JDAN JOURNAL OF DIETITIANS ASSOCIATION OF NIGERIA

GENERAL INFORMATION

JDANJOURNAL OF DIETITIANS ASSOCIATION OF NIGERIA

Journal of Dietitians Association of Nigeria, official organ of Dietitians Association of Nigeria, is a peer reviewed journal published biannually (two volumes per year).

The major objectives of the journal are to:
- publicize the profession of Dietetics.
- disseminate information in the area of Nutrition and Dietetics and other related field of study.
- maintain high journal standards.
- produce two issue publications yearly.

The information for authors appears in the first volume issue of each year. Subject and author indexes appear in the second volume issue of the year.

Copyright

BUSINESS MATTERS

Subscription

Annual subscription price	
Individual (member)	N2, 500.00
Non-member	N3, 000.00
Student Rate	N1, 500.00
Institution (Local)	N4, 500.00
Institution (International)	$150.00
Individual (International)	$100.00

Advertisement Rate

(a)	Full Page	
	Black and White	N35, 000.00
	Colour	N45, 000.00
(b)	Half page	
	Black and White	N30, 000.00
	Colour	N40, 000.00
(c)	Inside Back	
	Black and White	N40, 000.00
	Colour	N50, 000.00
(d)	Back Cover	
	Black and White	N50, 000.00
	Colour	N65, 000.00

JOURNAL OF DIETITIANS ASSOCIATION OF NIGERIA

EDITORIAL OFFICE
Dr. Uche Onyechi
Editor-in-chief, JDAN
Department of Home Science, Nutrition and Dietetics
University of Nigeria, Nsukka.
E-mail:uche.onyechi@gmail.com
Tel: +234 806 679 4814 or +234 812 115 3438.

JOURNAL OF DIETITIANS ASSOCIATION OF NIGERIA
GUIDE FOR AUTHORS

MANUSCRIPTS

The following types of manuscripts are considered: original research articles, review articles issues and opinions, special communications, letters to the Editor, book reviews, and proceedings of symposia. Manuscripts must be original, in whole or in part has not been, nor is it being considered for publication elsewhere. However, only reviewed articles sought by the editorial board shall be published.

SUBMISSION OF MANUSCRIPTS

Manuscripts must be typewritten on one side of the paper only, double spaced on numbered pages with adequate margins, 0.5cm on both sides. All articles should conform to the requirements for manuscript submitted to biomedical journals. An electronic copy of all manuscripts should be sent to the Editorial Office, via e-mail address *danscientific@yahoo.com*. This should be typed using Microsoft Word Processing Package (running under Windows) or using Page Maker. Each manuscript must be accompanied by a letter stating that the authors wish to have it evaluated for publication in the **Journal of Dietitians Association of Nigeria.** Authors may suggest the names and addresses of at least 3 appropriate reviewers. The Editor-in-Chief reserves the right to determine the final reviewer.

ORGANIZATION AND STYLE OF MANUSCRIPTS

Manuscripts must be written in concise and correct English, corrected for errors for typographical errors before being submitted. Manuscripts should be arranged in the following order: title page, abstracts and keywords, texts and acknowledgments, reference figures, legends and table. Use separate sheets for each of these items. All pages should be numbered starting with abstract as page 1.

Page Title

This should include: (a) title of paper, (b) an abbreviated version of the title not exceeding 40 letters and space; (c) name of authors including first name(s); (d) name of department(s) institution(s) where the work was done, including full postal address, email and phone number(s); (e) name and full postal address of the author to whom the galley proofs and request for reprints should be sent.

Abstract

An original article must contain a structured abstract of not more than 200-300 words. The abstract should be divided into: background, objective, subjects/materials and methods, results and conclusion. Authors may list a maximum of five key words for subject classification at the bottom of the abstract in both reviews and original articles.

Text

Original articles should conform to the following format.

Introduction

This should start on a fresh page and should provide a brief review of the literature related to the subject of the paper. A short statement on the aims of the work should be presented.

Materials and Methods

This should be sufficiently detailed with reference where possible to permit other workers to duplicate the

study. Sources of materials used must be given and statistical methods must be specified by reference unless non standard ones are used.

Results

This must be clearly and concisely reported with appropriate illustrative tables and or figure.

Discussion

This section should explain the reasons for the results obtained as well as their implication and consequences. Conclusions made should be based on findings of the study and evidence from literature that supports conclusions. The discussion should also highlight conflicting evidence, applicability of the study, limitations of the study and implication for future research. Unjustified speculations should be avoided.

Acknowledgments

This should be brief and presented on a separate page. Technical assistance and advice may be acknowledged.

Reference

Number of references should be adequate and appropriate. Each reference should be cited in consecutive numerical order (in parenthesis) in the text and listed in the same numerical order at the end of the paper. References to materials on the Internet should include author(s), the title of the article and date of access. Articles in press (i.e.) accepted for publication, may be included and cited appropriately indicating name, volume and year in which journal would appear.

References to unpublished material may be cited in parentheses in the text, but not in the bibliography. Avoid the use of abstract(s) as reference(s) when possible, but if they have to be used; identify them as "(Abstract)" in the citation at the end of the reference. Reference to articles in journals should be listed as follows: **authors name and initials, year of publication in parenthesis, title of articles, name of journal, volume, and page.** The style of journal abbreviation that is used in the current edition of index medicus published by the National Library of Medicine (*http://www.nlm.nih.gov/citingmedicine*)

1. Journal:

Onyechi, U. A. (2009). The effects of Detarium microcarpium soup meal on the plasma glucose and insulin levels of healthy non-diabetic adults. Nig. J.Nutr. Sc.; 30(1):10-18.

2 Books:

i. References to articles or chapters in books should be listed as follows: author names and initials, date of publication in parenthesis, title(s) of article(s) or chapter, title of book name and initials of editor(s), edition (other than the first), publisher, city of publication, year, volume, e.g. Ene-Obong, H.N(2001)

Eating Right, University of Calabar Press, Calabar.

Citing an Article that has more than two authors, you may use "et al" e.g. Akiyemi et al. (1).

For multiple citations in one year from the same authors use a, b, c, etc after the year e.g. 1990a, 1990b, 1990c.

ii. In citing abstracts: Ngwu, E.K.and Nwabunze, A. M. title of the abstract. Journal 2, 30, 2008(abs).

iii. Thesis: Ndiokwelu, C.I. Title of the Thesis. Doctoral Thesis, University of Nigeria, Nsukka. 1998.

iv. In Press articles: Asinobi, C.O. and Anyika, J. Title of the article Journal (in press) 2010.

TECHNICAL NOTES-SHORT PAPER/SHORT COMMUNICATIONS.
These are reports of small investigations and application/ preliminary investigations and should not exceed 2500words, including tables, references and figures

PREVIEW (About 10, 000 words)
These are concise, critical but constructive and conclusive topical accounts of current interest.

Foot Notes
All footnotes to the title, author's names should be indicated by Arabic numerical superscripts, not by letters or other symbols. These footnotes should be typed at the bottom of the page in which they appear.

Tables
Tables should be typewritten on separate sheets numbered consecutively using Arabic numerals (1, 2, 3, etc.). Each table should include a title and be comprehensible without reference to the text. Tables adapted or reproduced from another source must acknowledge that source in a footnote.

Figures
Illustrations should be numbered consecutively with Arabic numerals. Details of charts and graphs must be clearly legible when reduced to the size used in the journals. Each figure should have a label pasted on the back indicating the figure's number and the names of the authors. Graphs should be submitted as glossy prints and labeled in soft pencil at the back. Colour illustrations will be published when approved by the editorial board. One transparency and three copies of colour prints should be provided.

Publication Charges
Manuscripts are subjected to page charges at current cost of publication, usually approved by the association. Authors will be asked to contribute to the cost of colour illustrations.

Proofs
Galley proofs will be sent to first author, unless otherwise indicated. Proofs should be returned within eleven days of receipt. Other than printer's errors, any correction may be charged to the authors.

Reprints
Reprints may be purchased at the prices indicated in the reprint order form accompanying the galley proofs.

Abbreviations and Units
Abbreviations are to be used sparingly and given at first mention of the word. Metric units (SI units) should generally be used.

Informed Consent
All manuscripts reporting the results of experiments conducted using human subjects should include a statement confirming that informed consent was obtained from each subject or subject's guardian, after approval of the experimental procedures or protocol by a local human ethics committee**.**

NOTICES
Notices or announcement of future scientific meetings, career opportunities for young graduates either at Federal, State non-governmental organizations are encouraged and should be submitted as far as in advance of the event as possible.

Reviewing
All submitted manuscripts are examined by Editorial Board and sent out to two referees. Authors are usually notified within 8 to 10 weeks as to the acceptability of their manuscripts.

CORRESPONDENCE
All manuscripts and inquiries are to be directed to:
Dr. (Mrs.) U.A. Onyechi
Editor-in-Chief,
Department of Home Science, Nutrition & Dietetics
University of Nigeria, Nsukka
E-mail: ***danscientific@yahoo.com***
Phone: +234(0)806 6794 814

About Dietitians Association of Nigeria (DAN)

Dietitians Association of Nigeria (DAN) is an association of all dietitians in Nigeria. According to the International Confederation of Dietetic Association's (ICDA) definition, "a Dietitian is a person with a qualification in nutrition and dietetics recognized by national authority (s). The minimum level of education of a dietitian is a bachelor's degree and a period of supervised professional practice of at least 500h (internship programme in an accredited health facility). A dietitian applies the science of nutrition to the feeding and education of individuals and groups in health and disease ". DAN is an off shoot of Nigerian Dietetic Association (NDA) following the Federal Government approval on 4th August, 2008 of a Scheme of Service for Dietitians in Nigeria, structured on: GL 08-17(Federal) and GL 08-16 (State) for graduate dietitians (Professional/Officer Cadre) and re-designation of the sub-professional cadre as Assistant Dietitian cadre on GL 07-14 for those with Higher National Diploma.

DAN is registered with the Corporate Affairs Commission (CAC) of Nigeria and the International Confederation of Dietetic Associations (ICDA), incorporated in Canada. DAN is primarily a national association of all graduate dietitians with membership strength of over 250 registered Dietitians (RDs). Dietitians in any country are represented in the International Confederation of Dietetic Associations (ICDA) by only one national association and DAN is the national association for dietitians in Nigeria. DAN has participated in three major activities organized by ICDA in 2009/2010.

Mission: To ensure that Dietitians in Nigeria meet uniform minimum education and practice standards set by ICDA through accreditation of programmes and continious monitoring. Create awareness and promote evidence-based medical nutrition therapy.

Dietitians Associations of Nigeria supports members and the general public to achieve:
- An integrated communication system
- An enhanced image of the Dietetics profession
- An increased awareness of standards of education; training and practice in dietetics.

Role of Dietitians
Most people think that dietitians work primarily in a hospital or a Food Service setting. With increased consumer interest in healthy eating and advent of information technology, the role of the registered dietitian has evolved beyond this. Dietitians are essential members of the health care team and have a wide range of job opportunities.

Work places of Dietitians:
Hospital/ rehabilitation centre
Medical clinic with family physicians
Community health centre
Home Care services Nursing home/long term care facility
Health education/public health agency
Employee cafeteria
School food and nutrition service
Military food and nutrition service

Corrections food and nutrition service
Food industry (manufacturers/producers)
Catering/ hospitality industry
Pharmaceutical industry
Universities and/or colleges
Media
Consultant/ private practice
Other government department/ agency

Clinical Dietitians
They identify nutrition problems and assess the nutritional status of patients; develop care plans and monitor effectiveness of nutrition interventions; and counsel patients on therapeutic diet modifications.

In the community:

Public Health Nutritionists / Dietitians; Dietitians working in Community Centers:
They assess the nutritional needs of populations; identify community nutrition problems; and develop health promotion strategies, nutrition education programs and healthy eating resources. They work with individuals and groups to improve their nutritional well-being; prevent nutrition-related diseases; increase access to food and enhance personal control of health.

In Food Service management:

Administrative Dietitians manage food production, distribution and service of high quality meals/snacks, ensuring adherence to sanitation and safety standards and a cost effective operation. They manage Food Service Departments in hospitals and other health care facilities, schools, universities, and businesses and may be employed by contract food companies.

In private practice:

Consulting Dietitians:
They provide expertise in nutrition to promote health and prevent disease, counseling services for nutrition-related disease and disorders, and management advice to food service operations. They operate their own private consulting practices or businesses and work with, groups, workplaces, and media.

In industry:

Dietitians in Business and Industry assist the private sector with research, development, marketing, and consumer education. Working with food and pharmaceutical companies, marketing association and food service providers, dietitians are able to develop, promote and market better food and nutritional products.

In government, education and research:

Dietitians in government develop nutrition and food policy based on scientific evidence in consultation with stakeholder groups. They also direct and administer nutrition programs and services and may work at the Federal, State, Local Government or Community level.

Dietitians in Education teach nutrition, food chemistry or food services administration to students in nutrition and dietetics, nursing, medicine, pharmacy, or the food and hospitality industry. These courses are taught at various levels elementary and secondary school, college, university, professional schools and hospitals.

Research Dietitians plan and direct research projects which will ultimately enhance patient care and

improve the cost effectiveness of food service. Universities, health care facilities and industry all support research by Dietitians.

Standards of dietetic professional service.

To help clarify activities that are within defined RDs' scope of practice, six Standards of Professional Practice are described by ICDA and American Dietetic Association which can be adapted in individual area of practice:

STANDARD 1: PROVISION OF SERVICES

Dietitians provide effective quality client-centered dietetic service.

STANDARD 2: APPLICATION OF RESEARCH

Dietitians should be able to use research findings, generate or participate in research to enhance practice.

STANDARD 3: COMMUNICATION AND APPLICATION OF KNOWLEDGE

Dietitians should be able to apply and communicate unique body of knowledge in food and nutrition with others in different disciplines.

STANDARD 4: UTILIZATION AND MANAGEMENT OF RESOURCES

Dietitians should use available resources effectively and efficiently in practice

STANDARD 5: QUALITIES IN PRACTICE

Dietitians should continue to ensure that service rendered is in accordance with the ethical guidelines of the profession

STANDARD 6: CONTINUED COMPETENCE AND PROFESSIONAL ACCOUNTABILITY

Dietitians should engage in life long continuous learning to ensure competence in his/her area of practice.

From the editorial suite

Table of Content
Vol. 7 (1) 2016
ORIGINAL ARTICLES

NUTRIENT ANALYSIS OF SOME CONSUMED SNACKS IN SOUTH-EAST, NORTH-CENTRAL AND SOUTH-WEST REGIONS OF NIGERIA

Onyechi, U.A., Ibeanu V.N., Eme, P.E., Ani, P. and Iloka, C.C.
Department of Home Science Nutrition and Dietetics, University of Nigeria, Nsukka

ABSTRACT

Background: Nutrition is one of the basic requirements of any living organism to grow and sustain life. In most parts of Nigeria, people depend on ready-made convenient foods for their nutritional requirements.

Objective: This work was undertaken to determine the nutrient composition of some snacks consumed in South-East, North-Central and South-West regions of Nigeria.

Method: Samples of snacks consumed in South-East, (Agidi, Igbangwu oka, Okpa, and Akara), North-Central (Kulikuli, Donkwa, Ridi and Masa) and South-West (Kokoro, Robo, Chinchin and Moimoi) regions of Nigeria were purchased from Ogige (Nsukka), Galadimawa (Abuja), and Kupo (Ogun) markets in Nigeria. The samples were analyzed for proximate, photochemical, vitamins and mineral content using standard methods. All the analyses were conducted in triplicate and the mean score of the data was recorded. Data was subjected to analysis of variance and Duncan multiple range was used to separate the variant means.

Results: Moisture content of the samples ranged from 5.87% in 'Donkwa' to 81.27% in 'Agidi'. Crude fiber content ranged from 2.33% in 'Moimoi' to 6.13% in 'kulikuli'. Crude Ash content ranged from 0.67% in 'Chinchin' to 5.20% in 'kulikuli'. Protein content ranged from 4.37% in 'Agidi' to 26.80% in 'Donkwa'. Carbohydrate content ranged from 4.33% in 'Okpa' to 57.30% in 'Donkwa'. Fibre content ranged from 6.13% in 'Chinchin' to 2.33% in 'Kulikuli'. Fat ranged from 1.53% in 'Agidi' to 34.00% in 'Kulikuli'. Vitamin A content ranged from 25.07µg/g in 'Donkwa' to 36.13µg/g in 'Okpa' while Vitamin E content ranged from 2.30mg/100g in 'Agidi' to 4.68mg/100g in 'Ridi'. Iron content of the samples ranged from 182.10µg/g in 'Chinchin' to 497.17µg/g in 'Kulikuli'. Zinc content ranged from 208.10µg/g in 'Agidi' to 246.13µg/g in 'Kulikuli'. Calcium content ranged from 1057.80mg/100g in 'Ridi' to 2162.20mg/100g in 'Kulikuli'. Flavonoid content of the samples ranged from 148.77 to 423.77mg/100g with the highest content in 'Kulikuli' and least in 'Agidi'. Glycoside content ranged from 11.90mg/g in 'Agidi' to 21.10mg/g in 'Kulikuli'.

Conclusion: Knowledge of the nutrient composition of the different snacks would help in the proper selection of healthy and nutritious snacks.

Key words: Nutrients, Snacks, Nutrition, Malnutrition.

INTRODUCTION

Nutrition is the science that link foods to health and disease. It includes the process by which the human organism Ingests, digests, absorbs, transports and excretes food substances. Nutrition is a lifestyle factor that is a key to developing and maintaining an optimal state of the health of individuals. Malnutrition is therefore a condition of impaired development or function caused by either a long-term deficiency or excess in calorie and/ or nutrient intake. Malnutrition is a serious public-health problem that has been linked to a substantial increase in the risk of mortality and morbidity. The food habits of Nigerians are rapidly changing from the traditional foods to lighter foods such as snacks. A snack is composed of solid food(s), including those typically eaten with a utensil (with or without a beverage) that occurs between habitual meal occasions for the individual, it is not a substitute for a meal and provides substantially fewer calories than would be consumed in a typical meal (1). Snacks such as fruits, vegetables, low fat yogurt, and plain popcorn are healthy snacks because they provide needed nutrients and are low in calories, fat, sugar and sodium (2). It is believed that snacks contribute 15-20% of our daily energy and mineral intake and 13-17% of our daily vitamin intake (3). Snacks have been found to differ from meals in terms of size, nutritional content, hunger and thirst sensations before and after the event (4). Booth (5) states that a small amount of food eaten approximately an hour before a meal is unlikely to decrease intake at the next meal. It is hypothesized that it is fattening to consume even a small amount of energy (from food or drinks) between main meals (5). However there is little evidence that frequent snackers are nutritionally disadvantaged or have a higher percentage of body fat (6). Snacks are perceived as being unhealthy foods, for example confectionery, which is believed to provide "empty" calories and therefore provide no other nutrients. It is also argued that these snacks are replacing foods with a greater nutritional content, which further disadvantages the snacker. Snacks are inexpensive and widely consumed as they are often a major source of daily food intakes of children and adults (7). Snacks are important because majority usually do not eat enough at one meal to get all the nutrients they need for the day. Eating a healthy snack makes one get all the nutrients needed to keep one healthy and full of energy (8). The Twelve snacks from South-East, North-Central and South-West are discussed below:

Okpa (Bambara nut pudding): Bambara nut is the third eaten legume after groundnut (Arachis hypogea) and cowpea (vigna unguiculata) (9). It serves as an important source of protein in diets of a large percentage of the population, particularly to the poorer people, who cannot afford expensive animal protein. The bambara nut flour is often processed into okpa by the inhabitants of the Eastern part of Nigeria (10).

Agidi (fermented maize pudding) is a thick gel produced from fermented maize paste or flour. Agidi produced from fermented maize flour is inherently deficient in nutrients, especially lysine and some nutrients are leached out because of the poor processing techniques involved in its traditional production (11). Such deficiencies may result in protein malnutrition among consumers of Agidi particularly young children who are fed with the product as weaning food (12).

