properties (Andrade-Cetto et al., 2017). They can provide a range of biological activities such as anti-inflammatory, anti-mutagenic, antimicrobial, anti-aging, anti-atherosclerosis and anti-cancerous (Zhang, 2015). Phytochemical in spices such as

glycoside, steroid and tannin via their antioxidant properties play key roles in disease prevention by suppressing oxidative stress-induced DNA damage (Andrade-Cetto et al., 2017).

Nutrition therapy is a key in preventing diseases, managing existing diseases, controlling or reducing the rate of development of various diseases and complications. Unhealthy foods can increase the risk of developing many nutrition related chronic diseases such as diabetes mellitus, cancer, stroke and other cardiovascular diseases (Andrade-Cetto et al., 2017). Poor nutrition may have significant number of dangerous effects on health. Poor diet and sedentary lifestyle contribute to oxidative stress and excess free radical production (Nimse & Pal, 2015). Oxidative stress can play a crucial role in both diseases progression and other diet-related diseases.

Turmeric is a flowering plant of the ginger family known as *Zingiberaceae*. The rhizomes or underground stems have been used from antiquity as a spice, condiment, a textile dye, medicine and stimulant. Turmeric is a plant native to tropical South Asia. African black pepper is a flowering plant in the piper family known as *Piperaceae*. It is normally grown in tropical regions of central Western Africa. It is cultivated for its fruits, which is usually dried and used as a spice and seasoning. Ginger is an underground rhizome belonging to the family *Zingiberaceae.* It is one of the most widely consumed spices worldwide. Ginger is a plant native to China, South East Asia, West Africa and the Caribbean. Studies have reported that these functional spices are rich in biological properties such as anti-hyperglycemic, anti-inflammatory, antiviral, antibacterial, cleaning, anti-cancer, antioxidant, antiseptic, radioprotective, and cardioprotective properties of ginger, turmeric and black pepper in vitro and in vivo (Panahi et al., 2012; Okoye & Ebeledike, 2013; Zhu, Chen & Song, 2018). They are considered to have beneficial effects in the body beyond basic nutritional requirements (Lobo et al., 2010).

Turmeric is a polyphenolic compound with diverse pharmacologic effects including anti-inflammatory, antioxidant, antiproliferative, hypoglycemic properties and antiangiogenic, activities (Panahi et al., 2015). Ginger is an important herb which exhibits many medicinal and nutritional values (Zhu et al., 2018). *Piper. guineense* seed has antioxidant, anti-inflammatory, anti-flatulent, anti-bacterial, anti-virus, astringent, carminative and bioavaliability properties (Okoye & Ebeledike, 2013).

Plant sources contain various nutrients with antioxidant benefits which are considered to be safer than synthetic antioxidants in commercial food additives or oral orthodox drugs. These synthetic antioxidants may contain high amounts of preservatives, deficient in nutrients and may be toxic to health. They may have a number of serious adverse effects on health and can cause metabolic alterations and other degenerative conditions. Nasri and Shirzad (2013) reported that synthetic antioxidants have side effects

and can be toxic to human. The search for medicinal spices rich in nutrients with antioxidant benefits has continued to be an important area of research and of public interest in Nigeria.

Epidemiological studies have reported that many herbs and spices are clinically effective and relatively less toxic than the synthetic drugs in the treatment and management of chronic health problems (Nasri & Shirzad, 2013; Kaur & Arora, 2015). Clinical studies on these spices are limited. Therefore, identifying plant sources with various nutrients and antioxidant benefits can be a very good alternative to preventing, treating and managing health problems. Several Studies supported the view that *Curcuma longa, Piper guineense and Zingiber officinale* are rich in antioxidant vitamins, minerals and phytochemicals and can be used to manage and prevent diseases (Morvaridzadeh et al., 2020; Verma et al., 2018; Hong et al., 2020). Based on these, these spices were evaluated in order to establish enough evidence for the above claims.

Objectives of the study

The general objective of the study was to analyse the antioxidant vitamin, mineral and bioactive compounds of turmeric rhizome, African black pepper seed, and ginger rhizome (flour) spices. Specifically, the study determined:

1. antioxidant vitamin composition (pro- vitamin A, vitamin C and E) of the samples.
2. mineral contents (iron, calcium, magnesium, potassium, copper phosphorus, sodium, manganese, zinc) of the samples.
3. phytochemical constituents (steroid, tannin, glycoside) of the samples.

Materials and Methods

***Design of the Study*:** The study adopted pure experimental research design.

***Procurement of Materials*:** *Curcuma longa* rhizome (tumeric), *Piper guineense* seed (African black pepper) and *Zingiber officnale* rhizome (ginger) were used for the study. They were procured from Ogige local market Nsukka, Enugu State, Nigeria. They were identified in the Department of Plant Science and Biotechnology, University of Nigeria, Nsukka.

***Procedure for preparation of samples for chemical analysis*:** Three kilogrammes each of the samples: *Curcuma longa* rhizome (turmeric), *Zingiber officanale* rhizomes (ginger) and *Piper guineense* seed were sorted to remove debris and defects. The rhizomes and seeds were carefully washed with distilled water to remove dirt and sand, then allowed to drain in a plastic sieve. The rhizomes were peeled and cut into small sizes. They were dried in an oven at a temperature of 40 °C for 48 hours. The seeds were oven- dried at 40°C for 4 hours The dried rhizomes were polished to remove rough surface by handpicking. Ginger, turmeric and black pepper were ground into flour using a high speed electric blender (Soyona Japan). They were labeled, packaged and stored in a plastic air tight container under refrigeration for analysis.

***Chemical Analysis*: S**ome vitamins, minerals and antinutrient compositions of these samples were determined. All the analyses of the sample were done in triplicates using standard methods.

Antioxidant vitamin content determination of the samples

Pro vitamin A (Beta-carotene): Pro-vitamin A content was determined using the spectrophotometric method as described by Onwuka (2005). 0ne gram of the sample was weighed out followed by addition of 3ml of absolute ethanol. A precipitate of protein was formed, and the extract of vitamin with 5mL of heptanes layer taken to corvette and read at 450nm against a blank of heptanes in a spectrophotometer.

Vitamin C (Ascorbic acid): Vitamin C was determined by the method described by Association of Official Analytical Chemist, AOAC (2010). Two grammes of each sample was weighed into 250ml flat bottom flask and dissolved with 2 ml of distilled water. Trichloroacetic acid (TCA) was added and colour will be developed with 2, 6—dichloroindophenol. The colour (pink) developed was read.

Vitamin of E (tocopherol): Vitamin E was determined by the method of AOAC (2010). Two grams to the sample was weighed into a flat bottom flask. Ten milliliter of absolute alcohol and 20ml of tetraoxosulphate IV acid (H2SO4) was added. A clear solution was formed .Ten milliliter of the solution was pipetted into a test tube and heated in a water bath at 90 degree centrigrade for 30minutes. This was allowed to cool and absorbance was read in a spectrophotometer at 470nm wavelength.

Mineral Content Determination

Iron (Fe), Magnesium (Mg), Potassium (k) Copper (Cu) and Zinc content : The content of the samples were determined using the using the atomic absorption spectrophotometer method as described by AOAC (2010). Two grammes of the samples were ignited in muffle furnace at 55°C for 6 to 8 hours. The ash of the samples were dissolved with hydrochloric acid. The solution was shaked vigorously for 40 minutes. The different wavelengths at absorbance was measured. The absorbance reading for iron was read at 510nm wavelength when the colour of the solution turned pink. The absorbance reading for magnesium and potassium were taken at 560nm wavelength. The absorbance for copper was read at 520nm wavelength while that of zinc was taken at 530nm.

Quantitative Determination of phytochemicals

Total steroid content: This was determined by spectrophotometer method as described by Mahdu et al. (2016). Five grammes of the sample was transferred into 10 ml volumetric flasks. In addition, H2SO4 acid (2ml) and iron (III) chloride (0.5% w/v, 2 ml) were added, followed by potassium hexacyanoferrate (III) solution (0.5% w/v, 0.5 ml). The mixture was heated over water-bath at 70 ± 2o°C for 30 minutes with occasional shaking. The volume was made up to the mark with distilled water. The absorbance was

measured at 780 nm against the reagent blank.

Total tannin content: The Folin- Denis method as described by AOAC (2010) was used for the determination tannin content. Five grammes of the sample was extracted with 300ml diethyl ether for 20 hours at room temperature. The residue was boiled for 2 hours with 100ml distilled water, cooled and filtered and the extract was adjusted to a volume of 100ml in a volumetric flask. Then, calorimetrically using Folin-Denis reagent, the tannins content was determined by measuring the absorbance of the solution at wavelength of 760nm.

Total glycoside content: This was determined by spectrophotometric methods as described by Solich et al. (1992). Ten percent (10%) ethanol extract was mixed with 10 mL newly prepared Baljet's solution (95 mL of 1% picric acid + 5 mL of 10% NaOH). After an hour, the liquid was diluted with 20 millliter distilled water, and the absorbance was measured with a spectrophotometer at 495nm.

***Data analysis Techniques*:** The data was analyzed using mean and standard deviation. Results of three replicates were used. Analysis of variance (ANOVA) was used to determine statistically significant differences between the means. A probability value of < 0.05 was considered statistically significant.

RESULTS

Table 1: Antioxidant Vitamin composition of the samples (mg/100g)

Sample Pro	Vit A (µg/100 g)	Vit. C	Vit. E
Black Pepper	75.43^{a}±0.39	20.69^{a}±0.10	7.08^{a}±0.05
Turmeric	322.24^{c}±2.77	20.62^{a}±0.03	7.93^{b}±0.05
Ginger	177.16^{b}±0.44	27.73^{b}±0.44	7.49^{a}±0.41

n=3, values are represented as mean ± standard deviation means with the different superscript are statistically different ($p< 0.05$)

Table 1 shows the antioxidant vitamin composition of the samples. pro vitamin A content of turmeric was significantly higher (322.24 µg /100g) compared to ginger (177.16µg/100g) and black pepper (75.43µg /100g) Vitamin C content of ginger was significantly higher (27.73mg/100g) compared to black pepper(20.69mg/100g) and turmeric (20.62mg/100g. Vitamin E content of turmeric was significantly higher (7.93 mg/100g) compared to black pepper (7.08mg/100g) and ginger (7.49 mg/100g).

Table 2: Mineral composition of the Sample (mg/100g)

Minerals	Black Pepper	Turmeric	Ginger
Zinc	0.97^{b}±0.02	0.92^{a}±0.01	1.02^{c}±0.04
Magnesium	303.61^{c}±1.44	241.00^{b}±1.00	194.73^{a}±3.90
Calcium	357.67^{b}±3.21	167.67^{a}±1.53	162.00^{a}±3.46
Iron	0.34^{a}±0.00	0.29^{a}±0.04	0.51^{b}±0.04
Copper	46.47^{c}±1.74	12.20^{b}±0.13	3.43^{a}±0.09
Potassium	747.33^{c}±2.52	676.67^{a}±3.06	714.67^{b}±4.73
Manganese	25.84^{b}±0.29	23.03^{a}±0.05	23.71^{a}±0.54
Sodium	15.97^{b}±0.48	16.87^{c}±0.38	13.54^{a}±0.57
Phosphorus	125.34^{a}±1.16	214.00^{c}±4.00	198.33^{c}±1.53

n=3, values are represented as mean ± standard deviation means with the different superscript are statistically different ($p< 0.05$)

Table 2 shows the mineral composition of the samples. Magnesium content of black pepper (303.61 mg/100g) was significantly higher than that of turmeric (241.0 mg/100g) and ginger (194.73 mg/100g). Calcium content of black pepper was significantly higher (357.67 mg/100g) compared to turmeric (167.67 mg/100g) and ginger (162.0 mg/100g). The value of zinc in ginger was significantly higher (1.02 mg/100g) compared to black pepper (0.97mg/100g) and turmeric (0.92 mg/100g). The concentration of iron in black pepper was significantly higher (0.34mg/100g) compared to turmeric (0.29mg/100g) and ginger (0.51 mg/100g). Copper content of black pepper was significantly higher (46.47 mg/100g) than that of turmeric (12.20mg/100g) and ginger (3.43 mg/100g). Potassium content of the samples ranged from 676.67 to 747.33 mg/100g. The value of potassium in black pepper was significantly higher (747.33mg/100g) compared to ginger (714.67mg/100g) and turmeric (676.67mg/100g). The concentration of manganese in black pepper was significantly higher (25.84mg/100g) compared to ginger (23.71mg/100g) and turmeric (23.03mg/100g). Sodium was highest in turmeric (16.87 mg/100g) while black pepper and ginger contained 15.69mg/100g and 13.54mg/100g respectively. Phosphorus content of turmeric was significantly higher (214 mg/100g) than that of black pepper (125.34mg/100g) and ginger (198.33mg/100g).

Table 3: Phytochemical composition of the samples (mg/100g)

Sample	Steroid	Tannin	Glycoside
Black Pepper	1.80^{b} ±0.15	6.27^{b}±2.19	1.28^{a}±0.35
Turmeric	0.99^{ab} ±0.61	4.67^{ab}±0.27	6.93^{b}±0.05
Ginger	0.35^{a} ±0.25	3.50^{a}±0.30	1.39^{a}±0.41

n=3, values are represented as mean ± standard deviation means with the different superscript are statistically different ($p< 0.05$)

Table 3 shows the phytochemical composition of the samples. The steroid contents of the samples ranged between 0.35 to 1.80mg/100g. The concentration of steroid in black pepper was significantly higher (1.80mg/100g) compared to turmeric (0.99mg/100g) and ginger (0.35mg/100g). Tannin content of black pepper was significantly higher (6.27mg/100g) compared to turmeric (4.67mg/100g) and ginger (3.50mg.100g). Glycoside content of the samples ranged between 1.28 to 6.93mg/100g. Glycoside content of turmeric was significantly higher (6.93mg/100g) than that found in ginger (1.39mg/100g) and black pepper (1.28 mg/100g).

Discussion of findings

The findings of study on Table 1 showed the antioxidant vitamin composition of the spices. The pro vitamin A content of the spices were higher (75.43µg/100g to 322.24 µg/100 g) when compared with works by Okonkwo and Ogu (2014) with value range (7.08 to 14.83µg/100 g) where Pro vitamin A in black pepper was 7.08 µg/100g and ginger (14.83 µg/100g). The variation could be attributed to differences in climatic conditions. Studies have shown that agro- climatic locations along with temperature and rainfall have significant effects on the plant constituents **(**Nsuala, Kamatou, Sandasi, Enslin & Viljoen, 2017). Pro vitamin A in the diet are effective antioxidants for promoting immune system health, good vision and epithelial cell differentiation and can inhibit the development of certain diseases (Jomova & Valko, 2013; Roleira et al., 2015).

Antioxidant Vitamin C in the spices ranged from 20.62mg/100g to 27.73mg/100g. Vitamin C contents of these spices were lower in concentration when compared with work by Okonkwo and Ogu (2014) which reported higher vitamin C content value (292.62 to378.62mg/100g) where black pepper had 292.62mg/100g and ginger (378.62mg/100g). The discrepancy could be attributed to genetic variation, agronomic practices which may influence the environmental conditions and nutrients in the soil (Yesenia et al., 2021). Numerous studies have shown that spices are rich sources of antioxidants vitamin C which can scavenge free radicals from the body cells and prevent or reduce the damage caused by oxidation, promotes growth and repair of tissues, essential for the synthesis of collagen and carnitine (De La Torre et al., 2015; Olusoji, Adelowo & Taiwo, 2023; Ines et al., 2023).

Vitamin E in these spices showed that they are powerful antioxidant vitamins that can help the body to fight toxins, germs and boost the immune system as well as fulfill several roles in maintaining cellular homeostasis, scavenge free radicals, chelate metal ions and function as chain breakers in the lipid peroxidation cycle (Lobo et al., 2010; Ines et al., 2023).

The result of study on table 2 revealed the mineral composition of the spices. Potassium, calcium, magnesium and phosphorus concentration were found in appreciable quantities in all the

samples. Potassium is an essential nutrient and has an important role in the synthesis of amino acids and can help in the secretion of insulin in the pancreas (Gropper et al., 2018).

Calcium is reported to be essential for blood clotting, strong bones, teeth formation and as a co-factor in some enzyme catalysis and healthy communication between the brain and other parts of the body (Gropper et al., 2018). Phosphorus content of the extract samples ranged from 29.40mg/100g to 18.52mg/100g. Phosphorus has been reported to be good for bones and teeth formation. It contributes to energy production by participating in the breakdown of carbohydrates, protein and fats. It is needed for growth, maintenance, repair of tissues and cells, production of genetic materials and maintenance of acid-base balance (Miller & Welch, 2013). In humans, magnesium is involved in the formation of bones and teeth, serves as catalyst in energy producing reactions within the cells (Gropper et al., 2018). Magnesium plays crucial role in lipid membrane stabilization, replication and metabolic processes (Gropper et al., 2018).

The samples contain considerable amount of zinc, iron, copper, sodium and manganese. Iron is an essential trace element that is required in small amounts by the body. It helps the red blood cells transport oxygen to all parts of the body and is used by cells and tissues throughout the body for essential metabolic activities (Miller & Welch, 2013). Zinc plays a role in cell division, in numerous chemical reactions within the body, cell growth, vital in protein synthesis, cellular differentiation and replication, immunity and sexual functions, wound healing, and the breakdown of carbohydrates (Miller & Welch, 2013).

Manganese in these spices are essential for the metabolization of cholesterol, carbohydrates, and protein. Manganese is also necessary for normal brain and nerve function (Gropper et al., 2018). Copper plays a role in production of red blood cells, maintaining nerve cells and the immune system. It plays an important role in oxidation-reduction reactions and in scavenging free radicals. Sodium regulates the acid/alkali balance along with other minerals such as potassium, calcium and magnesium. Deficiency of sodium in the diet could lead to improper fluid balance throughout the abody (Miller & Welch, 2013).

The findings on phytochemical composition of the spices showed that steroid ranged between 0.35 to 1.80mg/100g. The steroid content of the spices were slightly similar when compared with works by Akem et al. (2016) with steroid value range (0.26 to 1.63mg/100g) were ginger recorded 0.60mg/100g and pepper (1.63mg/100g). Steroid in the diet is necessary for many physiological functions including growth, development, brain function, energy metabolism, homeostasis, reproduction, lowering cholesterol levels (Rudolph, Cornil & Mittelman-Smith, 2016; Morand & Tomás Barberán, 2019).

The tannin content of the spices ranged between 3.50 to 6.27mg/100g. Tannin content of the spices were

higher in concentration when compared with works by Nwinuka, Ibeh and Ekeke (2005) which reported lower and same tannin values in all the samples (0.01mg/100g) where black pepper had 0.01mg/100g and ginger (0.01mg/100g). The variation could be attributed to differences in climatic conditions **(**Nsuala, Kamatou, Sandasi, Enslin & Viljoen, 2017). Studies have reported numerous biological activities of tannin which include anti-cancerous, anti-allergic, anti-inflammatory, anti-helminthic and anti-microbial, cardioprotective, antitumor, antibacterial, antiviral and immune-modulatory effects (Kartik et al., 2019; Rashid et al., 2019).

The spices contained glycosides which can play some essential roles in the diet such as analgesic, anti-arrhythmic, regulation of glucose metabolism, cardioprotective, purgative effect **(**De La Torre et al., 2015; Williams, 2021).

Conclusion

The study provided some information on the antioxidant vitamin, mineral and phytochemical composition of the *Curcuma longa, Zingiber officinale* and *Piper guineense* spices. These spices contain appreciable quantities of micronutrients and bioactive compounds which are needed by human in fighting nutrition related diseases. The findings indicated that these local spices are promising sources of natural antioxidants and micronutrients. It strongly suggest that these spices should be used in preventing and managing nutrition related diseases.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. further research on the safe levels of the phytochemicals in the spices should be carried out.
2. further human studies should be carried out on the spices in order to explore therapeutic benefits of these phytochemicals in treatment and prevention of diseases.
3. patients suffering from degenerative diseases should be encouraged to use these local medicinal spices to prevent and manage their condition since they posses antioxidant nutrients and phytochemicals with therapeutic potentials.
4. incorporation of these local spices into recipes such as cake, drinks, biscuits and in food preparations will help to enrich these products and help prevent nutrient deficiencies.

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Strategies for Promoting Entrepreneurship Opportunities for Youths in Pig Farming in Arochukwu and Ohafia Local Government Areas, Abia State, Nigeria

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Abstract

The study evolved strategies for promoting entrepreneurship opportunities for youths in pig farming in Arochukwu and Ohafia Local Government Areas (LGAs), Abia State, Nigeria. Specifically, the study determined strategies which the following groups could adopt to equip youths for involvement in commercial pig farming in Abia state: youths themselves, groups in the community and governments. Three hypotheses (HOs) were tested. The study adopted descriptive survey research design. The population was made up of all commercial pig farmers and Agricultural Extension officers in the two LGAs. Questionnaire was used for data collection. Data were analyzed using mean and standard deviation. Findings include 13 youth related strategies youths could adopt to equip themselves for participation in commercial pig farming. These include among others; intending youth farmer should be able to locate reputable commercial pig farm to train ($\overline{X}$ = 3.26), complete the training on pig farming at the agreed time ($\overline{X}$ = 3.77). 12 community related strategies for equipping youths for involvement in commercial pig farming including, commercial pig farmers provide high quality breeds of piglets for youths to stock their farm ($\overline{X}$ = 3.56), farmers help youths to register their pig farms with regulatory agencies ($\overline{X}$ = 3.42) and others. Other findings are 15 government related strategies for equipping youths for involvement in commercial pig farming. These include among others, provide cash or subsides to youths interested in pig farm ($\overline{X}$ = 3.79), build market for youths to sell their pigs and pig products ($\overline{X}$ = 3.83), might sanction banks for failure to give leans at low interest rate. Findings on HOs show that there were no significant differences in the mean ratings of commercial pig farmers and Agricultural Extension officers on strategies for promoting entrepreneurship opportunities for youths in Arochukwu and Ohafia LGAs.

Keywords: Strategy, Youth, Entrepreneurship, Opportunities, Communities, Pig, Farming.

Introduction

A major issue of great importance at present in Nigeria is unemployment. This issue could threaten the wellbeing of members of the family especially youths, if it is not addressed (Ezema, 2017). Youths are young members of the society. The United Nations (UN) defined youth as those persons between the ages 15 and 24 without prejudice to other definitions by member states **(**UN, 1981**).** The definition serves for statistical purposes for assessing the needs of the young people and providing guidelines for youth development. The Federal Republic of Nigeria (FGN) supports this age bracket as it is used for statistical purposes too. Some of the youths are graduates of various academic institutions and skills acquisition centres, but unemployed or underemployed after years of graduation. In the context of this study, youths are considered as young people who are not employed or appropriately employed due to lack of relevant employment skill, among other constraints. Onuka and Isiwu (2017), also noticed that the course content of most academic institutions in Nigeria do not posses much entrepreneurial content; a situation that has made it difficult for their products to have employment. The unemployed youths still depend on their parents and friends for their economic needs. In the views of Onuka (2017), sometimes the society perceives them as never do well and look down on them; a situation that has made some of them to do odd jobs with meager salaries as low as N15, 000 which could hardly meet their economic needs. The situation has made some of the youths to adopt criminal approaches to obtain their economic needs (Mkpa, 2015). This partly informed the rising incidence of arm-robbery, kidnapping, and other social vices involving the youths. Government is indeed worried about the plight of these youths.

Government has done a lot to address the problem of youth unemployment. For instance, most Federal and State tertiary institutions have Entrepreneurial Development Units for the purpose of equipping students with entrepreneurial skills (Michael Okpara University of Agriculture, Umudike, 2023). Federal Government introduced the teaching of Animal Husbandry in Senior Secondary School subject. It was meant to prepare students to acquire entrepreneurial skill in Animal husbandry for entry into livestock enterprise later in life (Federal Republic of Nigeria, FGN, 2014). Government is promoting small-scale enterprises and giving grants to interesting youths (Mkpa, 2015). These are some of the government efforts to change the mind set of youths from that of looking for employment to that of creating employment. But, the implementations of these novel ideas have not been satisfactory, hence the need for entrepreneurship.

As a way out to youth's unemployment, many experts have recommended entrepreneurship. Entrepreneurship is the investment of

one's resources in a project in order to generate income (Okafor, et al, 2021). Onuka (2017), entrepreneurship is the process through which people create and develop enterprises. In the context of this study, entrepreneurship has to do with making a living by creating employment for oneself, instead of looking for employment else way. Anyone who is able to create an employment for self; without minding the risk involved is an entrepreneur. Entrepreneurs are known to be: innovative, have capacity to create wealth, have capacity for hard work and capable of translating ideas to reality (Ekumankama, et al, 2017.). There a number of entrepreneurship opportunities in the area of study. Among these are crop farming, hunting, food vending, poultry farming, goat farming, transport business, pig farming among others. However, the concern of this study is pig farming, because youth's investment in commercial pig farming stands in good stead in reducing unemployment among them. (Miller, 2020; Lawal, et al, 2021).

Pig, according to Dietze (2011), is a fat farm animal that has short legs and curved tail. Commercial pig farming is the business of rearing pigs in large number, mainly for the market and profit. According to Banerji (2013), the primary purpose of pig farming is the production of meat, in such forms as pork, bacon, lard and sausage; adding that pig products such as leather (pigskin), bristle and bone meal have industrial uses. Pig is prolific; its production is a fast means of proving protein-rich food and the meat, pork, is highly patronized (Sharma, et al, 2010). Thus, pig farming is the choice of many livestock farmers. Again, in the cause of the study, the researchers found out that Ohafia was a large cattle market for the people of Ohafia, Arochukwu and the environs, but due to constant farmer- herder clashes, the Ohafia community banned the consumption of beef and all forms of cattle trade in the area (Odita, 2020). The researchers further found that there is low number of commercial pig farming in the area of the study. The forgoing discursions provided a fertile ground for anyone wishing to engage in commercial pig farming. However, several strategies should be put in place to succeed in commercial pig farming. According to Olokor and Ibrahim (2017), strategy is a plan aimed at achieving a purpose. In the context of this study, strategies are plans or activities that are necessary for youths in Arochukwu and Ohafia LGA to to participate in commercial pig farming. The youth entrepreneurs need to strategize in order to succeed in pig farming. One of such strategies is for the youth to undertake a training programme in order to acquire entrepreneurial skills in pig farming.

Training is the step by step process of teaching an individual for the purpose of acquiring skills for productive activities. Training could mean the process by which someone is taught the skills that are needed for an art, profession or job (Beach, 2017; Yaduma & Adaga, 2019). It is about imparting skills in individuals and involves hands-on experience (Surbhi, 2017). In the context of this study,

training is an organized programme aimed at teaching youths in Arochukwu and Ohafia LGA, the business of pig farming. There are many steps to training. The steps according to Yaduma and Adaga (2019) include finding a reputable company to train as an apprentice. According to Onuka (2022), **a**pprenticeship training is a form of workplace learning or system which operates between two parties, the master and the apprentice and involves reciprocal obligations between the master and the apprentice. The apprentice is someone who has chosen a career and desires to work under a supervisor or much more experienced worker – the master, for a fixed period of time. The master trains, while the apprentice learns by watching and doing. The apprentice receives supervised training under the watch of the master at agreed period of time, ranging from months to years. An agreement is made in writing between the two, on whether the apprentice will pay or serve the master in lieu of payment after the period of training. Again, Beach (2017) opined that the trainee needs to practice on his own in line with what he has been taught by the instructor daily or regularly until the skills are mastered. These training processes apply to most commercial ventures, including pig farming (Orie & Ibekwe, 2014). The researchers observed that apprenticeship system of training is very popular among the people of Abiriba communities in Abia state. They transfer these skills to their relations and others who are willing to learn their businesses. Apprenticeship training has some benefits: It helps in imparting job skills to the apprentices, the master may assist him to set-up his own enterprise, depending on their agreement, training is on-the-job; that is, on the site, under the supervision of the master craft man and it involves mentoring (Onuka, 2022). It involves one-on-one assistance from experienced staff of a production industry such as pig production (Surbhi, et al, 2005).Youths wishing to embark on pig farming can adopt these procedures in Arochukwu and Ohafia LGAs.

The Government, including federal, state or local can devise its strategies of assisting youths to participate actively in pig farming. According to Lawal et al, (2021), federal and state governments can do this by, providing electricity, water, good roads and health centres; training centres for pig farmers, extension services, training workshops, interest free loan, good breeds of pigs for rearing, and make the process of acquiring land easy. Osagha and Omere (2021), added that the LGAs can provide interest free loan, guarantee collateral cover for loans obtained and organize training workshop for their youths.

Community where the youths live can assist them to succeed in commercial pig farming. Commercial pig farming business is usually situated in definite physical geographical location at a particular time. According to Orie and Ibekwe (2014), community includes, other entrepreneurs in the locality including commercial pig farmers who have been doing the business over the years in the

area, age grades, religious organization, among others. The authors maintain these people can assist the pig farmers by providing financial assistance, business premises and high quality livestock or seeds to start-up their businesses (Orie & Ibekwe, 2014). Lawal et al; (2021) also said that families, churches and other interest groups could patronize the youth entrepreneurs to encourage them.

The study has implications in Agricultural Education and training. Agricultural Education is a programme of study design for the teaching of agriculture. According to Olaitan (2017), Agricultural Education aims at equipping individuals with technical and pedagogical skills in areas of agricultural production to enable them work as classroom teachers and agriculturists. Therefore, the findings could help the unemployed youths to get the right training, information and assistants to embark on commercial pig farming, which is an aspect of farmer education. In addition, the Arochukwu and Ohafia LGAs could use the information provided by the study to train youths for commercial pig farming. Curriculum planners could use information provided by the study to design a programme of farmer education in colleges and universities to train student teachers. The foregoing discursions have made the study imperative.

Purpose of the study

The general purpose of the study was to evolve strategies for promoting entrepreneurship opportunities for youths in pig farming in Arochukwu and Ohafia Local Government Areas, Abia State, Nigeria. Specifically, the study determined strategies which the following groups could adopt to equip youths for involvement in commercial pig farming in Abia State:

1. youths themselves.
2. community groups.
3. governments.

Hypotheses

The following null hypotheses were tested at 0.05 level of significance.

There will be no significant difference between the mean ratings of commercial pig farmers and Agricultural Extension Officers on strategies for promoting entrepreneurship in commercial pig farming in Arochukwu and Ohafia LGAs in relation to the following:

HO_1: youths themselves

HO_2: community groups

HO_3: government.

Methodology

***Design of the study*:** The study adopted descriptive survey research design. The design is appropriate for the study as it sought the opinions of respondents using questionnaire.

***Area of the study*:** The study was carried out in Arochukwu and Ohafia LGAs in Abia State, Nigeria. The administrative headquarters of Arochukwu and Ohafia LGAs are Arochukwu and Ebem respectively. The LGAs were selected for the study because of unemployment among the youths in the area. Again, the ban on the consumption of beef by Ohafia community due to constant farmer-herder clashes have provided

opportunities for youths to engage in pig farming enterprises.(Oditas, 2020).

***Population of the study*:** The population was (103), made up of all of 47 Agricultural Extension officers and 56 pig farmers who registered with Agricultural Development Programme (ADP) at Ohafia Zonal Headquarters, Ebem Ohafia (ADP, Ohafia, 2022). The commercial pig farmers are masters of pig farming; who have acquired production and training skills over the years. The Abia State ADP is a government body in charge of all agricultural programmes and extension services in the state. The state headquarters is at Umuahia, while its zonal offices are located at Aba, Ohafia and Umuahia. Extension Officers are employees of ADP and major stakeholder in commercial pig farming because of their training and experience. Therefore, the opinions of pig farmers and those of Agricultural Extension officers are necessary in responding to the questionnaire.

***Sample and sampling techniques*:** The entire population of 103 was involved in the study because the population was manageable. Therefore, there was no sampling (Fieldman, 2013).

***Instrument for data collection*:** Questionnaire was used for data collection. It was developed from literature reviewed based on the three specific purposes of the study. Each questionnaire item four had 4-point respond scale of Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD), with corresponding value 4, 3, 2 and 1.The questionnaire was validated by three university experts in Agricultural Education, Agricultural Extension and Animal Production. It was tested for reliability using Cronbach Alpha reliability method and the test yielded a coefficient of 0.74.

***Method of data collection*:** The researchers and three research assistants administered 103 copies of the questionnaire to the respondents. The entire 103 copies were retrieved on completion. The research assistants were briefed on what to do before the training.

***Method of data analysis*:** Data collected were analyzed using mean and standard deviation to answer the research questions, while t-test was used to test the null hypotheses. In deciding benchmark for cut-off point, any item with mean value of 2.50 and above was interpreted as Agreed strategy, while any item below 2.50 was regarded as 'Disagreed strategy. The hypotheses off no significant difference was upheld for items with t-calculated value were less than t-table value and rejected if otherwise.

RESULTS

Table 1: Mean and t-test Results of the Responses of Agricultural Extension Officers and Pig Farmers on Strategies the Youths will Adopt in Equipping Themselves for Involvement in Commercial Pig Farming (N=103)

S/N	Youths' needed strategies	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_g$	t-cal	R
1	Intending youth farmer should be able to locate reputable commercial pig farm to train.	3.45	0.42	3.47	0.64	3.26	0.41	Agree/NS
2	Register as apprentices in commercial pig farming.	3.23	0.82	3.04	0.75	3.21	0.63	Agree/NS
3	Receive training under the watch of master pig farmer.	3.66	0.64	3.56	0.46	3.14	0.32	Agree/NS
4	Observe and learn activities in the commercial pig farms where they have registered.	3.73	0.34	3.63	0.75	3.68	0.93	Agree/NS
5	. Imitate the skills of the workers in pig farms.	3.44	0.87	3.31	0.79	3.38	0.52	Agree/NS
6	Practice pig farming with much supervision in the farm.	2.88	0.77	3.22	0.68	3.05	0.97	Agree/NS
7	Continue to practice with the instructor in the pig farm until they have acquired production skills.	3.43	0'45	3.88	0.65	3.66	0.82	Agree/NS
8	. Procure resources for practicing commercial pig farm project	3.67	0.27	3.57	0.37	3.62	0.85	Agree/NS
9	Establish small scale pig farm to further practice until the intended learning outcome (ILOs) is achieved.	3.65	0.32	3.91	0.64	3.78	0.26	Agree/NS
10	Complete the training on pig farming at the agreed time.	3.82	0.63	3.73	0.28	3.77	0.79	Agree/NS
11	Pay cost of training or serve the master in lieu of payment.	3.43	0.45	3.65	0.85	3.54	0.23	Agree/NS
12	Obtain loan to establish commercial pig farming.	2.97	0.75	3.21	0.32	3.09	0.67	Agree/NS
13	Establish commercial pig farms after successful training in commercial pig farming	3.17	0.56	3.23	0.32	2.20	0.12	Agree/NS

$\bar{X}$ = Mean of Respondents, SD = Standard Deviation of Respondents, N = Number of Respondents, t-tab=1.98, NS=Not Significant, R = Remark.

Table 1 reveals that the 13 items obtained mean scores above the cut-off point of 2.50. This means that the respondents agreed that the items are youth related strategies for equipping themselves for involvement in commercial pig farming in Arochukwu and Ohafia Local Government Areas. The table also shows that all the 13 items had their t-calculated values less than t-table value of 1.98. Therefore, there was no significant difference in the mean ratings of Agricultural Extension Officers and pig farmers on the strategies all the youths related.

Table 2: Mean Responses and t-tests Results of Agricultural Extension Officers and Pig Farmers on Strategies Community Related Strategies for Equipping Youths for Involvement in Commercial Pig Farming (N= 103).

S/N	Communities' Related Strategies	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_g$	t-cal	R
1	Commercial pig farmers provide high quality breeds of piglets for youths to stock their pig farms.	3.67	0.27	3.43	0.46	3.56	0.45	Agree/NS
2	Farmers help youths to register their pig farms with regulatory agencies.	3.50	0.30	3.33	0.51	3.42	0.32	Agree/NS
3	Pig farmers help youths to form cooperative societies and farm unions.	2.86	0.72	2.90	0.42	2.88	0.18	Agree/NS
4	Farmers help youths to avoid threats to pig farming.	3.17	0.27	2.93	0.61	3.07	0.41	Agree/NS
5	Parents help youths to obtain land for pig farming.	3.67	0.27	3.03	0.38	3.38.	0.26	Agree/NS
6	Parents help youths to establish commercial pig farms.	3.36	0.65	3.19	0.54	3.37	0.53	Agree/NS
7	Families provide labourers to help youths in their pig farms.	3.17	0.30	2.93	0.61	3.05	0.54	Agree/NS
8	Families give money to youths for the day to day running of their pig farms.	3.67	0.67	2.87	0.74	3.32	0.25	Agree/NS
9	Vigilante groups in the communities extend their security services to pig farmers.	3.33	0.67	3.06	0.68	3.29	0.37	Agree/NS
10	Vigilante groups sanction livestock thieves.	3.56	0.32	3.35	0.40	3.49	0.73	Agree/NS
11	strategies community groups will adopt in equipping youths for involvement in commercial pig farming	3.67	0.27	3.47	0. 46	3.57	0.681	Agree/NS
12	Churches and others interest groups patronize youths in pig farming.	3.33	0.31	3.31	0.65	3.31	0.64	Agree/NS

$\bar{X}$= Mean of Respondents, SD = Standard Deviation of Respondents, N = Number of Respondents, t-tab=1.98, NS=Not Significant, R = Remark.

Table 2 indicates that all the 12 items have mean scores above the cut-off point of 2.50. This means that respondents agreed that all the items are strategies community groups will adopt in equipping youths for involvement in commercial pig farming. The Table also shows that all the 12 items had their t-calculated values less than t--table value of 1.98. Therefore, there is no significant difference in the mean ratings of Agricultural Extension Officers and pig farmers on strategies community groups will adopt in equipping youths for involvement in commercial pig farming.

Table 3: Mean Responses and t-test Results of Agricultural Extension Officers and Pig Farmers on Governments Related Strategies for Equipping Youths for Involvement in Commercial Pig Farming (N=103).

S/N	Governments' Related Strategies	$\overline{X}_1$	SD_1	$\overline{X}_2$	SD_2	$\overline{X}_G$	t-cal	R
1	Government should provide essential amenities such electricity, pipe-born water and veterinary clinics for pig farmers.	3.65	0.45	3.49	0.67	3.57	0.65	Agree/NS
2	Builds skills acquisition centres where youths can train for pig farming.	3.43	0.58	3.63	0.53	3.39	043	Agree/NS
3	Make the process of acquiring land for commercial pig farming easy for youths.	3.43	0.47	3.40	4.11	3.41	0.49	Agree/NS
4	Liaise with state ADP to extend extension services to youths in pig farming.	3.74	0.57	3.69	0.63	3.58	0.54	Agree/NS
5	Can organize training workshops for youths in commercial pig farming.	3.43	0.61	3.47	0.75	3.44	0.21	Agree/NS
6	Reduce administrative charges on pig production business for youths.	3.22	0.65	3.20	0.68	3.21	0.41	Agree/NS
7	Provide cash or subsidies to youths interested in pig farming.	3.81	0.65	3.78	0.54	3.79	0.61	Agree/NS
8	Compel banks to give loans at low interest rate for commercial pig farming.	3.46	0.60	3.52	0.67	3.44	0.54	Agree/NS
9	Build market for youths to sell their pigs and pig products.	3.78	0.41	3.88	0.77	3.83	0.65	Agree/NS
10	Guarantees collateral cover for loans for their pig farms.	2.86	0.77	3.84	0.48	3.56	. 044	Agree/NS
11	Might sanction banks for failure to give loans at low interest rate.	3.86	0.76	3.78	0.68	382	0.43	Agree/NS
12	Ensure proper implementation of Animal Husbandry programme.	3.67	0.43	3.63	0.66	3.76	0.55	Agree/NS
13	Provide good breeds of pigs for rearing.	3.49	0.28	3.40	0.63	3.45	0.21	Agree/NS
14	Provide adequate resources for the implementation of the Entrepreneurship Development Units in schools.	2.94	0.76	3.31	0.78	3.34	0.31	Agree/NS
15	Ensure the quality of Students' Industrial Work Experience Scheme.	3.79	0.62	3.73	0.56	3.75	0.43	Agree/NS

$\overline{X}$ = Mean of Respondents, SD = Standard Deviation of Respondents, N = Number of Respondents , t-cal=1.98, NS=Not Significant, R = Remark.

Table 3 indicates that all the 15 items have mean that are above the cut-off point of 2.50. This means that respondents agreed that the items are strategies government will adopt in equipping youths for involvement in commercial pig farming. The Table also shows that all the 15 items had their t-calculated values less than t--table value of 1.98. Therefore, there was no significant difference in the mean ratings of Agricultural Extension Officers and pig farmers on strategies governments will adopt in equipping youths for involvement in commercial

pig farming in Arochukwu and Ohafia LGAs.

Discussion of Findings

Table 1 revealed strategies the youths will adopt in equipping themselves for involvement in commercial pig farming in Arochukwu and Ohafia Local Government Areas. They are: intending youth farmer should be able to locate reputable pig farms to train, register as apprentices in commercial pig farms, receive training under the watch of master pig farmer, observe and learn activities in the commercial pig farms they have registered, receive training under the watch of a master pig farmer, observe and learn activities in the pig farm where they have registered, imitate the skills of the workers in the pig farms, practice pig farming with much supervision, continue to practice with the instructor in the pig farms until they have acquired production skills, procure resources for practicing among other items. These findings collaborate with the opinions of Yaduma and Adaga (2019) who opined that new entrants to any business are required to find a reputable establishment to train and acquire production skills. It also aggress Onuka (2022) who outlined steps in apprenticeship training which included, among other things, that individuals wishing to lean a trade can do so by registering as apprentice with a master craft man, who would train the apprentice until production skills have been acquired.

Table 2 indicated 12 strategies community groups will adopt in equipping youths for involvement in commercial pig farming in Arochukwu and Ohafia Local Government Areas. They include: commercial pig farmers provide high quality breeds of piglets for youths to stock their farmers, farmers help youths to register their farms with regulatory agencies, pig farmers help youths to form cooperative societies and farm unions, farmers help youths to avoid threats to pig farming, parents help youths to obtain land for pig farming, parents help youths to establish commercial pig farms, families provide labourers to help youths in their pig farms and five other items. These finding are in consonant with the opinions of Orie and Ibekwe (2014), who submitted that communities can assist entrepreneurs in diverse ways, including assisting them to access fund for their businesses. The findings of this study are also in consonance with the views of Lawal et al; (2021) that interest groups, including churches, patronize the youth entrepreneurs to encourage them.

Table 3 discloses strategies governments will adopt in equipping youths for involvement in commercial pig farming in Arochukwu and Ohafia Local Government Area. They include among others: Government should provide essential amenities such as electricity, pipe-borne water, and veterinary clinics for pig farmers, builds skill acquisition centres where youths can train for pig farming, make the process of acquiring land for commercial pig farming easy for youths, liaise with state Agricultural Development Programme to extend extension services to youths in pig

farming, can organize training workshop for youths in commercial pig farming, reduce administrative charges on pig production business for youths, provide loans or subsidies to youths interested in pig farming. The findings of the study confirm the report of MOUAU (2023) that Government ensures that tertiary institutions of learning establish Entrepreneurial Development Centres for equipping students with entrepreneurial skills. The results also agree with Lawal et al; that LGAs should provide interest free loan to youths and guarantees collateral cover for loans they obtained. . The opinions of the various authors cited have helped to add credence to the validity of the study.

Conclusion

Unemployment among others factors have provides opportunity for unemployed youths to engage in commercial pig farming in Arochukwu and Ohafia LGAs because pigs are prolific, the meat is nutritious and live pig is less expensive compared to cattle. However, the youths wishing to embark on pig production know little about the enterprise. The situation provides this research opportunity to determine strategies for promoting youths' involvement in commercial pig farming. Accordingly, the study determined strategies which youths themselves, community groups, and Government could promote entrepreneurship opportunities for youths who are interested in commercial pig farming in Arochukwu and Ohafia Local Government Areas of Abia State. The study had therefore, made contributions to learning; as it has provided information on the subject which was not available before the present study. This is the gaps the study has filled.

Recommendations

Based on the findings of the study, it is recommended that:

1. Youths in Arochukwu and Ohafia Local Government Areas should use the information provided by the study to enroll in pig farming industries for training.
2. Commercial pig farmers should provide high quality breeds of piglets for youths to start-up their pig farms.
3. Age grades and vigilante groups should encourage entrepreneurs in pig farming by extending their security services to the pig farmers.
4. Federal, State and Local Government Areas should liaise with other stakeholders in pig farming to assist youth entrepreneurs financially and reduce administrative charges on pig production business.
5. The Arochukwu and Ohafia LGAs should also build skills acquisition centres for the purpose of training prospective pig farmers.

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Household Solid Waste Management, Attitude and Practices: A Case Study of Residents in the University of Nigeria Nsukka Staff Quarters.

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Abstract

The study investigated attitudes and practices of households towards solid waste management within the University of Nigeria, Nsukka staff quarters. Specifically, the study determined: attitude of the households towards solid waste management and their solid waste management practices. The study adopted survey research design. Population for the study consisted of 599 households in 517 senior staffs and 82 junior staff quarters. Questionnaire was used for data collection. Mean, standard deviation, frequency, percentages, ANOVA and Chi-Square were used for data analysis. Results show five negative attitude indicators, including, among others, " being willing to pay a fee or contribute towards improved waste management services within the staff quarters (**x** =2.44), feeling satisfied with the current solid waste practice of open dumping within the University of Nigeria Nsukka staff quarters (**x** =1.73). Households had moderate practice on three indicators including waste segregation (54.5%), open disposal of waste (42.4%), and high practice on three items, namely storing waste in plastic bag before disposal (75%). There was a significant difference in households' attitude towards solid waste management based on household size (F-value= 7.077, p-value= .000). There was no significant difference in household solid waste management practices based on household size (χ^2 = .970, P-value = .809). The study concludes that households in UNNSQs have more negative attitude indicators and moderate practice towards solid waste management. The study recommends provision of conveniently accessible public bins within the staff quarters by the school management will improve solid waste management practices. Households should be involved in the planning and implementation of solid waste management initiatives to help households develop more positive attitude towards solid waste management.

Keywords: Household, Solid, Waste, Management, Attitudes, Practices, Staff Quarters

Introduction

Solid waste management has been of research interest globally due to its detrimental effects on public health and environment. In 2016, global waste generation was estimated at 2.01 billion tonnes, and projected to surge to 3.4 billion tonnes by 2050, with the majority of it coming from households (World Bank, 2018). Africa generates 62 million tonnes of solid waste annually as stated by Hoornweg, et al. (as cited in Orhorhoro & Oghoghorie, 2019). Nigeria with a population estimated at 200 million has been regarded as one of the Africa's largest producers of solid waste, and generates more than 30 million tons of solid waste annually, mostly by households (Dada & Righelato, 2022). Household solid waste comprises of garbage, rubbish, ash and residues, dead animal, agricultural waste, animal faeces and hazardous wastes (Hadi, Ghasem & Rama, 2021). Waste generation is completely unavoidable, and when indiscriminately disposed, it can be a breeding site for mosquitoes, disease causing organism, and vectors with the tendency of disease outbreaks, poor quality of health and life of families within the community.

Waste is primarily classified into liquid, solid and gaseous forms and can be categorized by sources of generation as domestic (household), industrial, institutional, municipal, health-care waste among others (Adeniyi, 2019). The study focuses on household solid waste because it is the major source of domestic solid waste in the society (World Bank, 2018). Household waste connotes waste generated by households and small businesses. Daily, households constitute a significant portion of the overall sources of domestic solid waste (Bushara, et al, 2022), generated from activities, such as cleaning, cooking, gardening and sweeping. It includes used products or material, such as plastics, polythene bags, cloths, cans, food residues, milk cartons, appliances, glass and paper. Items discarded by families as part of their daily activities should be properly collected, stored and disposed in such a way that family health is persevered. The activities that constitute proper household solid waste management practices include: source separation, storage, waste collection, transportation, recycling or processing and disposal of solid waste (Eshete, et al, 2023; Laor et. al. 2018). Indiscriminate disposal of household waste can attract insects and rodents, vectors which can transmit diseases like cholera and dengue fever (Adetokumbo & Herbert as cited in Omang, et. al. 2021). Hence, proper solid waste management is necessary in reducing the rate of infectious diseases, mortality rate as well as improving quality of life (Omenka, 2016) of families and communities.

Communities like the University of Nigeria Nsukka staff quarters, household solid waste management is the responsibility of each family resident in the quarters. There are undesignated open dumpsites where different households dispose waste which is burnt after a while. During open burning of waste, fire may escape sometime, and endanger the families. Household solid waste management

practice of open dumping and burning among households in the quarters not only constitute to pollution, it is a potential source of health risks. Odiana and Olorunfemi (2021) posited that in most Nigerian communities, solid waste management is not carried out adequately. Olukanni, et al, (2020) posited that insufficient environmental policies, and a lack of awareness among the public contributes to waste management problems, as well as negative attitudes and practices. Enumah, et al, (2022) reported negative attitude towards solid waste management by respondents. Mahajan and Sudan (2022) reported poor household solid waste management practices among household in Jammu City, India. Hassan and Elsery (2022) reported unsatisfactory household solid waste management practices among majority of rural women in Egypt. Stewart, Micheal and Walters (2022) reported poor solid waste management among residents in Abua/Odual LGA, River State, Nigeria. Sultana, et al, (2021) reported moderate level practice of household solid waste management among Dhaka community people. Omar, et al, (2018) reported positive attitudes towards solid waste management among households in et al, (2008) established that household size is very significant in the management of solid waste. Fadhullah, et al, (2022) reported respondents' background (household size) influenced the household solid waste practices and perceptions in Panji sub-district, et al,(2022) assessed household's practices towards solid waste management to be high.

The management of solid waste is a pressing concern within the University of Nigeria staff quarters. Inefficient household solid waste management has far reaching physical, biological, health and psychological consequences. For example, indiscriminate dumping of household solid waste leads to land degradation, soil contamination, air and water pollution as well as providing breeding cites for disease causing organisms such as flies, rodents and insects pests which cause many diseases such as diarrhoea, dysentery, gastrointestinal problems, worm infection, food poisoning, dengue fever, cholera, leptospirosis and bacterial infection ; irritation of the skin, nose and eyes; as well as respiratory symptoms (Gutberlet & Uddin, 2017; Maheshwari, et al, 2015; Mamady, 2016; Norsa'adah, et al, 2020). Studies have estimated that the pollutions from the dumpsites might cause cancers of different types such as liver, kidney, larynx, pancreas, and non-Hodgkin lymphoma (Ncube, et al, 2017), birth defects, preterm babies, congenital disorders and Down's syndrome (Ncube, et al, 2017; Norsa'adah, et al, 2020) and some psychosocial effects such as disturbing odour, unsightly waste, and thinking, cognitive and stress-related problems (Aminuddin & Rahman, 2015; Ncube, et al, 2017; Norsa'adah, et al, 2020). Again, household waste management practices at the staff quarters have a direct impact on the immediate living environment and the broader University community. Research has shown that attitude and practices of residents toward waste influences

waste management. Attitude can be positive or negative. Positive attitude are those disapproval of unfavourable waste practices and handling waste appropriately through proper collection and storage of waste in a covered waste bin and disposing the waste in such a way that it does not constitute harm to health and environment. Negative attitude are those approval of unfavourable waste practices such as indiscriminate waste disposal, littering of surroundings with waste, open burning of waste, not using designated dumpsites for waste disposal, among other negative attitude towards waste. Fadhullah, et al, (2022) noted that poor waste disposal practices hampers progress towards an integrated solid waste management in households. The study therefore sought to determine attitude and practices of households in UNN staff quarters towards solid waste management.

Purpose of the Study

The general purpose of the study was to investigate attitude and practice of households towards solid waste management in the University of Nigeria Nsukka UNN Staff Quarters. Specifically, the study determined:

1. attitude of households towards solid waste management in UNN staff quarters; and
2. practices they adopt in solid waste management in UNN staff quarters.

Research Questions

The following research questions guided the study.

1. What is the attitude of households towards solid waste management in University of Nigeria Nsukka staff quarters?
2. What practices do households adopt in their solid waste management in University of Nigeria Nsukka staff quarters?

Hypotheses (HOs)

The following null hypotheses were postulated for the study.

HO_1. There is no significant difference in the mean responses on attitude indicators of households towards solid waste management in University of Nigeria Nsukka staff quarters based on household size.

HO_2 There is no significant difference in the percentage responses of households on their solid waste management practices in University of Nigeria Nsukka staff quarters based on household size.

Methodology

***Design of the Study*:** Survey research design was utilized for the study.

***Area of the Study*:** The study was conducted within the University of Nigeria Nsukka staff quarters (UNNSQs). UNNSQs is divided into senior staff quarters (SSQs) and junior staff quarters (JSQs). There are dumpsites in the staff quarters where households dump their solid waste. Some streets with many blocks of flats, created undesignated dumpsites. Thus, solid waste litter around some parts of the quarters.

***Population of the Study*:** The population of the study comprised of all the 599 households resident in

UNNSQs (517 senior staff and 82 junior staff) (Personnel Services Department & Council Unit, University of Nigeria Nsukka, 2023). The respondents for the study were home-makers in the households. This is because it assumed that they are the home-makers in charge of the operations of the home including how household waste was managed.

The entire population was involved in the study. This is because the population size was considered manageable. Hence, there was no sampling technique used in this study.

***Instrument for Data Collection*:** The instrument for data collection was questionnaire. It was developed from literature based on the objectives of the study. The instrument had a 4- point scale of Strongly Disagree= SD (1), Disagree = D (2), Agree = A(3) to Strongly Agree = SA (4). It was validated by three university experts in health education. Reliability of the instrument was established using split-half method of reliability. Spearman-Brown correlation formular was used to determine internal consistency of section C while Cronbach Alpha was used for section B because the responses were polychotomously scored. Reliability coefficient of 0.71 and 0.70 was obtained for sections B and C, indicating a satisfactory acceptance level based on Cohen, Manion and Morrison (2011) guidelines.

***Data Collection Method*:** A total of 599 copies of the questionnaire were distributed by hand to home-makers in the households. A total of 371 copies were returned, giving a return rate of 62 percent.

***Data Analysis*:** Data were analyzed using mean, standard deviation, frequencies, and percentages to answer the research questions. ANOVA and Chi-square were used to test the hypotheses. Attitude indicators were interpreted as positive and negative based on the mean scores. Criterion mean for decision making was 2.50. Mean scores of less than 2.50 were interpreted as negative attitude while mean score equal to or greater than 2.50 were interpreted as positive attitude. Practices were interpreted using percentages. Percentage scores below 20%=very low practice; 20-39%=low practice; 40-59%= moderate practice; 60-80%=high practice; 80% and above= very high practice.

RESULTS

Table 1: Mean Responses on Attitude Indicators of Households towards Solid Waste Management in University of Nigeria Nsukka Staff Quarters (n = 371)

S/N	Attitude Indicators	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_3$	SD	$\bar{X}_4$	SD	$\bar{X}_g$	D
1.	I am willing to pay a fee or contribute towards improved waste management services within the staff quarters.	2.82	0.88	2.69	0.89	2.48	1.02	1.75	1.06	2.44	NA
2.	I am willing to invest time and effort in adopting sustainable waste management practices in my household.	3.13	0.77	3.18	0.77	3.30	0.74	3.42	0.90	3.26	PA
3.	I believe that my household size influences the amount of waste generated.	2.91	0.97	2.92	1.02	3.21	0.95	2.58	1.31	2.91	PA
4.	I feel satisfied with the current solid waste practice of open dumping within the University of Nigeria Nsukka staff quarters.	1.94	1.02	1.93	0.97	1.98	1.06	1.08	0.29	1.73	NA
5.	I believe that disposing my solid wastes through burning is good and less stressful.	2.31	0.93	2.52	0.89	2.56	1.06	1.67	1.15	2.27	NA
6.	I don't feel that recycling of solid waste is a good practice.	1.91	0.93	1.87	0.89	1.60	0.86	1.33	0.65	1.68	NA
7.	I feel I can reduce my solid wastes by reusing some solid waste materials (e.g., nylon bags, cartons, plastic containers).	2.81	0.98	2.87	0.88	3.04	0.85	2.67	1.15	2.85	PA
8.	I don't feel that getting rid of my food and vegetable waste (e.g., remains of cooked rice, orange peels) by composting is good.	1.99	0.87	2.08	0.93	1.98	1.00	2.08	1.24	2.03	NA
9.	I feel that there is need for a public bin within the staff quarters to enable me dispose my waste properly.	3.07	1.08	3.45	0.85	3.55	0.82	2.92	1.31	3.25	PA

$\bar{X}_1$= mean for size 1-3; $\bar{X}_2$= Mean of 4-6; $\bar{X}_3$= Mean of 7-9; $\bar{X}_4$= Mean of 10+; $\bar{X}_g$ = Grand mean. Positive Attitude (PA)= equal to >2.5; Negative Attitude (NA)= <2.5; x = mean score; SD= Standard Deviation; D=Decision.

Table 1 shows the grand mean responses of households towards solid waste management in UNNSQ on all the attitude indicators. On attitude indicators 1, 4, 5, 6 and 8, households had negative attitude towards waste while on attitude indicators 2, 3, 7 and 9, households had positive attitude towards waste management. This shows that the households slightly had more negative attitude indicators towards solid waste management.

Table 2: Responses on Selected Solid Waste Management Practices (SWMP) among the Households in University of Nigeria Nsukka Staff Quarters (n =371)

S/N	Selected SWMP	Yes $f(\%)_1$	Yes $f(\%)_2$	Yes $f(\%)_3$	Yes $f(\%)_4$	Overall $f(\%)_0$
1	Do you store your household waste in a plastic bag before disposal?	54(79.4)	150(77.3)	58(59.8)	10(83.3)	68(75.0)
2	Do you separate recyclable materials (e.g., paper, plastic, glass) from non-recyclable waste (e.g., food waste, fruit/vegetable peels, batteries)?	39(57.4)	98(50.5)	42(43.3)	8(66.7)	47(54.5)
3	Do you dispose hazardous waste (e.g., batteries, chemicals) separately from regular waste?	37(54.4)	83(42.8)	33(34.0)	7(58.3)	40(47.4)
4	Do you use composting methods to manage organic waste (e.g., food leftovers, fruit or vegetable waste)?	37(54.4)	116(59.8)	63(64.9)	8(66.7)	56(61.5)
5	Do dispose your solid waste indiscriminately without minding if it's a designated refuse dump or not?	15(22.1)	29(14.9)	27(27.8)	1(8.3)	20(18.3)
6	Do you reduce the amount of solid waste you generate by practicing methods such as reusing or repairing items?	42(61.8)	112(57.7)	69(71.1)	8(66.7)	58(64.3)
7	Do you dispose your household waste in a public bin?	47(69.1)	128(66.0)	70(72.2)	8(66.7)	63(68.5)
8	Do you dispose your household waste in a pit in your compound?	21(30.9)	53(27.3)	21(21.6)	1(8.3)	24(24.)
9	Do you dispose your household solid waste in open spaces/dumping grounds.	36(52.9)	94(48.5)	50(51.5)	2(16.7)	46(42.4)
10	Do you burn your household waste in open areas?	25(36.8)	61(31.4)	34(35.1)	3(25.0)	31(32.1)

**Yes $(f\%)_1$ = responses of family size 1-3; $(f\%)_2$= responses of family size 4-6; $(f\%)_3$ responses of family size 7-9; $(f\%)_4$= responses of family size 10+; $f(\%)_0$ = overall, Below 20%=very low practice; 20-39%=low practice; 40-59%=moderate practice; 60-80%= high practice; 80% and above= very high practice.*

Table 2 shows the overall solid waste management practices of households in UNNSQs. Households had moderate solid waste management practice for items 2, 3 and 9 while for items 1, 4, 6, and 7, households have high practice. However, households in UNNSQs had very low practice for item 5 and low practice for item 10.

Table 3: Summary of ANOVA Analysis for the Difference in the Mean Responses on Attitude Indicators of Households towards Solid Waste Management in University of Nigeria, Nsukka Staff Quarters Based on Household Size (N= 371)

Variable	Sum of squares	Df	Mean square	F	Sig	Decision
Between groups	208.412	3	69.471	7.077	.000	S
Within groups	3602.419	367	9.816			
Total	3810.830	370				

***** *Significant (p<.05) **Not significant (p>.05)*

Table 3 shows that there is a significant difference in the attitude towards solid waste management among households in University of Nigeria Nsukka staff quarters based on household size (F-value= 7.077, p-value= .000), since the p-value is less than .05 level of significance. This implies that a significant difference exists between household size and households' attitude towards solid waste management in University of Nigeria, Nsukka staff quarters. Therefore, the null hypothesis is rejected.

Table 4: Summary of Chi-Square Statistics of Percentage Responses on the Difference in the Solid Waste Management Practices among Households in University of Nigeria Nsukka Staff Quarters Based on Household Size (n=371).

S/N	Variable (Household size)	Yes O(E)	No O(E)	x^2value	Df	*P*-Value	Decision
1	1-3	42(40.1)	26(27.9)				
2	4-6	110(114.5)	84(79.5)	.968	3	.809	NS
3	7-9	60(57.3)	37(39.7)				
4	10 and above	7(7.1)	5(4.9)				

*Key: NS= Not significant; S=Significant * The P value is significant at 0.05 level; O(E) = Observed frequency(Expected frequency)*

Table 4 shows there is no significant difference in the percentage responses on solid waste management practices among households in University of Nigeria Nsukka staff quarters based on household size as shown by the Chi Square of independence test (x^2 = .970, P-value = .809)

Discussion

The findings of the study in table 1 indicate that households in UNNSQs have slightly negative attitude indicators towards solid waste management-SWM. The findings of the study were not expected because the households residing at the staff quarters are educated and are expected to be environmentally conscious, having positive disposition towards SWM. The result aligns with the findings of Aderounmu (2022) who reported that households struggle to adequately manage waste, and those of Enumah et al. (2022) who reported negative attitude towards solid waste management among respondents, but contradicts the findings of Omar, Hossain and Parvin (2018) who reported positive attitudes towards solid waste management among households in Mogadishu, Somalia. However, table 1 shows that household in UNNSQs had some positive attitude indicators towards SWM. This finding agrees with the reports of Ugwu, et al, (2020) which highlighted a general positivity and willingness to engage in waste management practices and those of Rawat and Daverey (2018) indicating a willingness among people to segregate waste. This willingness signifies a proactive approach towards responsible waste management and is indicative of a positive attitude towards the subject, suggesting that awareness of the environmental impacts of improper waste disposal is necessary in UNNSQs to reawaken and bring to consciousness, the adverse health and environmental effects of improper SWM.

Findings of the study in table 2 show the solid waste management practices-SWMP of households in UNNSQs. Households had moderate solid waste management practices for items 2, 3 and 9 while for items 1, 4, and 6, households have high practices. However, households in UNNSQs had very low practice for item 5 and low practice for item 10. This shows an overall moderate SWMP among households. This result is unsatisfactory and shows that households dispose waste mostly inappropriately, supporting Muiruri, et al, (2020) assertion that the challenges associated with waste management practices are more of improper disposal in open areas. Findings of the study align with studies of Sultana, et al, (2021) who reported moderate level practice of household solid waste management among households in Jammu City, India; Hassan and Elsery (2022) who reported unsatisfactory household solid waste management practices among majority of rural women in Egypt; Stewart, et al, (2022) who reported poor solid waste management among residents in Abua/Odual LGA, River State, Nigeria. Bushara, et al, (2021) and Omang, et al, (2021) highlighted that despite some positive attitudes, actual waste management practices are often less than optimal, suggesting that although households in UNNSQs has some positive attitude indicators towards SWM, waste practice is not optimal. Nonetheless, it is important to note that inadequate infrastructure and lack

of convenient disposal options can hinder households' ability to translate those some positive attitude indicators into effective practices. The findings therefore underscore the need for education, awareness campaigns, supportive policies and provision of effective SWM system within the quarters to improve waste management practices. Studies such as Ugwu et al. (2020) and Enumah, et al, (2022) highlight the role of awareness campaigns and training in motivating individuals to engage in proper waste disposal.

Table 3 indicates a significant difference in the mean responses on attitude indicators towards solid waste management based on household size (F-value= 7.077, p-value= .000). This suggests that the number of factors within a household may influence attitude towards waste management. This finding is not surprising because Afon (2008) established that household size is very significant in the management of solid waste. This result is in line with the study by Mahajan and Sudan (2022) which demonstrated that the size of a household can impact waste generation and disposal practices. Larger households might generate more waste, face challenges in waste storage, or hold varying perceptions of waste management needs. The result of this study is also similar to that of Chikowore (2020), which discussed how household characteristics influence waste management practices and those of Fadhullah et al. (2022) who reported that respondents' background (household size) influenced the household solid waste practices and perceptions. Thus, waste management strategies should consider household size variations, tailoring education and initiatives accordingly. This implies that households with more members might require more comprehensive waste management solutions.

The finding in table 4 shows that there is no significant difference in the percentage responses on solid waste management practices among households in University of Nigeria Nsukka staff quarters based on household size. The Chi –Square statistics of independence indicated that there is no significant difference between the household sizes (χ^2 = .970, P-value = .809) and solid waste management. The finding contradicts those by Chikowore (2020) which suggests that smaller households may find it easier to manage waste due to lower waste generation rates. However, it is important to note that the findings might be influenced by factors beyond household size. Socioeconomic factors, cultural norms, and access to waste collection services can also play a significant role in waste management practices. The study by Opaleye (2021) on the perception of undergraduate students towards waste disposal emphasizes that even within a specific demographic group, waste management practices can vary widely based on factors such as education and awareness.

Conclusion

Solid waste management is a critical issue that affects both the environment

and public health. This study highlighted the attitudes indicators and practices of households toward solid waste management in UNN staff quarters. The findings show that households in UNNSQs have slightly negative attitude indicators towards SWM and moderate solid waste management practices. The implication of this finding is that SWM is not taken seriously among the residents in the quarters which can poses health risks to families in the quarters and the University at large.

Recommendations

Based on the findings of the study the following recommendations were made,

1. conveniently accessible public bins should be provided within the staff quarters by the school management to improve SWMP;
2. residents should be involved in the planning and implementation of solid waste management initiatives in the campus.
3. SWM system should be put in place for proper collection and disposal of waste in the quarters

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Skills Needed in Rabbit Production by Retired University Lecturers for Sustainable Income Generation in Ebonyi State, Nigeria

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Abstract

The study evolved skills needed by retired university lecturers in rabbit production for income in Ebonyi State, Nigeria. Specifically, it determined skills needed by university lecturers in housing, feeding and disease control in rabbit production. Three research questions and three null hypotheses guided the study. The population of the study was 78 rabbit farmers and Animal science lecturers. Survey research method was adopted in this study. Questionnaire was used for data collection. Data were analyzed using mean, standard deviation and t-test were used to test the hypotheses at 0.05 level significance. Results show that 13 rabbit housing skills need by the retired university lecturers. These include, among others, understand environmental conditions of areas/sites for housing ($\overline{X}$ = 3.46), install noisy alarms such as bell, chimes and gongs for security ($\overline{X}$ = 3.42), select conducive site ($\overline{X}$ = 3.63). Other findings are 13 skills on feeding of rabbits. These include, supply water to the rabbit ($\overline{X}$ = 3.77), feed rabbits at the right time ($\overline{X}$ = 3.65), was and clean of feeder and drinker ($\overline{X}$ = 3.60). Further findings are 10 diseases control skills, including administer drugs ($\overline{X}$ = 3.45), spray insecticide without affecting the birds identify the causative agent of diseases, (pathogens: fungi, bacteria, nematode, protozoa and environmental factors) ($\overline{X}$ = 3.44), carry out routine cleaning exercise ($\overline{X}$ = 3.41). Based on the findings, three recommendations were made.

Keywords: Skills, Rabbits, Retired, University, Lecturers, Production, Income.

Introduction

Rabbit is a common domestic animal that belongs to the family of leporidae and the species of oryctolagus curriculums, which have the following features, long ears, long hind, soft fur and a cottony tail. Iwena (2017) observed that rabbits are monogastric herbivores with a large caecum which functions as a site for microbial fermentation process, and specifically, to separate nutrient categories in order to retain the most readily fermented nutrient in the caecum. The male rabbit is called buck and female called doe while the young ones are litters or bunnies. The buck attains a mature live weight ranging between 4.5 to 5kg in eight to nine months when it is ready to be used for breeding. Eze (2015) noted that, rabbits are highly prolific animals with about 7-15 kittens per kindling. They can kindle for more than 7 times in a year. The young ones are born blind. Rabbit have a gestation period of 30-31 days. Akinokun (2000) reported that its high reproductive potentials is as a result of their short gestation period, early sexual maturity and their ability to rebreed shortly after parturition. They grow fast and reach maturity weight in five to six month. They are efficient converter of wide range of vegetable matter into meat because they have the ability of turning forages into high quality protein (Fielding, 2003). Rabbits are easy to handle and manage and also have high rate of disease resistance but susceptible to stress (Iwena, 2017).

Available report indicates that, rabbit make good quality meat, more delicious and nutritious than beef Aduku and Olukosi (2002). The meat of rabbit is rich in protein, vitamin and minerals. It contains less fat and has higher proportions of essential poly unsaturated lenoleic fatty acids. A cooked piece of rabbit meat is reported to be high in protein (56%), low in fat (9%), low in cholesterol, sodium and calories (8%) and contain 128% phosphorus, 13% of iron, 16% of zinc, 14% riboflavin, 6% thiamin, 35% B12 and 48% niacin.

There are other important aspects of rabbit. Rabbit skin also has some commercial values. They may be dressed, dyed and made into fur garment and slippers. Most domestic rabbits are raised for meat production while some are for laboratory and biological purpose (Loosh, 1997). Rabbit droppings are high in nitrogen and phosphorus and useful in improving soil fertility. Rabbit productions thus have enormous potential in alleviating the problem of animal protein supply in developing countries (Ezea, 2004). Fielding (2016) also reported that the skin and fur can be used for making jackets, head-gear, carpet or rugs and other decorative household ornamentals.

Eze (2015) noted that rabbit meat is a source of white meat. White meat (rabbit meat) has a lower level of cholesterol which can protect a person from heart disease. It is also reported that rabbit meat (white meat) can protect a person from alzheimer disease. Omega-3 fatty acid is present in rabbit meat and is a major solution to depression. Rabbit production could serve as a source of sustainable income to farmers, unemployed retired civil servants including university lecturers.

Retired university lecturers are persons who have retired from active service in their teaching profession. Retirement is the act of retiring or the state of being retired, that is to withdraw oneself from business, public life or and to remove one from active service. A close observation of many retired teachers in Ebonyi state and the problems they are facing draw the attention of all and sundry. These problems seem to range from sudden loss of life, loss of the usual monthly salary, anxiety about a residential home, physical disabilities and aging. Retirement is an age long practice in both private and public services (Bolaji, 2015), he stressed that it is a major stage in adult development and it essentially marks the split from middle years to old age. He further noted that at 65 years of age, mental and physical exuberance dwindle; it however becomes rationale to relieve the person of some strenuous and excruciating duties that may weigh him down and consequently threaten his health. This therefore, results to the retirement age of 65 in developed and economically buoyant countries. But in Nigeria due to economic crunch and high rate of unemployment, the minimum legal age for mandatory retirement was put at 55 until recently when the federal government of Nigeria pegged it to 60 years. (Ndem & Elom 2016). These groups of people need skills in order to be-engaged to earn income for their maintenance.