Groundnut cake (Kuli-kuli) is a commonly produced snack by the Hausas that is primarily made from peanuts (13).
Masa (fried fermented cereal-base paste) is a traditional fermented snack food that is widely prepared and consumed in Northern and some part of Western states in Nigeria. It can be produced from maize (Zea mays), millet (Pennisetum typhoideum), sorghum (Sorghum vulgare) and rice (Oryza sativa). Masa serves as breakfast and snacks items for many people (14).
Chinchin is a traditional Nigerian snack prepared using wheat flour, butter, milk and eggs from which a stiff paste is made which is then deep fried until golden brown and crisp (13).
Kokoro is a snack food in western Nigeria. It is made from maize flour mixed with sugar and gari (cassava or yam flour) and deep fried (13). It is therefore a predominantly carbohydrate food lacking in some essential nutrients.
Donkwa (groundnut-maize cake) is a mixture of dried groundnut and maize paste (13).
Ridi (sesame cake) commonly known as Beniseed is one of the cultivated oil seed crops in the world. The sesame cake is made from the defatted sesame seed.
Akara (fried bean cake) is a deep-fat fried ball prepared from whipped cowpea paste, flavoured with pepper, onion and salt (15).
Robo (groundnut-melon cake) is a ready to eat snacks produced from residue obtained from oil extraction of groundnut and melon.
Moimoi (Steamed Bean pudding) is a Nigerian steamed bean pudding made from a mixture of washed and peeled peas, onions and pepper (13)
Igbangwu oka (Steamed maize paste) is a savory dish made from steamed maize flour or paste with other ingredients like palm oil, vegetable, salt, pepper, crayfish and spice (16).

MATERIALS AND METHODS
Study design: This study design is experimentalSample procurement:Samples of snacks consumed in South-East, (Agidi, Igbangwu oka, Okpa, and Akara), North-Central (Kulikuli, Donkwa, Ridi and Masa) and South-West (Kokoro, Robo, Chinchin and Moimoi) regions of Nigeria were purchased from Ogige (Nsukka), Galadimawa (Abuja), and Kupo (Ogun) markets in Nigeria.Analysis of the samples:Proximate analysis of the samples were carried out to determine the moisture, protein, fat, crude fibre and ash contents of the snacks using AOAC (17). The carbohydrate content was determined by difference. Vitamins (A and E) and Minerals (Iron, Zinc and Calcium) using the standard procedure described by pearson (2000) for vitamin A and AOAC (17) for Vitamin E, Zinc, Iron and Calcium. Phytochemical composition (flavonoid and glycoside) of the samples were also determined using the standard procedures described by Salchi,(18) and Onwuka (19).Statistical analysis:All the analyses were conducted in triplicate and the mean and standard deviation were calculated. Data was subjected to analysis of variance and Duncan multiple range was used to separate the variant means.
RESULTSTable 1 and 2 shows the proximate composition of the snacks, the result showed that the carbohydrate content of the samples ranged from 4.33 ± 0.58% in 'OKP' to 57.30 ± 2.10% in 'DON'. Moisture content of the snacks ranged from 5.87 ± 0.12% in 'DON' to 81.27 ± 0.12% in 'AGI'. Crude fiber content ranged from 2.33 ± 0.23% in 'MOI' to 6.13 ± 0.78% 'KUL'. Crude Ash content ranged from 0.67 ± 0.12 % in 'CHI' to 5.20 ± 0.20 % in 'KUL'. Protein content ranged from 4.37 ± 0.15 % in 'AGI' to 26.80 ± 4.09% in 'DON'. Fat ranged from 1.53 ± 0.31% in 'AGI' to 34.00 ± 0.01% in 'KUL'. Flavonoid content of the samples ranged from 148.77 ± 7.81 to 423.77 ± 25.62 mg/100g with highest content in 'KUL' and least in 'AGI'. Glycoside content ranged from 11.90 ± 0.86mg/g in 'AGI' to 21.10 ± 2.08mg/g in 'KUL'.

Table 1: Proximate composition of the snacks (%).

	Carbohydrate		Fat		Protein		Moisture		Ash	
Sample	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
KOK	51.50	1.45	18.07	0.12	16.03	1.63	9.13	0.31	1.73	0.12
RID	38.17	2.14	29.60	0.20	18.70	2.25	7.93	0.23	1.47	0.12
KUL	45.20	3.92	34.00	0.01	15.13	2.84	6.07	0.31	5.20	0.20
DON	57.30	2.10	18.27	0.31	26.80	4.09	5.87	0.12	2.07	0.12
ROB	4.60	1.15	31.6 7	0.12	21.57	2.60	7.33	0.12	3.27	0.31
CHI	5.30	0.72	18.67	0.46	12.63	1.32	8.40	0.20	0.67	0.12
MAS	4.40	2.09	5.07	0.31	7.87	1.31	47.87	0.12	0.87	0.12
AKA	5.50	0.50	12.73	0.12	14.80	3.40	46.87	0.23	1.93	0.12
AGI	5.90	1.28	1.53	0.31	4.37	0.15	81.27	0.12	1.27	0.12
MOI	5.23	0.40	3.73	0.50	8.93	1.00	75.33	0.23	1.47	0.12
OKP	4.33	0.58	4.47	0.12	18.07	1.27	60.27	0.31	2.47	0.12
IGB	5.73	0.87	3.67	0.12	7.15	2.56	73.13	0.23	1.27	0.12

KEY:
KOK: Kokoro
RID: Ridi
KUL: kulikuli
DON: Donkwa
ROB: Robo
CHI: Chinchin
MAS: Masa
AKA: Akara
AGI: Agidi
MOI: Moimoi
OKP: Okpa
IGB: Igbangwu oka.

Table 2: Fiber composition of the snacks (%)

Sample	Mean	Standard deviation
KOK	3.53	0.12
SES	4.13	0.12
KUL	2.33	0.23
DON	5.93	0.23
ROB	5.10	1.35
CHI	6.13	0.78
MAS	3.63	0.78
AKA	3.63	0.66
AGI	6.01	0.01
MOI	5.01	0.60
OKP	5.13	0.42
IGB	5.50	2.18

KEY:

KOK: Kokoro
RID: Ridi
KUL: kulikuli
DON: Donkwa
ROB: Robo
CHI: Chinchin
MAS: Masa
AKA: Akara
AGI: Agidi
MOI: Moimoi
OKP: Okpa
IGB: Igbangwu oka.

Table 3 shows that Vitamin A content ranged from 25.07 ± 0.45µg/g in 'DON' to '36.13 ± 2.41µg/g in 'OKP' while Vitamin E content ranged from 2.30 ± 0.11mg/100g in 'AGI' and 4.68 ± 0.49mg/100g in 'RID'.

Table 3: Vitamins A and E composition of the snacks

	N	Mean		Std. Deviation	
Samples		Vitamin A(µg/g)	Vitamin E(mg/100g)	Vitamin A	Vitamin E
KOK	3	25.70	3.37	0.82	0.19
SES	3	27.67	4.68	0.89	0.49
KUL	3	30.40	4.41	2.88	0. 09
DON	3	25.07	5.70	0.45	0.14
ROB	3	29.83	4.95	2.57	0.49
CHI	3	28.13	3.65	2.46	0.61
MAS	3	26.57	4.12	1.45	0.80
AKA	3	25.77	2.64	3.58	0.35
AGI	3	25.77	2.30	1.17	0.11
MOI	3	26.93	2.58	0.81	0.49
OKP	3	36.13	2.89	2.41	0.53
IGB	3	28.73	3.02	0.40	0.52

Table 4 show that the Iron content of the samples ranged from 182.10 ± 3.99µg/g in 'CHI' to 497.17 ± 14.08µg/g in 'KUL'. Zinc content ranged from 208.10 ± 6.69µg/g in 'AGI' to 246.13 ± 6.77µg/g in 'KUL'. Calcium content ranged from 1057.80 ± 276.63 mg/100g in 'RID' to 2162.20 ± 46.85mg/100g in 'KUL'.

Table 4: Mineral composition of the snacks

	N	Mean			± Std. Deviation		
Snacks		Iron (µg/g)	Zinc (µg/g)	Calciu m (mg/100g)	Iron	Zinc	Calcium
KOK	3	363.23	226.90	1515.53	9.67	20.18	109.63
SES	3	186.53	216.67	1057.80	13.74	2.55	276.85
KUL	3	497.17	246.13	2162.20	14.08	6.77	46.8 6
DON	3	232.53	212.80	1231.10	5.77	5.10	31.51
ROB	3	318.50	220.93	1508.90	3.85	1.99	60.49
CHI	3	182.10	211.97	1168.90	3.99	4.16	10.18
MAS	3	184.90	209.83	1088.90	3.34	11.50	47.28
AKA	3	242.57	210.70	1293.30	1.19	12.81	74.26
AGI	3	194.57	208.10	1088.90	30.81	6.69	80.09
MOI	3	223.90	216.23	1226.70	4.81	5.14	104.81
OKP	3	211.43	235.07	1231.10	7.13	3.92	50.50
IGB	3	182.93	214.53	1182.20	7.51	12.88	13.85

The table below (table 5) shows that the Flavonoid content of the samples ranged from 148.77 to 423.77mg/100g with the highest content in 'Kulikuli' and least in 'Agidi'. Glycoside content ranged from 11.90mg/g in 'Agidi' to 21.10mg/g in 'Kulikuli'. It was represented in Table 4.5 below.

Table 5: Phytochemical composition of the snacks

	Mean		Std. Deviation	
Snacks	Flavonoid (mg/100g)	Glycoside(mg/g)	Flavonoid	Glycoside
A	416.03	13.47	30.71	1.07
B	326.47	13.67	25.05	1.26
C	423.77	21.10	25.62	2.08
D	345.43	14.63	33.70	1.58
E	417.70	17.23	30.12	2.78
F	354.80	12.93	33.39	0.21
G	261.87	15.43	46.26	2.07
H	221.50	11.93	28.86	0.49
I	148.77	11.90	7.81	0.86
J	188.77	12.83	26.55	1.25
K	201.27	14.00	33.23	0.91
L	223.73	15.13	16.29	0.90

- The unit of flavonoid is mg/100g while Glycoside is mg/g.

DISCUSSION

The result of the proximate composition as shown in Table 1 & 2 showed that carbohydrate content was highest in DON compared to OKP which was the least. Carbohydrates are the single most important source of food energy in the world. They comprise sum of 40-80% of total food energy intake depending on local, cultural considerations or economic status (20). The crude protein content of IGB was significantly low compared to DON. Protein content is one of the important qualities of any food. FAO (21) recommended the protein content of 20% for any food. However, it is expected that IGB should be complemented with good sources of protein. The high moisture content of AGI was similar to the work done by Okeke (22). Moisture (Water) is important in human diet because it provides body fluids and help to regulate the body temperature. Fat is a concentrated source of energy, highly useful in increasing density of diet, this is particularly important for young children who have limited gastric capacity. Owing to the fact that fat provide essential fatty acids and their influence on the absorption of liposoluble nutrients (23). The fat content of each of the snacks purchased from the three regions were analyzed. The result however showed that KUL had the highest fat content. The ash content of a feedstuff is the inorganic residue remaining after the organic matter has been destroyed by combustion in the muffle furnace (24). The ash content of each of the snack samples purchased from the different regions depicted in Table 1 revealed that the ash

content of KUL was significantly higher compared to the rest of the snacks with CHI having the least. Table 2 showed that CHI had the highest fibre content although it ranged closely with that of AKA. Vitamins are organic nutrients which are essential for life.

The human body requires these nutrients to ensure normal growth and physical wellbeing. While plants and micro-organisms can themselves produce the vitamins necessary for metabolism, humans and animals lost this ability during the course of evolution. Lacking the enzymes necessary for synthesizing vitamins in the body, humans therefore have to take these in through their diet. On this note, Vitamin A content was highest in DON and least in OKP while Vitamin E content was least in AGI and highest in RID. Iron content of the snacks was highest in KUL and least in CHI. Zinc content was highest in KUL and least in AGI. Calcium content was highest in KUL and least in RID. KUL had the highest Flavonoid and Glycoside content respectively while AGI had the least Flavonoid and Glycoside content respectively. Snacks from the North-central (DON, MAS, RID and KUL) were more Nutrient dense than others especially DON which had the richest Protein and Carbohydrate content. The snacks obtained from South-East were not quite rich in many nutrients but had high moisture content. Snacks obtained from the south west (KOK, ROB, MOI and CHI) were considerably higher in many nutrients than those from the South-East. These differences could be as a result of the ingredients used for the preparation of the snacks. In the North-Central and South-West, the snack compositions were mainly from legumes. Those from the South-East were mainly cereals. The result therefore showed that foods that contained legumes had greater protein content than those that contained mainly cereals. Ihekoronye and Ngoddy (25) noted that the most important difference in the use of legume seeds for food is related in part, to ethnic background, customs and traditions.

Conclusion: DON and ROB are protein-rich snacks which can be used to supplement the expensive animal protein which is unaffordable by some poor individuals and families. The samples of OKP, KUL, ROB, and IGB contained higher amounts of Vitamin A while DON, ROB, and RID contained higher Vitamin E contents. Vitamins A and E are antioxidants necessary for the elimination of free radicals. The snacks obtained from the different regions had varying composition of nutrients which could be as a result of the processing methods or the ingredients used for the preparation of the different snacks. In other to make high profit, some of the producers adulterate or use less quantity of ingredients to prepare the snacks thereby making it less nutritious. The knowledge of the nutrient composition of the different snacks would help in the proper selection of healthy and nutritious snacks.

References

1. Danielle, R.D. (2010). Defining snacking. Society for Nutrition education.
2. Katheleen, L. (1996). Healthy snacking. Consumer decision making contest.
3. Summerbell, C.D., Moody, R.C., Shanks, J., Stock, M.J., & Gaissler, C. (2005). Sources of energy from meals vs snacks in 220 people in four age groups. European Journal of Clinical Nutrition. 49, 33-41.
4. Bellisle, F., Dalix, A.M., Mennen, L., Galan, P., Hercberg, S., de Castro, J. M., & Gausseres, N. (2003). Contribution of snacks and meals in the diet of French adults : a diet-diary study. Physiology and Behavior. 79, 183-189.
5. Booth, D. A. (1980). Acquired behaviour controlling energy intake and output. In Stunkard, A. J. (Ed.) Obesity. Philadelphia, PA:W.B. Saunders. 101- 143.
6. Drummond, S., Kirk, T., & de Looy, A. (1999). Snacking: Implications in body composition and energy balance. British Food Journal, 97, 12-15.
7. Food Nutrition and Agriculture, (1996). Street Foods. Food and Agriculture Organisation. 17/18: 4-6.
8. Foskett, T.A., Barrett-Connor E.L., & Wingard D.L. (2004). Practical Cookery. Snacks, light meals, Savories and Convenience Foods.15:616-632.
9. Omoikhoje, S.O. (2008). Assessment of the nutritive value of Bambara groundnut as influenced by cooking time. Livestock Resources Rural Development.
10. Adumanya, O.C.U.1, Obi-Adumanya, G.A.1. & Chukwu, M.O.1 (2012). The vitamin and mineral contents of "Okpa" prepared with fluted pumpkin and scent leaves. 3rd RUFORUM biennial meeting, Entebbe, Uganda.
11. Adeyemi, I. A., & Beckly, O. (1986). Effect of period of maize fermentation and souring on chemical properties and amylograph pasting viscosity of ogi. Journal of cereal Sciences. 4 : 353-360.

12. Onyeka, U., & Dibia I. (2002). Malted weaning food made from maize, soybean, groundnut and cooking banana. Journal of Science of Food and Agriculture, 82:513-516.
13. http://www.Nigerianfoodrecipes.com
14. Ayo, J. A., Agu, H., & Famoriyo, A. F. (2008). Effect of different cereals on quality of Masa. Pakistan Journal of Nutrition, 7(4): 530-533.
15. Olapade, A.A., Ozumba, A. U., Solomon, H. M., Olatunji, O., & Adelaja, S. O. (2005). Rheological properties and consumer acceptance of moin-moin premix. Nigerian Food Journal. Vol 23, 144-147.
16. http://www.dobbissignature.com
17. AOAC, (2010). Official methods of analysis of the Association of official Analytical Chemists. 10th Edition Vol. II .Washington, DC, U.S.A.
18. Salchi. M. H., Aynechi, Y., Amin, G. H.and Mahmoodi, Z. (1992). Survey of Iranian plants for Saponins, alkaloids, flavonoids and tannins. 2, 281-291.
19. Onwuka, A. G. (2005). Food analysis and instrumentation. Anapolis print.3rd Ed., A division of HG support Nig. Ltd. 133-161.
20. FAO., 1998. Carbohydrate in Human Nutrition. Food and Agriculture Organization of the United Nations, Rome, Italy, 66.
21. FAO, (1996). Grain legumes in Africa (3rd edition) – Food and Agricultural Organization, Rome. 82 – 83.
22. Okeke, E. C. & Ene-Obong, H. N. (1995). Nutrient Composition of Conventional Foods as Eaten in Northern Anambra State, Nigeria. Journal of Nutrition in Recipe and Menu Development, 1(3): 27-33.
23. FAO., 1998. Carbohydrate in Human Nutrition. Food and Agriculture Organization of the United Nations, Rome, Italy, 66.
24. AOAC, (1990). Official methods of analysis of the Association of official Analytical Chemists VOL.II Washington, DC, U.S.A.
25. Ihekoronye, A.I. & Ngoddy P.O. (1988). Integrated Food Science and Technology for the tropics. Macmilian, London.

THE EFFECT OF FERMENTATION AND GERMINATION ON THE NUTRIENT AND ANTINUTRIENT COMPOSITION OF MILLET(Pennisetus glaucum)FLOUR

OKEKE PHILOMENA NGOZI[1], MADUFORO ALOYSIUS NWABUGO[2]
[1]Department of Nutrition and DieteticsImo State University, Owerri

[2] Department of Nutrition and Dietetics, School of Biomedical and Allied Health Science, College of Health Sciences, University of Ghana, Korlebu Campus Accra, Ghana

Email:ngoziobiakor2001@yahoo.com[1]; preciousman179@yahoo.com[2]
Phone Number: +234(806)6728512[1]; +233 (0)231581538[2]

ABSTRACT
Background: Fermentation and germination of cereals and grains has been an ancient traditional practice in different parts of the Nigeria. In this study, the influence of fermentation and germination on the chemical properties of millet (Pennisetus glaucum)flour was evaluated.
Aim: The study was aimed at determining the effects of different fermentation and germination time on the proximate, minerals and antinutrient composition of millet flours.
Methods: The flours were analyzed for their proximate, mineral and antinutrient composition, using the standard analytical methods.
Result: The result showed that fermentation and germination increased the moisture, protein and ash content of the flours while fibre, fat and carbohydrate were decreased. The minerals: iron, copper, zinc and phosphorous increased due to germination and fermentation. The phytate and tannin levels were drastically reduced in both the fermented and germinated flours.
Conclusion: The result of this study demonstrated that fermentation and germination facilitates increased accessibility of the nutrient in millet and reduces the antinutrients. It is therefore recommended that in milletprocessing, fermentation and germination methods should be adoptedfor richer and more bioavailability of the nutrients in them.

Keywords: proximate, minerals, Antinutrient, Fermentation, Germination,millet

INTRODUCTION

Millets belongs to a group of highly variable small-seeded grasses[1]. They are widely cultivated around the world as cereal crops or grains for animal and human food. Millets are important crops in the developing countries where there is food scarcity and cereal foods make up the major source of energy and easily affordable food by all[1]. Such countries include semiarid tropics of Asia and Africa especially in India, Mali, Nigeria, and Niger. It is reported that 97% of millet production is in developing countries.Millet cultivation in these areas is favored due to its yield and short growing season under dry, high-temperature conditions[1]. In Nigeria where malnutrition has persistently plagued the populace, it is important to process foods to enhance the utilization of the nutrients contained in them[2].

There is high level of severe acute malnutrition (SAM) and moderate acute malnutrition (MAM) in many developing countries such as Nigeria.Severe acute malnutrition (SAM) and moderate acute malnutrition (MAM) are found to be more among children because they are weaned abruptly into starchy foods. Improving the nutritional value of complementary foods formulationsproduced from local and ready available raw materials has received considerable attention in Nigeria. Although the commercially standardized foods are generally adequate to meet the nutritional requirements of young children in both developed and developing countries but not all the classes of people can afford to buy these foods. However, the development of low cost, high nutrient dense food supplements for infants'complementary food is a constant challenge for developing countries where traditional foods used during the food transition process from exclusive breastfeeding to introduction of complementary foods are frequently characterized by low nutrient density and high bulk, which can adversely affect infant's health [1].

The objective of the researchwasto evaluate the effects of fermentation and germination on the chemical composition of millet. The result of this study would provide nutrition and food processing education to mothers living in both rural and urban communities on the best method of producing nutritious and cheap flours that can be used for complementary foods from the millet flours.