Skill is special ability to perform in a particular field, especially acquired by learning and practice. Turnbull (2010) stated that, skill is a well established habit of performing tasks in a manner acceptable by workers in a profession. Ben (2010) stated that, skills are the ability and capacity acquired through deliberate, systematic and continuous effort to learn. It is the manifestation of acquired knowledge; it is knowledge that an individual has which is translated into practical activity. In other works, skills can be described as knowledge that is put into practical used once it is translated into activity. Skills in this context is referred to as the ability and capacity to carry out any task involving complex activities such as; ability to carry out practical tasks and adapt to new technology. Skills in rabbit production involves ability to identify rabbit breeds, select best breeds, determine the stocking rate, provide equipment needed for rearing of rabbit, select the right type of topography, constructing the hutch, formulate and balance feed, identify sick rabbit, select and administer medication. It also involves housing, feeding and diseases control of rabbit. (Ndem & Elom 2016)

They also stressed that skills in rabbit production involve complex activities such as; ability to carry out practical tasks and adapt to new technology, identify rabbit breeds, select best breeds, determine the stocking rate. Other skills are provide equipment needed for rearing of rabbit, select the right type of topography, constructing the hutch, formulating and balance feed, identifying sick rabbit, select and administering medication. These rabbits production skills can be used to equip retirees, including retired university lectures for

income generation. Retirement is a serious challenges in Nigeria..

A close observation of many retired university teachers in Ebonyi State indicates that many are facing a lot of difficulties such as loss of the usual income, payment of residential rent, deteriorated health condition, physical disabilities and aging. Many retired university lecturers experience nightmare as a result of delay or non-payment of gratuities and pensions. They also suffer loneliness and idleness. Sometimes the pension payment is not enough to cater for their needs including feeding, clothing, health and family maintenance. Many of the retired teachers have met their untimely death due to non-payment or efficient retirement benefit. They therefore need to acquire some post retirement skills that could help earn some income. Acquisition of rabbit production skill could help them, hence this study.

Purpose of the Study

The main purpose of this study was to evolve skills needed in rabbit production by retired university lectures in Ebonyi state of Nigeria. Specifically the study determined skills needed by retired university lecturers in:

1. housing rabbits
2. feeding of rabbits
3. disease control in rabbits

Hypotheses

The following hypotheses guided the study:

There is no significant difference in the mean rating of rabbit farmers and Animal science lecturers on skills needed by retired university lecturers in:

1. housing of rabbits
2. feeding of rabbits
3. disease control in rabbits

Methodology

***Design of the study*:** The study adopted survey research design.

***Area of the study*:** Ebonyi State of Nigeria was the area of the study. Ebonyi State is located in the South-eastern zone of Nigeria. There are many rabbit farmers in the state who are engaged in commercial rabbit production. The study was carried out in Ebonyi state because of the thriving nature of rabbits in the area.

***Population of the study*:** The population of the study was 78 respondents made up of 63 Animal science lecturers from universities in Ebonyi state and 15 registered rabbit farmers in the area of the study. The lecturers are experts in animal production and animal science, thus competent in providing the appropriate information on skills in rabbit production. The rabbit farmers are engaged in rearing of rabbits. They therefore possess the required skills, knowledge and experience in rabbit farming. The entire population was manageable and was involved in the study. There was no sampling.

***Instrument for data collection*:** The instrument for data collection was questionnaire. It was developed based on the purposes of the study. The instrument was structured based on 4-points rating scale of "Very highly needed (VHN)", "Highly needed (HN)", "Moderately needed (MN)", and "Not needed (NN)" with

respective values of 4,3,2,1. It was validated by three experts in Animal science. The reliability of the instrument was determined by carrying out a pilot test using 20 rabbit farmers and animal science lecturers in outside the area of the study. The data obtained were analyzed using Cronbach Alpha statistics. Overall reliability coefficient of 0.62 was obtained.

***Data collection method*:** A total of 78 copies of the questionnaire were administered by hand to the respondents. The trained research assistants were used. The entire 78 copies were retrieved. This represented 100 percent retrieval rate.

***Data Analysis Technique*:** The data were analyzed using mean with standard deviation to answer the research questions while the hypotheses were tested using t-test at a 0.5 level of significance. Mean of 2.50 was used as the cutoff point or bench mark for decision making. Hence, any item in the questionnaire with the mean score of 2.50 and above ($\overline{X} \geq 2.50$) was regarded as the production skills needed, while any item with the mean score below 2.50($\overline{X} \leq 2.50$) was regarded as "Not needed production skills". In testing the hypotheses, the t-calculated was compared with the critical t-table and if t-calculated value exceeds the critical or the t-table values, the null hypotheses (Ho) was rejected and the alternative hypothesis (Ha) uphold, but if the t-calculated value was less than the t-table value, the null-hypotheses was accepted at 0.05 level of significance.

RESULTS

Table 1: Mean Responses, Standard Deviation and t-test Results on Skills Needed by Retired University Lecturers in Housing Rabbits (N = 78)

S/N	Housing Skills	$\overline{X}_1$	SD_1	$\overline{X}_2$	SD_2	$\overline{X}_g$	t-cal	R
	Ability to:							
1	understand environmental conditions of areas/ sites for housing	3.52	0.69	3.40	0.82	3.46	0.62	NSD
2	select conducive site	3.73	0.54	3.52	0.69	3.63	1.24	NSD
3	select site which is flat and gentle slopping	3.12	0.73	3.49	0.71	3.31	1.29	NSD
4	mark and measure the dimension of the site	3.06	0.70	3.41	0.83	3.24	0.55	NSD
5	construct length of the hutch	3.06	0.79	3.19	0.80	3.13	0.49	NSD
6	construct width of the hutch	3.00	0.75	3.17	0.75	3.09	-0.14	NSD
7	construct the height of the hutch	3.66	0.61	2.96	0.82	3.31	-2.68	NSD
8	construct floor space with correct specification.	2.06	1.43	3.11	0.74	2.59	1.82	NSD
9	install noisy alarms such as bell, chimes and gongs for security	3.60	0.63	3.23	0.96	3.42	-2.20	NSD
10	construct foot dip in the rabbit tent	3.61	0.62	2.87	1.23	3.04	-1.05	NSD
11	construct rabbit tent (the house that houses the hutch)	3.21	0.79	3.36	0.80	3.29	1.00	NSD

12	construct rabbit nestling boxes	2.60	1.40	3.47	0.71	3.03	1.20	NSD
13	control temperature in the hutch	3.40	0.73	3.17	0.80	3.28	-0.99	NSD

Nl = Number of lecturers = (63), Nf = Number of farmers = (15), $\bar{X}_1$ *= Mean Responses of farmers,* $\bar{X}_2$ *= Mean Responses of lecturers,* SD_1 *= Standard Deviation of farmers,* SD_2 *= Standard Deviation of Lecturers,* X_g *= Grand mean of farmers and lecturers, t-cal = Calculated t-test, Df = Degree of Freedom (76), t-critical = 1.98, R = Remarks, NSD = Not Significant Difference.*

Table 1 reveals that 13 skills in housing of rabbits are needed by the retired university lecturers for rabbit production. This is because each of the skill has mean score of 2.5 and above(x> 2.50). The Table also indicates that there was no significant difference between the mean responses of the rabbit farmers and the animal sciences lecturers on the skills needed in housing of rabbits. Therefore, the null hypothesis was accepted.

Table 2: Mean Responses, Standard Deviation and t-test Results on Skills Needed by Retired University Lecturers in Feeding of Rabbits (N = 78)

S/N	Feeding Skills	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_g$	t-cal	R
	Ability to:							
1	locate available food stuff (fruit tubers vegetables, grasses even household refuse)	3.38	0.77	2.82	0.74	3.10	1.15	NSD
2	gather available food stuff material	3.19	0.88	3.51	0.70	3.35	0.69	NSD
3	prepare household refuse for feed	3.01	0.89	3.66	0.61	3.33	0.68	NSD
4	prepare concentrate	3.04	0.91	3.50	0.60	3.27	1.18	NSD
5	prepare supplement feed for feeding rabbits	3.36	0.64	2.54	0.51	2.95	0.94	NSD
6	prepare maintenance feeds for adult rabbits	3.42	0.52	2.70	0.54	3.06	1.04	NSD
7	select appropriate green folder (grasses) for feeding of rabbits	3.37	0.71	2.69	0.60	3.03	0.71	NSD
8	select appropriate legumes for feeding of rabbits	3.35	0.77	3.76	0.61	3.55	0.46	NSD
9	feed rabbit at the right time	3.54	0.59	3.76	0.62	3.65	1.55	NSD
10	feed rabbit with the right diet	3.67	0.59	3.51	0.60	3.59	0.32	NSD
11	supply water to the rabbit	3.67	0.55	3.88	0.59	3.77	1.09	NSD
12	wash and clean of feeder and drinker	3.67	0.56	3.54	0.82	3.60	0.98	NSD
13	identify the time for increase in water supply	3.45	0.71	2.86	0.47	3.15	1.60	NSD

Nl = Number of lecturers = (63), Nf = Number of farmers = (15), $\bar{X}_1$ *= Mean Responses of* farmers, $\bar{X}_2$ = Mean Responses of lecturers, SD_1 = Standard Deviation of farmers, SD_2 = Standard Deviation of Lecturers, X_g = Grand mean of farmers and lecturers, t-cal = Calculated t-test, Df = Degree of Freedom (76), t-critical = 1.98, R = Remarks, NSD = Not Significant Difference.

Table 2 reveals that 13 skills in feeding of rabbit are needed by retired university lecturers in rabbit production. This is because each of the

skill has mean score of 2.5 and above(x> 2.50). The score of the standard deviations indicates that the means are not far from the central mean. The Table also indicates that there was no significant difference in mean ratings of the rabbit farmers and the animal science lecturers on the feeding skills of rabbit. Therefore the null hypothesis was accepted.

Table 3: Mean Responses, Standard Deviation and t-test Results on the Skills Needed by the Retired University lecturers in Disease Control in Rabbits Production (N = 78).

S/N	Disease Control Skills	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_g$	t-cal	R
	Ability to:							
1	detect sick rabbit	3.39	0.70	3.33	1.04	3.36	0.28	NSD
2	identify disease symptoms of rabbit	3.19	0.93	3.20	0.67	3.19	-0.04	NSD
3	administer vaccine to rabbit	3.01	0.73	2.86	1.18	3.00	0.61	NSD
4	cull sick rabbit	3.14	0.97	3.26	0.59	3.12	-1.07	NSD
5	administer drugs	2.98	0.66	3.60	0.50	3.45	-1.63	NSD
6	carry out routine cleaning exercise	3.30	0.46	3.40	0.63	3.41	0.19	NSD
7	spray insecticide without affecting the birds	3.42	0.54	3.40	0.82	3.38	-0.20	NSD
8	identify causative agents of diseases (pathogens: fungi, etc)	3.36	0.66	3.43	0.91	3.44	0.29	NSD
9	use right disinfectant in the foot dip	3.28	0.79	3.62	0.61	3.45	-1.43	NSD
10	use personal safety measures while spraying insecticide such as hand gloves, nose mask	3.47	0.61	3.60	0.63	3.53	-1.92	NSD

Nl = Number of lecturers = (63), Nf = Number of farmers = (15), $\bar{X}_1$ = Mean Responses of farmers, $\bar{X}_2$ = Mean Responses of lecturers, SD_1 = Standard Deviation of farmers, SD_2 = Standard Deviation of Lecturers, X_g = Grand mean of farmers and lecturers, t-cal = Calculated t-test, Df = Degree of Freedom (76), t-critical = 1.98, R = Remarks, NSD = Not Significant Difference.

Table 3 indicates that the retired university lecturers need 10 skills in disease control in rabbit production. This is because the items had the mean scores ranging between 3.53 and 3.00 which are above 2.5. (x> 2.50). The scores of the standard deviation indicate that the opinions of the respondents did not vary far from the central mean. Also the table shows that there was no significant difference in the mean ratings of the rabbit farmers and the animal science lecturers on the skills needed in disease control in rabbit production.

Discussion of Findings

The result in Table 1 shows that 13 skills in housing were needed by retired university lecturers. This finding is in line with Bassey (2010) who reported that skills in housing of rabbit by farmers are necessary for effective production of rabbits. Gilson (2002) also reported that when constructing rabbit hutches metal materials should be used to help prevent sanitary condition that can lead to health problems. The findings also supported Eze (2015) who said

that well built hutch promotes rabbit production.

Additionally, Iwena (2012) stated that in construction of rabbit hutch, it is essential to provide nest made of soft materials where the young rabbits will feel comfortable. This finding also supports Aduku and Olukosi (2002) who reported that, the floor of the rabbit hutch should be made of concrete materials to prevent the rabbit from boring hole and escape.

Result in Table 2 shows that 13 skills in feeding of rabbit were needed by retired university lecturers for rabbit production. The result supports Aliyu (2002) who noted that feeding is one of the most essential management practices in rabbit production. Additionally the findings of this work is in agreement with Eze (2015) who reported that rabbits require good feeding for prolific production.

Finding of the study also support Ezea (2004) who remarked that legume plants should be incorporated in the feeds of rabbit for protein supply.

Result in Table 3 indicates that 10 skills in disease control of rabbit are needed by the lecturers. Such as skills in detecting sick rabbits, identify diseases symptoms of rabbit, administration of vaccines and drugs to rabbits and routine sanitation in the hutch among others. This finding is in line with Fielding (2003) who stated that disease control is one of the major management practices in rabbit production. She further explained that effective control of disease improves rabbit production. Bolaji (2005) also reported that improper disease control in rabbit may lead to high mortality rate. He added that a rabbit farmer must be skillful in identifying diseases in the hutch for immediate action. He further stressed that diseases control in rabbit production should be handled by an expert who has the competency in that field. Equally the finding agrees with Fielding (2003) who reported that early dictation of diseases in rabbit will make it easy for the farmer to control it. The opinion of fielding implies that a rabbit farmer must possess the competency in disease dictation at the early stage in order to make the control of diseases in the rabbit farm easy.

Furthermore Ndem & Elom (2016) reported that disease in rabbit farm if not controlled may lead to high mortality rate of the farm animal. They further explained that rabbits affected by disease do not look healthy and this could affect their production. In order to achieve high productivity on the Rabbit farm, disease control should be effectively carried out. Further, Ndem & Ogba (2017) explained that diseases in farm animals can cause more than 70 percent loss in farmer's output. They stressed that disease control of the farm animals should be one of the major actions to be taken by the farmer in order to achieve success in the farming business. The findings of Ndem and Ogba implies that disease control on the rabbit farm should be taken seriously in order to ensure that the farmer achieves success in the rearing of the rabbit. These are all in line with the findings of this present study.

Conclusion

The results of this research have revealed that the retired university lecturers need skills in housing of rabbit production, feeding rabbits and controlling diseases in rabbit production. Possession of these skills will enable the retired university lecturers to be engaged. As the skills are imbibed and utilized, income generation would be promoted.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Conferences, workshops, seminar and symposia should be organized by Ebonyi state by appropriate ministries on skills needed in rabbit production for the retired university lecturers.
2. Lecturers in Faculty of agriculture should ensure that rabbit farming skills are taught more vigorously to enable students acquire the skills which will help them on retire from service.
3. Government of Ebonyi state should always train the retired lecturers and other retirees on rabbit production through the skill acquisition centers in the state.

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Evaluation of Nutritional and Microbiological Properties of a Beverage Made from *Baobab* (*Adansonia digitata*)

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Abstract

The objective of this study was to evaluate nutritional and microbiological properties of beverage made from baobab (*adansonia digitata*). Specifically, the study evaluated proximate content of beverage made from baobab fruit pulp (*Adansonia digitata*), assessed mineral composition of beverage made from baobab fruit pulp (*Adansonia digitata*), determined microbiological properties of beverage made from baobab fruit pulp (*Adansonia digitata*). A laboratory-based experiment was applied to prepare and analyze samples of the Baobab drink. The results revealed that, even though, the drink had a high moisture content (83.69g) it could supply energy from carbohydrates (12.49g) and contained fat and protein in smaller amounts. Mineral composition was substantial for most nutrients but exceptionally high for potassium (5700ppm). The microbiological properties show that comparatively, the Baobab drink's microbial status was within safe levels. However, the presence and absence of high moisture in drink and powder influenced the microbial load and isolates from both products respectively. It was recommended that the need to carry out consumer acceptance studies on the drink to guarantee adoption among *baobab* drinking growing populations. Also a scale-up of this drink to provide healthier replacements for sugar sweetened beverages.

Keywords: Baobab, Drink, Fruit, Pulp, Powder, Microbial, Status, Nutrition,

Introduction

Baobab (*Adansonia digitata*) is a popular tree in Sub-Saharan Africa that adapt to extreme drought conditions. It absorbs and stores water in its trunk enabling it to produce a nutrient-dense fruit when all vegetation around it dries and become arid (Osman, 2004). In Nigeria, baobab tree is popularly called *igi ose* among Yoruba speaking communities. The baobab tree is usually grown for its leaves and fruit. The fruit consists of acidic pulp and shell with large seeds embedded in it. The utilization of baobab tree for food and crafts dates back to thousands of years and it holds special cultural meaning to people (Blench, 2007; Buchmann et al., 2010). The baobab tree is a multipurpose plant that is widely used. Its leaves and fruits are nutrient-rich and are consumed

regularly by indigenous populations in many African nations for food, medicine, and other purposes (De Caluwé et al., 2009; Gadour et a l., 2017; Muthai et al., 2017). The fruit and seeds may be used for fertilizer, fuel and soap or plaster (Obizoba and Anyika, 1994) while strong fibre that can be used to make ropes can be found in the bark and roots (Sidibe and Williams, 2002). The baobab leaf is one of the most nutrient-dense vegetables particularly rich in micronutrients and it has been successfully made into various recipes such as baobab and banana (*Musa acuminata*) ice-cream, baobab blue berry and different flavours of smoothie. In a community in Kwara State, Northcentral Nigeria, its leaf is used in preparing a sauce known as "*luru*" in the local dialect (Amusa et al., 2017), while the Hausa people uses the leaves to prepare "*Miyan kuka*" a popular soup (Asogwa et al., 2021). Studies on the qualities of baobab have revealed that their seeds, leaves, pulp, root tubers, and bark have the potential to be used for pharmaceutical purposes (Ramadan et al., 1994; Amusa et al., 2017; Lisao et al., 2017).

The dried pulp can also be crushed into powder and then dissolved in water or milk to produce a beverage with a distinctive flavor that resembles grapefruit, pear or vanilla flavours. The milky beverage can be made either using the dried pulp alone or by combining it with the flour of a grain called Acha (*Digitaria exilis*) (Asogwa et al., 2021). The seed are then mixed with the '*kunu*' which is considered as a supplement for milk (Amusa et al., 2017). Baobab fruit pulp contains substantial amounts of nutrients and antioxidants and has also been applied therapeutically in treatment of smallpox and measles (Silvia, 2002; Rahul et al 2015). High levels of vitamin C (Chadare et al., 2008), calcium (Osman, 2004), and antioxidants (Salih and Yahia, 2015) which are useful in protecting cells from damage-causing free-radicals can also be found in baobab pulp

In tropical Africa, beverages especially carbonated drinks are very popular due to the need to rehydrate in hot temperatures. There are renewed public health concerns regarding their consumption especially as it relates to their sugar content and their contribution to the epidemiology of non-communicable diseases overtime (Luger et al., 2017). This is not the case with locally sourced beverages which generally contain more nutrients and are usually cheaper than their sugar sweetened counterparts. Consequently, it is imperative to produce healthy alternatives. Baobab pulp serves as an healthy drink (Gruenwald and Galizia, 2005). It has been used as a beverage and also licked raw in some parts of the Africa (Abdullai et al., 2010, Adekunle et al, 2013). Hence, this study sought to produce a novel baobab fruit pulp beverage using a boiling method and then proximate, mineral and microbiological properties were evaluated.

The general objective was to evaluate nutritional and microbiological properties of beverage made from

baobab (*adansonia digitata*). Specifically, the study:

Specific Objectives

1. evaluated proximate content of beverage made from baobab fruit pulp (*Adansonia digitata*).
2. assessed mineral composition of beverage made from baobab fruit pulp (*Adansonia digitata*).
3. determined microbiological properties of beverage made from baobab fruit pulp (*Adansonia digitata*).

Materials and Methods

***Study Design*:** The study applied a laboratory based experimental design to prepare a drink and analyze its nutritional and microbiological composition.

Preparation of Sample: The drink was produced in the analytical laboratory of the Department of Human Nutrition and Dietetics, University of Ibadan, with some modification (addition of coconut milk).

Frstly, edible portion of the baobab (pulp) was collected and rinsed after removal of the inedible portion (bark, fibre and seeds). It was then steeped for 1hour, then hand pounded and filtered to pass through sieve 40 mesh size. It was then boiled at 105^{o}C, sugar and coconut milk was then added. It was allowed to cool and then packaged. The residue obtained during the filtration process was also evaluated for microbiological properties.

Determination of proximate composition: Proximate composition evaluations were carried out according to the standard methods of AOAC (2005).

Determination of mineral composition: Mineral composition was determined according to AOAC (2005) methods using an Atomic Absorption spectrophotometer.

Isolation and Enumeration of Microorganisms

Duplicate of 10g and 10 ml of the drink was homogenized with 90m1 sterile peptone water. The homogenate was serially diluted to the appropriate levels and directly inoculated into Petri dishes containing various isolation media. Aerobic bacteria were enumerated on Plate Count Agar (PCA), and incubated at a temperature of 37°C for 24h. Poteto Dextrose Agar supplemented with 250mg/ml chloramphenicol was used to enumerate mould and yeast extract agar for isolation of yeast. Inoculated plates were incubated at 25°C for 5 days. The deMan Rogosa Sharpe (MRS) agar were used for enumeration of total Lactic Acid Bacteria (LAB). Plates were incubated micro-aerobically at 37°C for 48h. MacConky agar was used for enumeration and isolation of Enterobacteriaceae. Selected colonies with distinct morphological differences such as colour, shape and size were purified by re-streaking them on the medium used for isolation. Pure isolates were stored on slants at 4°C.

Characterization and Identification of Isolates: Isolates were examined for colony and cell morphology; motility, cell arrangements, Gram reaction;

catalase reaction; growth in broth at 15 and 45°C; growth in the presence of 6.5% NaCl; production of ammonia from arginine; starch hydrolysis; carbon dioxide production and sugars fermentation pattern were determined (Harrigan,1998). Identification was based on morphological, physiological and biochemical characteristics by referencing Bergey's Manual of Systematic Bacteriology (Sneath et al., 1986) and Holzapfel and Wood (1995). Enterobacteriaceae were identified based on their morphological and biochemical characteristics. Microscopy (including Grams staining, motility, cell shape) and the ability to produce gas (from glucose, sucrose, arabinose, mannitol, lactose, raffinose) were done according to Harrigan (1998). Other tests included production of indole from tryptophan, utilization of citrate, hydrogen sulfide production, Voges-Proskauer test and methyl red test. Yeasts were identified using the method described by Deak and Beuchat (1996). The sugar fermentation patterns, growth at 37°C, increase in 50% glucose-yeast extract, growth in the presence of 6% NaC1 and mycelium was examined microscopically (Harrigan, 1998). The mould isolates were identified based on visible and microscopic features. For the macroscopic characteristics; colour and surface texture of colonies on their respective plates were observed. Microscopic examination was based on the use of Lactophenol cotton blue stain that was placed on a clean slide and a small piece of mycelium was carefully transferred into it with the aid of sterile inoculating needle. It was then gently smeared, covered with a clean slip and examined under high-power magnification (x 40) objective lens of the microscope for the presence of fruiting bodies like conidia and sporangiospores (Barnett & Hunter, 1998).

RESULTS

Table 1: Proximate Analyses of Baobab Drink (grams per 100g)

Nutritional Parameter	Composition (g/100g)
Moisture content	83.69
Crude protein	0.98
Crude fat	2.24
Crude fibre	0.68
Ash content	0.61
Carbohydrate content	12.49

Table 1 shows the proximate composition of the baobab drink. Expectedly, the sample had high moisture content (83.69%). Carbohydrate content of the drink was 12.49 percent while the crude fibre was 0.68 percent. The crude fat content was 2.24 percent, crude protein was 0.98 percent and the ash content was 0.61 percent.

Table 2: Mineral Composition of Baobab Drink in Parts Per Million (ppm)

Nutritional Parameter	Composition (ppm)
Phosphorus	300
Calcium	500

Magnesium	400
Potassium	5700
Sodium	64
Manganese	32
Iron	69
Copper	22
Zinc	14

Table 2 shows the mineral composition of baobab drink. Sodium is an essential source of electrolyte for the body system and the value was found to be 64.39 ppm. The drink contained 68.99 ppm of iron. Phosphorus (300 ppm) and calcium (500 ppm) were relatively high. This study reveals baobab drink to be a good source of potassium presented to be 5700 ppm.

Table 3: Microbial Load of Organisms Isolated from Powder and Modified Baobab Drink

Microorganisms	Powder of Baobab Drink (cfu/mg)	Modified Baobab Drink (cfu/ml)
Total plate counts	6.2×10^3	7.0×10^6
Yeast counts	1.7×10^1	3.1×10^4
Moulds counts	3.0×10^1	1.5×10^3
LAN counts	4.1×10^2	1.2×10^5
Coliform counts	6.0×10^2	5.0×10^1

Table 3 shows the microbial load of organisms in the powder and drink. It shows that yeast counts were lowest in the powder (1.7×10^1 cfu/mg) and coliform counts in Baobab drink (5.0×10^1 cfu/ml). The highest were coliform counts for powder (6.0×10^2 cfu/mg) and LAN counts for drink (1.2×10^5 cfu/ml) respectively.

Table 4. Microorganisms isolated from modified Baobab drink

Category	Microorganisms
Yeast	*Saccharomyces cerevisiae and candida tropicalis*
Moulds	*Aspergillus flavus, Penicillium citrinum, Rhizopus stolonifera*
LAB	*Lactobacillus (L) delbrukii, L. fermentum and L. plantarum*
Coliform	*Proteus vulgaris, Klebsiella pneumonia and Escherchia coli*

Table 4 presents results of microorganisms isolated from modified Baobab drink. Yeast contained *Saccharomyces cerevisiae and candida tropicalis* while Coliform contained *Proteus vulgaris, Klebsiella pneumonia and Escherchia coli.*

Discussion

Moisture content plays an important role in food, most especially in terms of freshness and storage stability. The moisture content of the drink was found to be very high (83.69%) which is typical of refreshing drinks. Moreover, the values found were found to be higher than those reported for Kunnun zaki (72.4%) by Adeniji and Keshinro, (2015) and slightly higher for tiger nut drink (86.5%) by Obadesagbo et al. (2023) but lower than soy milk drink (89.3%) by Nwoke et al. (2015). However, the high moisture content of the drink is an indication of its high susceptibility to microbial attack, which goes a long way in determining the shelf life. Carbohydrate is a crucial part of a healthy diet as it provides the body with glucose to sustain metabolic processes and physical activity. In this study, the carbohydrate content of the drink was higher than what was reported for tigernut drink (7.20 %) by

Obadesagbo et al. (2023), Kunu zaki (4.1%) by Adeniji and Keshinro, (2015) and soymilk (1.99 – 2.69%) by Odu et al. (2012). Dietary fibre has been regarded vital for optimum human health. Epidemiological studies have shown that diets that are low in dietary fibre, which is primarily found in plant-based foods, and high in fat, sugar, and salt can predispose an individual to the many chronic diseases of this contemporary times, including diabetes (Shaw and Sicree, 2008), obesity (Feskens et al., 2014), cardio-vascular disease (Kochar et al., 2011), certain cancers (Chajes and Romieu, 2014), and more (Buttriss and Strokes, 2008). The crude fibre content of the drink was found to be higher than soymilk (0.081 – 0.087%) by Nwoke et al. (2015) but lower in tigernut drink (1.52%) by Obadesagbo et al. (2023). The ash content was relatively lower (0.61%) than the pulp (5.83%) by Erwa et al. (2018). Also, the ash content was significantly higher (4.40%) in a drink made by dissolving the pulp in cold water by Adedayo et al. (2011)

Sodium is an essential source of electrolyte for the body system; the value was found to be 64.39 ppm. This presents the drink as a fair source of this essential mineral especially since it is higher than a similar drink evaluated in literature (Adedayo et al., 2011). Iron plays an important role in the formation of red blood cells. Since children, women of reproductive age and pregnant women are the most vulnerable to micronutrient deficiency (especially iron deficiency anemia), the consumption of this drink might serve as a substantial source of dietary iron for this group of individuals. Phosphorus and calcium have been reported as key minerals required by children, pregnant and lactating woman for bones and teeth development (Sodamade et al., 2013). Phosphorus and calcium were found relatively high in the drink which presents it as a good source of these minerals. Copper, which is required for enzyme production and some other biological activities in the body, was found to be substantial while zinc, which plays an influential role in gene expression, formation of co-enzymes and regulation of cellular growth, was found to be lower. Potassium was the most abundant among all the minerals determined in the drink. The role of potassium as a major cation and in the utilization of iron in human body has been reported to be very important and this is mostly beneficial to patients suffering from inefficient utilization of potassium and those taking diuretics to control hypertension (Arinathan et al., 2003).

Total plate counts of the powder and modified Baobab drink (*Adansonia digitata*) were 6.2x101 cfu/g and 7.0 x l06 cfu/ml respectively. These results were higher than was reported for a baobab milk nectar evaluated by Chadare et al. (2017). Total Yeast counts of 1.7 x l01 cfu/g and 3.1 xl03 cfu/ml were detected in the powder and modified Baobab drink (*Adansonia digitata*) respectively. Moulds counts was 3.0 x 101 cfu/g and 1.5 x103 cfu/ml in the powder and modified Baobab drink (*Adansonia digitara*) respectively. However, lactic acid bacteria counts of 4.1 x102 cfu/g and

1.2 x105 cfu/ml was detected in the powder and modified Baobab drink (*Adansonia digitata*) respectively while Coliform counts as not detected in the powder but 5.0 x101 cfu/ml was recovered in the modified Baobab drink (*Adansonia digitata*). A safety assessment of the powder and drink shows that except for the total plate count of the modified drink, the microbial status of the products was within an acceptable level (International Commission on Microbiological Specifications for Foods, 2011; Kamatou et al., 2011).

Among microorganisms isolated from modified Baobab drink (*Adansonia digitata*) are Yeast isolates identified as Saccharornyces cerevisiae and Candida tropicalis while Lactic acid bacteria were Lactobacilius (L) deThrukii, L. fermentum and L. piantarum. Moulds isolated were *Aspergillus Jiavus, Penicillium citrinum* and *Rhizopus stolonifer* while Enterobacteriaceae such as Proteus vuigauis, Kiebsiella pneumonia and Escherichia coli were isolated from the samples. The presence of microorganisms is usually increased with exposure to humidity (Chadare, 2017).

Conclusion

This study was designed to evaluate the nutritional properties of a modified Baobab drink and the microbiological properties of the drink and powder. To the best of our knowledge, this is the first attempt to evaluate such products from Baobab fruit pulp applying the described methodology. The results reveal that the drink has high moisture content and could also supply energy from carbohydrates but contains other proximate in smaller amounts. Mineral composition was high especially for potassium. The microbiological properties show that comparatively the Baobab drink's microbial status is within safe levels. However, the presence and absence of high moisture in drink and powder impacted on the microbial load and isolates from both products respectively.

Recommendation

1. There is need to carry out sensory evaluation/consumer acceptance studies on the drink to guarantee adoption among *Baobab* drinking growing populations.
2. A follow-up study on the willingness to pay should be preformed to explore the commercialization of this drink to provide healthy options for sugar sweetened carbonated beverages.

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Food Hygiene Knowledge and Practice among Undergraduates: A Case Study of Enugu State University of Science and Technology (ESUT) Enugu

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Abstract

The study investigated issues relating to food hygiene among undergraduates in Enugu State University of Science and Technology (ESUT). Specifically, it determined: proportion of undergraduates in ESUT who possess knowledge of food hygiene and food hygiene practices adopted by the undergraduates. Two research questions and two null hypotheses guided the study. The study adopted a descriptive cross-sectional survey research design. Population for the study consisted of 44,201 undergraduates in ESUT. The sample was 480 undergraduates drawn using multi-staged sampling procedures. Questionnaire was used for data collection. Frequency, percentages and Chi-square statistics were used for data analysis. Findings reveal that overall, the proportion of undergraduates in ESUT who possess knowledge of food hygiene was high (61.6%). Specifically, a high proportion of undergraduates knew the meaning of food hygiene (74.6%), throwing away food when in doubt is a preventive measure for food poisoning (67.1%), food hygiene practice (66.5%), and risk factors for food poisoning (65.8%). Overall, majority of undergraduates (89.5%) adopted good food hygiene practices such as; buying clean and fresh foods for cooking (92.3%), covering of the hair while cooking (84.2%), not wearing accessories like rings, bracelets when cooking food (78.6%) and washing of fruits and vegetables before eating (75.9%). There was no significant difference in the level of knowledge of food hygiene among undergraduates based on age ($X^2 = .679$, $p = .712 < .05$) and gender ($X^2 = .004$, $p = .947 < .05$). There is a significant difference in the food hygiene practices adopted by undergraduates based on age ($X^2 = 25.978$, $p = .000 < .05$) and gender ($X^2 = 40.983$, $p = .000 < .05$). it was recommended that Health educators, Home Economists, teachers, and other relevant stakeholders should enlighten the undergraduates of ESUT and general public on the importance of adopting good food hygiene practices irrespective of age and gender.

Keywords: Food, Food-borne, Illnesses, Hygiene, Knowledge, Practice, Undergraduates

Introduction

Food hygiene is a significant public health issue in prevention and control of food-borne illnesses. World Health Organization (WHO, 2020), estimated that 600 million, almost one in 10 people in the world, fall ill after eating contaminated food and 420,000 die every year, resulting in the loss of 33 million healthy life years. The incidence of food-borne diseases is rising in developing countries, including Africa. In African, food-borne illnesses continue to be a subject of great concern. Monney, Agyei, and Owusu (2013), reported that about 65,000 persons died yearly due to food-borne illnesses in Ghana. According to WHO (2020), consuming unsafe foods pose a significant public health threat in the African Region. The case is also worrisome in Nigeria.

In Nigeria, there has been disturbing reports of food-borne illnesses due to the adoption of poor food hygiene. Emmanuel et al. (2015) reported that knowledge and practice of food hygiene and safety was low among food vendors and a significant proportion of them were not trained in food handling and preparation. Reports indicate that as much as 70 per cent of diarrhoeal diseases in developing countries are believed to be of food-borne origin (Emmanuel et al., 2015). It is therefore, important, to adhere to food hygiene principles.

Food is any substance liquid, solid or powdered which when eaten and digested provides the body with energy, enhances growth, replaces worn-out tissue and regulates the body processes. Food is also any healthy substance consumed to provide nutritional support for the body (Sadler et al. 2021). Everybody's state of health is determined by the food required by the body (Dimassi, Haddad, Awada, Mattar, & Hassan, 2021). According to the Food and Agricultural Organization (FAO) and WHO (2009), food is important for the nutrients it provides. The nutrients in food provide energy for activity, growth, and all functions of the body such as breathing, digesting food, and keeping warm, growth and repair of the body, and for keeping the immune system healthy (FAO & WHO, 2009). Food is usually of plant or animal origin, and contains essential nutrients, such as fats, proteins, vitamins, or minerals. Food has to meet physiological requirements in terms of quantity, quality, and not to form food borne diseases to be socially and culturally acceptable (Islam et al., 2022). Hence, food hygiene becomes important.

Food hygiene is one of the three aspects of hygiene, with the others being environmental and personal hygiene. Food hygiene is a conscious effort to keep food safe from potential contamination and protect the health of consumers. Food and Agricultural Organization (FAO) and WHO (2009) defined food hygiene as all the practical measures involved in keeping food safe and wholesome through all the stages of production to the point of sale and consumption. Tuglo et al. (2021) defined food hygiene as handling, preparing and storing food or drink in a way that best reduces the risk of

consumers becoming sick from the food-borne disease. Food should be protected from spoilage and harmful microorganisms, harmful bacteria in the food should be destroyed by thorough cooking or processing, and that food should be safe, sound and wholesome when it reaches the consumer (White, 2006). Unsafe food creates a vicious cycle of disease and malnutrition, particularly affecting infants, young children, elderly and the sick (WHO, 2020). Food-borne diseases impede socioeconomic development by straining health care systems, and harming national economies, tourism and trade.