MATERIALS AND METHODS

The millet grain used for the study were purchased in bulk from a city market "Eke-Ukwu" Owerri,Imo state Nigeria.

PREPARATION OF SAMPLES

Processing of fermented millet flour
Two kilogrammes (2kg) of millet was cleaned and divided into four equal portions. One portion served as a control. It was washed, dried and milled directly into flour. The flour was stored in an air-tight container for analysis. The other three portions were subjected to varying fermentation periods. The grains were separately soaked in cold water in the ratio 1:3 (w/v) and allowed to ferment by the micro-flora inherent in them for 24, 48 and 72 hours at a temperature 28°C + 2°C respectively. The fermented grains were separately dried at 55°C in the laboratory drier, dehulled and milled into the fine flour (70mm Mesh Screen) and stored in polythene bags for analysis.

Processing of germinated millet flour
Two kilogrammes (2kg) of millet was soaked for 30 minutes and spread on a wet jute bag, covered with muslin cloth and another wet jute bag was used to cover the seeds. The seeds were allowed to germinate for 48, 72 and 96 hours at 28°C + 2°C. The germinated seeds were dried and milled into fine flour (70mm Mesh Screen) and stored in air-tight container for analysis.

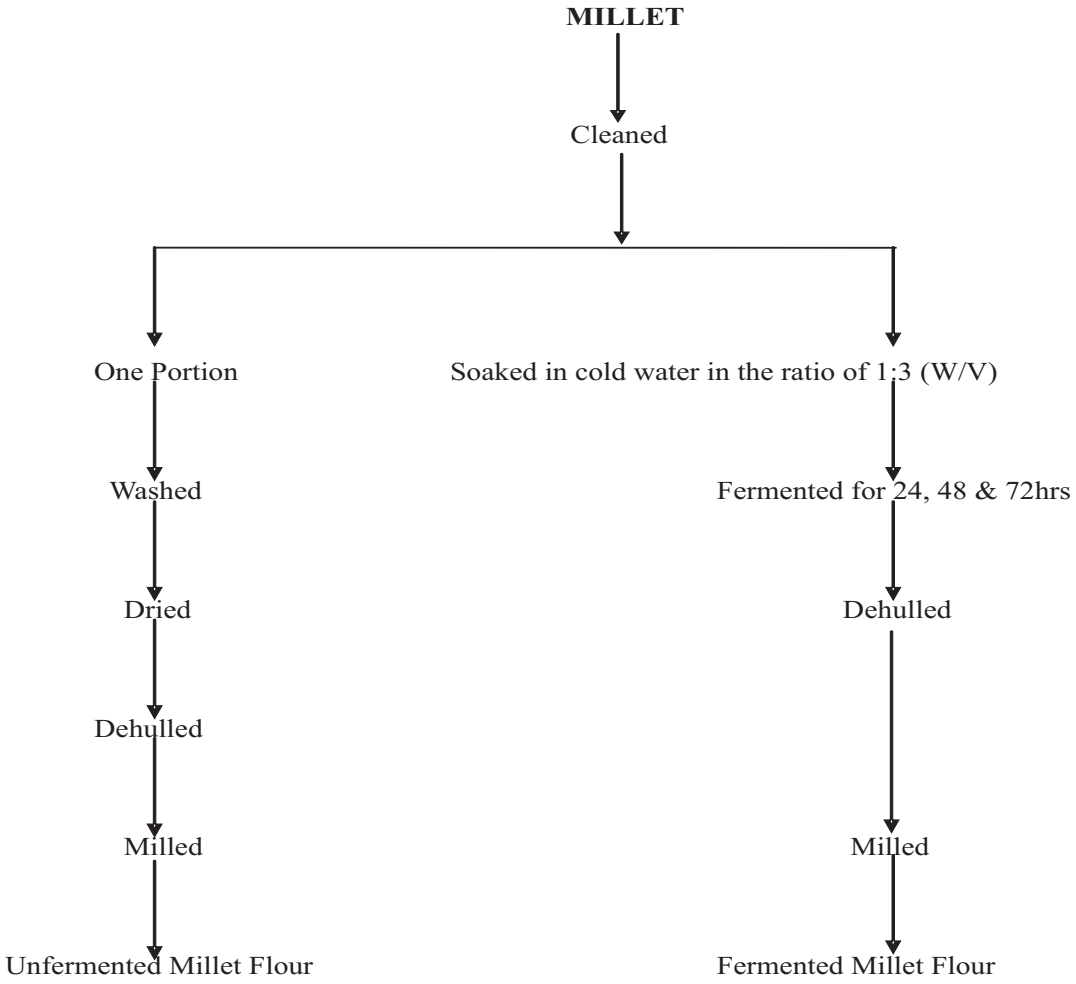


Figure 1: Processing of Fermented Millet Flour

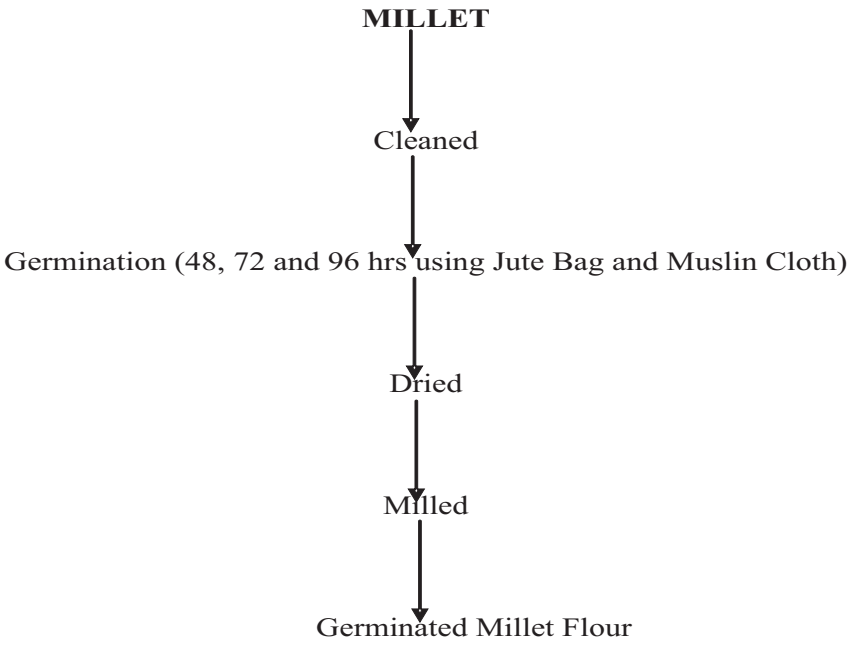


Figure 2: Processing of Germinated Millet Flour

Proximate Analysis

Moisture Determination

The moisture content of the flour was determined using the air oven method [3]. Procelain dishes were washed and dried in gallenkamp oven at 100°C for about 24 hours and allowed to cool in dessicators. The dishes were weighed and weights were recorded accordingly. Two grammes (2g) of each flour was weighed into the porcelain dishes and placed in an oven for moisture determination. The oven was operated at 100°C for 24 hours.

After 24 hours of drying, the flour samples were removed and cooled in desiccators to prevent the re-absorption of moisture. After cooling, the dishes were weighed and placed again in the oven, cooled and reweighed. This action was repeated until constant weights were attained.

Percentage moisture was calculated:

$$\% \text{ Moisture} = \frac{W_2 - W_3}{W_2 - W_1} \times \frac{100}{1}$$

Where:

W_1 = Weight of Empty Dish
W_2 = Weight of Empty Dish + Sample
W_3 = Weight of Empty Dish + Dried Sample

Protein Determination

Protein was determined by automated Micro-Kjeldahl method as described by AOAC [4]. One gramme (1g) of each sample was weighed into the micro kjeldahl flask. About 20ml concentrated H_2SO_4 and mercury tablet which acted as catalyst were added to the flask. The flask was heated on an electric heater. The mixture was boiled till all specks disappeared. 5ml of the sample was placed in the sample chamber of the apparatus, steam from the sample generator was placed through the distillation apparatus. 5ml of boric acid mixed indicator or (1:2) methyl blue and 2 drops of methyl (red) was placed in a 100ml conical flask. The conical flask was placed under the condenser such that the condenser tip was under the liquid. Glass lip of the apparatus was closed to prevent the passage of the steam to the sample and 100ml of 60% NaOH was added. This was carefully let in to prevent the escape of NH_3. Steam was then let through for about 5 minutes; each replicate was titrated with 0.02N H_2SO_4 to a pink end point. The percentage nitrogen calculated in each was multiplied with a factor 6.25 to get the percentage protein.

$$\% \text{ Nitrogen} = \frac{\text{Titre} \times \text{normbility} \times \text{dilution}}{\text{Sample weight} \times 100} \quad \frac{\text{factors} \times N_2 \times 100}{}$$

$$\% \text{ Protein} = \frac{\text{Titre} \times 0.01 \times 20 \times 14 \times}{0.2\text{g} \times 1000} \quad \frac{6.25}{1} \times \frac{100}{}$$

Fat Determination

Fat content of the samples were determined using Soxhlet Extraction method [4]. The extraction flask was washed, dried and allowed to cool and weighed. Two grammes (2g) of each sample were weighed into filter paper and introduced into the timble. Petroleum ether was placed in the flask, the apparatus was set up and extraction was carried out for 6 hours at 120°C. After 6 hours, the solvent (petroleum ether) was recovered, leaving only the extracts in the flask. The extract was dried in the oven for 15 minutes at 100°C to drive off any remaining solvent, cooled in desiccators and weighed.

$$\text{Crude Fat (Ether) \%} = \frac{W_2 - W_1}{S} \times \frac{100}{1}$$

Where:

W_1 = Weight of empty evaporating dish
W_2 = Weight of evaporating dish + content after drying
S = Sample Weight (g)

Ash Content Determination

This was determined by the method of AOAC[4]. Two grammes (2g) of each flour sample was weighed into crucibles. The contents were heated in a furnace at a temperature of 600°C for about 3 hours. The crucible was put in desicator to cool and then weighed.

$$\% \text{ Ash} = \frac{(\text{Weight of Crucible} + \text{Ash}) - \text{Weight of Crucible}}{\text{Sample Weight}} \times \frac{100}{1}$$

Determination of Crude Fibre

The crude fibre content of the flour sample was determined according to AOAC [4]. procedure. The entire residue from their either extract's determination (that is the residue in the soxhlet timble) was transferred quantitatively from timble into a 600ml beaker. Exactly 200ml of boiling 1:25% suphuric acid was added and boiled gently for exactly 30 minutes. The beaker was kept covered with a large watch glass.

Boiled distilled water was added at intervals to minimize the volumes. After boiling, it was immediately filtered through a

sintered glass Buchner funnel with stirring the residue was washed with distilled water. The residue was washed back into the beaker with 200ml of boiling 1:25% sodium hydroxide solution and boiling continued for another 30 minutes. Since frotting was likely to occur, this was done carefully by adding a few drops of anti-foam reagent to minimize it. The volume of liquid was maintained after boiling. It was filtered through Geesh Crucible prepared with asbestors, then with 100ml of 1% hydrochloric acid and finally hot water. The residue was dried in crucible to constant weight. The content of the crucible was ignited in muffle furnace at dull red heat (550 – 600°C), cooled and weighed again.

$$\% \text{ Crude Fiber} = \frac{\text{Loss in Weight from Incineration}}{\text{Weight of Sample}} \times \frac{100}{1}$$

Carbohydrate Determination

Carbohydrate was calculated by difference (100 – % Moisture + Ash + Protein + Fibre + Fat)

Mineral Analysis

Determination of Phosphorus

Phosphorus in the sample was determined by the vanadomohybdate (yellow) spectrometry described by James [5]. One milliliter (1ml) extract from each sample was dispensed into a test tube. Similarly, the same volume of standard phosphorus solution as well as water was put into other test tubes to serve as standard and blank respectively. The content of each tube was mixed with equal volume of the vanado-mohybdate colour reagent. They were left to stand for 15 minutes at room temperature before their absorbance was measured in Jenway electronic spectrophotometer at a wave length of 420mm. Measurement was given with the blank at zero.

Phosphorus content was given by the formula:

$$g/100g = \frac{100 \times Au \times C \, Vf}{W \quad As \quad Va}$$

Where:

W	=	Weight of sample analyzed
Au	=	Absorbance of text sample
As	=	Absorbance of standard solution
Vf	=	Total volume of filtrate
Va	=	Volume of filtrate analyzed.

Determination of Calcium and Magnesium

Calcium and magnesium contents of the test sample was determined by the Versanale EDTA comlexiometric titration [6]. Twenty milliliters (20mls) of each extract was dispersed into a conical flask and pinches of the masking agents – hydroxyltannin, hydrochlorate and potassium cyanide were added followed by 20ml of ammonia buffer solution (P^H 10.0). A pinch of the indicator-Erich Rome black was added and the mixture was shaken very well. It was titrated against 0.02N EDTA solution and the cololour changed from mauve colour to a permanent blue colouration. A separate titration was then conducted for calcium alone. A reagent black consisting of 20ml distilled water was also treated as described above. The titration gave a reading for combined Calcium and Magnesium complexes in sampler. Titration for calcium alone was a repeat of the previous one with slight change. 10% NaOH solution at (P^H 12.0) was used in place of the ammonia buffer while solechrome dark blue (calcon) was used as indicator in place of Erichrome black T.

Calcium and magnesium contents were calculated separately using the formula below:

$$\% \text{ Calcium or Magnesium}/100gg = \frac{100 \times Ew \times (N \times Vf)T}{W \quad 100 \quad Va}$$

Where:

W	=	Weight of sample analyzed
Ew	=	Equivalent weight of the sample
Vf	=	Total volume of extract
N	=	Normality of EDTA = 0.02N
Va	=	Volume of extract titrated
T	=	Titer value was blank

Determination of Zinc

This was determined using the method of AOAC [4]. One gramme (1g) of the sample was first digested with 20ml of acid mixture (650ml) concentrated HNO_3, (80ml perchloric acid PCA). About 5ml of the digest was collected and diluted to 100ml with distilled water, this now serves as sample solution for the readings collected. Also, a standard solution of zinc was prepared in concentration of 0.0, 0.2, 0.4, 0.6, 0.8 and 1.0. the zinc content was calculated by extrapolation using the standard curve.

$$Zn(mg/100g) = \frac{Vf \times X \times 100 \times D}{Vx \quad 10^3 W}$$

Where:

X	=	Concentration from the graph
Vf	=	Total volume of extract
Vx	=	Volume of extract
W	=	Weight of sample used
D	=	Dilution factor

Antinutrient Analysis

Phytate

This was determined by photometric method adapted from the method of Latta and Eskin [7]. 5g of each sample was extracted with 2.4% HCl, 0.1ml NaCl was added to elude inorganic phosphorus and 0.7ml NaCl added to elude phytate.

Tannins

Tannins were determined by the spectrophotometric method as described by Prince and Butter [8]. 0.5g of each sample was extracted with zinc methanol, the filtrate was mixed with 50ml water, three milliliter (3mls) of 0.1ml FeCl and 0.8ml $K_2Fe(CN)_6$ was added to the solution, the extracts were read at 72nm on a spectrophotometer.

STATISTICALANALYSIS

The data obtained were statistically analyzed using SPSS version 15 to determine the mean and standard deviation of the triplicate data analysed.

RESULTS AND DISCUSSION

Table 1: Proximate Composition of Processed and Unprocessed Millet Flour (g/100g)

Sample	Moisture	Protein	Fat	Ash	Fibre	Carbohydrate
RM		11.70±0.03	5.70±0.02	2.00±0.01	2.50±0.07	64.40±2.10
MF_{24}	9.90±0.06	12.00±0.03	5.00±0.06	2.20±0.01	1.80±0.06	64.48±2.11
MF_{48}	11.00±0.03	15.06±0.02	4.80±0.06	3.30±0.01	1.96±0.06	72.61±2.11
MF_{72}	12.00±0.03	13.69±0.01	5.10±0.06	4.5±0.01	1.66±0.06	66.72±0.16
MG_{48}	11.50±0.06	14.00±0.06	3.93±0.09	2.26±0.06	2.00±0.06	63.21±0.12
MG_{72}	12.10±0.06	15.30±0.11	4.60±0.11	3.10±0.06	2.27±0.02	67.81±0.12
MG_{96}	13.40±0.06	15.00±0.09	5.00±0.18	3.36±0.07	3.00±0.02	66.60±0.11

Mean ± SD of three determination

RM	=	Raw Millet
MF_{24}	=	Millet Fermented for 24 hours
MF_{48}	=	Millet Fermented for 48 hours
MF_{72}	=	Millet Fermented for 72 hours
MG_{48}	=	Millet Germinated for 48 hours
MF_{72}	=	Millet Germinated for 72 hours
MF_{96}	=	Millet Germinated for 96 hours

The moisture content of the fermented and germinated millet flours varied. The variations in the moisture content of the millet flours were a function of the treatment, the values ranged from 9.70 – 13.40g/100g, there was an increase in the fermented and germinated flour samples. It was observed that as fermentation and germination periods increased, moisture content increased. All the germinated flour samples and 72 hours fermented flour with high moisture content are predisposed to shorter shelf – life because studies have shown that micro-organisms that cause food spoilage flourish well with adequate moisture [9 - 10].

There were variationsin the protein content of both fermented and germinated millet. The value ranged from 11.70 – 15.30 g/100g. Fermentation and germination resulted in an increase in the protein content of the flour samples. The highest increase was at 72 hours germination (15.30 g/100g), relative to the control (11.70 g/100g). The process of fermentation and germination resulted to increased level of the protein composition of the millet flours. The increase in protein might be due to the breaking down of protein – tanninincomplexes that released more free amino acids for the synthesis of new protein. This observation was similar to the findings of many researchers[11 - 13].

There was a decrease in the fat level of both fermented and germinated millet flours. The 48 hours germinatedmillet flour had the least (3.93 g/100g) fat values when compared with the control and other processed flour samples. The decrease in fat level of the millet flours followed the same

pattern either when germinated of fermented. The fat content was lowest at 48 hours.The decrease in fat could be attributed to hydrolysis of lipids to free fatty acids by lipases for the synthesis of new lipid. Also the use of fat by the microflora for energy in metabolism during fermentation and germination could be the reason for the decrease. Fats or protein serves a s a source of energyto the growing seedling when enough carbohydrate is not available. Studies have shown that the low fat values for the processed flours increased their keeping quality. It is known that the lower the fat contents of given flour, the lower the risk of oxidative rancidity[14 - 15].

There was significant increase in the ash content of the flours due to fermentation and germination. Fermentation and germination increased ash tremendously in millet flours (2.20 – 4.50 g/100g) compared to the raw (2.00 g/100g) with the exception of 24 hours fermented and 48 hours germinated flour samples, with the ash value of 2.20 and 2.60, others had 3.10 – 4.50 g/100g ash.This increase in ash value of millet was not surprising. studies reported that one of the characteristic features of millet grains is their high ash content[15 - 17]. The observed increase in ash was similar to the reports of Nnam[16]. The fibre content of the flour were comparable (4.00 – 4.62 g/100g). The 48 hours fermented lima bean had the lowest fibre value (4.00 g/100g)[16 - 18].

Relative to the control, fermentation drastically reduced the fibre content of the millet flour (1.66 – 1.96 g/100g) when compared to the raw (2.50 g/100g). However, germination increased the fibre value. The decreased fibre in the fermented millet flours was contrary to some reports in literature[19].

The carbohydrate value of the fermented and germinated flour samples differed. It ranged from 64.40 – 72.61 g/100gin the millet flours. Germination also decreased carbohydrate content (57.90 – 63.04 g/100g) when compared with the control (67.10 g/100g). This reduction in carbohydrate might be due to the use of carbohydrate by the micro-organisms as a source of energy for metabolic processes during fermentation. This finding was similar to that of Obizoba and Egbuna [20], reported 91% reduction of oligosaccharides after a 4 days germination of chick pea.The increase in the fermented and germinated millet flours as against the control was not a surprise, millet stores carbohydrate as its source of energy. It might also be that less carbohydrate was used by the micro-organism for metabolism. Equally, the growing seedling may not have used much carbohydrate as energy source[17 – 18].

Table 2: Mineral Composition of Processed and Unprocessed Millet Flour (mg/100g)

Sample	Iron	Copper	Magnesium	Zinc	Phosphorus
RM	5.30±0.03	1.60±0.00	180.00±0.21	2.50±0.00	320.00±0.21
MF_{24}	5.63±0.06	1.60±0.06	171.00±0.18	2.90±0.06	352.00±0.21
MF_{48}	6.88±0.07	2.90±0.01	166.06±0.12	2.70±0.09	422.06±0.11
MF_{72}	6.88±0.07	2.63±0.01	139.21±0.12	3.10±0.07	379.12±0.11
MG_{48}	7.50±0.09	1.30±0.00	137.00±0.11	4.00±0.09	281.00±0.09
MG_{72}	9.30±0.11	1.06±0.00	137.00±0.11	4.20±0.09	215.00±0.11
MG_{96}	13.90±0.13	0.44±0.00	13300±0.09	3.19±0.09	161.00±0.09

Mean ± SD of three determination

RM = Raw Millet
MF_{24} = Millet Fermented for 24 hours
MF_{48} = Millet Fermented for 48 hours
MF_{72} = Millet Fermented for 72 hours
MG_{48} = Millet Germinated for 48 hours
MF_{72} = Millet Germinated for 72 hours
MF_{96} = Millet Germinated for 96 hours

The iron content of the flour samples differed. It ranged from 5.30 – 13.90 mg/100g for millet. Fermentation increased the iron content of millet flours.Also, germination resulted in an increased in the iron level of millet flours (7.50 – 13.90 mg/100g) against the control (5.30 mg/100g). The 96 hours germination produced almost a two-fold increase in iron value (7.50 – 13.90mg) when compared with the control (5.30 mg/100g). Obiakor [21]recorded a similar observation in different lima bean varieties. The observed increase in the iron content of millet flours were similar to the findings of Obizoba [22].

The variations of the copper levels of the flour samples were a function of treatments. Fermentation increased the copper values of millet (1.60 – 2.90 mg/100g) as against the control (1.60 mg/100g). The 96 hours germinated flours reduced the copper in millet (0.44 mg/100g) as against the control (1.60 mg/100g). This observed decrease in copper for germinated millets is contrary to the report of Manay and Shavaswarny [23]. They reported increased copper in dry seeds after sprouting.

The magnesium content of the flour samples differed. They ranged from 133 – 180 mg/100g in millet flours. Germination drastically reduced the magnesium content of millet flours (137 – 133 mg/100g) when compared with the control (180 mg/100g). Fermentation also caused a significant decrease in magnesium level of millet (139.21 – 171.00 mg/100g) as against the control (180 mg/100g). The high magnesium value of the raw millet relative to the fermented and germinated flour samples showed that millet

is a rich source of this mineral (magnesium) and the food processing methods applied in this study made it more available in the food.

Fermentation increased zinc level in the millet flours. Germination also increased zinc in millet flours (2.90 – 4.20 mg/100g) when compared with the control (2.50 mg/100g). The increase in the zinc content of the flours due to fermentation in lima bean and millet was not a surprise. It is known that fermentation improves the bio-availability of minerals such as iron, phosphorous and zinc as a result of phytic acid hydrolysis.

There were variations in the phosphorous content of the flour samples. The values ranged from 161.00 – 422.06 mg/100gin millet flours. Fermentation increased phosphorousmillet (352.00 – 422.06 mg/100g) as against their control (320 mg/100g). The relatively high phosphorous value for the fermented and germinated millet flours was in line with the report of FAO [17] that millet is rich in phosphorous. However, germination decreased the phosphorous content of millet especially the 96 hours period. Rao and Deosthale [19] observed that 72 hours germination significantly reduced the phytic phosphorus content of both pearl and finger millet.

Table 3: Antinutrient Composition of Processed and Unprocessed Millet Flours (mg/100g)

Sample	Phytate	Tannin
RM	0.27 ± 0.07	0.17 ± 0.05
MF_{24}	0.26 ± 0.07	0.17 ± 0.05
MF_{48}	0.10 ± 0.02	0.08 ± 0.00
MF_{72}	0.21 ± 0.06	0.11 ± 0.01
MG_{48}	0.21 ± 0.06	0.11 ± 0.01
MG_{72}	0.27 ± 0.00	0.06 ± 0.00
MG_{96}	0.36 ± 0.06	0.02 ± 0.00

Mean ± SD of three determination

RM	=	Raw Millet
MF_{24}	=	Millet Fermented for 24 hours
MF_{48}	=	Millet Fermented for 48 hours
MF_{72}	=	Millet Fermented for 72 hours
MG_{48}	=	Millet Germinated for 48 hours
MF_{72}	=	Millet Germinated for 72 hours
MF_{96}	=	Millet Germinated for 96 hours

The phytate content of millet (0.27 – 0.10 mg/100g) flours were reduced by fermentation and germination when compared with the control (0.270.10 mg/100g). Besides 72 hours germinated millet that had comparable phytate value with the control (0.270.10 mg/100g) all others had lower phytate value except the 96 hours germinated millet that had slightly higher phytate than the control (0.36 mg/100g). The enzymatic hydrolysis of phytic acid by phytase during fermentation and germination processes was responsible for the reduced phytate in both flour samples. This observation was similar to Lorenze [24]. Fermentation drastically reduced tannin in the fermented flours (0.16 – 0.02mg) when compared with the control (12.17 – 0.17mg). Fermentation and germination therefore are good method to make micronutrients especially minerals that phytate and tannin antagonizes more bioavailable for utilization.

Conclusion

Fermentation and germination are simple food processing methods capable of reducing the antinutrients levels in food plants. They make nutrients more available for utilization. Fermented and germinated millet flours are safe and could be used as suitable substitute/complement to the maize complementary food (pap) in Nigeria.

REFERENCES

[1]. McDonough, C.M., Rooney, L.W.,& Serna-Saldivar, S.O. (2000). "The Millets". Food Science and Technology: Handbook of Cereal Science and Technology (CRC Press). 99 2nd ed: 177–210

[2]. WHO (1998). Complementary feeding of young children in developing countries, a review of current scientific knowledge. Geneva, WHO; Pp. 137 – 140.

[3]. AOAC (2000). Official Methods of Analysis, Association of Official Analytical Chemists, Washington DC.

[4]. AOAC (1995). Official Methods of Analysis, Association of Official Analytical Chemists, Washington DC.

[5]. James S.C (1995). Analytical Chemistry of Foods. Chapman and Hill Printers, London. Pp. 173.

[6]. Udoh J.E and Gunwale J.A. (1986): Laboratory manual for the analysis of soil plant and water samples, University Press, London. Pp. 260 – 267.

[7]. Latta, M & Eskin, M (1980). A simple and rapid colorimetric method for phytate determination J. Agric, Fd, Chern 29:1315 – 1317.

[8]. Price, M.L& Buttler L.G (1980). Rapid visual estimation and spectrophotometer determination of tannin content of sorghum grain. J. Agric. Fe. Chern. 25: 1268 -1270.

[9]. Frazier W.C and Westhoff D.C (1978). Food Microbiology. MCGraw Hill Pub. Co. Ltd., New York.

[10]. Fox B.A & Cameron A.G (2007). Food Science, Nutrition and Health, 7th Edition, Gutenbery Press Ltd, London, Pp. 106.

[11]. Hamad A.M & Fields M.L (1979). Evaluation of Protein Quality and Available Lysine of Germinated and Fermented Cereals. Journal of Food Science, 44:456 –459.

[12]. Akobundu E.N.J &Hoskin F.H (1987). Potential of Corn-Cowpea Mixture for Infant Food. J. SSC. Food. Agric. 1:111 – 114.

[13]. Eka O.U (1980). Effect of fermentation on the nutrient status of locus beans. Food Chem.,5; 308.

[14]. Anosike E.O and Egwuatu C.K (1981). Bio-Chemical changes during the fermentation of castor oil (Ricinus communis) seeds for use as a seasoning agent. Plant Food. Hum. Nutr. 30:181 – 185.

[15]. Obiakor P.N. (2001). Nutritional and Organaloptic Evaluation of Fermented Baobob, Rice, Maize flours and their products. M.Sc. Thesis, Dept. of Home Science and Nutrition, University of Nigeria Nsukka.

[16]. Nnam N.M (1999). Chemical and Organoleptic Evaluation of Complementary Foods Formulated from Maize, Cowpea and Plantain Flours. Nig. J. of Nutr. Sci. pp. 55 – 60.

[17]. FAO/WHO (1995). Assessment and research report of Joint FAO/WHO workshop on fermentation as a household technology to improve food safety in collaboration with the Department of Health, Public, Republic of South Africa, Pretoria, 11 – 15th Dec., 1995.

[18]. FAO (1989). Utilization of Tropical Foods: Cereals. FAO Food and Nutrition Paper, 47/1, Rome, Italy.

[19]. Rao D.S & Deosthale Y.G (1993). Mineral composition iron and soluble zinc in malted grains of pearl millet and Ragi. Food Chemistry 11:217 – 230.

[20]. Obizoba I.C &Egbuna H.T. (1992). Effect of germination and fermentation on the nutritional quality of Bambara nut (Vaandonia subterranean) and its products.Plant Food. Hum. Nutr. 42:13 – 23.

[21]. Obiakor- Okeke, P. N.(2014). Comparative Evaluation of Chemical and Functional Properties of Some Lima Bean Varieties (Phaseolus Lunatus) Consumed in Arondizuogu, Imo state, Nigeria Journal of Food and Nutrition Sciences. 2;(4); 168-172.

[22]. Obizoba I.C &Atti J.V (1991): Effect of Soaking, Sprouting, Fermentation and Cooking on the Nutrient Composition and some Anti-Nutrient Factors of Sorghum (Guinesia) Seeds Plant Food. Hum. Nutr. 41:203 – 211.

[23]. Manay N.S & Sharaswanny M.S (2008): Food Facts and Principles, New Age Intl. Ltd., New Delhi, India.

[24]. Lorrenz W.S (1993): Nutritional and Microbiological Evaluation of Fermented Weaning Foods, Chalmers Bibiliokets Repro. Service, Gentebory, Sweden.

NUTRIENT COMPOSITION AND SENSORY PROPERTIES OF FOOD PRODUCTS (MOI-MOI AND AKARA BALLS) BASED ON FERMENTED LIMA BEAN (*PHASEOLUS LUNATUS*)AND MAIZE (*ZEA MAYS)* FLOUR BLENDS

BY

OBIAKOR-OKEKE, P.N. AND NWOKOCHA, M.O.

Department of Nutrition and Dietetics
Imo State University, Owerri
Department of Nutrition Dietetics
Imo State Polytechnic, Umuagwo

ABSTRACT

Objective: This study evaluated the nutrient composition and sensory properties of moi-moi and akara balls made from fermented lima bean and maize flour blends.

Materials and methods: Two varieties of lima bean seeds (black and dark red) and maize (yellow variety) used for the study were purchased from a local market in Arondizuogu, Imo State Nigeria. The seeds were fermented and processed into fine flours. The fermented flours were used to formulate composite which was used for the moi-moi and akara preparation. The moi-moi and akara were prepared using standard recipe and analysed for nutrient composition using the standard methods and the sensory properties of the product evaluated using a nine point hedonic scale. Data was analysed using Statistical Package for Social Sciences (SPSS) version 15 for means and standard deviation.

Results: Results of the proximate composition of the products showed that the protein contents of moi-moi and akara based on fermented flour blends were much higher than those of unfermented composites (30.47, 29.15 vs 28.41% and 31.45, 27.89 vs 25.67% respectively). There is also a slight increase in fat content of products from fermented flour blends as against the control (1.55 vs 1.24%). The moi-moi and akara made from fermented black lima bean and maize four blends for 48 and 72h periods had higher carbohydrate values when compared with their control (34.90, 38.69 vs 34.85% and 41.42, 57.17 vs 33.74%). There were significant increase in the calcium content of all the moi-moi and akara made from the fermented flour blends. The black lima bean fermented for 48h had the highest calcium (122.24 and 117.57mg). The potassium, phosphorus and iron content of the products were increased as a result of fermentation, relative to the control (2.66.80 and 337.63 vs 165.96mg and 286.80 vs 265.13mg respectively). Fermentation improves the bioavailability of minerals such as iron and zinc as a result of phytic acid hydrolysis. Fermentation improved the organoleptic properties of the products. The colour scores (7.40 and 7.00) for the moi-moi based on 48 and 72h fermented black lima bean and 48h fermented maize. The flavour of the products followed the same trends as the colour (7.07, 7.03, 6.50 and 5.60 vs 6.56, 5.37, 4.70 and 5.60 respectively). There were also increase in both texture and general acceptability of the products from 48h fermented flour blends. Based on the results of this study, the moi-moi and akara balls from fermented lima bean and maize flour blends have good nutrient profile as well as improved organoleptic attributes.

Keywords: Lima bean, maize, flour, fermentation, moi-moi, akara, nutrient and sensory properties

INTRODUCTION

Lima bean is one of the under exploited food crops with nutritional and food industry processing potentials. It is among the lesser known legumes in the southern part of Nigeria. Lima bean is an important food though of limited local interest in Nigeria, because many people are not aware of its nutrient potentials and utilization methods (1). However, it could easily be utilized in many food preparations. It is a good source of B-complex vitamins, protein, fibre, iron, zinc, potassium and magnesium.Lima bean contains the phytochemicals, coumestrol and saponins compounds that may impart anticancer benefits (2). Maize is one of the predominant staples in Nigeria. It is prepared and consumed in various forms. It represents 19% of the world's food calories (3).

Materials and Methods

Two varieties of lima bean (black and dark red) were used for the study. About three kilogramme of each lima bean variety as well as maize (yellow variety) were purchased from a local market in Arondizuogu, Imo State Nigeria.

Processing of Fermented Lima Bean and Maize Flours

Lima Bean

Four kilograms (4kg) of each lima bean variety were cleaned and divided into four portions. One portion which served as the control, was washed, dried, dehulled and milled into fine flour. The flour was kept in an air tight container until analyzed. The remaining three portions were subjected to different fermentation periods. The seeds were soaked separately in cold water in a ratio of 1:3(W/V) and allowed to ferment by the microflora inherent in them for 24, 48,and 73hour at 28± 2^{o}C. The fermented seeds were separately dried in an air oven (model No 320, Gallenkamp, England) at 55^{0}C to 96% dry matter, dehulled and milled in a laboratory

hammer mill (Model ED-5, Thomas Wiley, England) to fine flour (70mm mesh screen) and stored in air tight container until analyzed.

Maize

Four kilogrammes of maize grain (yellow variety) were cleaned and divided into two equal portions. One portion which served as the control was washed, dried and milled into fine flour (70mm mesh screen). The remaining portion was subjected to 48h fermentation. The maize grains were allowed to ferment by the microflora inherent in them at temperature of 28±2°C. The fermented grains were dried at 55°c in an air oven, hammer milled into fine flour.

Formulation of Composite Flours

The fermented flours from both varieties of lima bean that have high protein content and least antinutrients values especially hydrogen cyanide (HCN) were used together with 48h fermented maize to formulate composite in a ratio of 70:30 (protein basis).

Preparation of Moi-moi and Akara Balls

Moi-moi and Akara balls were produced using the recipe below

Recipe for Moi-moi

Ingredient			Quantity
Composite flour	-	250g	
Meat broth		-	100ml
Cray fish		-	50g
Onions		-	50g
Tartarshi	-	20g	
Vegetable oil		-	25ml
Maggi		-	2cubes
Salt		-	pinch (to taste)
Pepper		-	10g

Method

The fermented composite flours were used to prepare moi-moi. Two hundred and fifty grammes (250g) of four were mixed with warm meat broth in a bowl. Other food ingredients (onions, magi, crayfish, tartarshi, vegetable oil, salt and pepper) were blended into the mixture and stirred thoroughly.

The mixture were dispensed into wrapping foil and steamed for 60 minutes. The moi-moi was kept in a food flask for evaluation.

Recipe for Akara Balls

Ingredients			Quantity
Composite flour	-	150g	
Water		-	50ml
Fresh pepper		-	10g
Onions		-	50g
Salt		-	pinch (to taste)
Vegetable oil or groundnut oil		-	200ml

Method

Akara balls were prepared from the fermented composite flour. One hundred and fifty grammes of flour were mixed with 50ml of water in a bowl and allowed to absorb water. The paste was whipped with mortar and pestle until fluffy. Onions and pepper were added and salt to taste. The paste were moulded into small balls and fried in a hot oil at a temperature of 60°C until golden brown in colour. The akara balls were removed from the oil and put in a colander to drain the excess oil and stored in a food flask for evaluation.

Sensory Evaluation

The organoleptic attributes (colour, texture, flavour and general acceptability) of the products were evaluated using a nine-point hedonic scale. Thirty subjects were selected from staff and students of nutrition and dietetics department, Imo State University on the basis that they had participated in sensory evaluation of food products. Each was given a glass of water to rinse their mouth before tasting each product.

Chemical Analysis

The proximate composition of both moi-moi and akara were analyzed using standard methods of AOAC (4). The microkjeldahl method was used for the estimation of protein. Ash was estimated by weighing 1g of each sample into a tarred porcelain crucible. It was incinerated at 600°C for 6hr in an ashing muffle furnace until ash was obtained. Lipid was estimated by exhausting extracting a known weight of sample with petroleum ether (B.pt 40-60°C) using tecator soxhlet apparatus. Moisture was determined using hot air oven method (5) and carbohydrate content was obtained by difference.

The mineral content of the samples were estimated by the method of Ranjiham and Gopal (6), after wet digestion with concentrated nitric and perchloric acids. The minerals calcium (Ca), magnesium (mg), potassium (K) and Iron (Fe) were determined by atomic absorption spectrophotometer (Model 3030 perkin Elmer, Norwalk, USA). Phosphorus (P) was determined calorimetrically with spectrophotometer using phosphor-vana domolybdate method. All analyses were done in triplicates.

Statistical Analysis

Means and standard deviation were calculated for all the samples. One way analysis of variance (ANOVA) and Duncan's new multiple range test were used to separate and compare differences between means (7).

Results

Results of the proximate composition of the products (moi-moi and akara) were shown in table 1. The moi-moi from both black and dark red lima bean and maize flour blends had higher moisture values (17.31 to 19.72%) when compared with akara (11.24 to 16.14%). The protein contents of moi-moi and akara based on fermented flour blends were much higher than those of unfermented composites (30.47, 29.15 vs 28.41% and 31.45, 27.89 vs 25.67% respectively). The fat values for moi-moi and akara regardless of the variety of lima bean had slight increases in some of the blends when compared with their controls. Moi-moi based on black lima bean and maize flour blend fermented for 48h had higher fat as against the control (1.55 vs 1.24%). There was also a slight increase in fat of akara made from 48h fermented black lima bean and maize ($PNO\text{-}B_{48}M_{48}$) as compared with the control (1.62 vs 1.46%). However, there were decrease in the fat content of moi-moi and akara from fermented dark red lima bean and maize flour blends relative to the control (1.19 and 1.52% vs 1.73%). The MEO (FD_{48} M_{48}) blend had the least fat

1.19% on the other hand the SCC (FD_{72} M_{48}) had 0.05% decrease in fat when compared with the control (1.21 vs with their control is attributed to fermentation. Fermentation improves the bioavailability of minerals such as iron and zinc as a result of phytic acid hydrolysis.

The high value for colour of moi-moi and akara based on the 48h fermented black and dark red lima bean and maize against their controls might be associated with improved colour due to fermentation. Chikwendu (13) observed that processing, especially fermentation enhanced the colour of moi-moi based on ground bean. The colour scores (7.40 and 7.00 for the moi-moi based on 48 and 72h fermented black lima bean and 48h fermented maize were in agreement withthe report of Onuoha (14).

The decreases in colour of moi-moi and akara based on the 72h fermented black and dark red lima bean and the 48h fermented maize as against the 48h fermented products (7.00, 5.90, 5.47 and 5.0 vs 7.40, 7.10, 6.87 and 6.23 respectively) indicated that fermentation of the two varieties of lima bean beyond 48h decreased colour. Regardless of decreases in colour the values were more than one half of the nine point hedonic scale.

The flavour of the products (moi-moi and akara) followed the same trend as the colour. The flavour of the products based on the 48h fermented lima bean and maize flour blend increased and those based on the 72h fermented flour decreased (7.07. 7.03. 6.50 and 5.60 vs 6.56. 5.37. 4.70 and 5.60 respectively) as against the 48h fermented flour and their controls. It is known that fermentation especially the 48h period improved the organoleptic attributes as well as the nutritional quality of plant foods (15, 16, 17).

There were increases in both texture and general acceptability of the two products based on the 48h fermented flours as against their controls.