Knowledge enhances ones judgment necessary for good choice. Hence, knowledge can be crucial in adopting adequate food hygiene practices. Practice involves doing a particular thing habitually. Practice is the actual performance or application of knowledge (Miller, 2018). Bamidele et al. (2015) defined food hygiene practice as all actions taken with regards to prevention of contamination of food stuffs at all stages of production, collection, transportation, storage, preparation, sale and consumption. Adequate food hygiene practices may include; buying clean and fresh foods for cooking, hand washing before and after cooking, washing of fruits and vegetables before eating, not wearing accessories like rings, bracelets when cooking food, use of neat apron when cooking, among others (Stratev et al., 2017; Lema et al., 2020). It is therefore necessary to investigate the knowledge and practice of food hygiene among undergraduates.

Undergraduates are mostly carefree and so engage in behaviours that could expose them to different health disorders including adopting inadequate food hygiene practices (Samuel, 2006). They are prone to preparing and storing food haphazardly due to the nature of their environment and the activities they engage in which is usually stress related. The knowledge and practice of food hygiene among undergraduates may be influenced by certain factors including age, gender, year of study, marital status, family type, study programme, place of residence and others (Farahat et al., 2015; Odonkor et al., 2020; Okugn & Woldeyohannes, 2018; Tuglo et al. 2021). However, the factors of interest in this study are age and gender.

Age is one of the factors associated with food hygiene knowledge and practice among undergraduates. Farahat, El-Shafie and Waly (2015) reported that age was significantly associated with food hygiene practices among Saudi women. Odonkor, Kurantin, and Sallar (2020) reported that the odds of performing good food handling practice among respondents within the age group of 36-45 years were five times higher compared to those within the age group of 18-25 years. On the part of gender, Stratev, Odeyemi, Pavlov, Kyuchukova, Fatehi, and Bamidele (2017) reported that gender did not affect food safety knowledge, attitudes and practices among veterinary medicine students at Trakia University, Bulgaria.

Investigating these factors will help to shed light on the knowledge and practice of food hygiene among undergraduates in Enugu State University of Science and Technology (ESUT).

Enugu State University of Science and Technology (ESUT) is a university in Nigeria that was founded on 30 July 1980. There are ten faculties and 49 departments in the university with over 40,000 students. It has been observed that undergraduates in ESUT adopt poor food hygiene practices such as not washing hands before eating, not washing vegetables and fruits, storing of both cooked and raw food in the same place, buying food from vendors who have not been approved by the school authority, and others. These practices may be due to low level of knowledge of food hygiene and is importance. Over the years, the university authority has made efforts to regulate the activities of food vendors in the school and ensure that food sold to students within the university is of hygienic standards. However, the university has no control over what undergraduates eat and how they prepare their own food. Hence, undergraduates of ESUT seem to be vulnerable to food related illnesses due to the inability to organize time, stress of examination and deadlines, irregular sleeping patterns, new peer's relationships, and inability to acclimatise to the new surroundings. All of which affect the type, procedure and hygiene with which they prepare their own food.

Food hygiene has become an issue of global attention particularly due to its significant link to public health and the need to minimise foodborne diseases. This study therefore aimed to tackle the problems of food hygiene by investigating the knowledge and practice of food hygiene among undergraduates in ESUT. Findings from this study may be beneficial in enabling health educators, Home Economists, teachers, and other relevant stakeholders identify areas where food hygiene can be improved in terms of knowledge and practice.

Objectives of the Study

The major objective of the study was to investigate knowledge and practice of selected indicators of food hygiene among undergraduates in ESUT. Specifically, the study determined:

1. proportion of undergraduates in ESUT who possess knowledge of food hygiene;
2. food hygiene practices adopted by undergraduates in ESUT.

Research Questions

Two research questions guided the study.

1. What is the proportion of undergraduates in ESUT who possess knowledge of food hygiene?
2. What are the food hygiene practices adopted by undergraduates in ESUT?

Hypotheses (HOs)

HO_1: There is no significant difference in the proportion of undergraduates in ESUT who possess knowledge of food hygiene based on socio-demographic factors (age and gender)

HO_2: There is no significant difference in the food hygiene practices adopted by undergraduates in ESUT based on socio-demographic factors (age and gender).

Methodology

***Design of the Study*:** This study adopted a descriptive cross-sectional survey research design.

***Area of the Study*:** The area of the study was ESUT, in Enugu, Enugu state. Enugu State University of Science and Technology (ESUT) was founded on July 30, 1980. It the time of the study, it had ten faculties and 49 departments.

***Population for the Study*:** The study population comprised of undergraduates in ESUT. The number of undergraduates in ESUT was 44,201 students at the time of the study (Information Communication Technology unit, ESUT, 2022).

***Sample for the Study*:** The sample size was 480 respondents. This was determined using Cohen, Manion, and Morrison (2011) Standardized Table for Sample Size, Confidence Levels and Confidence Intervals for Random Samples. A multi-stage sampling procedure was used to select the respondents. Six faculties were randomly selected out of ten faculties in ESUT. Then four departments from each of the six faculties were also randomly selected. This gave a total of 24 departments. Convenience sampling technique was then used to select 20 undergraduate students consisting of 10 males and 10 females, each from the twenty four departments selected in stage two, which gave a total of 480 undergraduates. Convenience in the sense that undergraduates in the different departments, who had time and expressed their consent in responding to the questionnaires, were used.

***Instrument for Data Collection*:** Questionnaire was used for data collection. It consisted of 22 items divided into parts A, B, and C. Part A consisted of two socio-demographic variables (age and gender). Part B consisted of 15 items on knowledge of food hygiene. Part C consisted of 10 items on food hygiene practices. It was developed based on literature review and specific objectives of the study. The questionnaire was validated by five experts from Public health education. A reliability index of .753 was obtained for the instrument as a whole, while a reliability index of .767 for Section B and .788 for section C of the instrument were obtained using split half (Spearman's Rank Order Correlation). These were adjudged reliable for the study.

***Data Collection Technique*:** A total number of 480 copies of the questionnaire were distributed to the undergraduates by hand. Out of 480 copies administered, 468 copies were returned. This gave a return rate of 97.5 percent.

***Data Analysis Technique*:** Frequency count and percentage were used to answer the research questions. Chi-square statistic was used to test HOs at .05 level of significance.

RESULTS

Table 1: Frequency and Percentage Responses on Level of Knowledge of Food Hygiene possessed by the Undergraduates of ESUT

S/N	Knowledge of food hygiene	Knowledge "Yes" F(%)	Knowledge "No" F(%)
1.	Food hygiene is concerned with all types of hazards and how to achieve safe preparation of food	349(74.6)	119(25.4)
2.	There are seven classes of food	264(56.4)	204(43.6)
3.	Not wearing of jewellery during cooking is part of food hygiene	306(65.4)	162(34.6)
4.	Food poisoning is caused by eating contaminated food and water.	242(51.7)	226(48.3)
5.	Viruses and parasites are the most common causes of food poisoning	289(61.8)	179(38.2)
6.	Symptoms of food poisoning include vomiting, fever, abdominal pain and cramps.	277(59.2)	191(40.8)
7.	Leaving the hair open while cooking is a risk factor for food poisoning	308(65.8)	160(34.2)
8.	Throwing away food when in doubt is a preventive measure for food poisoning	314(67.1)	154(32.9)
9.	Washing of hands, utensils and food surfaces before and after use is one of the preventive measures of food poisoning	275(58.8)	193(41.2)
10	Laboratory screening can diagnose food poisoning	281(60.0)	187(40.0)
11	Chilling or freezing eliminates harmful germs from food	150(32.1)	318(67.9)
12	To prevent food poisoning, leftover foods should be heated until they are boiling hot	303(64.8)	165(35.2)
13	Bacteria is the microorganisms that causes most food-borne illnesses	261(55.8)	207(44.2)
14	Washing dishes immediately after meal is an important food hygiene practice	311(66.5)	157(33.5)
15	Leftover foods should be stored in the refrigerator for a maximum of four days	223(47.6)	245(52.4)
	Cluster %	**61.6**	**38.4**

Key: *below 20% = very low knowledge, 20-39% = low knowledge, 40-59% = average/moderate knowledge, 60-80% = high knowledge, 80% and above = very high knowledge.*

Table 1 shows that overall, the proportion of undergraduates in ESUT who possess knowledge of food hygiene was high (61.6%). Specifically, a high proportion of undergraduates knew that food hygiene is concerned with all types of hazards and how to achieve safe preparation of food (74.6%), throwing away food when in doubt is a preventive measure for food poisoning (67.1%), washing dishes immediately after meal is an important food hygiene practice (66.5%), leaving the hair open while cooking is a risk factor for food poisoning (65.8%), and not wearing of jewellery during cooking is part of food hygiene (65.4%).

Table 2: Frequency and Percentage Responses on Food Hygiene Practices Adopted by Undergraduates of ESUT

S/N	Food Hygiene Practices	Practice Adopted	
		"Yes" F(%)	"No F(%)
1	Buying clean and fresh foods for cooking	432(92.3)	36(7.7)
2	Washing of hands before and after cooking	189(40.4)	279(59.6)
3	Washing of fruits and vegetables before eating	355(75.9)	113(24.1)
4	Reading labels to identify the expiry date of packaged food before purchasing	341(72.9)	127(27.1)
5	Washing and rinsing cutting boards, knives and plates used for raw meat before using them for other food items	310(66.2)	158(33.8)
6	Not wearing accessories like rings, bracelets when cooking food	368(78.6)	100(21.4)
7	Use of apron when cooking	237(50.6)	231(49.4)
8	Protecting raw food from insects and rodents	241(51.5)	227(48.5)
9	protecting cooked food from insects and rodents	327(69.9)	141(30.1)
10	Covering of the hair while cooking	394(84.2)	74(15.8)
	Cluster %	**89.5**	**10.5**

Table 2 shows that overall, majority of undergraduates (89.5%) adopted good food hygiene practices. Specifically, food hygiene practices among undergraduates in ESUT include; buying clean and fresh foods for cooking (92.3%), covering of the hair while cooking (84.2%), not wearing accessories like rings, bracelets when cooking food (78.6%) and washing of fruits and vegetables before eating (75.9%).

Table 3: Chi-Square Analysis of Proportion of Undergraduates in ESUT Who Possess Knowledge of Food Hygiene Based on Socio-demographic factors

Factors	N	True O(E)	False O(E)	X^2	df	p-value
Age						
16 – 19 years	212	136(136.8)	78(75.2)			
20 – 24 years	142	89(91.6)	53(50.4)	.679	2	.712
25 years and above	114	77(73.6)	37(40.4)			
Gender						
Male	126	81(81.3)	45(44.7)	.004	1	.947
Female	342	221(220.7)	121(121.3)			

Table 3 shows the Chi-square value with the corresponding p-value for hypothesis of no significant difference in the proportion of undergraduates in ESUT who possess knowledge of food hygiene based on age (X^2 = .679, p = .712< .05) and gender (X^2 = .004, p = .947< .05). Since the p-value was greater than .05 level of significance, the null hypothesis was therefore not rejected. This implies that there is no significant difference in proportion of undergraduates in ESUT who possess knowledge of food hygiene based on

socio-demographic factors (age and gender).

Table 4: Chi-Square Analysis of Food Hygiene Practices Adopted by Undergraduates Based on Socio-demographic factors

Factors	N	YesO(E)	NoO(E)	X^2	df	p-value
Age						
16 – 19 years	212	205(189.8)	7(22.2)			
20 – 24 years	142	124(127.1)	18(14.9)	25.978	2	.000
25 years and above	114	90(102.1)	24(11.9)			
Gender						
Male	126	94(112.8)	32(13.2)			
Female	342	325(306.2)	17(35.8)	40.983	1	.000

Table 4 shows the Chi-square value with the corresponding p-value for hypothesis of no significant difference in the food hygiene practices adopted by undergraduates based on socio-demographic factors of age (X^2 = 25.978, p = .000< .05) and gender (X^2 = 40.983, p = .000< .05). Since the p-value was less than .05 level of significance, the null hypothesis was therefore rejected. This implies that there is a significant difference in the practices adopted by undergraduates in a Nigerian university based on socio-demographic factors (age and gender).

Discussion

Table 1 reveals that overall, the proportion of undergraduates in ESUT who possess knowledge of food hygiene was high. Also, the Table shows that a high proportion of undergraduates knew that food hygiene is concerned with all types of hazards and how to achieve safe preparation of food, throwing away food when in doubt is a preventive measure for food poisoning, washing dishes immediately after meal is an important food hygiene practice, leaving the hair open while cooking is a risk factor for food poisoning, and not wearing of jewellery during cooking is part of food hygiene. The finding was expected and agrees with the finding of Mendagudali et al. (2016) that women of Khaza bazar had consistently good knowledge of food safety. The finding is also in consonant with the finding of Elechi and Allison (2018) that 80.5 per cent of food handlers in Port Harcourt LGA of Rivers State had good knowledge of food hygiene. However, the findings disagree with Islam et al. (2022) who found that only 41.8 per cent of university students in Bangladesh had knowledge of food handling and safety. Although the respondents from these studies are different, the similarity in findings cannot be over looked because all the respondents are exposed to similar environmental condition which exposes them to foodborne diseases and the need for proper food hygiene.

Findings in Table 2 showed that overall, majority of undergraduates

adopted good food hygiene practices. Food hygiene practices among undergraduates in ESUT included buying clean and fresh foods for cooking (92.3%), covering of the hair while cooking (84.2%), not wearing accessories like rings, bracelets when cooking food (78.6%) and washing of fruits and vegetables before eating. The findings are expected because undergraduates usually handle food for their personal consumption and so may have their health and wellbeing at heart when handling food. The findings are in line with the findings of Faremi, Olatubi and Nnabuife (2018) that 78.2 per cent of food vendors in Obafemi University Ile-Ife, South Western Nigeria had satisfactory food safety hygiene practices. The finding however, disagrees with the finding of Azanaw, Gebrehiwot, and Dagne (2019) that only 49.0 per cent of food handlers in Gondar city had good food handling practice. The disparity in findings maybe because Azanaw, Gebrehiwot, and Dagne (2019) investigated food handlers who are handling food for commercial reasons while the current study dealt with only undergraduates who prepare food for personal consumption.

Table 3 showed that there is no significant difference in proportion of undergraduates in ESUT who possess knowledge of food hygiene based on socio-demographic factors of age. This is surprising as older age is expected to come with more knowledge and exposure. The findings agree with the finding of Stratev et al. (2017) that age and gender did not significantly affect food safety knowledge among veterinary medicine students at Trakia University, Bulgaria. However, the findings disagree with the finding of Farahat, El-Shafie and Waly (2015) that Saudi women with higher age groups showed higher mean knowledge in food safety than those in low age groups. Also, Table 3 showed that there is no significant difference in the proportion of undergraduates in ESUT who possess knowledge of food hygiene based on socio-demographic factors of gender. This finding is not expected because in the Nigerian culture, it is assumed that the woman's place is in the kitchen and the female is expected to be conversant with food handling than the male who is glorified for being a man. The findings disagree with the finding of Johnson (2019) that good food hygiene knowledge was significantly associated with female gender among food vendors in Uyo, Nigeria. The outcome of this finding, however, maybe because with the struggle to achieve gender equality, both the gender now take up similar responsibilities, including food handling, especially as it regards to their personal health and wellbeing.

Findings in Table 4 that there is a significant difference in the food hygiene practices adopted by undergraduates based on socio-demographic factors of age and gender. The findings on age disagree with the findings of Stratev et al. (2017) that age did not affect food safety practices among veterinary medicine students at Trakia University, Bulgaria. The findings on age are also in contrast with the findings of Odonkor,

Kurantin, and Sallar (2020) that the odds of performing good handling practice among postnatal mothers within the age group of 36-45 years were five times higher compared to those within the age group of 18-25 years in Western Ghana. The disparity in findings may be because undergraduates aged 20 years and above may be in their final year and so are faced with tedious academic requirements making it difficult for them to adopt proper food hygiene practices when handling their food. On the part of gender, females are trained by their mothers at very young age on how best to handle food. These trainings are usually not provided to the male child. The findings are in line with the findings of Okugn and Woldeyohannes (2018) that sex of household head was a factor associated with food handling practices in Abobo district, south-western Ethiopia. The findings however, disagree with the findings of Lema et al. (2020) that being male was an independent predictor of food safety practice of food handlers at University of Gondar, Northwest Ethiopia.

The limitations of this study include that, this study did not include characteristics of the respondents such as their socio-economic status, background, cultural beliefs and values which may have also affected some of the food hygiene practices in the study. Therefore care must be taken while drawing sharp conclusions on the findings of this study.

Conclusion

The finding of this study shows that the proportion of undergraduates in ESUT who possess knowledge of food hygiene was high and that majority of undergraduates adopted good food hygiene practices. The study also shows that no significant difference in the proportion of undergraduates in ESUT who possess knowledge of food hygiene based on socio-demographic factors (age and gender) and a significant difference in the food hygiene practices adopted by undergraduates based on socio-demographic factors (age and gender).

Recommendations

1. Health educators, teachers, and other relevant stakeholders should enlighten undergraduates on the importance of adopting good food hygiene practices.
2. Undergraduates should read up and gather information on food hygiene and also practice proper hygiene for preparing and handling their own food.
3. Government and non-government agencies should sponsor programmes in the universities to teach undergraduates ways to handle their food.
4. Further studies should consider using a larger, randomized and more representative population, considering other factors associated with the knowledge and practice of food hygiene in a larger study area.

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Strategies for Improving Women Participation in Agriculture in Abia State

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Abstract

This study was to evolve strategies that could be put in place for improving women participation in agriculture in Abia state. Specifically, the study determined strategies which each of the following should put in place for improving women's participation in agriculture in Abia state; agricultural based non-governmental organization (NGOs) and relevant government bodies. It was survey. Population was made up of Agricultural Extension workers, registered Agric-based non-governmental organizations (NGOs) and registered rural women farmers in the area of the study. Questionnaire was used for data collection. Mean and standard deviation were used for data analysis. Findings include 15 NGOs strategies. These included among others; provide credit and financial facilities for women in agriculture (WIA) ($\overline{X}$ = 3.44), strengthen technical and entrepreneurial skills of WIA ($\overline{X}$ = 3.45), invite successful women farmers to give career-talks and serve as role models to rural women ($\overline{X}$ = 3.46) and assist rural women to attend agricultural shows, field trips or work-visit ($\overline{X}$ = 3.40). Other findings are 21 government strategies. These include; provide adequate social amenities to rural women farmers such as good roads ($\overline{X}$ = 3.39), create agricultural policies that will favour WIA ($\overline{X}$ = 3.07), enhance women knowledge of basic farming activities($\overline{X}$ = 3.39), establish new agricultural training centers and strengthening existing ones ($\overline{X}$ = 3.46), help women acquire agricultural land ($\overline{X}$ = 3.27) and others. It was recommended, among others, that the government should promote a more agricultural financial supportive for the women.

Keywords: Agriculture, Women, Extension, Workers, Participation, Strategies, Rural, Development.

Introduction

Agriculture remains central to national economies, reason why the international development community / bodies have recognized agriculture as one of the key ways for economic growth and poverty reduction in countries where it is the main occupation of the people. Women make essential contributions to the agricultural and rural economies in all developing countries. Their participation vary considerably between and within regions and are changing rapidly in many parts of the world, where economic and social forces are transforming the agricultural sector (Anderson , Reynolds, Biscaye , Patwardhan and Schmidt, 2020).They are often seen as the primary drivers of the development of national economies and local communities. This is because; women constitute more than 40 percent of the global share of the labour force in agriculture, which rises to more than 75 percent in sub-Saharan African (SSA) countries (Food and Agriculture Organization, 2018). In SSA, rural households that are small-scale farmers contribute more than 75% of agricultural production (FAO, 2018). This contribution is a result of the fact that women constitute the most significant proportion of the share of the labour force in agriculture. However, gender inequality which adversely affects their overall performance and output has persistently manifested in a number of ways: high level of poverty (World Bank, 2014), vulnerability to external and uncontrollable hazards, low strength or energy level (Nwaru, 2015), low educational attainment, poor anthropometric variables marginalization by agricultural extension, high productive and reproductive work load, and restricted access to productive resources (World bank, 2014). These indicators favor the men folk, thus justifying current government efforts to empower women and enhance their productivity. Noteworthy in this regard are such program as the Women-in-Agriculture (WIA), Better Life for Rural Women (BLP) and Family Support Programs (FSP), as well as the activities of Women Development Associations, Women-in-Development Associations (WDA), Women-in-Development (WID) and Gender and Development (GAD) Programs. These were targeted at reducing marginalization of women and promoting gender equity and equality. The current Commonwealth 'Gender Mainstreaming' policy applied to agriculture is a deliberate attempt to consider the different needs and circumstances of male and female farmers, and use same as criteria for fashioning out agricultural and rural development strategies for greater productivity. Gender has been recognized as an essential variable for analyzing the roles, responsibilities, constraints, opportunities, incentives, costs and benefits in Agriculture(Umeh&Nwachukwu, 2015). The WIA extension program was established by the Federal Agricultural Coordinating Unit (FACU) in all the Agricultural Development Programs (ADP) of the Federation, and was

designed to make the agency (ADP) address gender-specific agricultural production and post-harvest technology issues. Specifically, Women in Agriculture (WIA) was designed to; developed innovative gender-specific programs for women farmers in close collaboration with research institutions, promote the development and use of appropriate agricultural technologies which reduce drudgery and meet the needs of women, assist in linking women farmers to sources of credit, support group/individual women activities aimed at increasing the animal protein resources of the country, improve skills of women in food processing, utilization and marketing, organize women into cooperatives to gain credit, information etc, and encourage women farmers keep livestock to improve their nutritional status (Osabohien, Olurinola, Matthew, Azuh. and Aderounmu 2021). Women in agriculture have been able to transfer a number of agricultural technologies to farmers in Abia State.

Although the program has recorded great achievements nationwide, women's low participation (Etuh, 2012) has been attributed to ignorance, low income, low level of education, lack of input and credit facilities and poor communication. In most cases, these women have limited or closed access to land and credit and other productive resources. Thus, development assumes special significance for two important reasons; first about two thirds of the population still lives in villages and there cannot be any progress so long as rural areas remain backward (Katz, 2013) and secondly, the backwardness of the rural sector would be a major impediment to the overall progress of the economy. While poverty affects many households, there appears to be gender influence on the manifestations of poverty. Survey carried out by Umeh and Nwachukwu(2015) on inequality and poverty in rural Nigeria showed that across the country, 40 percent of male farmers and 72 percent of female farmers cultivate less than one hectare of land per household. Women play a major role in the production, processing and marketing of food crops. Despite the integral role women play in the agricultural sector, Yokying and Lambrecht (2020)opined that their contributions are not valued or recognized, nor are they reflected in the National Accounting Systems or given prime considerations in agricultural policy processes. Chinsman (2013) reported that because of the gender division of labour and responsibilities for household welfare, women bear a disproportionate burden. The female share of the agricultural labor force in the country and Africa as a whole has greatly decreased, from 45 percent during the period 1990- 1995 to almost 34 percent in 2011, while men's contribution has considerably increased from 66 to 55 percent during the same period (FAO, 2018). The above is in spite of the critical roles they play in agricultural production, processing and marketing; household commitments including childcare; and farm and home decision making, etc.

Various factors militate against women as they participate in agriculture in Abia state. It is necessary

to evolve strategies that could help ameliorate the challenges. Such strategies could culminate into meaningful support for the women. Supporting the women could come in form of governmental and agricultural based non-governmental strategies and is a sure way of breaking the vicious cycle that leads to rural poverty and the expansion of slums in the cities (Obayelu, Ogbe and Edewor, 2019). Government related strategies are plan of action designed by the government or through their ministries to achieve a long-term or overall aims while non-governmental related strategies are plan of action designed by a person or a group of people to find solutions to problems facing humanity. The strategies should consider women as a critical factor in development, by paying particular attention to their challenges and need for social skills both within and outside the agricultural sector. Such strategies are put in place; they would likely improvements in women's participation in their various farm activities. It is therefore of utmost important to evolve strategies for improving women participation in agriculture in Abia state.

Objectives of the study

The general objective of this study was to evolve strategies that could be put in place for improving women participation in agriculture in Abia state. Specifically, the study determined strategies which each of the following should put in place for improving women's participation in agriculture in Abia state:

1. agricultural based non-governmental organization(NGOs).
2. relevant government bodies.

Methodology

***Design of the study*:** Design of the study was a descriptive survey.

***Area of the Study*:** The study was carried out in Abia state. Women in Agriculture (WIA) programme are active in the state. Women in Abia state in both urban and rural areas, play a major role in the production, processing and marketing of food crops. Despite the integral role they play in the agricultural sector, their contributions are not valued or recognized because of the gender division of labour and responsibilities for household welfare, women bear a disproportionate burden.

***Population for the study*:** The population of the study was made up of 176 rural women who were registered members of WIA, 67 Extension workers, 13 registered Agricultural-based non-governmental organizations (NGOs) in the area of the study. These gave a population size of 256 respondents. Since the population size was manageable, there was no sampling, hence all the 256 respondents were involved in the study.

***Instrument for data collection*:** The instrument for data collection was questionnaire. It was developed based on literature review and the specific objectives. It had a 5-point response scale of Strongly strategy (SA), Strong strategy (SA), Undecided strategy (UNS), Disagreed strategy (DS) and Strongly disagreed strategy (SDS) with

corresponding values of 5, 4, 3, 2, and 1 respectively. The instrument was face validated by three experts in agriculture. Their corrections and suggestions were utilized to improve the draft of questionnaire. Cronbach reliability method was adopted to determine the internal consistency of the questionnaire items, Alpha coefficient of 0.81 was obtained.

***Data collection method*:** A total of 256 copies of the questionnaire were administered with the help of three trained research assistants to the respondents. The entire copies of questionnaire were retrieved. This represents 100 percent retrieval return.

***Data Analysis Techniques*:** Data were analyzed using mean and standard deviation for answering research questions. A criterion mean of 3.00 was used as the benchmark for decision making for each item. Thus, item with a mean of 3.00 and above was regarded as agreed strategy, while below 3.00 was disagreed strategy. Decision was based on the grand mean (($\overline{X} \geq 3.0$).

RESULTS

Table 1: Mean Responses and Standard Deviation on the Agricultural based Non-governmental Organization (NGOs) Strategies for Improving Women Participation in Agriculture in Abia state.

S/N	Agriculture-based NGOs Strategies	$\overline{X}_1$	SD_1	$\overline{X}_2$	SD_2	$\overline{X}_3$	SD_3	$\overline{X}_g$	R
	NGOs should:								
1	provides credit and financial facilities for women in agriculture (WIA)	3.46	.56	3.40	.99	3.47	.70	3.44	Agreed
2	strengthen technical and entrepreneurial skills of WIA	3.32	.61	3.36	.94	3.68	.47	3.45	Agreed
3	invite successful women farmers to give career-talks and serve as role models to rural women	3.47	.70	3.23	.75	3.69	.46	3.46	Agreed
4	enhance women knowledge of basic farming activities through establishing new agricultural training centers and strengthening existing ones.	3.68	.47	3.10	.50	3.46	.56	3.41	Agreed
5	provide fertile land(s) in support of rural women's entrepreneurship.	3.69	.46	3.26	.77	3.32	.61	3.42	Agreed
6	assist women to acquire land for farming	3.18	.58	3.53	.47	3.47	.70	3.39	Agreed
7	assist rural women to attend agricultural shows, field trips or work-visits	3.66	.56	3.20	.62	3.36	.94	3.40	Agreed
8	participate in women training courses in action-oriented methods	3.31	.73	3.32	.61	3.68	.47	3.43	Agreed
9	maintain a field presence in remote locations, where it is difficult to keep government staff in post	3.40	.64	3.47	.70	3.69	.46	3.52	Agreed
10	work with farmers to draw on local knowledge systems in the design of technology options.	3.40	.64	3.68	.47	3.18	.58	3.42	Agreed
11	assist in providing storage facilities to make year – round women agricultural	3.31	.73	3.69	.46	3.66	.56	3.55	Agreed

	production possible								
12	assist in providing basic amenities like good roads, water supply among others for rural women farmers	3.26	.68	3.18	.58	3.31	.73	3.25	Agreed
13	assist in providing farming inputs such as fertilizer, herbicides, pesticides and distribute to rural women farmers	3.26	.68	3.66	.56	3.40	.64	3.44	Agreed
14	develop new and improved crop varieties and livestock through research.	3.24	.76	3.31	.73	3.40	.64	3.32	Agreed
15	assist in providing quality extension services to rural women farmers.	3.22	.75	3.40	.64	3.31	.73	3.31	Agreed

$\overline{X}_1$ = mean scores of Extension workers; SD_1 = standard deviation of Extension workers; $\overline{X}_2$ = Mean scores of women; SD_2 = Standard deviation of women, $\overline{X}_3$ = mean scores of NGO; SD_3 = standard deviation of NGO, $\overline{X}_g$ = Grand mean; R = Remark.

Table 1 shows the mean rating of the respondents on the 15 items had their grand mean ranged from 3.25 – 3.55 and were all above the cut-off value of 3.00 on a 5-point rating scale. These however indicated agreed. Therefore, the mean of 3.25 – 3.55 showed that the respondents are in agreement with the identified the non-government organization strategies for improving women participation in agriculture in Abia state. The standard deviation of all the 15 items ranged from .46 to .70 which showed that the respondents were not too far from the mean and the opinion of one another in their responses on the non-government organization strategies for improving women participation in agriculture in Abia state.

Table 2: Mean Responses and Standard Deviation on the Governmental Strategies for Improving Women Participation in Agriculture in Abia State.

S/N	Governmental strategies Government should:	$\overline{X}_1$	SD_1	$\overline{X}_2$	SD_2	$\overline{X}_3$	S_3	$\overline{X}_g$	R
1	provide credit and financial facilities for WIA	3.81	.39	3.31	.73	3.00	.94	3.37	Agreed
2	provide adequate social amenities to rural women farmers such as good roads.	3.44	.55	3.40	.64	3.32	.46	3.39	Agreed
3	create agricultural policies that will favour the WIA.	2.72	.72	3.31	.73	3.18	.64	3.07	Agreed
4	enhance women knowledge of basic farming activities.	3.10	.94	3.26	.68	3.04	.72	3.39	Agreed
5	establish new agricultural training centers and strengthening existing ones	3.32	.46	3.26	.68	3.81	.39	3.46	Agreed
6	help women acquire agricultural land	3.31	.73	3.28	.70	3.22	.75	3.27	Agreed
7	arrange for successful women farmers to give career-talks and serve as role models to rural women	2.98	.64	3.24	.76	3.44	.55	3.22	Agreed

8	enable women participate in agricultural decisions affecting them	3.44	.55	3.40	.64	3.32	.46	3.39	Agreed
9	enable women acquire technical and entrepreneurial skills to improve their engagement in value chains	3.38	.78	3.31	.73	3.20	.94	3.30	Agreed
10	enhance capacity of relevant institutions to provide gender-sensitive services and equipment to rural women	3.69	.46	3.26	.77	3.32	.61	3.42	Agreed
11	provide financial and other basic life incentives in rural areas	3.18	.58	3.53	.47	3.47	.70	3.39	Agreed
12	provide storage facilities to make year – round women agricultural production possible	3.66	.56	3.20	.62	3.36	.94	3.40	Agreed
13	evolve solutions to agricultural development through research.	3.40	.64	3.31	.73	3.24	.76	3.32	Agreed
14	provide farming inputs such as fertilizer, herbicides, pesticides and distribute to rural women farmers	3.31	.73	3.28	.70	3.22	.75	3.27	Agreed
15	expose rural women to agricultural field trips/work-visits organized in technological firms, experts and professionals	3.38	.78	3.31	.73	3.20	.94	3.30	Agreed
16	provide quality extension services to rural women farmers.	3.69	.46	3.26	.77	3.32	.61	3.42	Agreed
17	provide appropriate quarantine services to rural women farmers.	3.24	.76	3.22	.75	3.22	.75	3.23	Agreed
18	create awareness to improve women farmers' agricultural knowledge in new technology usage	3.81	.39	3.31	.73	3.00	.94	3.37	Agreed
19	establish and identify agricultural marketing channels for women farmers.	3.44	.55	3.40	.64	3.32	.46	3.39	Agreed
20	give awards to best women farmers in rural to encourage hard work among them	2.72	.72	3.31	.73	3.18	.64	3.07	Agreed
21	establish standard farms in every rural areas for women to boost their agricultural production	3.10	.94	3.26	.68	3.04	.72	3.39	Agreed

$\bar{X}1$ = mean scores of Extension workers; SD1 = standard deviation of Extension workers; $\bar{X}2$ = Mean scores of women; SD2 = Standard deviation of women, $\bar{X}3$ = mean scores of NGO; SD3 = standard deviation of NGO, $\bar{X}g$ = Grand mean; R = Remark.

Table 2 shows the mean rating of respondents on the 21 items had their grand mean ranged from 3.07– 3.46 and were all above the cut-off value of 3.00 on a 4-point rating scale. These however indicated agreed. Therefore, the mean of 3.07– 3.46 showed that the respondents are in agreement with the identified governmental strategies for improving women participation in agriculture in Abia state. The standard deviation of all the 21items ranged from .39 to .94 which showed that the respondents

were not too far from the mean and the opinion of one another in their responses on the governmental strategies for improving women participation in agriculture in Abia state.

Discussion of Findings

The findings were discussed based on the following sub-heading derived from the study objectives and research questions: non-government organization strategies and government strategies for improving women participation in agriculture in Abia state. The findings in mean rating of the respondents on the 15 items had their grand mean ranged from 3.25 – 3.55 and were all above the cut-off value of 2.50 on a 5-point rating scale. These however indicated agreed. This showed that non-government organization strategies such as; non-government organization strategies, provides credit and financial facilities for women in agriculture, strengths the technical and entrepreneurial skills of women, invite successful women farmers in all areas to give career-talks and serve as role models to rural women, enhance women knowledge of basic farming activities through establishing new agricultural training centers and strengthening existing ones, provide fertile lands in support of rural women's entrepreneurship, assist women to acquire land for farming, assist rural women to attend agricultural shows, among others improves women participation in agriculture in Abia state. This finding is supported by the view of FAO (2018) who stated that private sectors should be engaged in contributing to an enabling environment to support of rural women's entrepreneurship and creation of farm and non-farm decent employment opportunities. Furthermore, the outcome of the study is supported by the view of Obayelu, Ogbe and Edewor(2019) who suggested that policy makers should endeavour to provision of credit facilities for youths commercial banks. More so, Fernandez (2013) revealed that it is the group-organizing and human resource development skills of NGOs which have tended to complement the technical skills and facilities available to government and that NGOs are concerned to develop local capacities for experimentation which build solely on farmers' indigenous knowledge or on this and relevant "outside" ideas. This strategy may contribute to rural advancement in its own right, and the capacity it creates may prove a useful independent source of innovations in the absence of usable technologies from government. The views and observations of the authors cited on the non-government organization strategies for improving women participation in agriculture in Abia state helped to justify the findings of the study on research question 1.

In Table 2, the mean rating of respondents on the 21 items had their grand mean ranged from 3.07–3.46 and were all above the cut-off value of 2.50 on a 4-point rating scale. These however indicated agreed. Therefore, this means that governmental strategies such as; provide credit and financial facilities

for women in agriculture, provide adequate social amenities to rural women farmers e.g improved transport system, create agricultural policies that will favour the women in agriculture more, enhance women knowledge of basic farming activities, establish new agricultural training centers and strengthening existing ones, help women acquire agricultural land, arrange for successful women farmers to give career-talks and serve as role models to rural women, enable women participate in agricultural decisions affecting them, enable women acquire technical and entrepreneurial skills to improve their engagement in value chains, enhance capacity of public institutions and service providers, among others improving women participation in agriculture in Abia state. This outcome is in line with Maertens and Swinnen (2009) who stated that provision of economic opportunities and autonomy; access to economic resources, including credit facilities, land ownership and inheritance; access to education and support services and in the decision making process increases individual participation agricultural productivity. More so, the result is also inline with the view of FAO (2018), who stated that government strengthening the technical and entrepreneurial skills of rural women to improve their engagement in value chains and providing credit and financial facilities are some of the ways to support the women in agriculture. The views and observations of the authors cited on the government strategies for improving women participation in agriculture in Abia state helped to justify the findings of the study on research question 2

Conclusion

This study identified 15 agricultural-based NGO related strategies and 21 government strategies that could be put in place for improving women participation in agriculture in Abia state. These strategies covers numerous areas including, technologies, training, agricultural input among others.

Recommendations

Based on the findings from the study, the following recommendations are made;

1. All government agricultural development programmes in Abia state should make use of the findings of this study to improve women participation in agriculture.
2. Agricultural-based NGOs who were involved in the study should find ways of supporting the women in their agricultural activities.
3. Agricultural extension agents should intensify their work with the women in their farming activities.

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Biochemical Effect of Aqueous Extracts of Turmeric (*Curcuma longa*), Ginger (*Zingiber officinale*) and African Black Pepper *(Piper guineense)* on Blood Glucose Level of Alloxan Induced Diabetic Albino Wistar Rat

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Abstract

The study investigated biochemical effects of aqueous extracts of turmeric, ginger and black pepper on blood glucose levels of induced diabetic albino wistar rats. Specifically, it determined effects of aqueous extracts of turmeric, ginger and black pepper on fasting blood glucose level of diabetic albino rats and body weight of the rats. Sixty- six healthy rats (138-144 grams) were used. Rats were distributed into 11 groups (8 test and 3 control groups) of six rats. Blood glucose level of the rats were determined before diabetes induction. Rats underwent 16 hours overnight fasting prior to induction. They were induced with alloxan injection based on body weight. Diabetes was confirmed using glucometer. Rats with fasting blood glucose level ≥ 200gm/dl were considered diabetic. Various doses of the aqueous extracts were administered orally to different groups based on body weight. Blood glucose level was measured on day 1,7, 14, 21 and 28. Data were analysed as mean ± standard deviation. Analysis of variance (ANOVA) was used to test for differences among all the experimental groups. Duncan's New Multiple Range Test was used to separate and compare means for significant differences. A p – value of < 0.05 was considered statistically significant. The study revealed significant ($p < 0.05$) decrease in blood glucose level of treated rats compared to the untreated (diabetic control) rats. The group treated with combined extracts of turmeric and black pepper with ratios 80:20 (TBP) (80: 20) had the highest reduction in blood glucose level (35.93%) than the other test groups. The group treated with TBP (80:20) had the highest increase in bodyweight (4.08%) compared to the other groups. The findings showed antihyperglycemic activities of these extracts and suggest they may be useful in control of postprandial rise in blood glucose particularly in diabetic condition.

Key Words: Diabetes, Glucose, Alloxan, Aqueous, Extracts, Antihyperglycemic, Bodyweight.

Introduction

Diabetes mellitus is one of the most common endocrine diseases that can affect blood sugar. It is caused by a breakdown in the glucose metabolic process which can result in abnormal blood glucose fluctuations (American Diabetes Association, (ADA) 2020). This chronic metabolic disease occurs either when the pancreas does not produce enough of the hormone, insulin or when the body cannot effectively use the insulin it produces. This is associated with high blood sugar and usually with passage of sugar in the urine (Anita & Abraham, 2010). This impaired insulin secretion and variable degrees of peripheral insulin resistance can lead to hyperglycemia (Simon & Wittmann, 2019).

High blood sugar is an abnormal state for the body and creates specific symptoms and possible long term health problems. ADA (2018) stated that fasting blood sugar above 125 mg/dL (7 mmol/L) indicates that an individual is diabetic. Acute life threatening consequences of uncontrolled diabetes are hyperglycemia with ketoacidosis or non ketotic hyperosmolar syndrome. Oxidative stress plays pivotal role in progression and development of diabetes and its complications. Oxidative stress involved in type 2 diabetes mellitus harmfully affects the insulin activity (Ito, Sono & Ito, 2019; Rehman & Akash, 2017). This Oxidative stress is produced by an excess of the reactive oxygen species and could deteriorate the islets β-cells of the pancreas resulting in the reduced release of insulin (Rehman & Akash, 2017).

Unhealthy diet and lack of exercise could lead to diabetes mellitus. A diet high in fat, calories, and cholesterol can increase the risk of diabetes. Consumption of sugar sweetened drinks in excess, high-fat diet and high intakes of saturated fat raise risk of diabetes metabolic syndrome (Malik 2010 et al., 2010; Popkin, 2015). Inappropriate diet can contribute to oxidative stress and thus the risk of many adverse health conditions, including the world's major non-communicable diseases (NCDs) such as coronary heart disease (CHD), type 2 diabetes, breast and colon cancers which shortens life expectancy (ADA, 2020).

Many studies confirmed that medicinal spices and their extracts may have some positive biochemical effect on blood sugar level (Roy & Awasthi, 2017; Zhang, 2015). Biochemical effect can be defined as the response of an organism to chemical changes that may occur in the body (Walker et al., 2011). Aqueous extract can be defined as elicit obtained by separation of medicinally active soluble plant materials or secondary metabolites using water as the solvent or extraction medium. Studies have reported that aqueous extracts of plants are safe, economical and eco-friendly alternative to use in treatment of diseases (Zhu, et al, 2018; Kocaadam & Şanlier, 2017). Medicinal plants and their aqueous extracts are the key bioresources of bio-active compounds and are well endowed with a variety of phytochemicals (Ojo et al., 2020; Evuen, Okolie & Apiamu,

2022). These extracts are currently of considerable importance because of their special attributes as a large source of therapeutic phytochemicals. They played an essential role in human nutrition have been linked to a reduced incidence of chronic health conditions such as diabetes, cancer, cardiovascular diseases and other chronic diseases (Zhu, et al, 2018).

Many traditional plant treatments exist as hidden wealth of potentials. Spices are also rich sources of phytochemical compounds with antioxidant activity which influence nutrition through many pathways (Kocaadam & Şanlier, 2017). Antioxidants have been shown to improve insulin sensitivity and reduce fasting blood sugars. They are compounds that can decrease oxidative stress, scavenge free radicals from the body cells, prevent and eliminate the damage caused by oxidation. Plant foods are rich sources of antioxidants. Foods that are high in antioxidants may reduce the risk of many diseases, including heart disease and certain cancers (Duyff, 2017).

Turmeric is a spice plant of the ginger family known as *Zingiberaceae*. The rhizomes have been used from antiquity as a spice, condiment, a textile dye, medicine and stimulant. Ginger is an underground rhizome that belongs to the family *Zingiberaceae*. It is also a spice with medicinal properties. Black pepper is spice plant from the family *Piperaceae*. The seed is used as a spice, seasoning, bioenhancer and medicine. Bioenhancers are defined as substances that increase the bioavaliability and bioefficacy of active substances in foods or drugs (Patil, et al, 2011). Spices are functional foods that can be demonstrated to have a beneficial effects on certain target functions in the body beyond basic nutritional requirements (Lobo, et al, 2010). Turmeric, black pepper and ginger have been reported to exert anti-hyperglycemic, anti-inflammatory, antioxidant, antiproliferative and anti-angiogenic activities effect both in laboratory animals and human subjects (Yadav, et al, 2013; Yadav, et al, 2016).

Nair (2013) stressed that curcumin in tumeric lowers blood sugar in multiple ways such as stimulating insulin production, improving activity of pancreas cells, improving sensitivity to insulin and stimulating utilization of glucose by the body. *Piper guineense* possess anti-bacterial, antioxidant and bioenhancing properties. Zhu, et al, (2018) revealed that the antioxidant in ginger could be helpful against a variety of health conditions, can manage and may even prevent type 2 diabetes and hypertension. Many oral orthodox drugs are toxic, contain active constituents and have a number of serious adverse effects on health. They can cause metabolic alterations and other degenerative conditions. They often lower blood sugar within range but actually increase morbidity and mortality. Many traditional plant treatments may be more effective, economical, less toxic in the treatment and management of chronic health problems.

Medicinal spices and their extracts are therefore becoming more popular because of their potential efficacy, minimal or no side-effects and

synergistic actions (Panda et al. 2013). Most synthetic oral anti- diabetic agents are toxic, can cause some metabolic alterations and other degenerative conditions (Jackuliak, et al, 2019). Van and Scheen (2015) reported that some of these synthetic anti- diabetic agents may lead to patients becoming overweight or obese. Epidemiological studies have reported that intake of plants rich in various antioxidants and phytochemicals reduce the risk of various chronic diseases (Yadav, et al, 2013; Kocaadam & Şanlier, 2017).

Unfortunately, some of these medicinal spices and their aqueous extracts have not been scientifically validated. Clinical trials using animal models are needed to exploit their therapeutics potentials. This is important for their scientific validation and for use in prevention, treatment and management of diabetes. Animal models such as albino wistar rats are non human species that are usually used in nutrition research. These rat strains have some important roles to play in understanding the aetiology and pathophysiology of diseases, testing herbal efficacy and safety in humans (Clemens, Jansson, Portal, Riess & Nguyen, 2014). Thus, the study investigated the biochemical effects of turmeric, ginger and black pepper aqueous extracts on blood glucose levels of induced diabetic albino wistar rats.

Objectives of the Study

The general objective of the study was to investigate the biochemical effect of aqueous extracts of tumeric, ginger and African black pepper on blood glucose level of alloxan induced diabetic albino wistar rats. Specifically, the study determined:

1. effects of aqueous extract of turmeric, ginger and black pepper on the fasting blood glucose (mg/dl) among the diabetic albino rats
2. effect of aqueous extracts of turmeric, ginger and black pepper on body weight of the diabetic albino rats.

Materials and Methods

Plant materials Collection and identification of samples: Fresh Turmeric rhizome *(Curcuma longa*), black pepper seed (*Piper guineense*) and ginger rhizome (*Zingiber officanale*) were procured from Ogige market Nsukka and were identified in the Department of Plant Science and Biotechnology, University of Nigeria, Nsukka.

Processing of samples: Two kilogrammes of each of the three samples (*Curcuma longa,* Zingiber officianale and Piper guineense) were sorted to remove debris and defects. The samples were, carefully washed with running tap water to remove dirt and sand and then allowed to drain in a plastic sieve. The samples were peeled, sliced and was dried in an oven at a temperature of 55°C for 24 hours. The pepper was oven-dried for 4 hours. Each of the three dried samples were ground separately into flour using a high speed electric blender (Soyona, Japan). Samples were then packaged in

plastic air tight containers, labeled and stored under refrigeration for analysis.

Preparation of the extracts: Four hundred grammes (400g) of each of the flour sample (*Curcuma longa, Piper guineense and Zingiber officanale*) were macerated with 800ml of distilled water with frequent shaking for 24 hours. They were filtered and the marc was again subjected to maceration with distilled water for complete extraction. The mixtures were filtered using Whatman No.42 filter paper to obtain the filtrate. After filtration, the aqueous extracts were concentrated with the help of an oven dryer at 50°C to obtain the crude extracts. The extracts were stored in an air tight container and were kept in a refrigerator prior to use. The desired consistency for feeding the rats was later reconstituted with distilled water for a known weight of the dried filtrate to give the required dose which was administered during the study. Water was added to the crude extracts of each sample (turmeric, ginger and African black pepper) in the ratio of 10: 1 (weight/volume). This provided 100mg/ml of each extract.

$$\text{Volume} = \frac{\text{dose (mg/kg) x weight (kg)}}{\text{stock concentration (mg/ml)}}.$$

Procurement and housing of rats: Sixty- six (66) healthy male albino rats with no prior drugs treatment weighing between 138–144 grams were used for the experimental study. The rats were purchased from Department of Veterinary Pathology University of Nigeria, Nsukka. The rats were randomly distributed into eleven (11) groups of six rats each based on body weight. They were allowed to acclimatize for 5 days and were fed with standard pellets. The rats had access to water and feed *ad libitum*.

Each group was allotted into metabolic and standardized rat cages equipped to separate feaces and urine of the animals during the rat study period. The study was carried out in the animal house (metabolic laboratory) of the Department of Nutrition and Dietetics, University of Nigeria Nsukka. They were maintained under standard environmental conditions (ambient temperature (25°C ± 2°C), humidity (45% ± 5%) and 12 hours light and 12 hours dark condition during the study.

Experimental Design: Pure experimental research design was adopted**.** The study was conducted for twenty- eight (28) days. This consisted of four days acclimatization period, 1 day for inducement of diabetes, two days for establishment of diabetes and 21 days of treatment with aqueous extracts. All rats were fed commercial pellet diet (rat chow) and water ad libitum throughout the period of experiment. The daily dose of the extracts that was administered to the rats was calculated from the result of acute toxicity test (LD_{50}). During the study period (28 days), blood samples of the rats were collected on day 1, 7,14, 21 and 28 to determine blood glucose level.

Inducement of diabetes: The blood glucose levels of the rats were determined before the inducement of diabetes. After the acclimatization period of four days, diabetes mellitus

were induced on the fifth day. The rats underwent 16 hours overnight fasting prior to induction of diabetes mellitus. The rats were induced of diabetes using single freshly prepared five percent aqueous solution of alloxan monohydrate powder (chemically called 2, 4, 5, 6-tetraoxopyrimidine). This was dissolved in normal saline solution (0.9g sodium chloride in 100ml). It was intraperitoneally injected to the rats at a single dose depending on body weight of the rats. The rats were allowed free access to 5% glucose solution for 48 hours to overcome the early hypoglycemic phase.

Formulation of aqueous extract of *Curcuma longa* and *Piper guineense* blend: Four different formulations of *Curcuma longa* and *Piper guineense* with different ratios were used to determine the dose response of different concentration *of Piper guineense* on *Curcuma longa*. These were obtained by combining two different concentrations of *Curcuma longa* and *Piper guineense.* Each blend was formulated by combining the two aqueous extracts in different ratios to obtain 100g of each of the samples. These combined extracts were administered based on body weight. The ratios were;

TBP90:10 = Turmeric and black pepper (90:10); TBP80:20 = Turmeric and black pepper (80:20)

TBP70:30 = Turmeric and black pepper (70:30) TBP60:40= Turmeric and black pepper (60:40)

Keys: T= Turmeric; BP= Black pepper

Feeding trial: Feeding trial commenced when diabetes had been established. Sixty-six (66) albino rats were used for the study. Rats that were diabetic were grouped and treated with the extract samples. They were grouped into 11 groups of six rats per group. The rats were fed normal rat chow and water ad libitum throughout the period of the experiment. The rat groups were treated by oral administration of different doses of the aqueous extracts at regular intervals of 12 hours. The treatments (different grams of various extracts, and antidiabetic drug dissolved in water) commenced the day the rats were confirmed diabetic. The treatments were given orally every day via a cannula attached to a syringe for 21 days.

Collection of Blood samples: Blood samples were collected from the animals before and after treatment from the animals. Blood samples were taken from the rats after 48 hours of inducement of diabetes to estimate the blood glucose level and to confirm diabetes. Blood glucose concentration was measured by a glucometer on a drop of blood from the tail. This was confirmed using accu-check glucometer and its test strip. Rats with fasting blood glucose level ≥ 200gm/dl were considered diabetic and were selected for the experiment (Mahmoud, 2013). When diabetes was established, treatment commenced with extracts. The dose of the extracts that were administered were based on mean lethality (LD_{50}) of the extracts.

At the end of the 28 days experimental period, the rats were anaesthetized using anaesthetic ether. The blood samples were used in the

determination of biochemical parameters such as blood glucose levels.

Body weight measurement: The initial individual body weights of the rats were taken at the beginning and at the end of the experiment for all animals to determine weight gain using the following equation. Body weight gain = final weight – initial. The initial and final weights of the rats were measured and recorded using an electronic weighing balance.

Biochemical analysis

Determination of Blood Glucose: Glucometer was used for estimation of blood glucose. Determination of blood glucose was measured by the Trinders principle using One Touch Basic glucometer (Lott & Turner, 1975). Rat's tail was cleaned and pricked with a sharp-pointed surgical instrument (lancet). 0.5 µl of blood was taken using a glucometer strip. The strip is then inserted into a glucometer. The test strip was inserted in the glucometer which automatically turns on. A small quantity of blood was dropped on the top white edge of the test strip. The blood glucose level in mg/dl was read on the meter and recorded.

Data Analysis Techniques: Data were analysed using mean ± standard deviation and analysis of variance (ANOVA). was used to test for differences among all the experimental groups. Duncan's New Multiple Range Test was used to separate and compare means for significant differences. A p – value of < 0.05 was considered statistically significant.

Results

Table 1: Effects of aqueous extract on the fasting blood glucose (mg/dl) of diabetic rats

Groups	Baseline	Endline	% Difference
T_{100}	259.40 ^{d} ± 11.72	237.00 ^{cd} ± 6.63	11.60
T_{200}	235.80 ^{bc} ± 10.85	204.80 ^{b} ± 14.39	14.15
G_{100}	243.80 ^{cd} ± 14.86	201.20 ^{b} ± 20.06	18.47
G_{200}	264.80 ^{d} ± 22.73	205.80 ^{b} ± 19.12	21.38
$TBP_{90:10}$	246.80 ^{c} ± 8.23	224.60 ^{c} ± 9.39	20.01
$TBP_{80:20}$	269.00 ^{d} ± 8.86	195.60 ^{b} ± 17.30	35.93
$TBP_{70:30}$	253.60 ^{c} ± 8.26	223.40 ^{c} ± 8.88	17.91
$TBP_{60:40}$	260.20 ^{d} ± 7.56	241.40 ^{cd} ± 10.48	14.23
Normal control	75.20 ^{a} ± 8.84	74.80 ^{a} ± 8.23	0.93
Standard control	233.60 ^{bc} ± 28.38	166.40 ^{ab} ± 8.14	40.77
-ve control	252.80 ^{c} ± 22.74	293.40 ^{e} ± 9.58	15.06

*n=3. Results expressed as means ±SD . value; %D = percentage difference; * = (P < 0.05); baseline = after induction; end-line = after treatment; increase = ; decrease =*

Keys: T100=rats treated with 100mg/kgBW of turmeric extract; T200= rats treated with 200mg/kgBW of turmeric extract;G100= rats treated with 100mg/kgBW of ginger extract; G200= rats treated with 200mg/kgBW of ginger extract; TBP90:10= rats treated with 90:10mg /kgBW of turmeric and black pepper extract; TBP80:20= rats treated with 80:20mg/kg BW of tumeric and black pepper extract ; TBP70:30= rats treated with 70:30mg/kg BW of tumeric and

black pepper extracts; TBP60:40= rats treated with 60:40mg/kg BW of tumeric and black pepper extracts; Normal Control= rats fed with normal rat chow + water ; standard control=- treated with standard drug (glibenclamide) 0.6mg/kg body weight; negative control= rats fed with normal rat chow and water(induced but not treated)

Table 1 shows the effect of aqueous extracts of turmeric, black pepper and ginger on the fasting blood glucose levels of hyperglycemic rats. The fasting blood glucose level of the rats after induction of diabetes ranged from 233.60mg/dl to 269.00mg/dl with the highest found in the group treated with combined aqueous extracts of turmeric and black pepper at ratio 80:20mg/kg (TBP80:20). (269.00mg/dl). It was observed that initial blood glucose level of group treated with 200mg/kg turmeric extract only (235.80mg/dl) and standard control (233.60mg/dl) were significantly similar at ($p < 0.05$). Moreso, groups treated with combined extract with ratio 70 :30 with bodyweight (253.60mg/dl) and negative control (252.80 mg/dl) were significantly similar at ($p < 0.05$). The final blood glucose level of the treated rats ranged from 166.40mg/dl to 241.40mg/dl. The diabetic control group (negative control) had the highest blood glucose level of 293.40mg/dl. The group that was treated with standard drug (standard control) had the highest percentage decrease (40.77%) when compared with other groups. Among the group that was treated with aqueous extract, group 6 which was the group treated with combined aqueous extract TBP80:20 had the highest percentage decrease of 35.93%. The diabetic control group recorded an increase (15.06%) in blood sugar level.

Table 2: The effect of the aqueous extracts on body weight of the hyperglycemic rats

Groups	Initial weight	Final weight	% Difference
T100	141.80 [a] ±6.69	141.98 [a] ±7.83	1.13↑
T200	139.20 [a] ±9.01	140.40 [a] ±9.10	1.58↑
G100	140.20 [a] ±6.53	140.80 [a] ±6.38	0.71↑
G200	139.00 [a] ±8.19	140.70 [a] ±8.94	1.44↑
TBP90:10	142.60 [a] ±6.84	143.80 [a] ±6.69	0.84↑
TBP80:20	138.00 [a] ±8.76	141.80 [a] ±9.76	4.08↑
TBP70:30	141.80 [a] ±6.69	143.40 [a] ±7.83	3.13↑
TBP60:40	140.20 [a] ±6.53	141.20 [a] ±6.38	1.51↑
Normal control	142.20 [a] ±6.53	146.00 [ab] ±9.63	5.08↑
Standard control	142.20 [a] ±7.40	145.00 [ab] ±6.67	4.09↑
-ve control	144.00 [a] ±9.76	140.00 [ab] ±9.75	5.04↓

n=3. Results expressed as means ± SD. % D = percentage difference; increase = ↑ ; decrease = ↓
Keys: T100 = rats treated with 100mg/kgBW of turmeric extract; T200 = rats treated with 200mg/kgBW of turmeric extract;G100 = rats treated with 100mg/kgBW of ginger extract; G200 = rats treated with 200mg/kgBW of ginger extract; TBP90:10 = rats treated with 90:10 mg/kgBW of turmeric and black pepper extract; TBP80:20 = rats treated with 80:20mg/kg BW of tumeric

and black pepper extract ; TBP70:30= rats treated with 70:30/mg/kg BW of tumeric and black pepper extracts; TBP60:40 = rats treated with 60:40mg/kg BW of tumeric and black pepper extracts; Normal Control = rats fed with normal rat chow + water; standard control =- treated with standard drug (glibenclamide) 0.6mg/kg body weight; negative control= rats fed with normal rat chow and water(induced but not treated)

Table 2 shows the effect of aqueous extracts on body weights of the experimental rats. There was no significant difference ($p < 0.05$) in the body weights of rats used before diabetes induction. The mean body weight before induction ranged from 138.00g to 144.00g. After treatment, the mean body weight of the rats showed no significant difference ($p < 0.05$). None of the extracts caused significant weight increase. The mean bodyweight of the rats treated with aqueous extracts ranged from 140.40g to 143.40g. Among the treatment groups, the group treated with combined extract of turmeric and black pepper TBP (80: 20) had the highest percentage increase in weight (4.08%) when compared with the other rats treated with the extracts. The normal and standard control groups had significant increase in body weight with 5.08% and 4.09% increase respectively. The group fed with combined extract 80:20 (Turmeric: Black pepper) had the highest percentage increase in weight (4.08%) while the group fed with 100mg/kg Ginger extract only had the lowest percent increase (0.71%) in body weight. The negative control group had significant decrease in body weight (-5.04%) when compared with the diabetic treated groups.

Discussion of Findings

The findings of the study showed the effect of black pepper, turmeric and ginger aqueous extracts on the fasting blood glucose level of hyperglycemic rats after treatment period. It showed that there was significant rise in blood glucose levels after induction with alloxan injection in all diabetic rats as compared to the normal control rats. The increase in blood glucose level in the diabetic animals compared to that of the control rats could be as a result of chemical exposure to diabetogenic agent called alloxan. The is in line with works by Jain and Arya (2011) who demonstrated that intraperitoneal injection of alloxan into the rats causes significant diabetogenic response in wistar rats with significant rise in the blood glucose level of the experimental rats. Behl et al. (2020) stated that alloxan induces diabetes through reactive oxygen species which results to a rapid destruction of pancreatic beta cells causing hyperglycemia. The mechanism of action of alloxan is selective destruction of the beta cells of the pancreas through the formation of reactive oxygen species (Jain & Arya, 2011). Fakhruddin, et al, (2017) stated that oxidative stress is the main factor for initiation of various degenerative and chronic diseases. Zhu, et al, (2018) reported that high blood sugar (hyperglycemia) could be attributed to deficiency or impairment in insulin secretion and / or metabolic consequences of insulin resistance

which can affect carbohydrate, protein and lipid metabolism.

All treatment groups treated with aqueous extracts showed decrease in blood glucose level when compared against the diabetic control group. However it was observed that group with combined aqueous extracts of turmeric and black pepper with ratios 80:20 (TBP 80:20) had the highest percentage decrease in blood glucose level compared to the other groups that were treated with aqueous extract. This is in line with the findings by Prasad, et al, (2014) which demonstrated in an animal study that effect of combining turmeric (100mg/kg body weight) with lower dose of black pepper(25mg/kg body weight). This is similar with Manodeep, et al, (2017) in a rat study which demonstrated that incorporation of black pepper with the doses of 25 mg/kg with turmeric 100mg/kg exhibited significant beneficial effect compared to turmeric alone-treated group. Similar observations were made by Sunmonu and Afolayan (2013) using combined aqueous extract of *Phyllantus amarus* and *Artemisia afra* in a rat study respectively, for the treatment of diabetes.

The positive effects of these aqueous extracts on blood glucose level may be attributed to presence of some bioactive constituents (alkaloids, flavonoid, terpenoid, saponin, phenols and other antioxidants vitamin) in the extracts which have dietary and medicinal properties. The anti-hyperglycemic action of the extracts may be attributed to improved insulin sensitivity or inhibition of endogenous glucose production (Nimse & Pal, 2015). The extract may have achieved this anti- hyperglycaemic property via increased insulin secretion, increased peripheral utilization of glucose, inhibition of endogenous glucose production or by inhibition of intestinal glucose absorption (Manodeep, et al, 2017).

The findings on Table 2 demonstrated the change in body weight of the experimental rats. There was slight increase in the body weight of alloxan-induced diabetic rats that were administered various doses of these aqueous extracts when compared with the diabetic control group. Progressive increase in body weight was observed in normal control group and diabetic treated rats respectively when compared with their initial values, whereas the diabetic control group (negative control) recorded progressive decrease in bodyweight. The normal control rats showed body weight gain throughout the treatment period, while the diabetic control rats showed significant ($p < 0.05$) weight loss. The increase in body weight observed in diabetic rats administered aqueous extracts could be an indicated that these aqueous extracts is not toxic and does not have any harmful effect on the physiological state of the rats at the various dose level. This supports the works by Sunmonu and Afolayan (2013) which stated that aqueous extracts are safer, more effective and less toxic compared to synthetic drugs.

A study by Fakhruddin, et al, (2017) showed a significant increase ($p < 0.05$) in the body weight of alloxan-induced diabetic rats that were administered

various doses of phenolic aqueous leaf extract of *V.doniana* when compared with the diabetic control group. The combined aqueous extracts with ratios 80:20 had the highest percentage increase in body weight (4.08%) compared to other groups treated with aqueous extracts. Otunola and Afolaya (2015) reported that oral administration of combined aqueous extract of garlic, ginger and cayenne pepper modulated the body and organ weights of diabetic rats, reduced hyperglycaemia, attenuated blood and cellular toxicity parameters.

Conclusion

The present study provided some information on the biochemical effects of aqueous extracts of turmeric, ginger and black pepper on blood glucose level of alloxan induced diabetic albino wistar rats. It demonstrated that oral administration of these aqueous extracts had positive effects on blood glucose level and body weight of the rats. It revealed that the rats treated with graded doses of these aqueous extracts gained slight weight and no adverse effect was observed. It revealed the synergistic effect of combined aqueous extracts of turmeric and black pepper on blood glucose level and body weight of the diabetic rats. The findings showed that these aqueous extracts possess antihyperglycemic properties in the treated diabetic rats. The study suggests that aqueous extracts of turmeric, ginger and black pepper might help prevent, reduce and manage hyperglycemia in diabetic patients.

Recommendations

(1) Extensive investigations of the active ingredients of these aqueous extracts on clinical trials with human are needed to exploit their therapeutics utility to cure many diseases.
(2) Further research should be carried out on:
    (i) effect of high dose consumption of black pepper extracts in humans and animal models.
    (ii) whole samples rather than aqueous extracts to determine their therapeutic potentials.
    (iii) antimicrobial assay of these aqueous extracts.

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Utilization of Mannequins in Clothing Merchandizing by Retailers in Anambra State

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Abstract

The study investigated the utilization of mannequins in merchandizing ready-to-wear garments by retailers in Anambra State. Specifically, it determined the availability of mannequins in ready-to-wear garment shops in Anambra State, ways mannequins influence sales of ready–to-wear retail shops in Anambra State, functions of mannequins in merchandizing of ready-to-wear apparels in retail shops. Survey research design was adopted. Population was 820 ready-to-wear garment retailers in the area. Sample size was 110. Questionnaire was used for data collection. Data were analysed using percentage and mean. Findings revealed that flexible mannequin, wooden mannequins were averagely available. Findings reveal availability assorted types of 29 mannequins. They are grouped base-on their style; audience of focus; feature; colour; prose; materials; size and functionality. Availability frequency/percentage (F%) range from F(%) 88(19.7%) to 239(53.6%). Other findings are 18 ways mannequins influence sales of ready-to-wear garments. These include among others, help to draw customers to the ready-t-wear garment shops in order to make a purchase ($\overline{X}$ = 3.87), help to tell what products have arrived and in which store ($\overline{X}$ = 3.85), create a particular atmosphere or give a certain fell ($\overline{X}$ = 3.81). Further findings are 29 functions of mannequins in the shops. These include, among others, showcase merchandise ($\overline{X}$ = 3.04), help retailers to make good choice ($\overline{X}$ = 3.09), and increase the sales of clothing in retail shops ($\overline{X}$ = 3.07). Four recommendations were made for improving the mannequins clothing merchandizing. Based on the findings of the study, four recommendations were made. These including among others, workshop aqnd seminars should be organized by ready-to-wear garment association on effective utilization of mannequins for advertising ready-to-wear garments to their customers.

Keywords: Utilization, Mannequins, Merchandizing, Clothing, Retailers, Customers, Functionality, Availability.

Introduction

Mannequins are objects used to display articles for the purpose of attracting the attention of customers to business store. Collins (2019) defined mannequins as artificial dolls or dummies used by the retailers to display their merchandises. Mannequins are statement in visual merchandising when it comes to creating unique and eye catching store and window display design (Maier, 2021). Stores use mannequins to define offers, showcase merchandise and boost the brand values, standards and messages that they project and want to be recognised by both royal and new customers. The purpose of using mannequins according to Management Study Guide Team (2019) are to highlight the unique collections of the store, display the latest trends in fashion and influence the customers to buy a particular merchandise.According to Ross (2015) mannequins are used to enhance the store decoration which subsequently improves the shopping experience for customers. Garments can appear in custom- made and ready-to-wear. They are all made to fit people. Custom- made is crafted from a basic pattern and modified based on a handful of measurements**.**

Ready-to-wear is the term for factory-made clothing, sold in finished condition, in standardized sizes, as distinct from made to measure or bespoke clothing tailored to a particular person's body frame. Ready-to- wear garments are manufactured to accommodate various size ranges. Artteca (2019) described ready- to-wear as a pieces of expensive garments that are available to purchase at stores, boutiques, high-end department stores and online boutiques and even local market with the help of mannequins. Ready- to- wear garment is designed to provide consumers with pre-assembled apparel, in a range of standard sizes, designed to fit the average consumer. They are produced in standardize sizes, stocked in retail stores, and intended to be worn by the purchaser (Shan, Huang and Qian, 2013). By this definition, people whose measurements are not within the average size will experience difficulty with fit, either in part or in totality, when wearing standard size clothing (Anikweze, 2013).Ready- to- wear garments are available in shop for different age groups with varied colour combinations, up to date styles, latest prints, trims and also suitable for different occasions and seasons. In the past, ready- to- wear garments are purchased by only high income, groups, but now there are abundances of ready-to- wear clothes for various classes of consumers.

Both males and females are involved in retailing ready to wear garments and they make use of various objects and strategies to attract customers to their shops. Customers in this study are people who buy ready-to -wear garments in boutiques, shops, malls or even open places. Mannequins have strong relationship in compelling customers purchase for ready-to-wear garments. Effective use of mannequins by store owners will improve sales and

also help the customers in making right choice of ready to wear garments.

In Anambra State, many people are involved in buying and selling of ready to wear garments and mannequins are expected to be used to provide physical information about purchase and use of products. In the study area, there is a concentration of ready-to-wear retailers as well as customers but most of them are not considering the use of mannequins in buying and selling of their products. Those that manage to have few do not make use of them as they do not understand their usage to attract the attention of their customers. This situation can have serious impact on the customers' choice and the sale of retail store owners.

Customers today are presented with a bewildering array of choices, many ready to wear garments are kept in the shelves in stores without making use of mannequins and experience reveals that such customers do complain that they cannot find what they want. Many customers can be attracted to the shop but if they are met with too much frustration trying to find what they are looking for or, if they encounter only flat and uninteresting displays, they can break their search efforts and the merchandise will not be sold or bought. Therefore the use of mannequins cannot be underestimated as they are tools used by retailers to entire customers to make a purchase.

There is need to display products in a way that will easily catch the attention of the intended customers and thereby enhancing sales. Effective use of mannequins by store owners will improve sales and also help the customers in making right choice of ready-to-wear garments. All these problems call for the need to investigate the utilization of mannequins in clothing merchandizing by retailers in Anambra State hence, the present study.

Purpose of the Study

This study focused on utilization of mannequins in merchandizing ready-to-wear garments by retailers in Anambra State. Specifically, the study determined;

1. availability of mannequins in ready- to- wear garment shops in Anambra State
2. functions of mannequins in merchandizing of ready-to-wear garments in retail shops in Anambra State
3. ways mannequins influence sales of ready-to-wear apparels in retail shops in Anambra State

Hypotheses (HOs)

The following HOs guided the study:

There is no significant difference in the mean responses of male and female ready-to-wear retailers on:

HO_1: the perceived functions of mannequins in the purchase of ready-to-wear garments.

HO_2: influence of mannequins in the purchase of ready- to- wear garments.

Methodology

***Design of the Study*:** The study useda survey design.

Area of the Study: The area of the study was Anambra State. The State has many markets and malls that deal with retailing of ready-to-wear garments. Five major markets located in four major towns in the state include: Onitsha main market, Ochanja market in Onitsha, Nkwo Nnewi market, Eke market Awka and Eke Ekwuloba. There are also shopping malls and boutiques outside markets. Many people in this state are retailers of ready-to-wear garments in aforementioned markets, shopping malls and boutiques. Onitsha main market is however the largest market and the focus of the study.

***Population of the Study*:** The population for this study comprised 798 ready-to-wear garment retailers, in Onitsha main market. This was made up 500 male and 298 female ready-to-wear registered garment retailers (Association of fancydealers, an affiliate of Onitsha Market Traders Association {OMATA} 2021). The minimum education level of the retailers is first school leaving certificate while the maximum qualification is Ph.D degree.

***Sample for the study*:** A purposive sample of 110 ready-to-wear garment retailers was selected for trhe study. Only those relaiters who: had been in the business for at least on year, displayed their artices with mannequins and, were willing to participate in the study were selected. They were 75 and 35 male and female relaiters respectively.

***Instrument for Data Collection*:** The instrument for data collection was structured questionnaire. It has 76 items. It was developed based on the specific objectives of the study and literature review. It had a 4-point rating scale of strongly agree (4), agree (3), disagree (2), and strongly disagree (1). The instrument was face-validated by three university expert in clothing and textiles. The reliability was determined using Cronbach alpha. A reliability coefficient of 0.88 was obtained.

***Method of Data Collection*:** A total of110copies of the questionnaire were distributed to the respondents by hand with the help of three trained research assistants. Only100 copies were retrieved. This shows 90.91 percent return rate.