CONCLUSION

Lima bean is one of the legumes that have been neglected in recent times due to difficulties in its production, processing, preparation and utilization. It is now clear that lima bean could substantially improve the nutritional needs of a population, especially the low income groups. The result of this study showed that moi-moi and akara based on fermented lima bean and maize flour blends had high nutrient profile and desirable organoleptic attributes and can contribute immensely in the fight against malnutrition, since moi-moi and akara are popularly consumed.

RECOMMENDATION

- There is urgent need to increase awareness of lima bean and its nutrients potentials.
- Adequate processing of lima bean should be encouraged as it would widen the food use.
- Promotion of lima bean cultivation and consumption to help increase household food security and eradicate malnutrition.

REFERENCES

1. Obiakor P.N. (2009). Effects of processing techniques on chemical, functional and microbial properties of two varieties of lima bean (*Phaseolus lunatus)* and maize (*Zea mays)* flours and sensory properties of their products. Ph.D Thesis, Dept. of Home Science and Nutrition University of Nigeria, Nsukka.

2. Kee, E., Glancey, J and Wotten, T. (1997) The lima bean: A vegetable crop for processing Hort. Tech.

Table 1: Proximate composition of products (moi -moi and akara) made from black and dark red lima bean varieties and maize flours (%)

Sample	Moisture	Protein	Fat	Ash	Fibre	CHO
JNO (UFBM)	[illegible]	28.41±0.55	1.24±0.04	6.62±0.02	9.25±0.02	34.85±0.11
AOO ($FB_{48}M_{48}$)	18.83±0.09	30.47±0.22	1.55±0.55	4.97±0.04	9.28±0.02	34.90±0.11
MCO ($FB_{72}M_{48}$)	17.31±0.06	29.15±0.22	1.55±0.55	6.35±0.02	7.95±0.02	38.69±0.12
VNO (UFBM)	14.42±0.04	25.67±0.11	1.46±0.03	5.46±0.02	9.25±0.02	33.74±0.10
PNO ($FB_{48}M_{48}$)	12.12±0.03	31.45±0.55	1.62±0.03	4.15±0.02	9.24±0.05	41.42±0.09
VAO ($FB_{72}M_{48}$)	11.24±0.03	27.89±0.23	1.25±0.02	5.55±0.02	6.90±0.02	57.17±0.06
JCO (UFDM)	18.41±0.09	29.39±0.42	1.73±0.01	6.02±0.03	6.24±0.03	38.08±0.12
MEO ($FD_{48}M_{48}$)	19.72±0.09	30.70±0.14	1.19±0.02	5.22±0.02	5.94±0.02	36.43±0.11
AOB ($FB_{72}M_{48}$)	19.36±0.09	30.70±0.14	1.52±0.02	5.00±0.06	8.74±0.04	34.46±0.10
TAC (UFDM)	12.75±0.07	27.06±0.16	1.26±0.07	5.06±0.03	6.90±0.01	47.03±0.09
KCC ($FD_{48}M_{48}$)	13.11±0.07	29.10±0.21	1.28±0.01	511±0.09	6.74±0.02	44.71±0.07
SCC ($FD_{72}M_{48}$)	16.14±0.07	27.35±0.18	1.21±0.03	5.11±0.09	6.39±0.01	33.80±0.11

JNO- Unfermented black lima bean and maize moi-moi
AOO- Moi-moi from black lima bean and maize fermented for 48hours
MCO- Moi-moi from 72h fermented black lima bean and 48h fermented maize
VNO- Unfermented black lima bean and maize akara
PNO- Akara from black lima bean and maize fermented for 48h
VAO- Akara from 72h fermented black lima bean and 48h fermented maize
JCO - Unfermented dark red lima bean and maize moi-moi
MEO- Moi-moi from 48h fermented dark red lima beam and maize
AOB- Moi-moi from 72h fermented dark red lima bean and 48h fermented maize
TAC - Unfermented dark red lima and maize akara
KCC- Akara from 48h fermented dark red lima bean and maize
SCC - Akara from 72h fermented dark red lima bean and 48h fermented maize

Table 2: Mineral composition of products (moi-moi and akara) made from unprocessed and processed black and dark red lima bean varieties and maize composite flours (mg/100g)

Sample	Calcium (Ca)	Magnesium (Mg)	Potassium (K)	Phosphorus (P)	Iron (Fe)
JNO (UFBM)	89.51±4.62	13.54±0.00	258.20±2.80	209.47±1.62	11.87±0.20
AOO ($FB_{48}M_{48}$)	122.27±2.01	16.19±0.20	362.20±1.64	265.13±1.10	27.57±0.75
MCO ($FB_{72}M_{48}$)	117.57±2.32	13.44±0.02	310.02±1.75	286.80±1.39	19.43±1.62
VNO (UFBM)	89.51±2.31	41.23±0.24	306.27±2.10	244.83±1.19	26.78±0.54
PNO ($FB_{48}M_{48}$)	92.19±6.94	20.34±1.84	426.40±3.30	187.87±1.10	31.05±2.28
VAO ($FB_{72}M_{48}$)	90.85±2.31	13.31±0.28	326.70±7.00	242.63±3.13	19.13±0.83
JCO (UFDM)	88.84±3.06	15.77±0.58	410.80±1.39	165.87±1.62	10.10±0.28
MEO ($FD_{48}M_{48}$)	97.53±4.63	16.88±0.92	287.13±1.27	248.80±1.39	19.50±0.07
AOB ($FB_{72}M_{48}$)	93.52±6.12	16.95±0.08	312.00±6.93	213.83±3.34	12.21±0.03
TAC (UFDM)	86.84±1.16	20.13±1.65	165.93±4.36	214.67±1.15	9.26±0.08
KCC ($FD_{48}M_{48}$)	77.13±0.89	21.97±0.29	266.80±1.38	134.43±7.22	13.01±0.17
SCC ($FD_{72}M_{48}$)	57.46±2.30	13.48±0.03	337.63±8.50	124.43±2.27	11.70±0.02

Mean ±SD of three replications.

JNO - Unfermented black lima bean and maize moi-moi
AOO - Moi-moi from black lima bean and maize fermented for 48hours
MCO - Moi-moi from 72h fermented black lima bean and 48h fermented maize
VNO - Unfermented black lima bean and maize akara
PNO - Akara from black lima bean and maize fermented for 48h
VAO - Akara from 72h fermented black lima bean and 48h fermented maize
JCO - Unfermented dark red lima bean and maize moi-moi
MEO - Moi-moi from 48h fermented dark red lima beam and maize
AOB - Moi-moi from 72h fermented dark red lima bean and 48h fermented maize
TAC - Unfermented dark red lima and maize akara
KCC - Akara from 48h fermented dark red lima bean and maize
SCC - Akara from 72h fermented dark red lima bean and 48h fermented maize

Table 3: Sensory properties of products (moi-moi and akara) made from unprocessed and processed lima bean (black and dark red varieties) and maize composite flours

Sample	Colour	Flavour	Texture	General Acceptability
JNO (UFBM)	3.77[e]±2.24	3.75 [f]±1.83	3.13 [f]±1.83	2.87 [e]±2.18
AOO ($FB_{48}M_{48}$)	7.40[a]±1.45	7.07 [a]±1.34	6.23 [a]±2.25	6.17 [a]±2.04
MCO ($FB_{72}M_{48}$)	7.00 [a]±2.31	6.56 [b]±1.36	6.94 [a]±2.05	5.81 [b]±2.29
VNO (UFBM)	4.77 [d]±2.06	4.13 [d]±1.98	3.67 [d]±2.12	4.03 [c]±2.20
PNO ($FB_{48}M_{48}$)	6.87 [b]±1.89	7.03 [a]±1.27	6.10 [a]±2.11	6.07 [a]±2.08
VAO ($FB_{72}M_{48}$)	5.90 [c]±2.40	5.37 [d]±2.37	5.30 [b]±2.39	5.23 [b]±2.53
JCO (UFDM)	4.07 [d]±2.03	3.87 [e]±1.80	3.57 [d]±1.89	3.93 [d]±1.72
MEO ($FD_{48}M_{48}$)	7.10 [a]±1.21	6.50 [b]±1.68	5.83 [b]±1.90	6.87 [a]±1.14
AOB ($FB_{72}M_{48}$)	5.47 [c]±2.13	4.70 [d]±1.75	4.30 [c]±2.17	4.33 [c]±1.67
TAC (UFDM)	4.80 [d]±2.37	4.57 [d]±2.43	3.70 [e]±2.39	4.07 [c]±2.00
KCC ($FD_{48}M_{48}$)	6.23 [b]±1.50	5.60 [c]±1.54	5.43 [b]±1.74	4.97 [c]±1.75
SCC ($FD_{72}M_{48}$)	5.10 [c]±1.92	5.60 [c]±1.71	4.40 [c]±2.04	4.87 [c]±2.08

Mean ± 0 SD of 3 replications.

MCMS	-	Milled Cooked Maize + Spinach
SCAM	-	Soaked Cooked Cowpea ("AkidiOkpokpo")
SCAO	-	Soaked Cooked Cowpea "AkidiOjii"
SCAOK	-	Soaked Cooked Cowpea "AkidiMkpokoro"
CAMM	-	Cooked Cowpea (AkidiOkpokpo) + Maize
CAOM	-	Cooked Cocwpea (AkidiOjii) + Maize
CAOKM	-	Cooked Cowpea (AkidiMkpokoro) +Maize

EFFECT OF DIFFERENT PROCESSING TECHNIQUES ON THE NUTRIENTS AND ANTI-NUTRIENTS COMPOSITION OF TRIFOLIATE YAM (*DISCOREA DUMENTORIUM) FLOURS*

OBIAKOR-OKEKE P.N, APPOLOS, T AND NWOKOCHA, M.O.

Department of Nutrition and Dietetics
Imo State University, Owerri
Department of Nutrition Dietetics
Imo State Polytechnic, Umuagwo

ABSTRACT
The effects of some processing method (cooking, soaking and fermentation on the nutrient and anti-nutrient composition of trifoliate yam (*Discoreadumentorium)* were investigated. Chemical compositions of the processes flour samples were estimated. Standard assay methods were adopted for analysis of the data. The results revealed that fermentation, cooking and soaking improved the nutrients level of the flours. Specifically, soaking increased the protein and moisture content, while fermentation increased the protein as well as the ash at 72 hours. There were significant increases in the magnesium (Mg), Zinc (Zn) and Phosphorus (P) levels of the soaked and fermented flours. Tannin, phytate, oxalate, oxalate and alkaloid levels were drastically reduced in the processed flours.

Key words: Trifoliate yam, fermentation, soaking, cooking, flour, nutrient, anti-nutrient composition.

INTRODUCTION

Trifoliate yam is one of the under exploited food crop with nutritional potentials. It is a lesser known tuber in the Northern part of Nigeria. Recently, the food crop is one of the traditional staples been neglected in the Eastern part of Nigeria. However, the neglect is attributed to difficulties in cultivation, storage, preparation, utilization and negative image attached to it as "poor people's food". Trifoliate yam has bitter taste, longer cooking time and superstitious beliefs/taboo associated to it as compared with other yam species (1). This bitter taste and superstitious belief phenomenon is a particular drawback for its cultivation, consumption and food use.
Trifoliate yam belongs to Discoreacea family. It is an indigenous African yam as it originates in West Africa (2). It is easily distinguished from all other yam by its compound hairy leaves consisting of three leaflet, where it got the name "trifoliate or three leaves yam (3). The tubers usually appear in clusters and may be white, yellow or pale yellow in colour when peeled. There are different varieties of trifoliate yam, some variety have round smooth skin, while some have rough and cracked skin.

Trifoliate yam is rich in B-vitamins, crude protein, than other yam varieties and relatively high in ash which is concentrated in the peels (4-5). Trifoliate yam like other plant foods contains a wide range of toxic components and anti-nutrients (alkaloid, oxalates, phytate, tannin etc,) and cannot be consumed without adequate processing, as these affect digestibility and food value (6). Fermentation, cooking and soaking are among processing methods that hold promise for improving the quality of local staples. They improve digestibility, increase nutrient density, and reduce bulk and levels of anti-nutrients (7-9).

This study was aimed at investigating the effect of fermentation, cooking and soaking on the nutrient and anti-nutrient composition of trifoliate yam flours.

MATERIALS AND METHODS

The trifoliate yams were purchased from Ohaji Local Market, Imo state.

Processing of flour samples

Twelve tubers of trifoliate yam were thoroughly cleaned and the skin peeled off with a kitchen. They were washed with water, sliced into smaller pieces and divided into four portions. The first portion was not subjected to any treatment. It served as the control. It was dried in a hot oven at 60^{o}C and milled into fine flour (70 mesh screen).

The second portion was soaked in tap water in a ratio of 1:3 (w/v) for 3, 6, and 9 hours respectively. The soaked yam pieces were drained, dried (60^{o}C) and milled separately into fine flour.

The third portion was subjected to three fermentation periods 24, 48, and 72 hours, after each fermentation period, the yams were drained, dried (60^{o}C) and milled into fine flour, while the last portion was boiled until soft for human consumption. They were dried, milled into fine flour and kept separately in air tight containers until analysed.

Laboratory analysis

Proximate composition of the flour samples were analysed according to the standard procedures of A.O.A.C (10). All analysis was performed in triplicate. The all nitrogen (N) content was estimate by the analysis micro-kjeldhal method and crude protein content calculated as N x 6.25, while carbohydrate was obtained by simple difference.

The mineral contents of the flour samples, were estimated by the method described by Ranijiham and Gopal (11), after wet digestion with concentrated nitric and perchloric acids.
Tannin was determined by the modified vanillin HCL method of Price and Buttler (12) while phytate was estimated by a

photometric method adapted from the method of Latta and Eskin (13).

3. Eka, O.U. (1998). Roots and tubers, in nutritional quality of plant foods, Post-Harvest Research Unit University of Benin, Nigeria pp1-30
4. Eka, O.U. (1985). The chemical composition of yam tubers, IN: Advances in yam research, the biochemistry and technology of yam tubers Vol 1. Biochemical Society of Nigeria pp51-57.
5. Onwueme I.C. (1978). The Tropical Tuber Crops; Yams, Cassava, Sweet potatoes and Cocoyams, Chichester, John Wiley and Son Pp 234.
6. Onwueme, I.C. Yam; In Physiology of tropical field crops John Wiley and Sons Pp 569-588.
7. Nnam, N.M (1994). Evaluation of nutritional quality of fermented cowpea flours. Ecology of Food and Nutrition vol. 33 pp 273-279.
8. Obizoba I.C and Amaechi N.N, (1992). The effect of processing methods on the chemical composition baobab pulp and seed. Ecology of Food and Nutrition 29:199-205.
9. Tomkin A, Aliwick D, and Haggerty P., (1987). Fermented Food for improving Young Child Feeding in eastern and Southern Africa. Proceeding of a Workshop on Household level Food Technology. Nairobi Kenya 12-16.
10. A.O.A.C (1995). Official Methods of Analysis Washington DC. Association of Official Analytical Chemists.
11. Ranijiham S.K and gopal, K (1980). Wet chemical digestion of biological materials for mineral analysis in laboratory manual for nutrition research. Vikaspubhouse PVT. Ltd New Delhi Pp 83.
12. Price M.L, and Butter, L.G (1980). Chemical Treatment of Food fed and its effect on tannin. J. Agric Food. Chem. 28 459-62.
13. Latta M and Eskin (1980). A Simple and Rapid Calorimetric Method for phytate Determination. J. Agric Food chem. 29:1315-17.
14. Bassir O. (1969). Toxic Substances in Foods W.A. Journal of Biological and Applied Chemistry 13(1) 3-6.
15. FAO (1989). Utilization of Tropical Foods: Roots and tubers. FAO Nutrition Paper 47/2 Pg 29-31.
16. Steel R.G.D and Torrie J.H. (1960). Principles and procedures of Statistics. McGraw Hill Comp. Inc. New York.
17. Frazier, W.C. and D.C Westhoff. (1978). Food microbiology. MC Graw Hill Comp. Inc. New York.
18. Bradbury, J.H and Singh, U (1986). Ascorbic Acid and dehydroascorbic acid content of tropical root crops from the South Pacific J. Fd. Sci. 51 975-978.
19. Junek J, and Sistrunk, T. (1978). Sweet potatoes high in vitamin content but vitamin content affected by variety and cooking methods, Kana farm research 27:7.
20. Bell, A. (1984). Mineral content of yam tubers, raw, boiled and flour in "Tropical of Cops, production and uses in Africa IDRC – 211 Ottawa Pp 157-160.
21. Bradbury, J.H and Holloway, W. D (1986). Chemistry of tropical root crops; significance for nutrition and agriculture in the pacific ACIAR Monograph No. 6 Pp. 2001.
22. Nnabuchi F.C. (1983). The chemical and micro biological evaluation of fermented sorghum, maize

pigeon pea and groundnut. M.Sc Thesis University of Nigeria, Nsukka.

Table 1: The proximate composition of cooked, soaked and fermented trifoliate yam flour (% Dry weight)

Sample	Moisture	Protein	Fibre	Ash	Fat	CHO
RTY		5.47±0.05	1.05±0.02	3.04±0.04	0.57±0.00	79.63±0.06
CTY	15.45±0.03	2.77±0.02	0.87±0.01	2.92±0.02	0.54±0.00	77.46±0.06
STY 3	14.29±0.03	7.62±0.02	1.06±0.02	2.87±0.01	0.54±0.00	73.62±0.06
STY 6	16.56±0.05	8.34±0.06	0.98±0.01	2.99±0.02	0.47±0.01	70.66±0.02
STY 9	16.82±0.05	8.62±0.06	0.97±0.01	2.86±0.01	0.56±0.01	70.17±0.06
FTY 24	10.21±0.01	6.76±0.02	1.04±0.02	2.90±0.02	0.51±0.01	78.58±0.02
FTY 48	9.45±0.02	6.91±0.02	1.07±0.02	2.96±0.02	0.53±0.01	79.08±0.04
FTY 72	9.47±0.02	6.83±0.02	0.96±0.06	3.17±0.06	0.57±0.01	79.00±0.04

MEANS + SD Three Determinations
RTY: Raw Trifoliate Yam
CTY: Cooked Trifoliate Yam
STY: Soaked Trifoliate Yam
FTY: Fermented Trifoliate Yam
· The subscripts denote the soaking hours and fermentation periods.

Table 3: The Anti-nutrient composition of processed and unprocessed trifoliate yam flour (%)

Sample	Phytate	Oxalate	Alkaloid	Tannin
RTY	1.27±0.02	386.17±0.08	0.75±0.02	0.91±0.02
CTY	0.36±0.00	178.25±0.02	0.17±0.00	0.24±0.00
STY 3	0.48±0.01	194.26±0.03	0.26±0.01	0.45±0.01
STY 6	0.44±0.01	186.61±0.03	0.24±0.01	0.43±0.01
STY 9	0.44±0.01	181.68±0.03	0.24±0.01	0.41±0.01
FTY 24	0.71±0.03	257.17±0.06	0.47±0.02	0.63±0.02
FTY 48	0.67±0.03	260.45±0.06	0.42±0.02	0.62±0.02
FTY 72	0.62±0.03	227.48±0.06	0.39±0.01	0.61±0.02

NUTRITION – RELATED BEHAVIOURS AND NUTRITIONAL STATUS OF HIV ADULT PATIENTS ATTENDING FEDERAL MEDICAL CENTER UMUAHIA ABIA STATE NIGERIA

*Nzeagwu OC[1], Uwaegbute AC[2], Iheme GO[3]
[1,2,3] Department of Human Nutrition and Dietetics
Michael Okpara University of Agriculture Umudike
PMB 7267 Umuahia, Abia state. Nigeria
Author for correspondence: ogechinzeagwu@gmail.com

ABSTRACT
Background: Better nutrition is an input to and foundation for health and development. Living with a chronic illness like HIV can present certain nutritional challenges.
Objectives: The study considered some nutrition – related behaviours in terms of knowledge, attitude and practice of nutrition and nutritional status of HIV adult patients attending a hospital in Nigeria.