***Data Analysis Techniques*:** Frequency count and percentage were used specific purposes No 1. A cut-off point of 50 percent and above (≥ 50%) implies "average availability" while below 50 percent (≤ 50%) implies "low availability". Mean and standard deviation were used for specific purposes Nos. 2 and 3. A mean rating of 2.50 or above ($\bar{x} \geq 2.50$) was regarded as "important" while a mean less than 2.50 ($\bar{x} \leq 2.50$) was regarded as "not important".

RESULTS

Table 1: Frequency and Percentage (F %) Responses on Availability and Types of Mannequins in Ready-to Wear- Garment Shops in Anambra State

S/N	Types of Mannequins Available in Garment Shops	Available (Frequency)	(%)	R
A	**Mannequins by Style**			
1	Abstract mannequins	119 (26.7%)	26.7	*LA*
2	Headless mannequins	141 (31.6%)	31.6	*LA*
3	Realistic mannequins	88 (19.7%)	19.7	*LA*
4	Mini mannequins	141 (31.6%)	31.6	*LA*
B	**Mannequins by Audience**			
5	Child mannequins	146 (32.7%)	32.7	*LA*
6	Female mannequins	124 27.8%)	27.8	*LA*
7	Male mannequins	116 26.0%)	26.0	*LA*
8	Pregnant mannequins	121 2701%)	27.1	*LA*
9	Plus size mannequins	116 26.0%)	26.0	*LA*
C	**Mannequins by Feature**			
10	Flexible mannequins	203 (45.5%)	45.5	*AA*
11	Inflatable mannequins	130 (29.1%)	29.1	*LA*
12	Hanging mannequins	140 31.4%)	31.4	*LA*
13	Table top mannequins	142 31.8%)	31.8	*LA*
14	Muscular mannequins	156 35.0%)	35.0	*LA*
D	**Mannequins by Colour**			
15	Black mannequins	109 24.4%)	24.4	*LA*
16	White mannequins	141 (31.6%)	31.6	*LA*
17	Gold mannequins	154 (34.6%)	34.5	*LA*
18	Chrome mannequins	116 (26.0%)	26.0	*LA*
E	**Mannequins by Prose**			
19	Sexy mannequins	129 (28.9%)	28.9	*LA*
20	Sports mannequins	124 (27.8%)	27.8	*LA*
F	**Mannequins by Materials**			
21	Wooden mannequins	239 (53.6%)	53.6	*AA*
22	Fabric mannequins	123 (27.6%)	27.6	*LA*
23	Glass mannequins	128 (28.7 %)	28.7	*LA*
24	Silver mannequins	131 (29.4%)	29.4	*LA*
G	**Mannequins by Size**			
25	Full size mannequins	123 (27.6%)	27.6	*LA*
26	Half size mannequins	123 (27.6%)	27.6	*LA*
H	**Mannequins by Functionality**			
27	Dress form	120 (26.9%)	26.9	*LA*
28	Ghost mannequins	129 (28.9%)	28.9	*LA*
29	Training mannequins	139 (31.2%)	31.2	*LA*

F= frequency; % = Percentage; LA = Low Availability; AA = Average Availability; R = Remark

Table 1 shows a total of 29 assorted types of mannequins that are available in the ready-to-wear clothing shops in the markets in Anambra state. Table 1 also shows that none of the mannequins obtain 100 percent availability score. The Table further shows that two types of mannequins are "averagely available" scores (≥ 50%), while 27 types of mannequins are "low in availability" (≤5 0%).

Table 2: Mean Responses and Standard Deviations of Retailers (male and female) on the Influence of Mannequins on Ready-to-Wear Retail Shops in Anambra State

S/N	Influence indicators of Mannequins	$\overline{X}_1$	SD_1	$\overline{X}_2$	SD_2	$\overline{X}_g$	t-test	R
	Mannequins:							
1	increase customers emotional engagement on garment	3.03	.886	3.06	.890	3.04	.648	*Agree*
2	promote up-selling for retail shops	2.98	.835	3.04	.775	2.99	.963	*Agree*
3	attract customers to the ready to wear shop	2.98	.827	3.05	.825	3.04	.370	*Agree*
4	help in the promotion of brand and its sales	3.02	.740	3.01	.822	3.05	.999	*Agree*
5	showcase products so that customer can buy easily	3.02	.786	2.91	.828	3.04	.562	*Agree*
6	help to draw customers to the ready to wear garment shops in order to make a purchase	3.02	.780	3.07	.767	3.87	.867	*Agree*
7	give free publicity of the stores collection	3.06	.788	3.02	.809	3.06	.210	*Agree*
8	add value to the displayed merchandise	2.98	.785	3.01	.819	3.05	.546	*Agree*
9	draw attention to the collection of the shop and lure customers to buy	3.00	.754	2.89	.743	3.07	.697	*Agree*
10	enable customers to analyse all the aspects of the garment before entering the store	3.00	.806	2.97	.817	3.08	.081	*Agree*
11	impress customers and promote sales	3.00	.790	3.05	.818	3.06	.371	*Agree*
12	help to show what the store can deliver to the customers	3.01	.758	3.02	.848	3.24	.262	*Agree*
13	are guiding light to a particular area of the store	3.01	.862	2.82	.855	3.01	.430	*Agree*
14	act as an aspect of the interior design of the store.	3.03	.802	3.04	.850	3.27	.642	*Agree*
15	enhance the ambience and traits of the store.	2.96	.898	3.03	.779	3.06	.246	*Agree*
16	help to tell what type of cloths and customers the store will accommodate	2.99	.822	2.82	.760	2.99	.380	*Agree*
17	help to tell what products have arrived and in which store	2.92	.785	3.07	.844	3.85	.950	*Agree*
18	create a particular atmosphere or give a contain feel	2.97	.764	3.02	.777	3.81	.368	*Agree*

$\overline{X}_1$ = Male retailers; $\overline{X}_2$ = Female retailers; $\overline{X}_g$ = grand mean; SD_1 = Male retailers; SD_2 = Female retailers; t-value; of response of male and female Ready-to-wear Retailers

Table 2 reveals that all the 18 items had their mean values ranging from 2.82 to 3.07. These mean values are above the cut-off point of 2.50 indicating that all the 18 items are the influences of mannequins the sales of ready-to-wear retail stores in Anambra State.

Table 3: Mean Responses of Retailers (Male and Female)on the Perceived Functions of Mannequins in Ready to Wear Garments Shops in Anambra State

S/n	Functions of Mannequins	$\overline{X}_1$	$\overline{X}_2$	$\overline{X}g$	t-test	Remarks
	Mannequins:					
1	showcase merchandise	2.90	3.02	3.04	.607	*Agree*
2	helps retailers to make good choice	3.08	3.06	3.09	.632	*Agree*
3	compel people to buy more on impulse	3.03	2.99	3.05	.305	*Agree*
4	help people to visualize how the garment will look on them	3.02	3.07	3.92	.388	*Agree*
5	trigger an emotional purchase response on potential customers	3.05	2.82	3.08	.491	*Agree*
6	helps in promoting easy up-selling opportunities	3.02	3,06	3.05	.159	*Agree*
7	increase the sales of clothing in retail shops	3.03	2.98	3.07	.217	*Agree*
8	as non-personal communication to communicate to customers	2.97	3.04	3.03	.462	*Agree*
9	serves as advertising tools for ready- to- wear garments shops	3.04	3.02	3.06	.814	*Agree*
10	help customers to understand the product such as ready to wear garments	3.05	2.92	2.99	.527	*Agree*
11	improve the power of attraction of their displays/offerings	3.05	2.89	3.08	.828	*Agree*
12	improve the look of the ready-to-wear garment stores	3.03	3.05	3.09	.084	*Agree*
13	represents a diverse source of embodiment in ready to wear garment stores	2.92	3.07	3.06	.331	*Agree*
14	help stores to increase sales and patronages	2.96	3.06	3.05	.416	*Agree*
15	create brand awareness	2.98	3.02	3.08	.394	*Agree*
16	boost the brand values	2.99	3.07	2.92	.416	*Agree*
17	help customers have higher aesthetic response and approach and lower perceived risk to wearing clothing	2.95	2.82	3.08	.930	*Agree*
18	inspires a customer to purchase a complete outfit	3.00	3.06	2.99	.340	*Agree*
19	boost customers' confidence about the product	3.00	2.90	3.04	.132	*Agree*
20	highlight the very best assortment	3.02	3.01	3.09	.705	*Agree*
21	attract customers to the ready-to-wear garment shops	2.89	3.05	2.98	.492	*Agree*

22	make it easy to demonstrate entire outfits rather than simply single items of clothing	3.03	2.98	3.04	.815	*Agree*
23	gives customers chance to interact with the sellers	3.03	3.04	3.09	.387	*Agree*
24	help to offer more fashion choices for customers	3.05	3.07	3.08	.608	*Agree*
25	show shoppers some things they cannot see easily elsewhere	3.07	2.90	3.06	.528	*Agree*
26	give customer a better shopping experience	2.97	2.99	3.08	.829	*Agree*
27	create a more welcoming shopping environment in an easy manner	3.01	3.02	3.04	.085	*Agree*
28	give potential fashion designers style inspiration	2.92	3.08	3.09	.341	*Agree*
29	provide fit information	2.99	3.01	3.08	.418	*Agree*

x_1 = Male retailers; x_2 = Female retailers; x_g = grand mean; t-value; of response of male and female Ready-to-wear Retailers

Table 3 reveals that all the 29 items had their mean values ranging from 2.90 to 3.92. These mean values are above the cut-off point of 2.50 indicating that all the 29 items are the perceived functions of Mannequins in ready to wear garments shops in Anambra State.

Discussion of findings

The findings of the study reveal that some types of mannequins are averagely available while some are low in their availability in ready to wear garment shops in Anambra State. Some of these mannequins that are low in availability in ready to wear garment shops are: headless mannequins, realistic mannequins and black mannequins, mini mannequins, female mannequins, male mannequins, pregnant mannequins, plus size mannequins, inflatable mannequins, and chrome mannequins, child mannequins, flexible mannequins, hanging mannequins, table top mannequins, muscular mannequins, and white mannequins. The finding of the study on availability of mannequins in ready to wear garment shops also agreed with the submission of Valerie (2015) that retailers make different types of mannequins such as realistic, abstract, headless, plus size, pregnant, children and teen, sexy, sport, black, chrome, gold, other colour, dress forms, ghost or photograph, flexible, torso, standalone, parts and display mannequins available in their shops to define offers, showcase merchandise and boast the brand values ,standards and messages that they project and want to be recognised by both loyal and new customers. The findings of the study also were in consonance with the opinion of Mannequin Small Report (2016) that use and availability of some categorises of mannequins depend on locations and size of the ready to wear garment shops. Many types of mannequins according to Vember 2021 include headless mannequins, abstract mannequins, realistic mannequins, plus size mannequins among others.

According to Gonzalez, Meyer and Toldos (2021) mannequin play an important role in fashion sales, consumers undertake an imaginative

visioning process in which they mentally anticipate the fit and look of the displayed fashion clothing. Mannequins are artificial human body capable of attracting customers to a garment stores (Maire, 2021). Using mannequins can improve the power of window displays and sales of garments.

The findings of the study revealed 18 influences of mannequins on the market output of ready to wear retail stores. Prominent among the influences include sales increase when customers engage on an emotional level, mannequins promote up-selling for retail shops, mannequins attract customers to the ready to wear shop, mannequins help in the promotion of brand and its sales, shops use mannequins to showcase their products so that customer can buy easily, mannequins help to draw customers to the ready to wear garment shops in order to make a purchase, mannequins give free publicity of the stores collection, and mannequins add value to the displayed merchandise. This opinion is in support of Lindstron, Berg, Nordalt and Roggeveen (2015) who stated that mannequins have become an important visual merchandizing element in retail stores due to their ability to catch the attention of potential shoppers and virtually provide fit and style information. This opinion also is in support of Management Study Guide Team (2020) that mannequins highlight the unique collections of the store, display the latest trends in fashion and influence the customers to buy a particular merchandise. In the opinion Kiron (2022) mannequins attract the customers into the store and thus increase the revenue and profit responsible for upselling of the retail stores. In support of the finding, Kember (2021) states that mannequins have the ability to spark personal recognition in a client base, and thus serve as a way for customers to see themselves reflected in the shopping experience.

The findings of the study revealed 21 functions of mannequins in ready-to-wear garment shops and they include retailers using mannequins to showcase merchandise, helping retailers to make good choice, compelling people to buy more on impulse, helping people to visualize how the garment will look on them, triggering emotional purchase response on potential customers.

The finding of the study agreed with the opinion of Ross (2015) who defined mannequins as an object use to enhance the store decoration which subsequently improves the shopping experience of customers. The finding also agreed with the opinion of Collins (2019) that mannequins are artificial dolls used by the retailers to display their merchandise. Mannequins play an important role in usual merchandizing the mannequins perform functions of being used by retailers to draw the attention of customers to stores. The finding of the study was also in agreement with the opinion of Reach (2021) who stated that mannequins impact customers by giving them a look to aspire to. This shows that consumers have positive perception of the clothing on display.

Karin (2017) also stated that mannequins show what clothes, accessories, and products look like and give customers a better view of the style, fit, and silhouette of the products. By displaying items in realistic human form, the mannequins catch the eye of the customers and inspire them to buy.

There was no significant difference in the mean responses of male and female ready-to -wear retailers on the perceived functions of mannequins in the purchase of ready to wear garments. The findings of this study was in agreement with the findings of Shealy (2016) who examined the effect of mannequins type on consumers purchase decisions and found out that there was no significant difference between the responses of male and female retailers on perceived functions of mannequins in the purchase of ready-to-wear garments. The implication of this finding is that the level of retailers' experiences and knowledge did not significantly influence their opinion on the functions of mannequins in the purchase of ready to wear garments.

Conclusion

Many individuals are involved in selling ready-to-wear garments in Anambra State, using various types of marketing and advertising objects such as mannequins. The use of mannequins in the sale of ready-to-wear garments is expected to draw the attention of customers which in turn help product purchase. In the study area, there is a concentration of ready-to-wear garment retailers as well as customers but most of them, are not considering the use of mannequins and store image in buying and selling of their product. Those that manage to have few do not understand their usage to attract the attention of their customers. The situation poses serious impact on the customers' choice and the sales of retail store owners. Some of the mannequins available in ready-to-wear garment shops include abstract mannequins, headless mannequins, realistic mannequin, female mannequins, male mannequins among others. Garment sellers should consider all these mannequins to boost sales. Some of the influence of mannequins on ready-to-wear retail shops are increase customers emotional engagement, promote up- selling for retail shops, attract customers to ready-to-wear shops among others. Some of the perceived functions of mannequins in ready-to-wear garment shops include to showcase merchandise, help retailers to make good choice, compel people to buy more on impulse among others. Finally, conclusion was drawn that garment sellers should utilize mannequins to improve sales.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. Workshop and seminars should be organised by ready-to-wear garment associations on effective utilisation of mannequins for advertising ready to wear garments to their customers
2. Home economics lecturers in schools and colleges can

incorporate findings of this study in textiles and clothing programme

3. All the findings of this study should be implemented by read-to-wear garment retailers to improve sales.
4. Ready-to-wear garment sellers should make use of mannequins to catch the attentions of potential customers/buyers to their shops.

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Influence of Ethical Compliance by Accountants on Quality Financial Reporting of Selected Manufacturing Companies in Enugu State, Nigeria

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Abstract

The study explored influence of ethical compliance by accountants on quality financial reporting of selected manufacturing companies in Enugu State, Nigeria. Specifically, the study determined ways four indicators of ethical compliance namely, objectivity, integrity, professional competence and confidentiality of information could influence quality financial reporting of manufacturing companies in Enugu state. The study adopted descriptive survey design. Population for the study was made up of 20 accountants from three selected manufacturing companies in the study area. Questionnaire was used for the data collection. Mean, standard deviation and t-test were used for data analysis. Findings revealed 10 indicators of ways objectivity could influence quality financial reporting (QFR) of manufacturing companies in Enugu State. These include, among others, normative judgment ($\overline{X}_g$ = 2.78), seven indicators of ways integrity could influence QFR of manufacturing companies. These include among others, fair dealing ($\overline{X}_g$ = 3.96); seven indicators of ways professional competence could influence QFR of manufacturing companies. These include among others, education and experience appropriate to nature of professional work being performed ($\overline{X}_g$ = 3.84) and others. There also three indicators of ways confidentiality could influence QFR of the companies, including that information acquired in the course of professional work must not be used for personal advantage ($\overline{X}_g$ = 3.79). t-test results show that there are no significant differences between the mean responses of senior and junior accountants on the ways indicators of objectivity influence QQFR at 0.05 level of significance. However, there are significant differences between the means of both groups for the other two indicators of ethical compliance. Based on the finding two recommendation were made.

Keywords: Ethical compliance, Objectivity, Integrity, Professional competence and Confidentiality.

Introduction

The widespread corruption in the society and the failure of organization in all parts of the world have once more increased the need for accounting professionals to adhere strictly to the codes of professional ethics prescribed by international accounting bodies. According to Ogbonna and Ebimobowei (2011), the widespread corruption in the business environment seems to be the order of the day in all societies including Enugu State. Recently, business ethics have attracted renewed attention globally due to the several notorious corporate scandals like those of Enron, WorldCom, Arthur Anderson, Tyco International, Adelphia, Cadbury PLC, Lever Brothers PLC amongst others (Ojeka, Ogundana & Iyoha, 2017). David (2004), sees ethics as a systematic moral judgments and principles of intrinsic value, moral principles that an individual use in governing his or her behaviour. They concern issues that bother on key indicators of professional accounting ethics like conflict of interest, insider's dealings, compromising integrity, objectivity, independence, lack of professional competence, confidentiality/disclosure of official secret and destruction of official documents for financial benefits and other similar acts that are against moral principles and ethical standards. Hence, accountants should do all within their power to comply with laid down accounting ethical codes or principles. In this study, ethical compliance refers to a manufacturing company's conformity with relevant professional accounting ethical standards enacted by Institute of Charted Accountants of Nigeria (ICAN) Association of National Accountants of Nigeria (ANAN) and other relevant agencies. The use of ethical standards can both reduce the chances of a workplace lawsuit and help to create a positive work environment. In the accounting profession, ethical compliance reduces, if not end the tendencies of corporate scandals and raises the quality of financial reporting.

Financial reporting is a standard accounting practice that uses financial statements to disclose a company's financial information and performance over a particular period, usually on an annual or quarterly basis (Bensoussan, 2021). Components of financial statements include a balance sheet, income statement, statement of owner's equity, and statement of cash flows, but financial reporting is much broader than just a set of financial statements. Financial reporting components includes all financial communication from the business to outside users including press releases, shareholder minutes, management letters and analysis, auditor reports, and even the notes of the financial statements. Basically, anything that can convey financial information to the financial statement users in a manufacturing concern is considered financial reporting of some kind (Bensoussan, 2021).

International Federation of Accountants (IFAC, 2006) in its ethical indicators for professional accountants, a distinguishing mark of the accountancy profession is its acceptance of the responsibility to act in the public interest. This code

establishes the fundamental principles of professional ethics for professional accountants and provides a conceptual framework for applying those principles. There are among others, four major professional accounting ethics found in all code of professional ethics of various professional accounting bodies such as ICAN, ANAN & IFAC, etc. they include objectivity, integrity, professional competence and confidentiality.

The principle of integrity imposes an obligation on all Chartered Accountants to be straight forward and honest in professional and business relationships. Integrity also implies fair dealing and truthfulness. IFAC code of ethics for professional accountant (2006) buttresses this point that Professional accountant is required to comply with the principle of integrity which imposes an obligation on all Chartered Accountants to be straightforward and honest in professional and business relationships.

Objectivity as a code of professional ethics of an accountant implies not allowing bias, conflict of interest, or undue influence of others to override professional or business judgments. The principle of objectivity imposes an obligation on Chartered Accountants to be fair, intellectually honest, and free of conflicts of interest. Regardless of service or capacity, Chartered Accountants should protect the integrity of their professional services and maintain objectivity in their judgment. According to Izedonmi (2012), the principle of objectivity imposes a serious obligation on all accountants whether in private practice or industry to avoid jobs, assignments, relationships, and situations that are capable of compromising their professional judgment due to either coercion, undue influence from people, conflict of interest or even bias (Institute of Charted Accountants in England and Wales {ICAEW} 1997).

Another germane code of professional ethics is called Professional Competence and Due Care. IFAC (2005) & ICAN (2009) reiterates that professional accountant has a continuous duty of maintaining professional knowledge and skill at the level required to ensure that a client or employer receives competent professional service based on current developments in practice, legislation, and techniques.

IFAC (2005) & ICAN (2009) stated that professional accountant should respect the confidentiality of information acquired as a result of professional and business relationships and should not disclose any such information to third parties without proper and specific authority unless there is a legal or professional right or duty to disclose. Therefore, measures should be put in place by the management to ensure strict compliance by both senior and junior accountants.

Consequently, many academics and researchers have carried out research aimed at evaluating the existence of some of the indicators of ethical compliance on the quality financial reporting in Enugu state. However, it seemed, they have only concentrated on the non-manufacturing companies in Enugu

state. Hence, this study fills the gap by extending its scope to manufacturing companies in Enugu state, Nigeria.

Objectives of the Study

The main objective of the study was to investigate influence of ethical compliance by the accountants on quality financial reporting of selected manufacturing companies in Enugu state. Specifically, the study determined ways the following indicators of ethical compliance by accountants could influence quality financial reporting of manufacturing companies in Enugu State, Nigeria:

1. objectivity
2. integrity
3. professional
4. confidentiality

Hypotheses

There is no significant difference between the mean responses of junior and senior accountants on the influence of the following indicators of ethical compliance on quality financial reporting of manufacturing companies in Enugu State, Nigeria:

$Ho_{1:}$ objectivity
$Ho_{2:}$ integrity
$Ho_{3:}$ professional Competence
$Ho_{4:}$ confidentiality

Methodology

***Design of the Study*:** Descriptive survey design was adopted for the study. The design is considered appropriate for the fact that it facilitated the collection of detailed factual information on ethical compliance and the quality financial reporting of selected manufacturing companies in Enugu state.

***Area of the Study*:** Area of the study was Enugu State. Manufacturing industries including pharmaceutical, paints, motor vehicle, textile, lumbering, soft-drink bottling, brewing, furniture, and food processing etc. But the study was carried out in three selected manufacturing companies in Enugu State.

***Population for the Study*:** Population for this study was made up of senior and junior accountants in manufacturing companies in Enugu state. There are many such companies in the state. The study however focused only on food manufacturing companies.

***Sample for the Study*:** The study purposively selected three food processing manufacturing companies in the state. The companies were selected because they were very active in their operations. The senior and junior accountants in the three companies form the sample for the study. The sample was made up of eight senior and 12 junior accountants giving a total of 20 accountants.

***Instrument for Data Collection*:** The instrument of data collection was questionnaire. It was developed through literature review based on the specific objectives of the study. The questionnaire was structured on a four-point rating scale which ranges from 1 - 4 (Strongly Agree (SA) = 4; Agree (A) = 3; Strongly Disagree (SD) = 2; Disagree (D) = 1). Three university experts in Business Education validated the instrument. The reliability test was carried outside the

area of the study. The reliability was determined using Cronbach Alpha which yielded of 0.84 for objectivity, 0.89 for integrity, 0.85 for professional competence, and 0.90 for confidentiality with an overall coefficient of 0.87.

***Data Collection Method*:** A total of 20 copies of questionnaires were distributed by hand. All the administered copies of questionnaire were retrieved. This represent 100 percent return rate.

***Data Analysis Techniques*:** Data were analysed using mean and standard deviation to answer the research questions and inferential statistics (t-test) to test the hypotheses. Mean responses were categories into: SA=3.50-4.00, A=2.50-3.49, D=1.50-2.49, SD=0.00-0.49. The mean cut off point was 2.50.

RESULTS

Table 1: Mean Responses, Standard Deviation and t-value of Senior and Junior Accountants on Ways Objectivity could Influence Quality Financial Reporting (QFR) of Selected Manufacturing Companies in Enugu State, Nigeria

S/N	quality of Ways Objectivity Influence Quality Financial Reporting (QFR)	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	Xg	t	R
1	Normative judgment of an accountant.	2.56	0.00	3.00	0.00	2.78	-3.286	A
2	Evaluative judgment of accountants' results in quality financial reporting.	4.00	0.00	3.60	0.00	3.80	-0.005	SA
3	Impersonality/neutral values	3.88	0.35	3.51	0.00	3.70	0.001	SA
4	Not allowing bias or undue influence by others to override professional or business judgments	3.88	0.35	4.00	0.00	3.94	-2.543	SA
5	Impartiality by the accountants leads to quality financial reporting.	3.13	0.35	3.00	0.00	3.07	0.003	A
6	Not allowing conflict of interest to override professional or business judgments	3.88	0.35	4.00	0.00	3.94	-0.001	SA
7	When an accountant is fair and intellectually honest it eventually results to quality financial reporting.	4.00	0.00	4.00	0.00	4.00	-0.008	SA
8	Avoiding job, relationship or situation that is capable of compromising your professional judgment.	4.00	0.00	3.50	0.52	3.75	0.002	SA
9	Independence of minds.	3.00	0.00	3.08	0.29	3.04	-0.145	A
10	Faithfulness to facts results in quality financial reporting.	3.00	0.00	3.42	0.29	3.21	-0.236	A
	Cluster mean	**3.63**	**0.05**	**3.51**	**0.05**	**3.50**	**-6.218**	**SA**

X_1 = mean of junior staff, Standard deviation of junior staff, X_2 = Mean of senior staff, SD_2 = Standard deviation of senior staff, X_g = Grand mean of junior and senior staff, t = t-value, DF = 4 SA=Strongly Agree A=Agree; R = Remark.

Table 1 shows that all the 10 items, each has mean score of 2.50 and above. This shows that all the 10 items are indicators of ways objectivity influence QFR. Items 2, 3,4,6,7 and 8 have "strongly agree means of $\bar{x} \geq$

3.50, while Nos. 1, 5, 9 and 10 have "Agree" means of $\bar{x} \geq 2.50$. The calculated t-values ranged from -0.001-3.286 which is less than t-critical value of 0.004. Hence, the first null hypothesis is retained. This implies meaning that there is no significant difference between the responses of junior and senior accountants with regards to the ways indicators of objectivity influence quality financial reporting

Table 2: Mean Responses, Standard Deviation and t-value of Senior and Junior Accountants on Ways Integrity Influence Quality Financial Reporting (QFR) of Selected Manufacturing Companies in Enugu State, Nigeria.

S/N	Indicators of Ways Integrity Influence QFR	$\bar{X}_1$	SD	$\bar{X}_2$	SD	$\bar{X}_g$	t	R
1	Fair dealing results in quality financial reporting.	4.00	0.00	3.92	0.29	3.96	0.532	SA
2	Truthfulness by the accountants.	4.00	0.00	3.58	0.51	3.79	0.701	SA
3	Adherence to the fundamental principle of integrity by the accountants	4.00	0.00	3.92	0.29	3.96	0.545	SA
4	Deceit or subordination of principles, values and standards by the accountants	1.00	0.00	1.92	0.29	1.46	0.809	D
5	False and misleading.	2.00	0.00	1.92	0.29	1.96	0.656	D
6	Obscuring or omitting information required to be published by the accountant.	2.00	0.00	1.25	0.45	1.64	0.710	D
7	Straightforwardness and honesty in all business and professional dealings	4.00	0.00	3.92	0.29	3.96	0.550	SA
	Cluster mean	**3.43**	**0.00**	**2.92**	**0.29**	**2.96**	**4.503**	**A**

X_1 = mean of junior staff, Standard deviation of junior staff, X_2 = Mean of senior staff, SD_2 = Standard deviation of senior staff, $\bar{X}_g$ = Grand mean of junior and senior staff, t = t-value, DF = 4 SA=Strongly Agree A=Agree D=Disagree; R = Remark

Table 2 shows that items Nos. 1, 2, 3 and 7 obtained grand mean of 3.50 and above ($\bar{X}g \geq 3.50$). This implies that they are all "strongly agreed upon" indicators of ways integrity influence QFR. Items Nos. 4, 5 and 6 have grand means of less than 2.50 ($\bar{X}_g$ 1.46, 1.96 and 1.64 respectively). This implies that these are not ways indicators of integrity influence QFR. The calculated t-value ranged from 0.532-0.809 which were greater than t-critical value of 0.429. Hence, the hypothesis is rejected. This implies that there is significant difference between the responses of junior and senior accountants with regards to ways the indicators of integrity influence quality financial reporting.

Table 3: Mean Responses, Standard Deviation and t-value of Senior and Junior Accountants on Ways Professional Competence Influence Quality

Financial Reporting of Selected Manufacturing Companies in Enugu State, Nigeria.

S/N	Indicators of Ways Professional Competence Influence QFR	$\bar{X}_1$	SD	$\bar{X}_2$	SD	$\bar{X}_g$	t	R
1	Education and experience appropriate to the nature of professional work being performed.	4.00	0.00	3.67	0.00	3.84	0.089	SA
2	Knowledge of professional standard, techniques and technical subject matter	3.00	0.00	3.17	0.39	3.09	0.609	A
3	Professional accounting certifications	3.00	0.00	3.00	0.00	3.00	0.603	A
4	International Financial Reporting Standard (IFRS) training and certification	4.00	0.00	4.00	0.00	4.00	0.502	SA
5	In case of lack of competence by the accountant to perform a particular task, technical advice can be sought from experts such as lawyers, actuaries, engineers and valuers.	4.00	0.00	4.00	0.00	4.00	0.431	SA
6	Attendance of Mandatory Continuing Professional Development (MCPD) by ICAN and ANAN	3.88	0.35	3.83	0.58	3.86	0.579	SA
7	Capability to exercise sound judgment in applying professional knowledge	3.48	0.35	3.00	0.00	3.24	0.700	A
	Cluster mean	**3.62**	**0.00**	**3.53**	**0.29**	**3.58**	**3.513**	**SA**

X_1 = mean of junior staff, Standard deviation of junior staff, X_2 = Mean of senior staff, SD_2 = Standard deviation of senior staff, X_g = Grand mean of junior and senior staff, t = t-value, DF = 2 SA=Strongly Agree A=Agree; R = Remark.

Table 3 shows that all the seven items are ways indicators of professional competence influence QFR. Four of the items (Nos. 1, 4, 5 and 6) have grand means of $\bar{X} \geq 3.50$ indicating "strongly agree". The other three (Nos. 2, 3 and 7) have grand means scores of 2.50 and above ($\bar{X}_g \geq 2.50$), implying "agree". The calculated t-value ranged from 0.502-0.809 which is greater than t-critical value of 0.429. Hence, the hypothesis is rejected. This implies that, there is significant difference between the responses of junior and senior accountants with regards the ways indicators of professional competence influence quality financial reporting.

Table 4: Mean Responses, Standard Deviation and t-values of senior and junior accountants Ways Confidentiality Influence Quality Financial Reporting of Selected Manufacturing Companies in Enugu State, Nigeria

S/N	Indicators of Ways Confidentiality Influence QFR	$\bar{X}_1$	SD	$\bar{X}_2$	SD	$\bar{X}_g$	t	R
1	Respecting confidentiality of information	4.00	0.00	4.00	0.00	2.00	0.432	D
2	Information acquired in the course of professional work must **not** be used for personal advantage.	4.00	0.00	3.57	0.39	3.79	1.601	SA
3	In disclosing confidential information, interest of all parties who might be affected must be considered.	4.00	0.00	3.92	0.29	3.96	0.743	SA

4	Disclosure is required and proper if the information relate to committing of offences involving dishonesty and fraud.	4.00	0.00	3.67	0.49	3.84	1.220	SA
	Cluster mean	**4.00**	**0.00**	**3.79**	**0.16**	**3.40**	**3.996**	**A**

X_1 = mean of junior staff, Standard deviation of junior staff, X_2 = Mean of senior staff, SD_2 = Standard deviation of senior staff, X_g = Grand mean of junior and senior staff, t = t-value, DF = 2 SA=Strongly Agree; R = Remark.

Table 4 shows that three (Nos. 2, 3 and 4) of the four items all have grand mean scores of 3.50 and above ($\overline{X}_g \geq 3.50$). This implies "strongly agrees" while only No. 1 item has mean of 2.00 ($\overline{X}_g \geq 2.50$). This implies "disagree". The calculated t-value ranged from 0.432-5.636 which is greater than t-critical value of 0.001. Hence, the hypothesis is rejected. This implies that there is significant difference between the responses of junior and senior accountants with regards to the ways indicators of confidentiality influence quality financial reporting.

Discussion of Findings

The findings of this study in table 1, has shown that the respondents agreed with all the identified areas of objectivity of the accountants in Enugu state manufacturing companies. These findings were in agreement with Izedonmi (2012) who opined that the principle of objectivity imposes obligation on all accountants to avoid jobs, assignments, relationships, and situations that are capable of compromising their professional judgment. The t-test revealed that Junior accountants are as objective as their senior colleagues in their professional dealings. This is in agreement with the evidence given by ICAEW (1997) that objectivity is essential for any professional person.

Table 2 revealed through the grand mean that the respondents agreed to the identified areas of professional integrity of the accountants. These findings were in line with IFAC code of ethics (2006) Professional accountant is required to comply with the principle of integrity which imposes an obligation on all Chartered Accountants to be straightforward and honest in professional and business relationships and that professional accountant (senior accountants) should not be associated with reports, returns, communications or other information where they believe that the information: (a) Contains a materially false or misleading statement; (b) Contains statements or information furnished recklessly; or (c) Omits or obscures information required to be included where such omission or obscurity would be misleading. The test of hypothesis provided the evidence that more experienced accountants (senior accountants) tend to possess more integrity than the less experienced ones (junior accountants). The finding lends supports to Thompson (2021) that a senior accountant is more concerned with the integrity of the accounting, making

sure that everyone follows the proper accounting rules.

In Table 3, the respondents strongly agreed to the highlighted areas of professional competence of the accountants in Enugu state manufacturing companies. These findings were in line with IFAC (2005) & ICAN (2015) that professional accountant has a continuous duty of maintaining professional knowledge and skill at the level required to ensure that a client or employer receives competent professional service based on current developments in practice, legislation, and techniques. The test of hypothesis provided the evidence that senior accountants are more professionally competent than their junior counterpart. This is in consonant with Better Hiring (2022) that in most organization, junior accountants are not required to have professional qualifications like their senior counterpart.

In Table 4, the respondents strongly agreed to the highlighted areas of confidentiality of the accountants. These findings were in line with IFAC (2005) & ICAN (2015) which says professional accountant should respect the confidentiality of information acquired as a result of professional and business relationships and should not disclose any such information to third parties without proper and specific authority unless there is a legal or professional right or duty to disclose. The test of hypothesis provided the evidence that senior accountants are more confidential in their professional dealings than their junior counterparts this could be because over the years they have witnessed the catastrophic effects of divulging corporate information meant to be kept confidential. The finding lend support to parker & Lynch (2020) that major responsibilities of the senior accountants are: analysing complex financial reports, making recommendation based on the analysis, reviewing journal entries of the junior accountants to ensure accuracy, performing variance analysis etc. these shows that senior accountants are literarily exposed to confidential information day in day out in the course of their professional practice than the junior accountants.

Conclusion

Out of so many professional accounting ethics, this study has clearly shown that the four major indicators namely, objectivity, integrity, professional competence and confidentiality are the bedrock of quality financial reporting system. The findings concurred with the fact that quality financial reporting cannot be achieved in manufacturing company without strict adherence to professional accounting ethics.

Recommendations

1. Manufacturing companies should constitute ethical compliance committee who will ensure adherence to professional ethics.
2. Junior accountants should be given opportunity for professional improvement and acquisition professional ethical behaviour of integrity, and confidentiality.