Materials and methods: Ethical approval for the study was received from the Research Ethics Committee of the Federal Medical Center, Umuahia. One hundred and twenty respondents were randomly selected after informed consent to participate in the study was received. Structured questionnaire was used to determine their nutrition knowledge, attitude and practice. Anthropometric (weight, height, skinfold thickness) and biochemical indices (haemoglobin-Hb and CD4+ count) were determined using standard methods and compared with reference standards. Knowledge of nutrition was scored (0 – 10 as poor, 11 – 22 as fair, 23 – 32 as good); attitude to nutrition had 60points as maximum with 0 – 20 poor, 21 – 40 fair, 41 – 60 good; nutrition practice based on dietary practices was scored with 144 as maximum i.e. 0 – 40 poor, 41 – 100 fair, 101- 144 good. All statistical analysis was done with SPSS version 18. Correlation was used to determine relationship between variables.
Results: The result revealed that many (65%) had fair nutritional knowledge, half had fair attitude to nutrition while 49.2% had good attitude. About 56.7% had good nutritional practice and none had poor practice. Half (50.8%) had normal BMI, 12.5% were underweight and 36.7% were either overweight or obese. Using triceps skinfold measurements 60% were normal, 20% were underweight and overweight/obese respectively. More than half (58.3%) had normal Hb status, 30.8% had low Hb and 10.8% were anaemic. Some (42.5%) had low CD4+ count while 57.5% had normal levels. Significant relationship ($p < 0.05$) existed between knowledge and practice of nutrition ($r = 0.185$). BMI correlated significantly ($p < 0.01$, $r = 0.552$) with skinfold and with CD4+ ($r = 0.300$). Triceps skinfold also correlated significantly ($p < 0.01$) with CD4+ count ($r = 0.288$).

Conclusion: The positive relationship between knowledge and practice of nutrition shows that good knowledge about nutrition fosters better nutrition practices. Most of the respondents had good nutritional status, an indication that good nutrition-related behaviours which were probably acquired through dietary counseling which was part of their therapy could have enhanced nutritional status even among HIV patients.
Keywords: nutrition, behaviours, HIV, nutritional, status

INTRODUCTION:

HIV (Human Immunodeficiency Virus) is a lentivirus (literally meaning slow virus) that slowly attacks and destroys the immune system-the body's defense against infection, leaving an individual vulnerable to a variety of other infections and certain malignancies (1). The HIV/AIDS epidemic has had a devastating impact on health, nutrition, food security and overall socio-economic development in countries that have been greatly affected by the disease (2; 3). Studies have found that people living with HIV/AIDS (PLWHA) who have a healthy diet and good nutritional status can better tolerate HIV drugs, maintain weight and muscle mass more easily and feel better overall (4). On the other hand, malnutrition and its complication have been largely found to render HIV infected persons susceptible to opportunistic infections and reduce effectiveness and tolerance to medication and other therapies (5). Food insecurity and poverty have basically shown rippling effects on the feeding practices of HIV patients and the entire community at large (3). Food insecurity can encourage behaviours that increase risk for exposure and transmission of HIV, affect treatment, adherence and effectiveness and diminish the progress of programmes to improve health, economic status and other development efforts (3). HIV/AIDS in turn, significantly undermine a household's ability to provide for basic needs. Livelihoods are diminished when HIV infected adults cannot work and food production earnings decrease (6). Food-insecure households frequently struggle to meet ordinary household needs with the added stress of HIV. Their capacity to absorb the cost associated with HIV related illness and providing enhanced nutritional support makes it difficult to imbibe an impressive attitude towards nutrition with reference to its optimum knowledge.

Living with a chronic illness like HIV can present certain nutritional challenges. Without effective medication and treatment, replicating virus can tax the body, destroying lean body mass and impairing immune function and quality of life (7; 8). While this destruction of lean body tissue can be controlled by effective HIV antiretroviral combination therapy, other challenges like fat accumulation and increase in lipids and insulin resistance may arise in some patients after treatment (9).

Stigma also poses a major threat for all HIV/AIDS victims. The dread of ostracism can delay detection and effort to access needed services (10). Stigma and discrimination against PLWHA compound the negative effect of HIV/AIDS, thus making management more challenging (10).

Better nutrition means stronger immune systems, less illness, better health and good nutritional status (11). Thus better nutrition is a prime entry point to ending poverty and a milestone to acheiving better quality of life (12). Dietary behaviour including food choices are influenced by numerous environmental and individual factors. Some of the individual factors include socio-economic status and psychosocial factors such as knowledge, belief and perceptions about nutrition and health (13). Food and nutritional knowledge has been demonstrated to have positive effect on the quality of dietary intake (14). Therefore, improvements of nutrition knowledge by exposing an individual to new information, possibly arouse changes in attitude and possibly result in

improvements in dietary behaviour as it has been reported that education and counseling are essential features of

Drab kin's solution in a test tube (1.250 dilution), mixed well and allowed to stand for 10 minutes, the absorbance of the standard was read as grams of hemoglobin per 100ml of blood.

Historical information of the patient was extracted from their personal folders at the medical record department of the hospital. Relevant information obtained was the CD4+ count levels of the respondents which is a blood test used to determine how well the immune system is working in people who have been diagnosed with HIV.

Data analysis: Knowledge of nutrition: Each of the correctly answered knowledge question was scored 2. A composite score was calculated for each patient. The scores were divided into 3 as follows: 0-10 is poor knowledge; 11-22 is fair knowledge and 23-32 is good knowledge.

Attitude of nutrition questionnaire contained 20 questions. The options were provided in degrees/extent with a score of 3 assigned to a correctly ticked variable, score 2 for a 'do not know' response and score 1 assigned to the wrong variable. A composite score was calculated for each patient. The scores were divided into 3 as follows: 0-20 is poor attitude; 20-40 is fair attitude and 40-60 indicated good attitude

Thirty-six questions on nutrition practice were based on the respondents day-to-day household activities related to their dietary practices. Score number 4 was assigned to the most probable variable/answer expected to be ticked and score number 1 assigned to the least expected value pertaining to a healthy nutrition practice. A composite score was calculated for each patient. The scores were divided into 3 as follows: 0-40 showed poor practice; 40-100 indicated fair practice and 100-144 showed good nutrition practice.

The Body Mass Index of the respondents was determined, using BMI=Weight/Height (m^2). The respondents were thereafter classified as underweight, normal, overweight or obese using WHO classification (18). Triceps skinfold classification for adults was used to classify the respondents as underweight (males <7mm, females <12mm), normal (males 7-12mm, females 12-20mm) or overweight using their skinfold measurement (18). The respondents' haemoglobin levels were classified as normal, deficient or anaemic (males <11g/100ml, females <10g/100ml) as reported (21). A CD4+ level of > 350 cells/mm^3 shows a greater level of immunity i.e. normal state while 200-350 cells/mm^3 indicates severe state and < 200cells/mm^3 is a critical state (22).

Statistical analysis: Frequency and percentages were computed for the categorized and continuous variables such as knowledge score, attitude score, anthropometric and biochemical measurements. Correlation analysis was used to find the relationship between the variables. Significance was judged at $P \leq 0.05$. All statistical analysis was done using statistical package for social sciences (SPSS) windows version 17.

RESULTS

The result of the socioeconomic parameters of the respondents (Table 1) indicated that most of the respondents were 31-40 years (38.3%) and 41-50 (28.3%). There were more females (61.7%) than males (38.3%). Marital status of the respondents showed that 35.8% were single, 45.8% were married and others were either divorced (6%) or widowed (16%). Respondents' place of residence revealed that 53.3% resided in urban areas while 46.7% lived in rural places. The level of education showed that an insignificant proportion (0.8%) of the respondents had no formal education, only

12.5% had primary education, 47.5% had secondary education while 39.2% had tertiary education. Some of the

treatment of opportunistic infections like diarrhea increases body mass and fat stores (37). Thus increase in body mass and excess fat stores gives the patient a better chance of being normal or overweight when assessed using BMI and triceps skinfold measures. Therefore, most of the respondents in the normal nutritional status may be due to adequate nutrient intake and better nutrition practice of the respondents.

Common causes of low hemoglobin include deficiencies of iron, ascorbic acid, vitamin B_{12} and auto immune destruction of red blood cells (38). However, the chance of developing low hemoglobin status becomes greater with HIV/AIDS. Anaemia is a frequent complication that occurs in 20-80% of HIV-infected persons and is associated with faster disease progression and mortality (39). The normal hemoglobin status reported in more than half of the respondents may indicate the effectiveness of ARV drug in combating HIV progression to AIDS.

Some of the respondents and more than half had low and normal CD4+ count which is a measure of the immune response of an individual. The fewer functioning CD4+ cells, the weaker the immune system and therefore the more vulnerable a person is to opportunistic infections and illnesses (34). Therefore when immune function is impaired, CD4+ count is reduced. Malnutrition compromises immunity while adequate nutrition on the other hand provides support necessary for the immune system to mount a positive immune response (40). A well-nourished person with HIV who has a controlled viral load is more likely to be able to withstand the effects of HIV infection, supporting immune status and possibly delaying the progression of HIV diseases (41; 42). Studies have shown that multi-vitamin and mineral supplementation can slow progression of HIV diseases, which are associated with a 30% reduced risk of progression to AIDS and a 40% reduction in risk of low CD4+ (5). This supplementation is capable of delaying ART initiation which is only commenced when CD4+ count level drops below 350mmcells. Results from this study have shown that patients had better nutrition practice as well as good nutritional status. This might be the reason for the slight similarity with low and normal CD4+ count scores. The use of ARV drugs by respondents in this study may have played a part in the normal CD4+ count of most respondents in this study.

The implication of the relationship that existed between knowledge and practice is that the higher the nutritional knowledge, the better the nutrition practice. Maxists (43) propounded a theory which holds that man's practice alone is the criterion of the truth of his knowledge of the external world. He further stressed that man's knowledge is only verified when he achieves the anticipated result in the form of practice. Dietary behavior is influenced by numerous environmental and individual factors. The individual factors include socio-economic status and psychosocial factors such as knowledge, belief and perception about nutrition (13). Thus improvement of nutritional knowledge results in improvement in nutritional practice (29).

There was a 55.2% relationship between BMI and triceps skinfold at a significant level of 0.01. This implies a strong positive relationship, indicating that an increase in BMI leads to an increase in skinfold. However, the relationship between BMI and triceps skinfold could be due to a recorded majority of females whose BMI tends to be a better predictor of body fat than males (44). The strong positive relationship between BMI showed that as BMI increases, CD4+ also increases. The positive relationship between skinfold and CD4+ shows that as skinfold increases CD4+ count increases as well.

Underweight individuals often do not take enough protein, fat and other nutrients to support a healthy immune system. CD4+ count is a measure of the immune response of an

individual and the fewer functioning CD4+ cells the weaker the immune system. Impaired immunity opens the way for

Table 1 : Socio-economic status of the respondents

Parameters	Frequency	Percent
Place of residence		
Urban	64	53.3
Rural	56	46.7
Total	120	100.0
Sex		
Male	46	38.3
Female	74	61.7
Total	120	100.0
Age		
20-30	20	16.7
31-40	46	38.3
41-50	34	28.3
<50	20	16.7
Total	120	100.0
Marital status		
Single	43	35.8
Married	55	45.8
Divorced	6	5.0
Widowed	16	13.3
Total	120	100.0
Educational level		
No formal education	1	0.8
Primary	15	12.5
Secondary	57	47.5
Tertiary	47	39.2
Total	120	100.0
Occupation		
Farmer	5	4.2
Unemployed	6.0	5.0
Others	11	9.2
Student	17	14.2
Public servant	20	16.7
Civil servant	23	19.2
Trader	38	31.7
TOTAL	120	100
Personal income per month (in thousands)		
No income	15	12.5
>30	61	50.8
31-60	30	25.0
61-90	6	5.0
90-120	3	2.5
121-150	1	.8
>150	4	3.3
Total	120	100.0

Table 2: Knowledge, attitude and practice of nutrition scores of respondents

	Knowledge		Attitude		Practice	
Parameters	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**
Poor	25	20.8	1	0.8	0	0
Fair	78	65.0	60	50.0	42	43.3
Good	17	14.2	59	49.2	68	57.7
Total	**120**	**100**	**120**	**100**	**120**	**100**

Table 3: Health workers' influence on respondents' nutrition knowledge, attitude and practice of nutrition

	Frequency	Percent
Frequency of complimenting their attempts to eat a healthy food		
Often	47	39.1
Sometimes	51	42.5
Rarely	17	14.2
Never	5	4.2
Frequency of making them feel guilty for not eating healthy foods		
Often	19	15.8
Sometimes	53	44.2
Rarely	25	20.8
Never	23	19.2
Frequency of encouraging them to eat fruits		
Often	74	61.7
Sometimes	31	25.8
Rarely	9	7.5
Never	6	5
Frequency of encouraging them to eat vegetables		
Often	79	65.8
Sometimes	32	26.7
Rarely	9	7.5
Never	0	0
Frequency of talking about food and nutrition with them		
Often	74	61.7
Sometimes	32	26.6
Rarely	8	6.7
Never	6	5

Table 4: BMI, Triceps skinfold, heamoglobin, CD4+ parameters of the respondents

Parameters	Frequency	Percentage
BMI (kg/m^2)		
Underweight <18.5	15	12.5
Normal 18.5-24.9	61	50.8
Overweight/obesity 25.0-29.9	44	36.7
Total	**120**	**100**
Triceps skinfold (mm)		
Underweight	23	20.0
Normal	74	60.0
Overweight	23	20.0
Total	**120**	**100**
Heamoglobin (g/dl)		
Anaemic	13	10.8
Low	37	30.8
Normal	70	58.3
Total	**120**	**100**
CD4+ ($cells/mm^3$)		
Low	51	42.5
Normal	69	57.5
Total	**120**	**100**

Table 5: Relationship between nutritional knowledge, attitude and practice questions

Parameters		Knowledge	Attitude	Practice
Knowledge	Pearson Correlation	1	.168	.185*
	Sig. (2-tailed)		.066	.044
	N	120	120	120
Attitude	Pearson Correlation	.168	1	.170
	Sig. (2-tailed)	.066		.064
	N	120	120	120
Practice	Pearson Correlation	.185*	.170	1
	Sig. (2-tailed)	.044	.064	
	N	120	120	120

*. Correlation is significant at the 0.05 level (2-tailed).

Table 6: Relationship between nutrition s tatus assessment parameters (BMI , skinfold, hemoglobin and CD4+ count)

Parameters		BMI	Triceps Skinfold	Haem	Cd4+
BMI	Pearson correlation	1	.552**	.115	.300**
	Sig. (2-tailed)		.000	.209	.001
	N	120	120	120	120
Triceps Skinfold	Pearson correlation	.552**	1	.039	.238**
	Sig. (2-tailed)	.000		.669	.009
	N	120	120	120	120
Haem	Pearson correlation	.115	.039	1	.090
	Sig. (2-tailed)	.209	.669		.329
	N	120	120	120	120
Cd4+	Pearson correlation	.300**	.238**	.090	1
	Sig. (2-tailed)	.001	.009	.329	
	N	120	120	120	120

**. Correlation is significant at the 0.01 level (2-tailed).

REFERENCES

1. Tomislav M. What is lentivirus. http://www.news-medical.net/life_sciences/what-is-lentivirus.aspx. Accessed 8 December 2014.
2. FAO. The impact of HIV/AIDS on food security. Committee on world food security. Twenty seventh report. Rome 2001.
3. Gardner CF, Il C, Campa A. Position of the American Dietetic Association: Nutrition intervention and human immunodeficiency virus infection. J Am Diet Assoc 2010; 110:1106 – 18.
4. Piwoz E, Bonnard P, Castleman T, Cogill B, Elder L, Remancus S, Tanner C. Nutrition and HIV/AIDS: Evidence, gaps and priority actions. Support analysis and research (SARA) project, USAID 2004; 1 – 6.
5. Olayiwo IO, Agbon CO. Assessment of BMI and other socio demographic status of PLWHA in Abeokuta, Nigeria. Nig J Nutr Sci 2010; 31(2):18 - 23.
6. UNAIDS (Joint United Nations Programme on HIV/AIDS). Indices for nutrition assessment through physical examination. Am J Prev Med 1999; 18:597 - 618.
7. Wanke C. Pathogenesis and consequences of HIV-associated wasting. J AIDS 2004; 37:2214.
8. Brad M, Dworkins MD. Dietary intake in patients with AIDS related complex and serologically positive HIV patients. Clin Infect Dis 1990; 33(16):1390 -1412.
9. Shah M, Megabane B, Bivet F. The role of diet, exercise and smoking in dyslipidaemia in HIV-infected patients with lipodystrophy. HIV Med 2005; 6:291-298.

10. Weiner E. Fight against stigma and discrimination for PLWHA. Press Med 2002; 28:2057-2061.
11. USDHS (United States Department of Health and Human Services). Healthy people 2010: Understanding and improving health (2nd ed.) Washington, DC: US Government Printing Office. 2010; 345-349.
12. Basiotis P, Carlson S, Gerrior SA, Juan WY, Lino M. The healthy eating index. Washington, D.C. US department of agriculture. Centre for Nutrition Policy and Promotion 2002; 19-24.
13. Beydoun MA, Wang Y. Do nutrition knowledge and beliefs modify the association of socio-economic factors and diet quality among U.S adults. J Prev Med 2008; 46(2):145-153.
14. Gittelsohn J, Anliker J. Psychosocial determinants of food purchasing and preparation in American Indian households. J Nutr Edu 2006; 38(3):163-168.
15. Akinyemi E, Ibeheem A. Assessment of nutritional status of Queens college students of Lagos State Nigeria. Park J Nutr 2009; 8: 937-938.
16. Khattak MA, Khan A, Khattak MU. Energy and nutrients intake of male and female university students. Park J Nutr 2002; 3:1176-1182.
17. CIA (Central Intelligence Agency) (2011). Worldwide AIDS and HIV statistics 2011; 1-45.
18. WHO. Physical status: The use and interpretation of anthropometry. WHO Technical report series 1995; 854:375 – 409.
19. Todorovic A, Mackay E, Philip S. A guide to malnutrition universal screening tool for adults. Brit Assoc Parent Ent Nutr 2003; 11:452-503.
20. Jochie S, Walker UA, Venhoff N. Hemoglobin estimation by cyanomethaemoglobin; method and procedures. J Antimicrob 2000; 44:18-22.
21. WHO (World Health Organisation). Laboratory grading of hemoglobin in adults and children. http//:www.who.org/heamgrading 1972. Accessed March 15 2013.
22. Moore RD, Keruly JC. CD4+ cell count and commencement of highly active antiretroviral thraphy in persons with sustained virologic suppression. Clin Infect Dis 2007; 3:44.
23. UNAIDS. The Gap report. http://www.unaids.org/sites/default/files/media_asset/UNAIDS Gap_report_en.pdf. 2014.
24. Avert. Women and HIV/AIDS. Global information and advice on HIV and AIDS. http://www.avert.org/professionals/hiv-social-issues/key-affected-pop. 2016. Accessed 08 March 2016.
25. UNAIDS. Global report :UNAIDS report on the global AIDS epidemic 2013. http://wwwunaids.org/sites/default/files/en/media/unaids/contentassets/documents/epidemiology//2013.
26. ADA (American Dietetic Association). Position of the American Dietetic Association: Food insecurity and hunger in the United States. J Am Diet Assoc 2006; 106: 446 – 438.
27. Lin W, Lee YW. Nutrition knowledge, attitudes and dietary restriction behavior of the Taiwanese elderly. Asia Pac J Clin Nutr 2005; 14(3): 221 – 229.
28. Kostanjevec S, Jenman J, Koch V. The influence of nutrition education on the food consumption and nutrition attitude of school children in Slovenia. US-China Education and Review A 11 2012; 953 – 964.
29. Anderson A, Campbell D. Nutrition knowledge, attitude to dietary intake in pregnant compared to non-pregnant women. J Hum Nutr Diet 1993; 6 (4): 335-353.
30. Stulhofer A, Graham C, Bozicevic I, Kufrin K, Ajdukovic D. HIV/AIDS-related knowledge, attitude and sexual behaviours as predictors of condom use among adults in Croatia. International Family Planning Perspectives 2007; 23(2): 58 – 65.
31. McLeod SA. Attitudes and behaviours. Retrieved from www.simplypsychology.org/attitudes.html. 2014.
32. Rusell F. Psychology a tool for shaping positive attitudes. In: principles of psychology; Shwarzer M. (4th ed.) Desailly Publishing Inc. Lisbon. 1979; 345-362.
33. Feunke G, Degraf A. Food choice and fat intake of adolescents and adults; association of intakes within social networks. Prev Med 1998; 27: 645-656.
34. UNAIDS (Joint United Nations Programme on HIV/AIDS). Report on the global aids epidemic; Joint United Nations Programme on HIV/AIDS, Geneva 2008; 154:980-1126.
35. Thielman NM, Guerrant RL. Acute infectious diarrhea . New Eng J Med 2004; 124: 46-89.
36. Jacobson BC. Body mass index and symptoms of gastroesophageal reflux in women. New Eng Med 2006; 354: 2348-2379.
37. USAID. Toolkit: For countries applying for funding of food and nutrition programmes under the global fund to fight AIDS, tuberculosis and malaria (Round 11). Washington DC:FANTA- 2 FHI 2011; 360.
38. Attilis C, Pearson E, Costa M. CD4+ counts and immune regulation; zinc, selenium and protein

function on health maintenance. J Am Med Assoc 2004; 23:22-25.