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Strategies for Regulating Excessive Use of Smartphone among Agricultural Education Students in Universities in Abia State, Nigeria

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Abstract

The study evolved strategies for regulating excessive use of smartphone among Agricultural Education students in universities in Abia State, Nigeria. Specifically, the study determined perceived consequences of excessive use of smartphone as well as strategies which students, universities and parents could adopt in reducing excessive utilization of smartphone. Four research questions were answered and four hypotheses tested. The study adopted descriptive survey research design. The population of the study was 93 respondents, made up of 15 lecturers and 78 students of Agricultural Education in Abia State. Questionnaire was used for data collection. Data were analyzed using mean and t-test. Findings revealeight perceived consequences of excessive use of smartphone by Agricultural education students (Agric Ed). These include; reduces the academic performance of Agric Ed students ($\overline{X}$ = 4.16), reduces students interest in reading ($\overline{X}$ = 4.36), leads to a decline in the study habit of Agric Ed students ($\overline{X}$ = 3.64) and others. There are also eight strategies students could adopt for reducing excessive use of smartphones. These include, among others, read books to learn more about smartphone addiction and control ($\overline{X}$ = 7.71), control excessive use of smartphone by the use of role play ($\overline{X}$ = 4.43), set time limits to regulate the rate of use of the phone ($\overline{X}$ = 4.07). Other findings are nine stragtegies university could adopts. These including, specify time when servers should be on and off ($\overline{X}$ = 4.01), organize seminar/work for Agric Ed students on smartphone addicition ($\overline{X}$ = 3.94), forbid negligence arising from smartphone addiction among students ($\overline{X}$ = 3.79), among others. More findings are nine family related strategies including, parents should: ensure that children obey family guidelines on the ue of smartphone ($\overline{X}$ = 4.33), set clear guidelines on the use of smartphone ($\overline{X}$ = 3.94), and tell children the dangers of excessive phone use rather than hate them ($\overline{X}$ = 3.95). It was recommended among others that, the university management should work with students' leaders to regulate internet usage.

Keywords: Strategies, Regulating, Smartphone, Agricultural Education, Universities.

Introduction

Agricultural Education is the teaching of agriculture in formal institutions of learning such as the primary, secondary schools and tertiary institutions of learning, for the purpose of equipping learners with knowledge, skills and attitudes in agriculture. But, in universities, Federal Republic of Nigeria (FRN, 2014) provides that Agricultural Education is a teacher education programme in the universities which serves to train students to be classroom teachers, agriculturists and researchers. The teaching of agriculture is not limited to classroom instruction; it extends to field experience in the school farm, laboratory or workshop (Otetoobo & Onuka, 2021). According to Michael Okpara University of Agriculture Umudike (2019), Agricultural Education students offer courses in various fields of studies, including: Agriculture, Education, Languages and Applied Sciences. One important means of sourcing information for these courses is through the use of smartphone.

Smartphone is a hand held electronic device for accessing information. According to Kate (2023), smartphone is a portable device that could combine mobile telephone and computing functions into one unit. The device is a connected to a cellular network and the internet to perform diverse functions in Agricultural Education in any part of the world (Onuka, 2021; Ike, Iwu & Onwuagboke, 2015). The smartphone is used for diverse functions. For instance, Kate (2023), posits that smartphone is used to convert, store, protect, transmit and retrieve information. The phone is also used for playing games, listening to music, make or receive calls, take lectures, send or receive text messages, send or receive emails, or read news (Bialobrzeska & Cohen, 2015; Irby & Strong, 2013). Thus, the use of smartphone and other internet-connected devices has revolutionized the process of providing information and educational services. Smartphones are used by various classes of people; both the young and old. However, a study conducted in 11 emerging and developing countries, revealed that across all the 11 countries, smartphone use is very common among younger people below the age of 30 years. (Silver, Smith, Johnson, Jiang, Anderson & Rainie, 2023). Thus, youths make use of smartphone greatly. Among these youths are undergraduates of various universities, including those of Agricultural Education.

The undergraduate students use the phone for various purposes. According to Demirci, Akgonul and Akpinar (2015), smartphone serves as a portable device for communication, research, accessing educational information, taking notes during lectures, connecting with experts in various educational programmes, among others. These contribute features help to popularize the use of smartphones among the students. However, Agricultural Education students are particularly selected for the study because they have specialized focus on the unique practices and challenges within

agricultural education which may differ significantly from the broader body of students in the university. For instance they use smartphone for research, monitoring farm data through various applications in the phone among, others (Irby & Strong, 2013). This approach could help the researcher to gain in-depth insight into issues specific to agricultural education and advice accordingly.

Studies revealed that many students use the Smartphone excessively (Yeap, Ramayah, Halim, Ahmed & Kurmnia; 2016; Shek, Sun & Yu, 2013). Excessive use of Smartphone, according to Wigmore (2018), is known to be a situation in which someone depend on smartphone usage so much that it is hard to control or stop the urge; and a habit that is so difficult to stop despite its adverse effects. There are some indicators or signs of excessive smartphone use. Burke (2019) outlined these signs to include: restlessness, sleeplessness, anxiety, depression, and sleeping with the phone. Owolabi, Oyewole & Oke (2013) added that a lot of undergraduate students have formed the habit of over using the smartphone without minding time loss and that these students experience extreme reactions when the phone is separated from them. It is thus, is a very worrisome habit which has negative consequences to students generally. For instance, a study carried out by Yeap, et al, (2019) on the impact of internet addiction in India, revealed that smartphone addiction has increased students' absenteeism from classes, apathy to academic activities, social isolation and less time is spent on studies. In a similar study carried out by Onuka (2021), to ascertain the influence of internet use on the academic performance of students in Umuahia North LGA of Abia State, confirmed that students, including Agricultural Education students, spend so much time in social networks such as facebook, whatsapp, twitter, instragram and goggle to the point of addition. Again, studies have revealed that excessive use of smartphone is associated with depression, anxiety, emotional and cognitive challenges. (Demirci et al.,2015; Shek et al; 2013) The situation could threatened the family wellbeing as parents may suffer emotionally, socially and financially because of the attitudes of their children over excessive Smartphone use (Ezema, 2017).In the light of the foregoing discussions, there is need for universities in Abia State to regulate the use of smartphone on campuses to reduce its social-economic implications.

Regulating excessive use of smartphone is the activities of controlling the use of the device based on regulations; where they exist. These regulations are official instructions or rules that states how smartphones will be used in the universities. In the cause of the study, the researcher found that the universities under study do not have regulations guiding the use of smartphones. Based on this, there is therefore, a need to devise appropriate strategies for regulating smartphone use among Agricultural Education students in the area.

Strategy is known to be a method or way of achieving an aim. According to Onuka and Isiwu (2017), strategy is

a plan of action for actualizing a dream. In the context of this study, strategies for regulating excessive use of Smartphone among Agricultural Education Students in Universities in Abia State, are methods, ideas and ways that is intended to address the challenges of excessive use of smartphone. The university management, parents, students themselves and families can help to regulate smartphone. For instance, students can control excessive use of Smartphone by limiting phone use to only academic purposes (Onuka, 2021), reducing budget for recharge cards, or going for counseling when addicted by phone use, (Onuka, 2021; Ayamba, 2013). The university management and lecturers could: organize seminar/workshop for students on smartphone addiction, work with internet providers to regulate excessive use of smartphone, organize inter-hostel games to divert the attention of students from social network sites (Olowookere, 2018) as well as work with students' leaders to establish rules and standard on the use of internet (Ainin, 2012), among others. Families could set clear guidelines on the use of the device at homes, specify age their children will begin to use the phone, encourage open discussion with children on uses of smartphone, and set time when to use the phone at home (Onuka, 2021). In their views, Bialobrzeska & Cohen (2015) added that families can reduce budget on recharge cards, sanction children and wards for wrongful use of the smartphone and among others. These strategies could go a long way to reduce excessive use of the phone, even in the university.

There is hardly, any data on excessive use of smartphone in the area of the study. Therefore, a study on this subject is paramount to the understanding of regulation of smartphone use in the area of the study. It may enhance a greater understanding of Smartphone use in education generally and in Agricultural Education in particular. It is in light of this background that the research was carried to determine strategies for regulating excessive use of smartphone among Agricultural Education Students in Universities in Abia State. This is the gap the study has filled.

Purpose of the study

The study evolved strategies for regulating excessive use of smartphone among Agricultural Education (Agric Ed) students in universities in Abia State, Nigeria. Specially, the study determined:

1. perceived consequences of excessive use of smartphone by Agric Ed students in universities in Abia State,
2. student-related strategies for reducing excessive utilization of smartphone by Agric Ed students in universities in Abia State,
3. university-related strategies for reducing excessive use of smartphone by Agric Ed students in universities in Abia State.
4. family- related strategies for reducing excessive utilization of smartphone by Agric Ed in universities in Abia State.

Hypotheses

There is no significant difference between the mean responses of lecturers and students on:

H_{01}: perceived consequences of excessive use of smartphone among Agric Ed students in universities in Abia State.

H_{02}: student-related strategies for reducing excessive utilization of Smartphone, among Agric Ed students in universities in Abia State.

H_{03}: university-related strategies for reducing excessive utilization of smartphone among Agric Ed students in universities in Abia State.

Ho_4: family-related strategies for reducing excessive utilization of smartphone, among Agric Ed students in universities in Abia State.

Methodology

***Design of the study*:** The study adopted descriptive survey research design.

Area of the study: The study was conducted in universities in Abia State, Nigeria. Abia State is located in South Eastern Nigeria. The state was chosen for the study because of evidence of excessive use of smartphone among Agricultural Education students in universities in the state (Onuka, 2021). There are two universities that offer Agricultural Education programme in Abia State. These are Michael Okpara University of Agriculture, Umudike (MOUAU) and Abia State University, Umuahia campus (ABSU).

***Population of the study*:** The population of the study was 93 respondents, consisting of all the lecturers of Agricultural Education and penultimate students from the universities who offer Agricultural Education programme. Details of the population are as follows: MOUAU 10 lecturers and five lecturers from ABSU as well as 63 students from MOUAU and 15 students from ABSU (Records from Departmental offices of both universities at Umudike and Umuahia, 2021). The two groups of respondents are major stakeholders in the universities whose opinions are necessary in the study; the duo is selected in order to provide more targeted insight to the study because of their specific expertise and specialized knowledge in Agricultural Education. By focusing on them the researcher could develop interventions and recommendations on issues that are more likely to meet the specific needs of agricultural education students, which may differ significantly, from the broader student body.

***Sample and Sampling Techniques*: T**he entire population of 93 was involved in the study. There was no sampling as the number was small and can be managed by the researcher.

***Instrument for data collection*:** Questionnaire was used for data collection. It consists of sections which focused on personal data of the respondents and specific purposes of the study. The response scale for each questionnaire items are Strongly Agree (SA), Agree (A), Undecided (UN), Disagree (D) and Strongly Disagree (SD) with corresponding values 5, 4, 3,

2, and 1. The questionnaire was validated by three university experts in Agricultural Education and Computer Education. Cronbach Alpha method was used to determine the reliability of the instrument. A coefficient of 0.79 was obtained for the questionnaire. This was adjudged to be reliable.

***Method of Data Collection*:** A total of 93 copies of the questionnaire were administered on 93 respondents by hand with the help of three research assistants. All the 93 copies were properly completed and retrieved.

Method of Data Analysis: Data collected were analyzed using mean to answer the research questions, while t-test was used to test the null hypotheses at 0.05 level of significance. In deciding the cut-off point, any items in research questions 1, 2, 3 and 4, a mean of 3.00 was set as benchmark for decision making. Any item whose mean is greater than or equal to 3.00 was interpreted as "Agree" while the mean below 3.00 was regarded as "Disagree". On the null hypotheses tested, the hypothesis of no significance difference was accepted when p-value was equal or greater than the alpha value of 0.05, but rejected where p-value was less than the alpha value of 0,05.

RESULTS

Table1: Mean Responses and t-test Results on Perceived Consequences of Excessive Use of Smartphone by Agricultural Education (Agric Ed) Students in Universities in Abia State, Nigeria (N=93).

SN	Consequences of excessive use of Smartphone	$\overline{X}_1$	SD_1	$\overline{X}_2$	SD_2	$\overline{X}_g$	t-	Remarks
	Excessive use of smart phone could:							
1	reduces the academic performance of Agric Ed students.	4.10	0.30	4.21	0.17	4.16	0.17	Agree/NS
2	reduces students interest in reading.	4.12	0.74	4.60	0.25	4.36	0.25	Agree/NS
3	increase students' urge to come late for lectures.	3.11	0.24	3.70	3.70	3.40	0.42	Agree/NS
4	cause students to often use their school fees for air time.	3.61	0.31	3.20	0.31	3.40	0.31	Agree/NS
5	may reduce students' interest in school activities.	3.32	0.81	3.22	0.12	3.27	0.12	Agree/NS
6	make Agric Ed students to use their phones even while working in the school farm.	3.44	0.65	3. 22	0.63	3.33	0.52	Agree/NS
7	leads to a decline in the study habit of Agric Ed students.	3.77	0.53	3.52	0.64	3.64	0.72	Agree/NS
8	make students to give priority to watching games instead of their class work.	2.72	0.73	3.32	0.51	3.02	0.56	Agree/NS

$\overline{X}_1$= *Mean of lecturers;* SD_1= *standard deviation of lecturers;* $\overline{X}_2$= *Mean of students;* SD_2 = *Standard deviation of students;* $\overline{X}_g$ = *Grand means of lecturers and students; t= t-Value*

Table 1 reveals that all the eight items obtained mean scores that are above the cut-off point, X ≥ 3.00.This means that the eight items are all perceived consequences of excessive use of smartphone among Agricultural Education students in universities in Abia State. The Table also reveals that all the eight items had p-value that ranged 0.12 to 0.72 which were greater than the alpha-value of 0.05. This means that there was no significant difference in the mean responses of lecturers and students of Agricultural Education for each of the eight consequences. Therefore, the null hypothesis of no significant difference for the two groups of respondents was accepted on the eight items at 0.05 level of significance.

Table 2: Mean Responses and t-test Results of Lecturers and Students on Student-Related Strategies for Reducing Excessive Use of Smartphone among Agricultural Education (Agric Ed) Students in universities in Abia State (N=93).

SN	Student-related strategies for Reducing Smartphone use	$\overline{X}_1$	SD_1	$\overline{X}_2$	SD_2	$\overline{X}_g$	t	Remarks
	Agricultural Education students should:							Agree/NS
1	restrict smartphone use mainly to academic activities	3.64	0.48	3.55	0.72	3.60	0.51	Agree/NS
2	organize group discussions among themselves on how to use smartphone.	3.78	0.60	3.81	0.53	3.79	0.66	Agree/NS
3	read books to learn more about smartphone addiction and control.	3.72	0.65	3.70	0.50	7.71	0.73	Agree/NS
4	control excessive use of smartphone by the use of role play.	4.21	0.50	4.65	0.48	4.43	0.39	Agree/NS
5	regulate use of smartphones by attending seminars to know the right way to use them.	3.22	0.64	3.40	0.50	3.31	0.45	Agree/NS
6	set time limits to regulate the rate of use of the phone.	4.15	0.52	3.98	0.51	4.07	0.53	Agree/NS
7	not recharge the phone always to avoid the temptation of addiction.	3.41	0.57	3.60	0.61	3.50	0.47	Agree/NS
8	seek counseling over addiction to smartphone use.	3.31	0.54	3.50	0.51	3.40	0.27	Agree/NS

$\overline{X}_1$ =*Mean of lecturers;* SD_1= *standard deviation of lecturers;* $\overline{X}_2$= *Mean of students;* SD_2 =*Standard deviation of students;* $\overline{X}_g$ =*Grand means of lecturers and students; t= t-Value*

Table 2 shows that all the eight items obtained mean scores that are above the cut-off point, X ≥ 3.00.This means that the eight items are all student-related strategies for reducing excessive use of Smartphone among Agricultural Education students in universities in Abia State. The Table also reveals that all the eight items had p-value that ranged 0.27 to 0.73 which

were greater than the alpha-value of 0.05. This means that there was no significant difference in the mean responses of lecturers and students of Agricultural Education for each of the eight student-related strategies. Therefore, the null hypothesis of no significant difference for the two groups of respondents was accepted on the eight items at 0.05 level of significance.

Table 3: Mean Responses and t-test Results of Lecturers and Students on University-Related Strategies for Reducing Excessive Utilization of Smartphone by Agricultural Education (Agric Ed) Students in Universities in Abia State, Nigeria (93).

SN	University-related strategies for reducing excessive Smartphone use	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_g$	t	Remarks
	The university management should:							
1	organize seminar/workshop for Agricultural Education students on smart phone addiction:	3.89	0.40	3.99	0.45	3.94	0.34	Agree/NS
2	use orientation programmes of fresh students to create awareness on smart phone addiction.	3.56	0.54	3.30	0.50	3.43	0.75	Agree/NS
3	direct academic advisers to closely monitor their supervisees to detect features of addictive behaviours among them.	3.13	0.60	3.28	0.42	3.21	0.42	Agree/NS
4	work with student union leaders to establish rules and standard on smartphone usage.	3.21	0.51	3.50	0.50	3.25	0.41	Agree/NS
5	work with internet service providers to regulate the use of internet among Agricultural Education students.	3.41	0.74	3.60	0.51	3.50	0.32	Agree/NS
6	tell students the dangers of smartphone addiction rather than hate them for their addictive behaviours.	4.22	0.52	3.80	0.48	4.01	0.52	Agree/NS
7	organize inter- hostel games to divert the attention of Agricultural Education students from social networks sites.	3.77	0.43	3.67	0.64	3.72	0.43	Agree/NS
8	forbid negligence arising from smart phone addiction among students coming late to classes or school farm .	3.65	0.64	3.94	0.61	3.79	0.51	Agree/NS
9	specify time when servers	4.12	0.07	3.89	0.66	4.01	0.65	Agree/NS

should be on and off.

$\bar{X}_1$=Mean of lecturers; SD_1= standard deviation of lecturers; $\bar{X}_2$ = Mean of students; SD_2 = Standard deviation of students; $\bar{X}_g$ = Grand means of lecturers and students; t= t-Value

Table 3 shows that all the nine items obtained mean scores that are above the cut-off point, X ≥ 3.00.This means that the nine items are all university-related strategies for reducing excessive use of smartphone among Agricultural Education students in universities in Abia State. The Table also reveals that all the nine items had p-value that ranged 0.34 to 0.75 which were greater than the alpha-value of 0.05. This means that there was no significant difference in the mean responses of lecturers and students of Agricultural Education for each of the nine university-related strategies for reducing excessive utilization of smartphone. Therefore, the null hypothesis of no significant difference for the two groups of respondents was accepted on the nine items at 0.05 level of significance.

Table 4: **Mean Responses and t-test Results of Lecturers and Students on Family-related Strategies for Reducing Excessive Utilization of Smartphone among Agricultural Education (Agric Ed) Students in Universities in Abia State, Nigeria (93).**

SN	Family-related strategies for reducing excessive smartphone use	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_g$	t	Remarks
	Parents should:							Agree/NS
1	show good examples of how to use smartphone.	3.56	0.56	4.01	0.67	3.78	0.68	
2	set clear guidelines on the use of Smartphone.	4.12	0.44	3.76	0.54	3.94	0.65	Agree/NS
3	specify the age when children will begin to use Smartphone.	4.01	0.34	4.31	0.26	3.84	0.53	Agree/NS
4	reduce budget on recharge cards.	3.65	0.70	3.66	0.64	3.65	0.70	Agree/NS
5	monitor their children's emotions to guard against excessive smartphone use.	2.83	0.77	3.32	0.67	3.07	0.71	Agree/NS
6	tell children the dangers of excessive phone use rather than hate them.	4.02	0.41	3.88	0.56	3.95	0.46	Agree/NS
7	organize games at home to divert the attention of their children from social networks sites.	3.75	0.54	4.01	0.44	3.88	0.68	Agree/NS
8	ensure that children obey family guidelines on the use of Smartphone.	4.22	0.45	4.44	0.36	4.33	0.73	Agree/NS
9	discipline children when they compromise guidelines on phone uses.	3.88	0.48	4.55	0,33	4.22	0.45	Agree/NS

$\bar{X}_1$=Mean of lecturers; SD_1= standard deviation of lecturers; $\bar{X}_2$ = Mean of students; SD_2 =Standard deviation of students; $\bar{X}_g$ = Grand means of lecturers and students; t= t-Value

Table 4 reveals that all the nine items obtained mean scores that are above the cut-off point, X ≥ 3.00.This means that the nine items are all family-related strategies for reducing excessive use of Smartphone among Agricultural Education students in universities in Abia State. The Table also reveals that all the nine items had p-value that ranged 0.45 to 0.73 which were greater than the alpha-value of 0.05. This means that there was no significant difference in the mean responses of lecturers and students of Agricultural Education for each of the nine family related strategies. Therefore, the null hypothesis of no significant difference for the two groups of respondents was accepted on the nine items at 0.05 level of significance.

Discussion of Findings

The result in Table 1 reveals perceived consequences of excessive use of smartphone by Agricultural Education students in universities in Abia State, Nigeria. They include: excessive use of smartphone reduces the academic performance of Agricultural Education students, reduce students interests in reading, increase students' urge to come late for lectures, cause students to often use their school fees for air-time, may reduce students' interests in school activities and make Agricultural Education students to use their phones even while working in the school farm. These findings are in consonant with the submissions of Yeap (2019) who said that students derive much pleasure accessing information using the smartphone excessively. The findings are also in line with the comments of Burke (2019), who named restlessness, depression, anxiety and poor academic performance as great consequences of Smartphone addiction on the academic performance of students.

The result in Table 2 discloses student-related strategies for reducing excessive use of smartphone among Agricultural Education students in universities in Abia State, Nigeria. They are Agricultural Education students may reduce smart phone addiction by limiting smart phone use mainly to academic activities, students can organize discussions classes among themselves on the uses of smart phone, Agricultural education students may read books to know more about smart phone addiction and control, Agricultural Education students can reduce the excessive use of smartphone through role play and five others. These findings are in consonant with the findings of Onuka (2021) and views of Ayamba (2013) that students can reduce excessive use of smartphone by limiting the use of smartphone to academic activities.

Table 3 reveals university-related strategies for reducing excessive use of smartphone among Agricultural Education students. They include among others, university management could organize seminars/workshops for Agricultural Education students on smartphone use, use orientation programme for fresh students to create awareness on consequences of smartphone addiction, direct academic advisers to closely monitor their supervisees to detect features of

addictive behaviours among them, work with student union leaders to establish standard on smartphone usage, work with internet providers to regulate the use of internet among Agricultural Education students, tell students the dangers of smartphone addiction rather than hate them for their addictive behaviours and organize inter-hostel games to divert the attention of Agricultural Education students from social networks sites. These findings support the views of Olowookere (2018) who opined that universities can control excessive use of smartphone by organizing seminars on smartphone addiction control.. The findings also support the views of Ainin (2012) that universities should work with student leaders to establish rules and standards on the use of internet by young adults.

Table 4 shows family-related strategies for reducing excessive utilization of smartphone among Agricultural Education students in universities in Abia State. They are parents should show: good examples of how to use smartphone, set clear guidelines on the use of smartphone, specify when children will begin to use smartphone, reduce budget on recharge cards, monitor their children's emotions to guard against excessive smartphone use, tell children the dangers of excessive phone use rather than hate them, organize games at home to divert the attention of their children from social networks sites and ensure that children obey guidelines on the use of smartphone. These findings agree with Onuka (2021) that families could set clear guidelines on the use of phone. The results also support the views of Bialobrzeska & Cohen (2015) that families can reduce budget on recharge cards, sanction children and wards for wrongful use of the smartphone to reduce excessive use of smartphone.

It was also found out that there was no significant difference between the mean responses of lecturers and students on perceived consequences of excessive use of smartphone and strategies adopted by students, universities, and families to reducing excessive smartphone use among Agricultural Education students in Abia State, Nigeria.

Conclusion

The use of smartphone in education has revolutionized the teaching and learning of Agricultural Education. Smartphone usage is increasingly becoming acceptable as a method of instructional delivery in universities the world over. However, it is suspected that many students of Agricultural Education in universities in Abia state are using the smartphone excessively and this could result to negative consequences to their academic performance. The study was therefore carried out to address the issue. The study determined perceived consequences of excessive use of smartphone, as well as strategies adopted by student, university, and families for reducing excessive utilization of smartphone in universities in Abia State.

The study had therefore provided information on excessive use of smartphone among Agricultural

Education students in universities in Abia State which was not available before the present study. It has therefore contributed to learning and filled the gap created by the absence of this information on the subject that was not available before the present study.

Recommendations

Based on the findings of the study, the following recommendations were made by the researcher:

1. Perceived consequences of excessive use of smartphone among Agricultural Education students should be avoided by the collaborative efforts of the university management, students and parents.
2. Agricultural Education students should organize seminar/workshop on the use of Smartphone as part of the students' week activities.
3. The university management should package the findings of the study into booklets and made available to students as reference materials and for counseling programmes.
4. Universities should organize recreational activities such as inter-hostel football competition to take the minds of students away from social media sites.
5. Parents should set guidelines on the use of smartphone in their family to control the use of this device among members of the family.

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Communication Patterns and Parent-Child Relationship Issues: A Case Study of Families Resident in University of Nigeria, Nsukka, Enugu State

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Abstract
This study focused on issues relating to communication patterns and parent-child relationships among households resident in University of Nigeria Nsukka (UNN) senior staff quarters. Specifically, the study determined ways family communication patterns influence parent/adolescent-child relationship among residents of UNN senior staff quarters (SSQs), digital communication channels used by families to enhance parent/adolescent-child relationship among residents of UNN SSQs, challenges that militate against parent/adolescent-child relationship and communication among residents of UNN SSQs and solutions to challenges militating against parent/adolescent-child relationship and communication among residents of UNN SSQs. The study adopted a survey design. Population for study comprised of residents of senior staff quarters in University of Nigeria Nsukka. Data were collected using questionnaire. Data were analyzed using mean and standard deviation. Findings include 11 possible ways communication patterns (open, close, aggressive and passive) influence parent/adolescent-child relationship. For instance, open communication pattern can engender "trust" ($\overline{X}$ = 2.97), "enjoyment" ($\overline{X}$ = 3.37), instruction/teaching/learning ($\overline{X}$ = 2.92), and so on. Other findings include seven groups of digital channels used in parent/adolescent-child communication. These include mobile application (APPs) ($\overline{X}$ = 3.31), video calls ($\overline{X}$ = 3.12), social media ($\overline{X}$ = 3.03), online learning ($\overline{X}$ = 2.72), and others. Further findings are eight challenges militating against parent/adolescent-child relationship and communication, such as, busy schedules of parents ($\overline{X}$ = 3.22), differences in communication styles among family members ($\overline{X}$ = 3.11). More findings are seven measures for ameliorating the challenges, including, establishing regular family communication time ($\overline{X}$ = 3.03), respect for other opinions ($\overline{X}$ = 3.11), use open communication patterns and be honest ($\overline{X}$ = 2.92). and others. Based on the findings four recommendations were made.

Keywords: Communication, Parent/Adolescent-child, Relationship, Family, Patterns, Positive, Negative

Introduction

The family is the basic unit of any society and the welfare of any nation depends on that of each of the families therein. According to Anyakoha (2015), family is a group of persons united by

the ties of marriage, blood or adoption and could be characterized by common residence and economic cooperation. The basic family is a group made up of a man, his wife and their children. The relationship within the family is of utmost importance as it significantly influences the welfare of the individuals therein and the unit itself. Relationships in family are between husband-wife, siblings relationship and between parent –child relationship. Husband-wife relationship is the relationship between the husband and the wife and they are key persons in a family. In order for the well-being of the family to be sustained, this relationship must continue to be strengthened through effective communication, affection and cooperation. Sibling relationship are those between children of the same parents and such relationship gives individuals benefits such as companionship, learning of manners, securing, understanding and support. Parent-child relationship is the unique and enduring bond between parents and children. According to Anyakoha (2015), parent-child relationships are broken into four types which are protective-dependence relationship, instruction-learning relationship, enjoyment-companionship relations and advising-evaluation relationship Protective dependence is inevitable because the child is fully dependent on the parents who are generally looked upon to give protection to the child. Instruction-learning is also inevitable because through parental love and provision of experiences, instruction-learning relationship is established and children learn good behaviour. Furthermore, enjoyment-companionship is inevitable because when children grow towards adulthood, a feeling of companionship with the parents arises and it involves sharing of interests and pleasures by parents and children on the basis of equality. Advising-evaluation is inevitable as when a child has reached adulthood and gained a large amount of independence from parents, giving rise to a situation in which the parents give advice to the child. The parent-child relationship is the crux of this study, especially the relationship between parents and their adolescent children.

Adolescence is a transition stage of development between childhood and adulthood, typically characterized by physical, psychological and social changes. It is marked by the onset of puberty, which involves the development of secondary sexual characteristics and usually extends until the individual reaches full physical and emotional maturity. According to Sawyer, Azzoipadi, Wickermanthne and Patton (2018), adolescents are individual between the ages of 13-19 years. These individuals are usually under the care of parents and are still given instruction, protection, companionship and advice. According to Hidayah, Lestari and Artha (2021), achieving a good relationship between parents and their adolescent children requires communication. It helps in building trust and creating emotional connection among parents and children. Furthermore, communication

encourages expression, helps in settling conflict and provision of support in the family.

Communication is defined as the process of exchanging ideas, information, thoughts and feelings between individuals or groups through verbal and non-verbal means (McPhee and Zaug, 2000). It involves the transmission of messages from a sender to a receiver through various forms such as verbal, written or through facial forms and body language. Effective communication requires not only the transmission of a message but also the understanding of the message by the recipient.

Communication has various elements which include, but are not limited to; sender, message, encoding, channel, receiver and feedback. The sender of a message is the person who initiates the communication process by creating and sending a message. This individual converts his/her thoughts or ideas into a form that can be transmitted. The message is the information, emotion or idea that the sender wants to communicate through various channels such as spoken words, body language or symbols. Encoding involves the process of converting the message into a format or code that can be easily understood by the receiver. The channel is the medium through which the message is sent from the sender to the receiver. Channels can include, but are not limited to; face-to-face communication, written communication and electronic communication. The receiver is the individual for whom the message is intended. Upon receiving the message, he/she decoded it, interprets the symbols, words or other forms used by the sender. Feedback is the response or reaction of a receiver to a sender's message. It allows the sender to gauge whether the message was understood as intended. Feedback can be verbal or non-verbal and is crucial for effective communication.

Communication follows various patterns in the family. Communication patterns are the recurring and predictable ways in which information is exchanged and shred among individuals or groups. It encompasses the various styles, methods and channels through which people convey messages, ideas and emotions to one another. Communication patterns are usually influenced by cultural norms, social context, individual preferences and the nature of the relationship between individuals.

The most common patterns of communication are open communication pattern, aggressive communication pattern, closed communication pattern and passive communication pattern. Open communication pattern is a communication style characterized by openness and transparency. In such a communication pattern, individuals communicate freely, honestly and without withholding any information. Aggressive communication pattern on the other hand is a style of communication that involves expressing one's thoughts, feelings an needs in a way that is forceful, dominating or confrontational People who use aggressive communication often prioritize their own needs and

desires over the needs of others and may disregard or disrespect the opinions and feelings of those they are communicating with. Passive communication pattern is one that is characterized by a lack of assertion or a tendency to avoid expressing one's needs, desires or opinions. Individuals who exhibit passive communication patterns often prioritize the needs of others over their own, usually tend to avoid conflicts and confrontations as well as sometimes have difficulty in setting boundaries. This communication style can lead to unexpressed feelings and frustrations as passive communicators may not assert themselves or communicate their thoughts effectively. Closed communication pattern is one in which information flows in a restricted or limited manner. In this pattern, communication tends to be more one-way and follows a structured and controlled path. Closed communication is usually characterized by limited information flow, a rigid and formal structure, controlled feedback and defined roles.

Different communication patterns are used in homes between parents and children. None of these communication patters however can be classified as perfect as each has its own advantages and disadvantages. According to Uddin (2008), communication patterns between parents and children play a crucial role in shaping the family dynamics, influencing the child's development and establishing a parent-child relationship. The right communication pattern can also benefit parents as it could help them have peace at home and be optimally productive in their careers, especially those working in mentally tasking careers such as university staff.

The University of Nigeria Nsukka, where this study is undertaken, is located in Nsukka town of Enugu Stat e in the South-East zone of Nigeria. It is a residential university, thus staff live within the campus with their families. Located within the campus is also a primary school and a secondary school, which meets the educational needs of the adolescent children of staff. The university campus also has sports facilities that cater for the recreational needs of staff and their children, thus making it imperative that parents need to communicate with their children regularly within the campus. The study is conducted at the University of Nigeria, Nsukka (UNN) to explore the current scenario of family communication patterns and parent-child relationships among the residents. The choice of UNN as the study location is due to its diverse population with a mix of cultural backgrounds and generational influences provides a suitable setting to explore how communication patterns vary within families and influence parent-child relationships.

The study's justification lies in its potential to contribute valuable insights into the importance of positive communication patterns for fostering healthy parent-child relationships and overall family well-being. Understanding the factors influencing communication patterns and their

implications on relationships can inform the development of effective family-centered interventions to promote positive parent-child interactions. Additionally, by exploring the communication channels used within families, the study can shed light on how communication patterns manifest and affect family dynamics in diverse context

Objectives of the Study

This study focused on issues relating to communication patterns and parent-child relationships among households resident in University of Nigeria Nsukka (UNN) senior staff quarters. Specifically, the study determined:

1. ways family communication patterns influence parent/adolescent-child relationship among residents of UNN senior staff quarters (SSQs).
2. digital communication channels used by families to enhance parent/adolescent-child relationship among residents of UNN SSQs.
3. challenges that militate against parent/adolescent-child relationship and communication among residents of UNN SSQs.
4. solutions to challenges militating against parent/adolescent-child relationship and communication among residents of UNN SSQs.

Methodology

Design of the study: The descriptive survey design was adopted for this study.

Area of the study: The University of Nigeria Nsukka campus has approximately 599 housing units which are categorized into senior and the junior staff quarters. The senior staff quarters has a total of 517 housing units (households) while the junior staff quarters has 82 housing units/households. This study focused on the senior staff units.

Population for the study: The population for this study comprised the residents of the senior staff quarters of the University of Nigeria Nsukka, which include, among others, parents and children within the age bracket of 13-17 years. The population was made up of parents and their adolescent children aged 13-17 years, in the households within the senior staff households. Population size was 517 households.

***Sample for the study*:** A total of 176 housholds, each of which had an adolescent child (13-17 years) at the time of the study was purposively selected for the study. One parent (father or mother) and one of their adolescent child, all of who were willing to participate in the study, were also purposively selected for the study. These gave a sample of 352 respondents for the study.

Instrument for Data Collection: Questionnaire was used to collect data for the study. It was developed based on literature review and the specific objectives of the study. It was validated by three university-based communication experts. The questionnaire was divided into two sections; the first section being the demographic information of the respondent while the second section contained items relating to the specific

objectives that guided the study. A four point rating scale of Strongly Agree (SA), Agree (A), Disagree (DA) and Strongly Disagree (SD) was used in the research instrument.

***Data Collection Method*:** The questionnaire was developed by the researcher and was distributed across the campus with the help of 3 (three) research assistants. A total of 352 questionnaires were distributed with a total of 343 filled and returned, making for a 97.4% return rate. The instrument's reliability coefficient was determined using the Cronbach Alpha reliability coefficient. A reliability level of 0.88 was obtained, indicating a satisfactory level of reliability

***Data analysis techniques*:** Mean and standard deviation were used to answer the research questions. A 4-point scale with a real limit of 2.50 was used for decision making in deciding whether had an item indicates acceptable level or unacceptable level.

RESULTS

Tables 1: Mean Responses and Standard Deviation on Ways Communication Patters (CP) Influence Parent/Adolescent-Child Relationship

S/N	Ways CP Influence Parent/Adolescent-Child Relationship Communication pattern can generate:	Communication Patterns Means ($\overline{X}$) $\overline{X}_1$	SD_1	$\overline{X}_2$	SD_2	$\overline{X}_3$	SD_3	$\overline{X}_4$	SD_4	$\overline{X}_{om}$
1.	trust	2.97	0.69	2.43	0.49	2.49	0.51	2.51	0.51	**2.60**
2.	hostility	2.33	0.41	3.11	0.81	2.45	0.48	2.53	0.54	**2.61**
3.	cooperation	3.12	0.79	2.35	0.46	2.39	0.41	2.66	0.59	**2.63**
4.	enjoyment	3.37	0.83	2.47	0.42	2.37	0.39	3.03	0.74	**2.81**
5.	support	3.21	0.81	2.48	0.43	3.10	0.82	2.78	0.68	**2.89**
6.	criticism	2.76	0.62	2.92	0.68	2.92	0.66	2.83	0.70	**2.86**
7.	instruction/teaching/ learning	2.92	0.67	2.77	0.62	3.01	0.79	2.91	0.73	**2.90**
8.	satisfaction	3.01	0.71	2.67	0.59	2.33	0.38	2.65	0.58	**2.67**
9	intimacy/closeness	3.03	0.72	2.33	0.44	2.44	0.41	2.92	0.68	**2.68**
10	care	2.99	0.68	2.71	0.63	2.97	0.69	2.99	0.68	**2.92**
11	protection	2.95	0.67	2.82	0.71	2.91	0.63	3.01	0.72	**2.92**
	Cluster Mean for CP ($\overline{X}_{cm}$)	**2.97**		**2.64**		**2.67**		**2.80**		

$\overline{X}_1$ = Mean score for open pattern; SD_1 = Standard deviation for open pattern; $\overline{X}_2$ = Mean score for closed pattern; SD_2 = Standard deviation for closed pattern; $\overline{X}_3$ = Mean score for aggressive pattern; SD_3 = Standard deviation of aggressive pattern; $\overline{X}_4$ = Mean score for passive pattern; SD_4 = Standard deviation of passive pattern; $\overline{X}_{om}$ = Overall means for Ways; $\overline{X}_{cm}$ = Cluster means for communication patterns.

Table 1 shows four communication patterns namely, open (OP), close (CP), aggressive (AP) and passive (PP) and 11 possible ways the patterns could influence parent/adolescent-child relationship. These 11 ways represent

possible outcomes of the communication patterns, that is, their resultant influences on parent/adolescent-child relationship. The Table further shows that the open communication pattern obtained the highest mean score for "trust" ($\overline{X}$ = 2.97) while closed pattern obtained the least mean score of $\overline{X}$ = 2.43. The Table also shows that the open pattern has the highest mean score ($\overline{X}$ = 3.37) for generating "enjoyment". Thus, the four types of communication patterns obtained varied mean ($\overline{X}$) scores for the 11 influence outcomes. The Table also shows the overall mean score of each of the 11 ways for the four communication patterns. The ways with the highest overall means are, "caring" ($\overline{X}_{om}$ = 2.92); "protecting" ($\overline{X}_{om}$ = 2.92), and "instruction/teaching/learning" ($\overline{X}_{om}$ = 2.90). Table 1 further shows the cluster mean ($\overline{X}_{cm}$), that is the mean scores for each communication pattern based of all the 11 ways the patters could influence parent/children relationship. Here, the "open" communication pattern has the highest cluster mean ($\overline{X}_{cm}$ = 2.97).

Table 2: Mean Responses and Standard Deviation of Digital Communication Channels Used in Parent/Adolescent-Child Relationship

S/N	Digital Channels Used	Utilization $\overline{X}$	SD	R
1	Video calls	3.12	0.81	2nd
2	Social media	3.03	0.76	3rd
3	Mobile applications	3.31	0.84	1st
4	Gaming	2.92	0.71	4th
5	Online learning	2.77	0.64	5th
6	Educational application	2.65	0.61	6th
7	Parental control measures	2.52	0.53	7th

$\overline{X}$ = Utilization Mean; SD = Standard Deviation; R = Ranking of Mean ($\overline{X}$) scores.

Table 2 shows the digital channels used for communication between parents and adolescent children. The Table shows that among the digital channels, mobile applications rank highest with the mean score of ($\overline{X}$ =3.31). These mobile applications involve the use of mobile phones for phone calls, instant messages such as whatsapp and short message services and conference calls. Results also showThe Table further shows that video calls rank second among digital channels used in communication between parents and children. Such video calls are done through mobile phones as well as via the use of personal computers, laptops and tablets. The social media channels used by parents and children in the environment for communication include Facebook, Instagram and Tik-Tok. Parents and their adolescent children use these channels to entertain each other as well as to keep each other abreast with their activities.

Table 3: Mean Responses and Standard Deviation of Challenges Militating Against Parent-Child Relationship

S/N	Challenges	$\overline{X}$	SD	R
1	Busy schedules of parents	3.22	0.81	1st
2	Busy schedules of children	2.82	0.71	5th
3	Technology taking valuable time of parents	2.78	0.68	6th
4	Social media taking valuable time of parents	2.69	0.64	7th
5	Lack of trust and openness	2.65	0.63	8th
6	Power struggle between parents and children	2.83	0.73	4th
7	Differences in communication styles among family members	3.11	0.81	2nd
8	Emotional barriers between family members	2.99	0.74	3rd

$\overline{X}$ = Utilization Mean; SD = Standard Deviation; R = Ranking of Mean ($\overline{X}$) scores.

Table 3 shows the challenges militating against parent-child relationship. The Table also shows that "busy schedule of parents" and "differences in communication styles among family members" are the top ranked ($\overline{X}$ =3.22 and $\overline{X}$ =3.11, respectively), challenges militating against parent-child communication among UNN campus residents. The Table further shows that "emotional barriers between family members" ($\overline{X}$ =2.29) and "power struggle between parents and children" are ($\overline{X}$ =2.83), also high ranking challenges militating against parent-child relationship.

Table 4: Measures for Ameliorating the Challenges Militating Against Parent-Child Relationship

S/N	Amelioration measures	$\overline{X}$	SD	R
1	Establish regular family communication time	3.03	0.81	2nd
2	Practice active listening	2.94	0.75	5th
3	Use open communication patterns and be honest	2.92	0.76	7th
4	Respect for others' opinions	3.11	0.89	1st
5.	Avoid negative language	3.01	0.80	3rd
6.	Find common interests	2.95	0.77	4th
7.	Seek outside help when necessary	2.93	0.76	6th

$\overline{X}$ = Utilization Mean; SD = Standard Deviation; R = Ranking of Mean ($\overline{X}$) scores.

Table 4 shows that respecting each other's opinions and establishing regular family time rank high $\overline{X}$ =3.11 and $\overline{X}$ =3.03 respectively, ameliorating as measures for the challenges militating against parent-child relationship in the family. The Table also shows that "avoiding the use of negative language" and "finding common interests" are also high ranking measures for ameliorating the challenges militating against parent-child relationship. Furthermore, "using open and honest communication" ($\overline{X}$ =2.93) as well as "seeking outside help when necessary" ($\overline{X}$ =2.93) are also fairly high ranking measures for

ameliorating against the challenges faced in parent-child relationship.

Discussion of findings

Results from the study showthat open family communication pattern build trust, foster cooperation and enjoyment as well as create a supportive atmosphere in the family. This is in line with the reports of Koerner and Schrodt (2014) that open communication enables family members trust each other with the deepest secrets and concerns. The reports further indicated that this communication pattern makes family members better rely on each other for advise and also assurance that matters are kept confidential within the family. Results from the study also showed that closed communication patterns and aggressive communication patterns could lead to hostility and increase in criticisms between family members. This is is in line with the views of Egenti (2014) who mentioned that the wrong communication pattern can engender hostility and weaken trust in families. Results from the study also showed that the four communication patterns engender learning, create satisfaction promote intimacy, care and protectiveness in the family. This is in line with the views of Singh and Tyagi (2023) who opined that parents usually see provision, care and protection as the crux of their responsibility the family. The authors further mentioned that parents take pride in protecting their children and see it as a necessity, as they view that their children do not have what it takes to survive the perils of the times at a very young age.

Results from the study showed that the digital channels used by families to enhance parent-child relationship include video calls, social media, mobile applications, gaming and online learning. These gaming activities include the playing of board games and video games between parents and children. Mobile applications used include phone calls, texts messages as well as messages on platforms such as whatsapp and viber. Results further showed that educational applications and parental control television applications significantly enhance parent-child relationships. The educational applications used by parents and children in enhancing their relationship include pre-loaded computer applications such as "U-Lesson" and "Smart-Teache"r applications. These findings are in line with the postulations of Gyasi, Kwarteng-Nantwi and Dery (2023) who mentioned that mobile phones and internet powered digital facilities such as tablets, laptops and personal computers significantly improve parent-child relationships as they make for seamless and quick real-time communication between parents and children. The author further mentioned that social media, games and online learning help in improving family bonding as both parents and children get to learn from each other. This is also in alignment with the views of Achakpa-Ikyo and Ogaba-Egba (2016) who mentioned that families who make effort to inculcate technology

positively in their communication measures experience significant success in creating strong family bonds. The authors further mentioned that the use of technology driven measures such as mobile telephones, video conferencing at given times help families to bridge geographical constraints and maintain family bonds.

Results from the study showed that some of the challenges militating against parent-child relationship in the University of Nigeria Nsukka include busy schedules of parents and children, technology and social media taking up valuable time of both parents and children as well as a lack of trust and openness on the part of both parents and children. These are in line with the views of Galvin and Braithwaite (2014) who opined technology, social media and tighter work and study schedules have significantly hampered the relationship between parents and children. Results also showed that a lack of trust and openness, power struggle between parents and children, differences in communication style among family members as well as emotional barriers between family members are a significant challenge that hamper parent-child communication. This s in line with the views of Koerner and Braithwaite (2012) who mentioned that lack of trust and openness prevents members of family from expressing their fears to each other and seeking advice from one another. The authors further mentioned that differences in communication styles could bring about friction and power struggle between parents and children, making for constant conflicts that could hamper communication in the family.

Results from the study showed that measures which can be used for ameliorating the communication challenges experienced between parents and children include establishing regular family communication, practicing active listening, the use of open and honest communication as well as respect for each others' opinions. These are in line with the observations of Akintayo and Fakorede (2019) who mentioned that regular communication between parents in an open and honest manner creates a conducive environment for inculcating trust, intimacy and understanding between parents and children. The author further mentioned that actions such as active listening and, setting apart fixed regular times for communication significantly deepen the relationship between parents and children. Results also showed that respect for each other's opinions, avoidance of the use of negative language, finding common interests and seeking outside help when necessary are significant measures for ameliorating the challenges militating against parent-child relationships in the family. These are in line with the views of Olapegba and Okuneye (2019) who mentioned that finding common interests helps parents and children to spend time with each other performing activities and enables them open up to each other well. The results are also in agreement with the views of Adegbola (2014) who mentioned that seeking professional help significantly improves communication among

family members and helps them ameliorate the challenges they face in communication with each other.

Conclusion

Communication influences every facet of family life and it being done properly can enhance the quality of life of the individual members of the family. The right communication pattern helps in building strong relationships between parents and children as well as improves the overall well-being of the family as a whole as it creates a harmonious atmosphere within the home. This paper provides a framework for understanding the different communication patterns used in families and how it impacts on various important attributes of family relationship.

Recommendation

Based on the findings of the study, the following recommendations are suggested:

1. The different communication patterns should be used in the right balance within the family in order to achieve optimal results.
2. Both parents and children should practice active listening in order to create an atmosphere of empathy and more trust.
3. Respectful and constructive feedback should be used to encourage members to learn from their mistakes and be better.
4. Clear boundaries and expectations should be set so as to reduce misunderstanding. However, reasonable flexibility should be encouraged where necessary.

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Proximate Analysis and Sensory Evaluation of Milk Drink Produced from Cashew Nut (*Anacardium occidentale*) and African Black Plum (*Vitex doniana*)

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Abstract

The main objective of the study was to evaluate proximate attributes and sensory properties of milk drink produced from cashew nut (*Anacardium occidentale*) and African black plum (*Vitex doniana*).Specifically, the study determined proximate attributes, vitamins, mineral, flavonoid content and sensory properties of the milk drink. Cashew nuts were bought from Oba market in Nsukka, Enugu State. The cashew nuts were washed thoroughly and soaked for eight hours and stored in the refrigerator. The cashew nuts were washed thoroughly the second time ground with a food blender to obtain the milk. The vitex doniana was washed thoroughly in salted water rinsed thoroughly, skinned and deseeded. Water was added to the pulp, the pulp was pasteurized. The cashew nut milk and vitex doniana pulp were mixed with honey and blended. The instrument used for data collection was the use of standard scientific method of chemical analysis of AOAC, 2010 and an organoleptic test template of 9-point hedonic scale was used. Findings reveal that the drink (drink made with cashew nut and African black plum and honey (DRMC)is high in energy (289.58 kcal), crude protein(5.85%), fat (10.15%) ash (2.43%) carbohydrate(8.85%) crude fibre(4.01%) moisture(84.77%)zinc (198.33 µg/100g). iron (3821.04µg/100g); potassium (17.58mg/100g), vitamin A, B,C,E, flavonoid(0.65mg/100g) and low level phytate (1.18mg/100g). The produced drink is therefore rich in nutrients and was highly accepted ($\overline{X}$ = 8.6), texture rated ($\overline{X}$ = 8.4), appearance ($\overline{X}$ = 7.8), taste ($\overline{X}$ = 8.8). Base on the findings three recommendation were made.

Keywords: Cashew, Nut, Plum, Milk, Drink, Proximate, Analysis, Sensory Evaluation, Honey,

Introduction

Drinks are liquids that are orally consumed for nourishment. According to Rashford (2023) drinks are liquids specifically prepared for human consumption to provide both fluid and nutrients. They can be sugary or tangy, plain like water or flavoured, light, or

heavy such as yoghurt or smoothie. They can also be coloured or plain. Burnett (2012) observed that drinks can be in any form, sweet or sour. Drinks can be made at home or manufactured in factories with fruits, roots, seeds, leaves nuts and barks of plants. According to Mason et al (2020) beverage crops are verse and drinks can be produced from any part of the plant. Drinks are also referred as beverages. Beverages produced from plants can also be classified into alcoholic and non-alcoholic drinks. Feroze, et al (2021) acknowledge that drinks can be classified into two major groups, alcoholic and non-alcoholic.

The non-alcoholic drinks are further grouped under refreshing, stimulating and nourishing drinks. Refreshing drinks include water, fruit, juices, sweetened and unsweetened soft drinks. Nourishing drinks provide protein and other nutrients to the body. According to Hattersley, et al (2023) nourishing drinks have high protein, energy, vitamins and mineral. Nourishing drinks include drinks prepared from fruits and vegetables, milk shakes and milk based products.

Milk based drinks are beverages that are made from milk products. Milk can be obtained from both animal and plant sources. Milk from plant sources are obtained from cereals, legumes, seeds, roots and nuts. Tyagi and Anurag (2016) noted that plant based milks are non-dairy beverages made from water based plant extracts. Some of these plant extracts include coconut, almond, walnuts, hazelnuts,pistachio, tiger nuts, soya beans and cashew nut.

Cashew nut is obtained from a tropical plant, the cashew tree. The oval ,round or oblong leaves are yellow lemon green and dark green in colour and abundant on the tree. The tree is a canopy growing up to 20metres in maturity (Nkumbula, 2023). According to Nkumbula(2023)the cashew (*Anarcadium occidantale*) is a perennial plant that may be found growing in various tropical regions it is a hardy tree that can thrive in a many environments. Cashew tree originated from Brasil. Gnagne et al (2023) noted that cashew originated from Brasil, then the European merchants introduced the plant into tropical African soil. *Anacardium occidentale* is cultivated through vegetative propagation. Elouaflin et al (2023) stated that vegetative propagation remains the only effective way of cultivating *Anacardium occidentale*. The plant grows rapidly in tropical soil whether muddy or sandy. When the tree is vegetatively propagated flowering starts in one year(Nkumbula et al, 2023).The cashew fruits have two distint parts, the fleshy juicy cashew apple from the stalk(false fruit) and the hard kidney shaped nut which is the real fruit. Akyereko (2023) stated that fleshy part of the fruit which is also rich in nutrients is the pseudo fruit while the nut is the proper fruit and that the nut is of more economic value than the cashew apple. Nigeria has high ranking in cashew nut production. According to Pelemo et al(2023) Nigeria is the fifth largest producer of cashew in the world. The cashew apples are eaten whole or used to make juice. In Nigeria the nuts are mainly

eaten as snacks or used as part of puddings and sweet dishes. Akyereko (2023) stated that most people eat the cashew apple whole but few use the fruit as puree or use the juice for alcoholic drink.

Cashew nut milk is a plant based milk obtained from cashew nuts. Apart from soy and rice milk, other plant based milk are now introduced to the market. Slade (2023) opined that the alternative milk market that was once dominated by soy and rice milk now has many varieties of nut-based milks, each of which provides a unique flavour and different nutritional benefits. Cashew nut milk may be an excellent alternative to dairy milk . This is because of the protein ,healthy fat and other nutrients it provides while still maintaining a creamier viscosity than other nut milk. According to Reyes-Jurado et al (2023) Cashew nut milk is a supreme alternative to dairy milk. Aydar (2023) further noted that yoghurt made from cashew nut milk has similar texture, colour and taste as the yoghurt made from dairy milk. Also It contains high levels of proteins, carbohydrates, polyunsaturated and monounsaturated fatty acids (PUFAs and MUFAs), ascorbic acid, reducing sugars and minerals (Ca, Fe, P, Mn, Cu, and Se), which act as cofactors that regulate the physiological mechanisms and metabolic functions(Aydar 2023). In the area of plant-based alternatives to dairy milk. As the world is searching for nutritious and environmentally sustainable alternatives to feeding, this nut based milk may become the favourite. Offering a lactose-free and dairy-free solution that appeals to the taste and health of many. It may boost immunity and improve heart, eye, and skin health (Reyes-Jurdo et al 2023)

Cashew nut milk has a creamy dull colour, in order to make attractive like a chocolate drink, the cashew nut milk was coloured with (*Vitex donianablack*) Africa black plum. *Vitex doniana* is not only a natural fruit with colour, it is also rich in food nutrients .Therefore *Vitex doniana* will also enrich the milk with nutrients. The colour of beverages and drinks play major roles in demand and choice of consumers. Echegaray, et al (2023) stated that the use of colourant in food industries is an essential ingredient in drinks and other products since color is one of the most essential attributes of food.

Vitex doniana (black plum) is a tree that grows widely in West Africa. This is abundant in all parts of Enugu state.The fruit is dark brown when ripe and succulent. According to Adoukonou-Sagbadjaet al (2023)*Vitex doniana* is a deciduous, nitrogen-fixing forest fruit tree found from coastal woodlands and savannah and dry forests to wetter areas at lower elevations in tropical Africa. Also Irinmwinuwa et al (2023) Stated that this medium-sized, deciduous tree is 8–18 m tall with a heavy, rounded crown, has oblong fruit that is about 3 cm long. The fruit is green when young and turns purplish black when ripe. It is sweet and eaten fresh or can be used for making jam or wine. Odoom et al (2023) states that the fruit can be used for making jam and wine. The plant has many names in Nigeria some call "*mbebe*", some call

"*mkwamkwa*", others call "*uchakiri*". The plant is also commonly referred to by other various local names in different regions, such as "*Kei apple*" in South Africa and black plum or "*mkani*" in various African languages. The fruit has high nutritional content of fat, carbohydrate, protein, vitamins and mineral. According to Audu et al (2023) African black plum (*Vitex doniana*) is rich in protein. fat, carbohydrate, iron, potassium, sodium, calcium, copper and also Vitamins A, B 1 , B 2 , B 6 Therefore African black plum (*Vitex doniana*) will fortify and supplement the nourishing drink with additional food nutrients. The fruits are picked and eaten raw, made into a preserve as jam or syrup.

Objectives of the Study

The main objective of the study was to investigate the proximate composition and sensory attributes of milk drink produced from cashew nut (*Anacardium occidentale*) and black plum (*Vtex doniana).*

Specifically, the study determined the following compositions of the milk drink produced from cashew Nut (*Anacardium occidentale*) and African black plum(*Vitex doniana*):

1. Nutrient and energy
2. vitamins
3. minerals
4. flavonoid
5. phytate
6. sensory properties

Materials and Methods

***Design of the study*:** Experimental research design was employed in the study.

***Materials*:** Cashew nut(*Anarcadium occidentale*),) was purchased from Oba market in Nsukka, Enugu State Nigeria. The Black plum *(Vitex doniana*) was picked from the trees in Federal Government College Enugu, Enugu State. Honey was bought from Nkwo Ibagwa Nsukka in Enugu state. Chemicals used in the study were of analytical grade and obtained from Energy Center University of Nigeria Nsukka. Vanilla flavour was bought from Ogbette main market in Enugu

Preparation of Materials: Materials were prepared as following:

Cashew nut milk: One cup of cashew nuts was washed with salt using clean boiled water. The nuts were soaked in sterilised container with water that had been boiled and cooled in the refrigerator for eight hours. The nuts were thoroughly rinsed three times until the water became clear. The cashew nuts were milled using Binatone blender with method described by Talor (2017). Ratio was one cup cashew nuts to two cups water. A creamy homogenous mixture. The milk obtained was not strained.

Black plum(*Vitex Doniana*) extract: 300grams of black plum was thoroughly washed with salt water and rinsed four times to remove any trace of salt. The fruits were skinned to remove the thin leathery peel. The pulp was washed out with one cup of water, the extracted brown liquid was pasteurized by heating in a double

boiler while stirring frequently for 1 minute.

Honey: The honey was also pasteurized by heating in a double boiler with low temperature for 5minutes.Bodor et al(2023) stated that heating honey under low temperature has no effect on the physicochemical parameters.

Formulation of cashew nut milk, black plum extract and honey milk drink:

Recipes**:**

1. 2 cups of cashew nut milk
2. 7 tablespoons of extract from black plum
3. 3 tablespoons of honey
4. ¼ teaspoon of vanilla essence flavour

The above were mixed with agitation in Binatone blender for 30 seconds to obtain the milk drink.

Nutrient Analysis**:** Analysis of the drink was carried out in triplicates using standard methods as follows:

Fat, protein, moisture, carbohydrate, and energy of nourishing drink were determined according to the AOAC(2016) method. Moisture content was determined via thermogravimetric in muffle furnace (Sanyo Gallenkamp, Weiss Technik, West Midlands,UK) at 500C for 24 h. Fat was determined by exhaustive extraction of 0.5g of sample with petroleum ether in a microsoxhlet extraction unit (Gerhardt, Bonn, Germany). Determination of protein was by Kjeldahl method. After distillation and titration, nitrogen was corrected using a factor of 5.25. Carbohydrate was obtained by the difference of moisture, protein fat and ash fom 100 percent.

Mineral Analysis: The mineral content of the nourishing drink was evaluated using the method of AOAC (2016). Calcium, Potassium, Zinc, iron and sodium were determined using the atomic absorption spectrophotometer (Buck Scientific 210 CGP, USA) after preparation of mineral solution.

Vitamin Analysis: The vitamins A, B2, B6, B12, C, and E of nourishing drink were determined according to the AOAC(2016)

Sensory Evaluation:

Selection of Panellist: A twenty-member panellist consisting of students of Home Economics and Hospitality Management Education University of Nigeria Nsukka were used for the sensory evaluation. The criterion for the selection of panellist was based on their knowledge of the products to be evaluated. The panellists were asked to sit on the laboratory stools with spaces apart with coded paper given to each of them to evaluate the drink. The panellists were instructed to rinse their mouth with water before and after tasting the drink.

Instrument of data collection**:** The instrument used for data collection was a sensory evaluation questionnaire. The drink sample was evaluated for appearance, taste, texture, flavour and overall acceptability. Each attribute was rated on a 9-point hedonic scale with 1= dislike extremely while 9=like extremely (Iwe, 2010)

Data collection**:** The instrument was administered to the students in the

sensory evaluation laboratory. Two (2) research assistants were also recruited and instructed on the method of administration of the questionnaire.
Data analysis technique: Results were analyzed statistically by mean rating of the sensory attributes.

RESULTS

Table 1: Energy, Protein, Fat, Ash, Crude Fibre, Moisture and Carbohydrate Contents of Milk Drink

Variables	DRMC (% nutrient composition 100g)
Energy content(Kcal)	289.58Kcal
Crude Protein (%)	5.85
Fat%	10.25
Ash	2.43
Crude Fibre	4.01
Moisture	84. 77
Carbohydrate	8.85

DRMC = drink made from cashew nut milk, black plum and honey.

Table 1 shows the energy and proximate composition of DRMC per 100g. The energy content was (289.58Kal) per 100g , crude protein content (5.85%),fat content (10.25%), ash content 2.43%, crude fibre 4.01%, moisture 84.77%, carbohydrate 8.85%.

Table 2: Vitamins contents of the milk drink

Variables	DRMC (vitamins in mg)
Vitamin A (mg/100g)	0.12
Vitamin C (mg/100g)	8.35
Vitamin E (mg/100g)	0.35
Vitamin B12 (ug/100g)	0.59
Vitamin B2 (mg/100g)	1.05
Vitamin B6 (mg/100g)	0.08

DRMC = drink made from cashew nut milk, black plum and honey.

Table:2 Shows that DRMC has vitamin A (0.12 mg/100 g), vitamin C (8. 35 mg/100 g), vitamin E (0.35 mg/100 g), vitamin B12 (0.59 ug /100 g), and vitamin B2 (1.05 mg/100 g) vitamin B6 is 0.08 mg/100 g as shown in table. Unlike the other vitamins, vitamin B12 was measured in micrograms because it is required in minute quantity to satisfy body need.

Table 3: Mineral contents of the milk drink

Variables	DRMC mineral content(mg/100g)
Zinc (µg/100g)	198.33
Iron (µg/100g)	3821.04
Potassium (mg/100g)	75.58
Sodium (mg/100g)	17.85
Calcium (mg/100g)	22.22

DRMC = drink made from cashew nut milk, black plum and honey.

Table 3 shows the mineral content of DRMC, zinc (198.33 µg/100 g), Iron (3821.04 µg/100 g), potassium content (75.58 mg/100 g), sodium content (17.85 mg/100 g) and Calcium content (22.22 mg/100 g). The zinc and iron were measured in micrograms because

they are required in minute quantities meet up with body needs.

Table 4: Phytochemical contents of the milk drink

Variables	DRMC (mg/100g)
Flavonoids (mg/100g)	0.65
Phytate (mg/100g)	0.18

DRMC = drink made from cashew nut milk, black plum and honey .

Table 4 show that DRMC has flavonoids 0.65mg/100g and phytate 0.18mg/100g

Table 5: Sensory properties of the milk drink.

Variables	**Mean values**	**Decision**
Appearance	7.8	Good
Taste	8.8	Good
Texture	8.4	Good
Aroma	8.2	Good
Flavour	8.6	Good
Overall acceptability	8.6	Good

DRMC = drink made from cashew nut milk, black plum and honey
Good=mean score within the limit of 9.00 -6.00

Table 5 shows that the taste of DRMC is the highest attribute. Even though the flavor and texture were also rated (8.4) higher than the appearance (7.8), the appearance also has good rating. The Table which has overall acceptability at 8.6 displayed optimum organoleptic acceptance.

Discussion

The higher energy value observed in DRMC could be attributed to sum of the fat, protein and carbohydrate composition of the ingredients such cashew nuts used in the production of the drink (Audu et al (2023) . The protein content of the drink sample is similar to the 6.0 g protein in dairy yoghurt, this collaborates the report by Aydar(2023) that cashew nut milk have closer nutrient quality to dairy milk than other nut milks. Higher protein content of the drinks suggests valuable contribution in combating protein energy malnutrition. The presence of fat in the drink samples could be attributed to the fat content of cashew nuts used in the production of the drink sample. The fat in the drink samples could suggest possible presence of fat-soluble vitamins and contributes to high rank in the flavoured score. The fats are also healthy plant fats as reported by Reyes-Jurdo et al (2023) that the fat from cashew nuts are polyunsaturated and monounsaturated fatty acids (PUFAs and MUFAs. The value of vitamin A and E observed in this study were low. The reason could be that all the sources of the ingredients used in the production of the drink samples are not good sources of vitamin A and E. Vitamins A and E are antioxidant that plays a significant role in fighting free radicals, vitamin A helps in the sight and boost immunity. Vitamin C is an antioxidant that mitigate oxidative stress, (Jodh et al 2023). Vitamin C is also enhancer of nonheme iron absorption, and help in wound healing. Riboflavin found in the sample drink could be traced to the food sources of the drinks used in its production such as cashew nut and *Vitex donaina*, approximately 108 ml and 91.7 ml of this drink per day will

provide an adult male and female, respectively with, respectively with 100% (1.3 mg for male and 1.1 mg for female) of their Recommended Dietary Allowance (RDAs) for their riboflavin requirement per day (McGuire &Beerman, 2011). Riboflavin is responsible for the production of flavin mononucleotide (FMN) and flavinadenin adenine dinucleotide (FAD), two important coenzymes for energy metabolism. This drink should be recommended for people who are suffering from riboflavine deficiency, alcoholics, people on poor diets and people suffering from thyroid disease for cost effective prevention and treatment of their conditions. Vitamin B12 also called cobalamin, was found in the drink sample. vitamin B12 in the sample DRMC in the study could furnish some percentage of the RDA for adults based on the 100 ml per day. Its role in the for ATP production and amino acid metabolism cannot be overemphasized, the low content of the vitamin B12 in the drink could be attributed to its uniqueness and for the facts that vitamin B12 cannot be made by plants or higher animals but only by microorganisms (such as bacteria and fungi).

Study observed high zinc and Iron content in drink sample DRMC made from Cashew nut milk coloured with vitex doniana extract and honey. This could be due to the high zinc and iron contribution of the individual ingredients for the production of the drink sample from cashew nut, vitex doniana and honey. High zinc and iron content of the drink have been reported to produce an essential micronutrient human body function. The presence of zinc, iron and vitamin C in the drink is essential role in haemoglobin formation, macronutrient oxidation, and central nervous system functioning it also helps in cell mediated immunity, control of infection and haemopoiesis and bioavailability of other nutrients (Totten et al 2023). Zinc is essential for human growth and immune functions. Higher consumption of drinks rich in zinc and iron will significantly help in combating malnutrition, iron deficiency anaemia, improve immune function and optimal growth and development. Potassium content in drink is of great value, Consumption of food rich in potassium is essential in the normal functioning of the skeletal muscles, heart and enzyme reactions (Etiola et al., 2018). The study observed that sodium content of the drink sample is lower compared to food product that contain 140 mg/100g of sodium or less that are considered as low sodium foods or drinks. The low sodium foods or drinks are suitable for individuals with conditions that require low sodium intake (Ezenwa and Iheme, 2021). The study observed Calcium content in DRMC, Calcium content in the sample drink would help in healthy bones and teeth.

The drink has flavonoids even though the flavonoid content of the drink sample was lower than the range (5 to 15%) reported for different brands of tea by (Ifemeje et al., 2020) and 92.86 to 115.35% of tisane produced from Aidan fruits (*Tetrapleura teraptera*) and *Uziza* seeds *(Piper guineense*) reported by Ezeocha and Urenwoke, (2023)

Flavonoids are strong anti-oxidants, with anti-inflammatory and antimicrobial properties (Okafor and Ogbobe, 2015). Even though there is phytate in the drink which is supposed to inhibits iron absorption, the vitamin C counteracts the inhibition effect of phytates,phytic acid also acts as antioxidant(Saleh et al 2023)

Organoleptic analysis of the drink indicated that the drink has high sensory attributes with optimum overall acceptability. The overall acceptability could be attributed to among other factors the attractive chocolate colour from *Vitex doniana* Echegaray, et al (2023) reported that the use of colourant in food industries is an essential ingredient in drinks and other products since color is one of the most essential attributes of food, that enhances acceptability.

Conclusion

The study concluded that the milk drink produced from cashew nut (*Anarcadium occidentale*) , Black plum *(Vitex doniana*) and honey showed that it is rich in fats, energy, protein and minerals such as iron, zinc, potassium, calcium and an appreciable amount of vitamins A, C E, B2, B6, and B12. The drink has high sensory score rate for all the attributes. Therefore, the drink should be promoted as a healthy and nutritious drink. Can be used for both prevention and management of malnutrition especially protein energy malnutrition (PEM), iron deficiency anaemia. The vitamins A, C,E, and minerals magnesium and zinc are essential in boosting immunity in adult and children. The drink can be a healthy alternative to people that are allergic to dairy milk and soy milk.

Recommendations

From this study, it is recommended that

1. The milk drink be promoted as a nutrient dense drink for quality health promotion.
2. The milk drink be consumed as better alternative to energy and carbonated drinks that predisposes people to nutritional problems especially among children in Nigeria.
3. The drink should be produced for individuals with dairy allergy problems.

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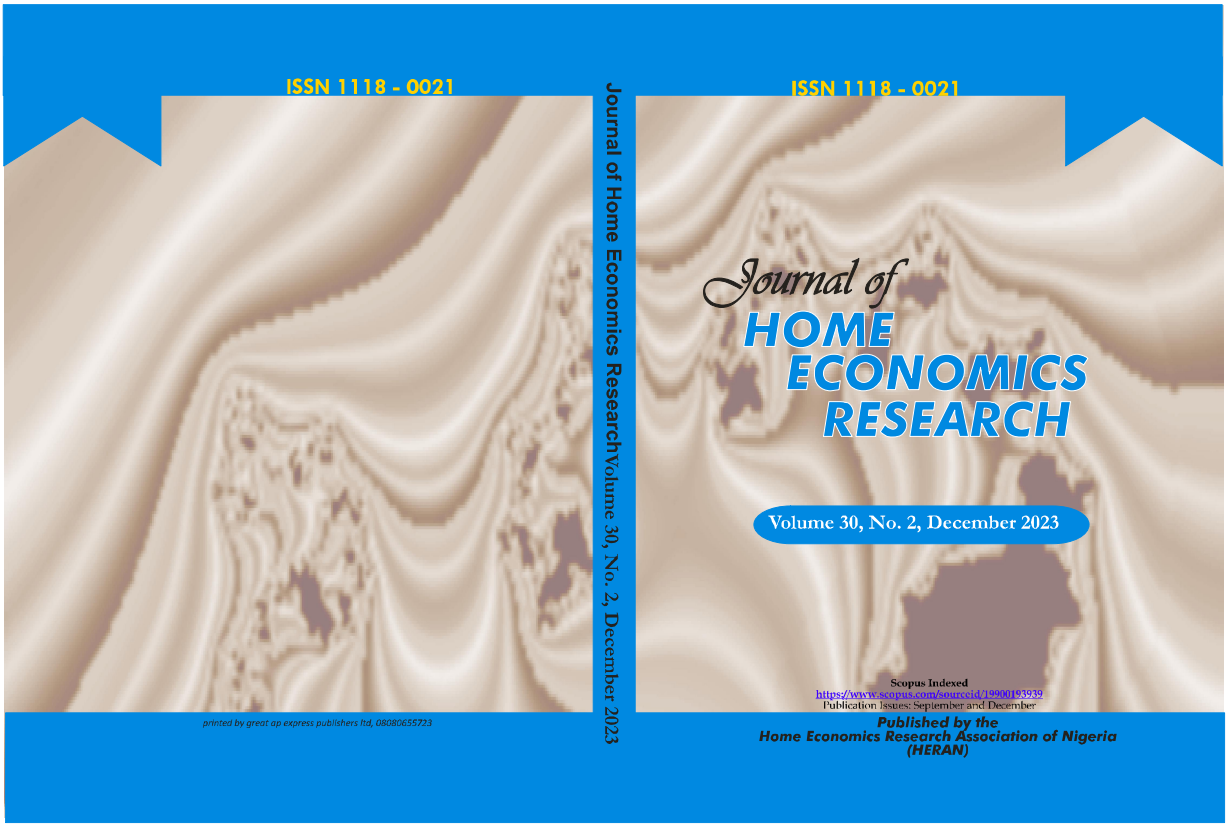
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