39. Belperio PS, Rhew DC. Prevalence and outcomes of anemia in individuals with human immunodeficiency virus: a systematic review of the literature. Am J Med. 2004;116 (suppl 7A):27S–43S.
40. Biesel O. Nature of disease progression on immunity; 25 years of HIV. Clin Infect Dis 2000; 34(213):78-101.
41. Fergusson P, Chinkhumba J, Orijalva-Eternod C, Bauda T, Mkangama C, Tomkins A. Nutritional recovery in HIV-infected and HIV-uninfected children with severe acute malnutrition. Arch Dis Child 2009; 94:512 – 516.
42. Thomas AM, Mkandawire SC. The impact of nutrition on physiologic changes in persons who have HIV. Nurs Clin North Am 2006; 41:455 – 468, viii.
43. Maxists. Sociology and the external world: Managing social practices, ken woods publishers, Tokyo 1997; 344-361.
44. Zeng Q, Jackson AE, Stanforth P, Gagnon JC. The effect of age, sex and race on estimating percentage body fat from body mass index. Int J Obes Relat Metab Disord 2003; 6(6):789-796.
45. ADA (American Dietetic Association). Position of the American Dietetic Association: Nutrition intervention and human immunodeficiency virus infection. J Am Diet Assoc 2010; 110(7):1105 – 1119.
46. Mathew C. The acute-phase protein response to infection in edematous and non edematous protein energy malnutrition. Am J Clin Nutr 2006; 135(5):122-147.
47. Keleman L, Ordovas M, Reid C, Smerud K, Morris J. Associations of dietary protein with muscle wasting and diseases in a prospective study with older adults. Am J Epidem 2001; 161: 239-249.

PREVALENCE OF SEVERE PROTEIN-ENERGY MALNUTRITION (0-60 MONTHS) FROM JANUARY 2007 TO DECEMBER 2008 IN THE PAEDIATRIC WARD OF UNIVERSITY OF NIGERIA TEACHING HOSPITAL, ITUKU/OZALA, ENUGU STATE.

DTN. COLLINS PEACE IFEOMA

Department of Nutrition and Dietetics, Federal Medical Centre, Umuahia, Nigeria.
Correspondence to: pastormrspeacecollins65@yahoo.com

ABSTRACT

Background and aims of the study: protein energy malnutrition (PEM) is one of the principal health problems in Nigeria. Protein energy malnutrition has been associated with the period of introducing complementary foods to infant in developing countries such as Nigeria. Childhood malnutrition is prevalent in Nigeria, as in most under-developed countries of the world. The etiology of protein energy malnutrition has been attributed to inadequate protein and energy food intake or unequal food distribution in the family due to ignorance, social taboo, infection, improper hygiene and poverty. The aim of this study was to determine the prevalence of severe protein energy malnutrition 0 - 60 months in the Pediatric Ward of University of Nigeria Teaching Hospital (UNTH), ituku/ozalla, Enugu state and to determine the age bracket mostly affected in other to provide appropriate age related intervention.

Methods: This is a retrospective study; one hundred and fifty-eight (158) children (0-60 months) from January 2007 to December 2008 were selected. 95(60.1%) were male and 63(39.9%) were female. Standard methods were used to determine the age bracket and sex of children mostly affected, which type of PEM and signs and symptoms present the highest prevalence rate of protein energy malnutrition. The data collected were presented as frequency distribution and simple percentage in systematic random sampling.

Results: The results show that prevalence of severe protein energy malnutrition admitted from January 2007 to December 2008 61(38.5%) mostly occurred between 6 to 24 months of age. Results of signs and symptoms shows that fever 116(12.66%), diarrohea 62(6.76%) and vomiting 57(5.99%) were the major condition associated with severe protein energy malnutrition on presentation before admission. The subjects show that ale 95(60.1%) were mostly affected and Marasmus had the highest frequency of 103 (65.1%), followed by kwashiorkor, 32 (20.3%), and then marasmic- kwashiorkor, 23 (14.6%).

Conclusion: The study has shown that the age bracket between 6 to 24 months 61(38.5%) has the highest prevalence rate of admitted cases of severe protein energy malnutrition. This is usually a transitional period and the period of introducing complementary food to infant and this could be linked with the mothers' nutritional knowledge deficit on preparation of adequate complementary foods to meet the child's nutritional needs.

KEY WORD: Protein-Energy Malnutrition, children under 5 years, treatment and prevention.

INTRODUCTION

Globally, protein energy malnutrition continues to be a major health burden in developing countries and the most important risk factor for illnesses and death especially among young children.[1,2] Recent data from the World Health Organization showed that about 60% of all deaths, occurring among children aged less than five years (under-five children) in developing countries, could be attributed to malnutrition. It has been estimated that nearly 50.6 million under-five children are malnourished, and almost 90% of these children are from developing countries.[3] Some risk factors for, or determinants of, P.E.M include area (rural/urban), socioeconomic status, eating habits, ignorance, social taboo, psychosocial deprivation, food availability and infections.[1-2,4-6] Malnutrition is as a direct cause of death in only two percent of infants and under-five mortality.[7] In Nigeria, more than 50 percent of all childhood deaths have under-nutrition as an underlying factor.[8] Malnutrition is a pathological condition brought about by the inadequate or over consumption of one or more of the essential nutrients necessary for survival, growth and reproduction as well as productivity at work.[9]

Anthropometric and morbidity survey in the under five children done in a semi-urban community in Northern Nigeria reported that most of them had protein energy malnutrition , and they were in the range of 12-18 months, which is the traditional weaning age when the protein-rich foods are denied these children for cultural, religious and socio-economic reasons.[10]

Despite marked improvements globally in the prevalence of malnutrition, rates of under- nutrition and stunting have continued to rise in African, where rates of under-nutrition and stunting have risen from 24% to 26%, and 47.3% to 48% respectively.[11,12] The World Health Organization estimates that by the year 2015, the prevalence of malnutrition will have decreased to 17.6% globally with 113.4 million children younger than 5 years affected as measured by low weight for age.[11,12]

The aim of the present study was to determine the prevalence of severe protein energy malnutrition among children admitted in a tertiary health centre in Nigeria for a period of 2 years from January 2007 to December 2008.

SUBJECTS AND METHODS

This is a retrospective study, to determine the prevalence of severe protein-energy malnutrition among under-5 children admitted at the University of Nigeria Teaching Hospital, ituku/ozalla, Enugu state, Nigeria. It is a

referral tertiary health facility which serves mainly the South-East, South-South, and parts of North-Central zones

TABLE 1: AGE DISTRIBUTION OF THE PROTEIN ENERGY MALNUTRITION PATIENTS.

AGE RANGE (MONTH)	NUMBER	PERCENTAGE
0-6	52	32.91
6-24	61	38.62
24-36	16	10.12
36-48	18	11.39
48-60	11	6.96
TOTAL	**158**	**100.00**

Sex distribution of subjects.
Of the 158 patients that were admitted between January 2007 and December 2008, there were 95 males, accounting for 60.1% and 63 females, accounting for 39.9%. This is shown in Table 2 below.

TABLE 2: SEX DISTRIBUTION OF PATIENTS

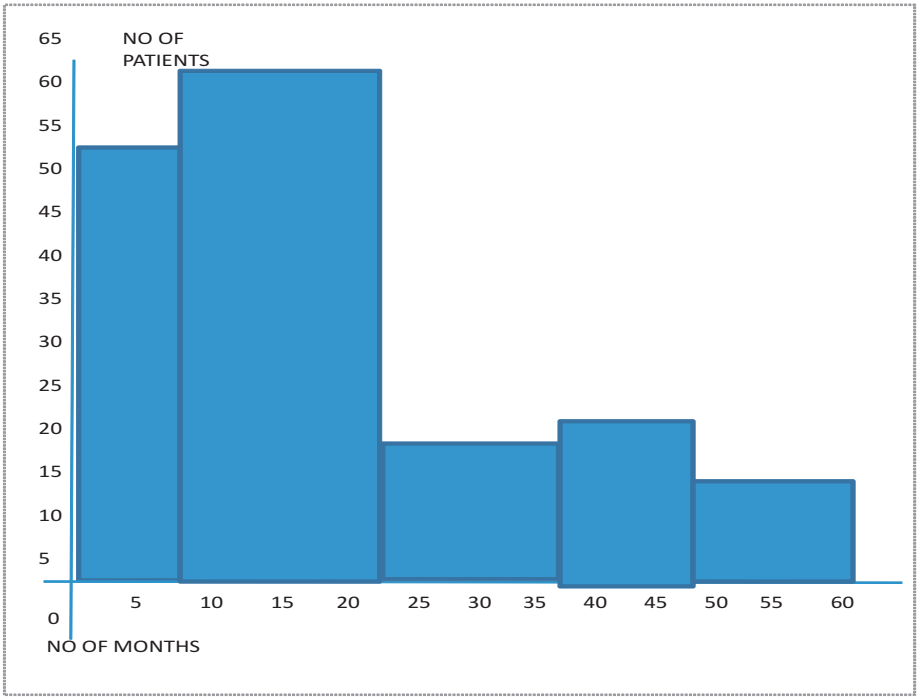
SEX	NUMBER	PERCENTAGE
MALE	95	60.1
FEMALE	63	39.9
TOTAL	**158**	**100.0**

TABLE: 3 THE HIGHEST INCIDENCE MONTH OF SEVERE PR OTEIN ENERGY MALNUTRITION

MONTHS	NUMBER	PERCENTAGE
January 2007	14	8.9
February 2007	9	5.7
March 2007	9	5.7
April 2007	7	4.43
May 2007	5	3.2
June 2007	6	3.8
July 2007	8	5.1
August 2007	6	3.8
September 2007	4	2.53
October 2007	18	11.4
November 2007	5	5.3
December 2007	5	5.3
January 2008	4	2.53
February 2008	2	1.3
March 2008	6	3.8
April 2008	2	1.3
May 2008	6	3.8
June 2008	2	1.3
July 2008	5	3.2
August 2008	4	2.53
September 2008	6	3.8
October 2008	7	4.43
November 2008	12	7.6
December 2008	6	3.8
Total	158	100

From the table, October 2007 has the highest percentage of admitted cases of PEM 18(11.4%)

FIGURE 1: A HISTOGRAM SHOWING THE AGE PREVALENCE OF SEVERE PROTEIN ENERGY MALNUTRITION.



Prevalence of protein-energy malnutrition

Marasmus was responsible for the majority of the cases of protein-energy malnutrition, accounting for 103 cases (65.1%). This is followed by kwashiorkor 32 (20.3%), and marasmic-kwashiorkor which contributed 23 cases (14.6%). This is shown in table 4 below.

TABLE 4: PREVALENCE OF PEM

TYPES OF PEM	NUMBER	(%)
Kwashiorkor	32	20.3
Marasmus	103	65.1
Marasmus-kwashiorkor	23	14.6
TOTAL	**158**	**100**

FIGURE 2: PIE chart showing the prevalence types of protein energy malnutrition.

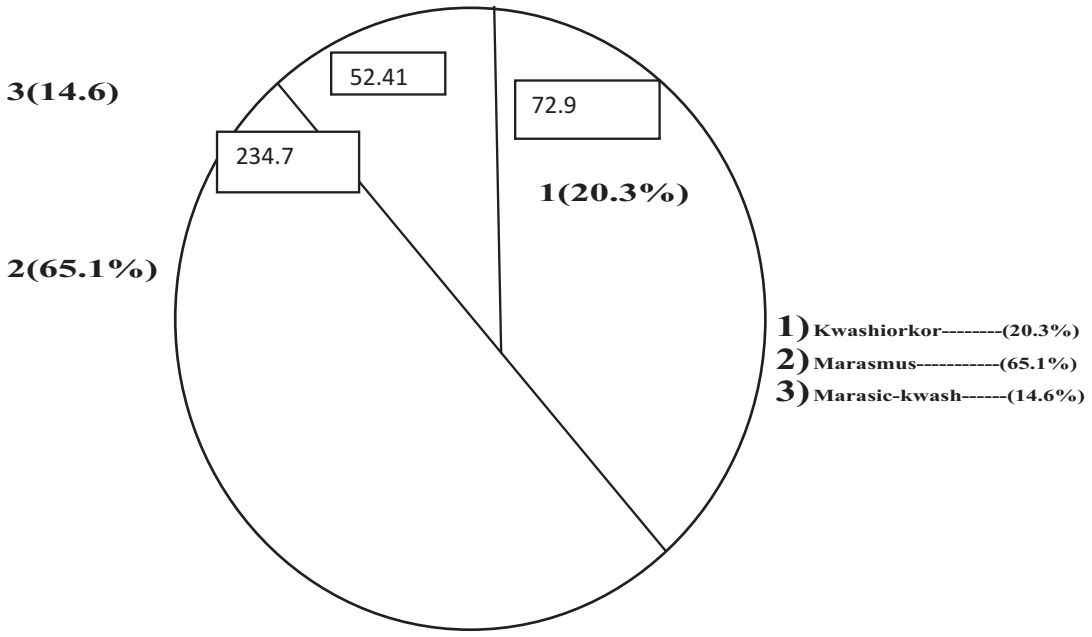


TABLE 5: PRESENT THE SIGNS AND SYMPTOMS ON PRESENTATION

Illness	J07	F07	M07	A07	M07	J07	J07	A07	S07	007	N07	D07	J08	F08	M08	A08	M08	J08	J08	A08	S08	O08	N08	D08	T
Fever	14	9	8	6	3	3	4	5	1	8	3	2	4	1	5	2	6	2	5	4	4	7	10	3	116
Vomit	6	5	2	2	2	2	-	-	1	-	3	1	4	-	3	2	-	-	4	2	2	2	8	3	57
Cough	9	6	1	1	1	3	2	1	2	6	3	2	4	-	3	2	3	2	2	2	3	2	8	3	71
Diarrh	4	4	1	3	3	2	1	2	1	5	2	1	4	-	4	2	2	1	2	2	3	4	6	3	62
Oral-thrush	3	-	1	3	-	1	-	1	-	-	-	1	4	-	1	2	5	-	-	-	2	1	1	-	26
catarrah	6	-	-	1	1	1	1	3	1	4	-	2	3	-	2	2	1	-	-	1	2	1	3	2	37
Loss of app	2	2	-	1	2	3	1	1	2	2	1	2	2	-	2	2	2	2	2	-	4	3	4	2	44
Small-for-age	5	4	3	2	2	2	-	1	1	-	3	2	2	-	4	2	6	2	3	-	3	3	6	2	58
Abdominal- pain	4	2	-	1	1	-	1	-	-	-	-	-	1	-	1	-	1	-	2	-	2	2	7	2	27
Pallor	3	2	2	1	-	-	2	1	-	1	3	2	4	-	3	2	3	-	3	1	2	3	5	2	44
Edema	2	1	-	1	1	1	-	-	-	-	2	2	2	-	2	-	-	-	1	1	2	3	5	1	27
Old face	-	1	-	-	-	-	-	-	-	-	1	1	2	-	1	-	-	-	-	1	2	1	3	-	13
Convulsion	2	2	1	1	1	1	1	1	1	-	1	-	-	-	1	-	-	1	3	1	6	2	6	2	34
Wheezing &breathlessness	3	1	1	-	2	1	-	-	-	-	2	1	-	-	2	-	-	1	2	-	3	2	3	-	24
Skin rashes	2	2	-	-	1	-	2	2	-	2	-	1	2	1	2	2	5	1	2	1	2	3	4	2	39
RVD	3	4	-	3	1	-	5	4	3	17	1	-	-	1	2	2	5	-	-	-	4	1	8	-	54
measles	-	1	1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	4
Loss of conscious	-	1	-	-	-	-	-	-	-	1	1	1	3	-	1	-	-	-	1	-	2	3	2	2	18
Loss of skin turgor	-	1	2	1	-	-	-	-	-	-	1	1	3	-	2	2	2	-	1	-	2	1	1	-	20
Fluffy hair	-	-	1	-	-	-	-	-	-	1	-	1	2	-	2	2	-	-	-	-	1	1	1	-	12
Flabby buttock	-	-	1	-	-	-	-	-	-	1	-	1	2	-	-	-	-	-	-	-	1	1	1	-	8
Dehydration	-	1	-	1	-	2	2	-	1	1	2	1	2	-	1	2	1	-	1	-	4	2	4	1	29
jaundice	-	-	-	-	-	-	1	-	1	2	-	-	-	-	1	-	-	-	1	-	2	1	1	-	10
Any other	9	7	2	5	4	4	3	4	-	3	2	3	4	-	1	-	3	3	8	2	8	4	12	3	81
Total	78	56	27	33	25	26	26	26	15	52	31	28	54	3	46	28	55	15	44	18	66	51	109	33	916

The table 6 above shows that majority of the subjects had fever on presentation 116(12.66%).

DISCUSSION

From the result, males accounted for the majority of the cases of malnutrition, that is, 95 males (60.1%) and 63 females (39.9%).This is in agreement with previous study[14] This may due to the fact that males are more active and playful, and then more likely to put objects which can cause diarrhoea into their mouths.[15] Diarrhoea disease is a known predisposing factor to malnutrition.[15-17]

From the results, the highest prevalence of severe malnutrition occurred in the age range 6-24 months. This finding corresponds with the results of previous studies that malnutrition is more common during the weaning period.[13,14] Weaning period usually starts from 6 months of age. Malnutrition may occur at this period probably because the mothers may not have the knowledge of proper preparation of adequate complementary foods to meet the child's nutritional needs. Acute diarrhoeal disease is also common during this weaning period, which is in agreement with findings from previous studies.[15,16]

From the results above, it was discovered that marasmus had the highest prevalence rate (65.1%), followed by kwashiorkor (20.3%) and marasmic-kwashiorkor (14.6%). The highest prevalence of marasmus disagrees with previous studies.[16-18] The fact that marasmus had a higher prevalence than kwashiorkor in our environment could be explained by the fact that children under age of 12 months are mostly affected by marasmus and are victims of gross malnutrition due to ignorance on the part of their mothers.[19]

From the study, majority of the subject had fever on presentation, accounting for 12.66%. Other clinical conditions such as anemia, angular stomatitis, gastroenteritis, and bronchopneumonia were also found in among the subjects studied. These are common associated conditions seen in severe protein energy malnutrition, and contribute to the morbidity and mortality seen in these children.[1,20-22]

CONCLUSION

From this study, it was found that the month octomber2007 had the highest number of admitted cases of Protein-Energy Malnutrition (PEM). This could be a result of unhygienic surroundings with polluted water and the presence of bacteria in the environment. It was also found out that, admitted cases of PEM were more in males compare to females.

According to the study, it was also found that PEM mostly occurred between 6 to 24 months of age. This is usually a transitional period and a period of introducing complementary foods to infant and it could be linked with the mother's nutritional knowledge deficit on preparation of adequate complementary foods to meet the child nutritional needs.

Moreso, vomiting and diarrohea was the major causes of PEM. Infection such fever occurs in all forms of PEM as we can see in this study. Untreated or delayed treatment and unrecognized infection of this diseases account for the death of severe PEM in children.

From the study it found that marasmus had the highest incidence rate than kwashiorkor and marasmic- kwashiorkor among the children presented with protein energy malnutrition

REFERENCES

1. Ubesie, A.C, Ibeziako, N.S, Ndiokwelu, C.I, Uzoka, C.M, Nwafor, C.A(2012): Under-five Protein Energy Malnutrition Admitted at the University of In Nigeria Teaching Hospital, Enugu: a 10 year retrospective review. *Nutrition J.* 9(11):43.
2. Müller, O and Krawinkel, M(2005): Malnutrition and health in developing countries. CMAJ 173(279):86.
3. Faruque, A.S.G, Ahmed, A.M.S, Ahmed, T, MunirulIslam, M, Hossain, M.I, Roy, S.K, et al(2008): Nutrition: Basis for Healthy Children and Mothers in Bangladesh. J Health Popul Nutr. Sep; 26(3): 325–339.
4. Baitun, N, Tahmeed, A, Brown, K.H, Hossain, M.I(2010): Risk Factors Associated with Severe Underweight among Young Children Reporting to a Diarrhoea Treatment Facility in Bangladesh. J Health Popul Nutr. Oct; 28(5): 476–483.
5. Laditan, A.A.O, Johnson, A.O.K, Azubuike, J.C and Nkanginieme, K.E. (1999): Nutritional disorders in Childhood. African Educational service, Owerri. Pp 166-176.
6. Bauchner, H(2007): Failure to thrive. In: Kliegman RM, Behrman RE, Jensen HB (eds). Nelson Textbook of Pediatrics: Saunders. Pp 33-36.
7. Ayenigbare, G.O(2013): Complementing malaria treatment efforts among children in Nigeria: A focus on adequate nutrition. Int J Nutr and Food Sc.2(4): 213-16
8. Child Survival in Nigeria(2002): Situation, Response, and Prospects. *Key Issues*. POLICY Project/Nigeria.Pp 23(8):6-24.
9. Amosu, A.M, Degun, A.M, Atulomah, N.O.S and Olanrewju, M.F(1999): A Study of the Nutritional Status of Under-5 Children of Low-Income Earners in a South-Western Nigerian Community. Current Resear J Biol Sci. 3(6): 578-85.
10. Osuhor, P.C(2000): Weaning practices amongst the Hausa. J of human nutrit. 34(4):273-280.
11. ACC/SCN. 3rd Report on the World Nutrition Situation(1997): *A report compiled from information available to the* United Nations-Administrative Committee on Coordination/Sub-Committee on Nutrition.
12. UNICEF(2OO1): Manual on feeding infant and young children.
13. Ogunjimi, L.O, Ibe, R.T and Ikorok, M.M:(2012): Curbing maternal and child mortality: The Nigerian experience. Int J of Nurs and Midwif,4(3):33-9.
14. Wamani, H, Astrom, A.N, Peterson, S, Tumwine, J.K and Tylleskar, T:(2007) Boys are more stunted than girls in Sub-Saharan Africa: a meta-analysis of 16 demographic and health surveys. BMC PediatricsPp,7:17.
15. Korie, F.C, Ikefuna, A.N and Ibe, B.C(2012) Bacterial agents associated with acute diarrhoea

in under-5 children in Enugu, Nigeria. *IOSR Journal of Dental and Medical Sciences, 2 (6): 40-5.*

16. Baqui, A.H and Ahmed, T(2006): Diarrhoea and malnutrition in children. BMJ. 18;332(7538): 378.
17. Rodriguez, L, Cervantes, E, Ortiz, R(2011): Malnutrition and Gastrointestinal and Respiratory Infections in Children: A Public Health Problem. Int J Environ Res Public Health, 8(4): 1174–1205.
18. Ibekwe, V.N, Ashworth, A(1994): Management of protein-energy malnutrition in Nigeria: an evaluation of the regimen at the Kersey Nutrition Rehabilitation Centre, Nigeria. Trans R Soc Trop Med Hyg. 88(5):594-5.
19. Anandita, D and Ranjan, B(2014): Status and Challenges of Child Malnutrition in West Bengal with Special Reference to Area under Kolkata Municipal Corporation. *Intern J of Human and Soc Sci Invent;3(4):56-63.*
20. Gernaat, H.B, Dechering, W.H and Voorhoeve, H.W(1998): Mortality in severe protein energy malnutrition at Nchelenge, Zambia. J Trop Paediatr. 44(4):211-7.
21. Cartmel,l E, Natalal, H, Francois, I, Ferreira, M.H and Grahnguist, L(2005): Nutritional and clinical status of children admitted to the malnutrition ward, Maputo central hospital: a comparison of data from 2001 and 1983. J Trop Paediatr,51(2):102-5.
22. Ejaz, M.S and Lati,f N(2010): Stunting and micronutrient deficiencies in malnourished children. J Pak Med Assoc,60(7):543-7.

CYANIDE CONTENT OF CASSAVA PRODUCTS (GARRI, FUFU AND ABACHA) PRODUCED IN THE THREE LOCAL GOVERNMENT AREAS OF IMO STATE SUCH AS OHAJI, OGUTA AND NGOR-OKPALA

1Afam-Anene, O.C, 2Tasie T.C*

1Department Of Nutrition and Dietetics, Faculty of Agriculture and Veterinary Medicine Imo State University, Owerri, Nigeria.

2Department Of Nutrition and Dietetics, Faculty of Agriculture and Veterinary Medicine Imo State University, Owerri, Nigeria.

*Corresponding Author: eduntd@gmail.com, eduntd@yahoo.com

ABSTRACT

Background: Cassava is diversified into different food products and these products are available year round thus making cassava an important staple food for many rural households in Nigeria. A safety concern among cassava products consumers arises from the presence of cyanogenicglucoside which upon hydrolysis produces cyanohydrin that further breaks down to release hydrogen cyanide - a known plant toxin.

Objective: This study was aimed at evaluating cyanide content of cassava products (Garri, Fufu and Abacha) produced from the three major cassava producing areas of Imo state that is Ohaji, Oguta and Ngor-Okpala local government areas (L.G.As).

Methods: Three communities were randomly selected from each of these three L.G.As. The different cassava products were randomly selected from processing centres in these communities with the assistance of staff of the Agricultural Development Programme (ADP). Information obtained through personal interview was type of cassava variety and processing method used. The fermentation period, methods of peeling, graters used and method of dewatering were also obtained.

Results: Result indicates that the mean ±SD cyanide level of garri from Ohaji was 4.78± 0.85mg/100g while that from Oguta and Ngor-Okpala were 4.32±0.51mg/100g and 4.91±0.93mg/100g respectively. Fufu from Ohaji had mean ± SD cyanide level of 5.15±0.51mg/100g while that from Oguta and Ngor-Okpala were 4.40±0.22mg/100g and 4.87±0.42mg/100 respectively. Abacha from Ohaji had mean ± SD cyanide level of 5.16±0.68mg/100g while that from Oguta and Ngor-Okpala were 5.68±0.47mg/100g and 4.68±0.56/100 respectively.

Conclusion: There was no significant difference ($P<0.05$) in the mean cyanide content of the cassava products from the three L.G.A. This study showed that the cassava products from the areas of study contain low amount of cyanide. There was no significant difference ($P<0.05$) in the cyanide content of the different cassava products within the same area.

KEY WORDS: CYANIDE, FUFU, GARRI AND ABACHA.

INTRODUCTION

Cassava (*ManihotesculentaCrantz)* is a major crop in the tropics and its starchy roots are significant source of calories for more than 500 million people world-wild (1). Cassava is diversified into different food products and these products are available year round thus making cassava an important staple food for many rural households in Nigeria (2).

A safety concern among cassava products consumers arises from the presence of cyanogenicglucoside which upon hydrolysis produces cyanohydrin that further breaks down to release hydrogen cyanide - a known plant toxin(3*)*. Hydrolysis occurs when the glucosides come in contact with the endogenous enzymes, linamarase, present in the roots which is released upon crushing of the root or damage of the cellular structure. Hydrolysis can also be affected by acid in the digestive tract. Thus ingested glucosides which in itself may not be toxic could be hydrolysed in the digestive tract into HCN (4).

The most important requirement in the processing of cassava roots is its detoxification by the reduction of the total cyanide content (bound and free) to acceptable levels (4). Cyanogenicglucosides are referred to as bound cyanide while hydrocyanide acid is referred to as free cyanide. Some traditional cassava products include Fufu (Akpu), Lafun, Garri, Abacha and Tapioca. The product of interest in this research is Fufu, Garri and Abacha. In Nigeria, the consumption patterns vary according to ecological zones.

Garri, a roasted granule is the dominant product and is widely accepted in both rural and urban areas. It can be consumed without any additives or it can be consumed with a variety of additives such as sugar, groundnut, fish, meat and stew (5). Fufu is a fermented wet paste from cassava that is widely consumed throughout the country especially in the Southern Zones. Most processors however complain that the wet paste and ready to eat forms (fufu) that are currently sold have a very short shelf life(5). Abacha is a boiled and shredded noodle shaped cassava product. The noodle shape was achieved by slicing with sharp knife. Later, a perforated metal plate was introduced and the shredding is now accomplished by scratching the boiled root on the perforated metal plate. Abacha is eaten in wet form without sun drying. If sun dried, it can be eaten dry but in most cases dry abacha is eaten as snacks with nuts or as a delicacy with a palm oil source along with smoked fish or meat.

Owing to the presence of the cyanogenicglucoside various methods which bring about a reduction in the toxicity of the roots are employed during the processing. However most of these method are tedious, having long fermentation period and ends up yielding products with repulsive odour and moderate level of HCN although the HCN level (20-50mglkg) reported by some workers (6) may be within the Standard Organization of Nigeria (SON) (12) standard.The cumulative effect due to its continuous consumption as a staple food may still lead to chronic cyanide toxicity (7).

The traditional and improved methods commonly used are targeted at encouraging natural linamarase to cause hydrolysis of cyanogenicglucoside, hence the long fermentation could be due to microbial enzyme activity which is usually reduced during fermentation (8).

The objectives of this research are as follows:

To evaluate the level of cyanide in these cassava products.
To identify which of the cassava products contains the

The wet starchy meals were allowed to sediment for some hours. The sediments was then packed into a sack bag or cloth bag, tied, squeezed and pressed under heavy loads of stones or wood. The semi compact meal was beaten into small balls and cooked in boiling water for about 30-40 minutes. The cooked mass was pounded in a mortar with a pestle to produce the fufu paste.

3.3 Abacha Processing

Fresh tubers were peeled and washed. The peeled cassava roots were boiled for about 10 minutes and allowed to cool. The boiled cassava tubers were shredded into noodle-shape with the aid of a perforated metal plate by scratching the boiled roots on the perforated metal plate. The shredded boiled 5-24 hours and then washed in cold water until wash water was clear. It was then sun dried

3.2 Determination of cyanide content of the cassava products.

The hydrogen cyanide of the samples were determined using the (10) Method.

About 10g of sample was mixed with 200ml of distilled water in a 1 litreKjedahl flask and allowed to stand for 4 hour for autolysis to take place. The mixture was distilled and the distillate collected in 20ml of 2.5% NaOH until about 150ml of the distillate was collected. The mixture was then titrated against 0.02N $AgN0_3$solution.

The milligram of HCN was caculated thus;

IML of 0.02N$AgN0_3$=1.08mg HCN

HCN content of sample = Average titre value x 1.08mg of HCN.

This was done in triplicates and the mean and standard deviation was calculated.

4. Statistical Analysis

Triplicate determination of the cyanide content of garri, fufu and abacha were done and the mean$\pm$ SD calculated using the method of (11). Analysis of variance (ANOVA) was used to determine the significant differences in the mean cyanide content of the cassava products from the three local government areas and within the cassava products. The mean percentage of cyanide levels of the cassava products were calculated.

Results

Table 1: Cyanide level of cassava products from the areas of study expressed in means ± SD (HCN(Mg)/100g)

SAMPLE	OHAJI	OGUTA	NGOR-OKPALA
A (Garri)	4.78±0.85	4.32±0.51	4.91±0.93
B (Fufu)	5.15±0.51	4.40±0.22	4.87±0.42
C (Abacha)	5.16±0.68	5.65±0.47	4.68±0.56

Results are means of triplicate samples ± standard deviation
Result indicates that the mean ± SD cyanide level of garri from Ohaji was 4.78± 0.85mg/100g while that from Oguta and Ngor-okpala were 4.32±0.51mg/100g and 4.19±0.93mg/100g respectively. Fufu from Ohaji had mean ±SD cyanide level of 5.15±51mg/100g while that from Oguta and Ngor-okpala were 4.40±0.22mg/100g and 4.87±0.42mg/100g respectively. Abacha from Ohaji had mean±SD cyanide level of 5.16±0.68mg/100g while that from Oguta and Ngor-okpala was 5.65±0.47mg/100g and 4.68±0.56mg/100g respectively.

Analysis of Table 1 shows that garri produced from Ngor-okpala has the highest cyanide level (4.91±0.931mg/100g) followed by garri produced from Ohaji (4.78±0.85mg/100g) and lastly garri from Oguta (4.32±0.22mg/100g).

The cyanide level of fufu from Oguta (4.40±0.22mg/100g) was lower than that from Ohaji and Ngor-okpala (5.15±0.51mg/100g and 4.87±0.42mg/100g) respectively. Abacha from Oguta has the highest cyanide level (5.65+0.47mg/100g) compare to that of Ohaji and Ngor-okpala (5.16±0.68mg/100g and 4.68±0.56mg/100g) respectively.Two-way grouping analysis of variance (ANOVA) used to determine the significant difference in mean cyanide content of the cassava products from the three local government areas and within the cassava products. Result obtained indicates that there was no significant difference ($P<0.05$) in mean cyanide content of the cassava products from the three local government areas. There was also no significant difference ($p<0.05$) in the mean cyanide level within these cassava products.

Table 2: mean percentage cyanide level of cassava products from the areas of study (HCN %).

AMPLE	OHAJI	OGUTA	NGOR-OKPALA
A (Garri)	34.11	30.83	35.04
B(Fufu)	35.75	30.51	33.77
C(Abacha)	33.31	36.47	30.21

From Table 2 the mean percentage cyanide present in garri from the areas of study ranged from 30.83% to 35.04%, the mean percentage cyanide present in fufu from the areas of study ranged from 30.51% - 35.73% and the mean percentage cyanide present in abacha from the areas of study ranged from 30.21% - 36.47%. Among the three cassava products studied, abacha from Oguta had the highest mean percentage cyanide level and abacha from NgorOkpala had the least mean percentage cyanide level.

Garri produced from Ngor-Okpala had the highest mean percentage cyanide level (35.04%) followed bygarri produced from Ohaji (34.11%) and then garri produced from Oguta (30.83%). Among thefufu studied in the three local government areas, fufu from Ohaji had the highest mean percentage cyanide level (35.71%) followed by fufu produced in Ngor-Okpala (33.77%) and Oguta (30.516) respectively. Also abacha produced in Oguta had the highest mean percentage cyanide level (36.47%) followed byabacha produced in Ohaji (33.31%) and lastly abacha produced in Ngor-Okpala (30.21%).

In all the cassava products produced in Ohaji, fufu had the highest mean percentage cyanide level (35.71%) followed by garri (34.11%) and then abacha (33.31%). In Oguta, abacha had the highest mean percentage cyanide level (36.47%) followed by fufu, and garri (30.51% and 30.83%) respectively while in Ngor-Okpala, garri had the highest mean percentage cyanide level (35.04%) followed by fufu and then abacha (33.77% and 30.21%) respectively.

Discussion

This study showed that cassava products from the areas of study contain low amount of cyanide. The mean cyanide level ranged from 4.32mg/100g-4.91mg/100g for garri, 4.40mg- 5.1mg/100g for fufu and 4.68mg/100g- 5.65mg/100g for abacha respectively. These values were far lower than the 50mg/100g minimum tolerant level recommended by Standard Organization of Nigeria (12). This indicates that the cyanide levels of the cassava products from these areas are lower than the safety limit (10mg/100g) reported in Onabolu et al (13) in their study. According to Ukpabi and Ndimdele (14), the smallest single dose of cyanide found to be fatal to an adult was 60mg/kg and individual have survived ingestion of 60mg HCN/kg .

Abacha from Oguta had the highest mean percentage cyanide level (36.47%) among all the cassava products studied. This could be that the cassava roots were not boiled for up to 35 minutes which is the minimum time allowed for boiling of cassava tubers for abacha (Iwuoha et al, (15). According to the same authors, boiling of raw cassava tubers in water for 35 minutes followed by sun drying caused up to 81.5% reduction in cyanide content of the steamed product. This could also be attributed to the fact that this cassava products does not undergo long fermentation during processing unlike garri and fufu. Fermentation period and dewatering method used in these areas might have contributed to the highest mean percentage cyanide content of garri produced in Ngor-Okpala than that from Ohaji and Oguta.

In Ngor - Okpala and Ohaji, fermentation period takes 2-3 days compared to Oguta which takes 3-4 days. Dewatering method is manual pressing compared to Oguta which is mechanical pressing.Asegbeloyin and Onyimonyi (16) reported that fermentation significantly reduced the cyanide content of either the sweet or bitter variety of cassava and the effect of fermentation has proved efficient in reducing the total cyanide content of garri.

According to Onyimonyi (17), fermented products which had enough time had the opportunity for their bound cyanide to be hydrolyzed and thus distributed to different forms and the volatile HCN content removed during frying. Also the enzyme lianamarase had more time to hydrolyze the bond cyanide in the product. Thus importance of fermentation in cassava processing is based on its ability to reduce the cyanogenicglucosides to relatively insignificant levels. It is also clear from this study that prolonged fermentation could however reduce the cyanide level of the cassava products.

According to Igbeke (18), method of dewatering cassava mesh is an important processing factor that determines the quantity of cyanide in garri especially mechanical method which should be taken into consideration in processing of garri in areas where dietary cyanide load is high.

Among the fufu studied in the three local government areas, fufu from Ohaji had the highest mean percentage cyanide level followed by Fufu fromNgorokpala and lastly fufu from Oguta. This could be attributed to the fact that the peeled cassava tubers from Ohaji and Ngor-Okpala were directly soaked in water for fermentation without been washed while in of Oguta the cassava tubers were properly washed and then soaked for fermentation. Okpokiri et al (6) reported that washing of cassava tubers before soaked for fermentation produced higher percentage reduction of HCN level in food produced compared with fermentation of roots without washing. Therefore washing appears to be very important for reducing the HCN levels in food products.

Low amount of cyanide content in these cassava products studied especially abacha conforms with the studies of Iwuoha et al, (15) and Okpokiri(6), They reported that boiling of cassava tubers reduced the initial cyanide content by 80-85%. There is no significant difference ($P<0.05$) in mean cyanide content of the cassava products from the three local government areas. Also no significant difference ($P< 0.05$) exists within the cassava products. This is not surprising since the processing techniques used in these localities to produce these cassava products were similar. Moreover the same varieties of cassava were also used. Thus the various methods used in these areas in processing of cassava tubers are efficacious and effective in reducing the cyanide content.

Cyanide compound is of health concern especially where cassava products are staple food and often used in feeding infants. This is common in most low to medium income families where infants are weaned directly to the family staple diet as early as 6 months. As a result cyanogen accumulation in the body become inevitable with continuous consumption of cassava products and this predisposes the individual to cyanide related disease such as ataxic neuropathy, goiter, cretinism, spastic paraphrases.

The finding of this study observed that although cassava products are the staple foods in these areas, cyanide related diseases were not common in these areas of study. This might be due to adequate processing given to these cassava products.

Conclusion and Recommendations

The results reported above shows that these cassava products contain non-lethal levels of cyanogenic compounds. However, in cases of prolonged consumption of these cassava products with up to 60mg HCN/kg, illnesses associated with cyanogen accumulation and detoxification in the body may occur. This would subsequently have lethal effects.

Therefore it is advisable to process cassava in such a way as to eliminate all the cyanogenicglucosides. Where this is not possible the low cyanide varieties should be planted and used for fufu, abacha, garri and other cassava products. There should also be a level of check from governmental agencies to ensure that unscrupulous processors do not sell inadequate processed fufu, abacha and garri to consumers. Regulatory authorities in Nigeria such as the national agency for food drug and administration control (NAFDAC), Standard Organization of Nigeria (SON) and other farmers Association should carry out awareness campaigns to educate the public on the dangers of this wholesome practice.

REFERENCES

1. FAO (2000), Food and Agriculture Organization of the United Nations. Championing the cause of cassava. File /A./ 5th August. Championing cause of cassava.
2. Onabolu, A.,(2001). Cassava processing, consumption and dietary cyanide exposure. IHCAR, KarohnskaInstitutet, Sweden, pp: 6-7.
3. Bokanga, M., (1994). Distribution of cyanogenicpotentialin cassava germplasm, In Proc. Workshop onCassava Safety (Bokanga, M., Esser, A.J.A., Poulter,N., Rosling, H. and Tewe, O. eds) 1-4 March,Ibadan, Nigeria, Acta. Hot., 375: 117-123.
4. Ajibola O.O, Ige M.T, and Makanjuala G.A, (1987). Preliminary studies of a new technique of cassava mash gelatinization, pp 36-100.
5. Nweke, F.I. and Kormawa P.M., (2004). A wide range of cassava snacks food; in food forum, cassava untapped mine, N1FST, Oshodi, pg24-33.
6. Okpokiri A.O., Ijioma, B.C., Alozie, S.O, Ejiofor M.A.N. (1985). Production of improve cassava fufu. Nigeria food journal (2,3), pp 145-148.
7. Maduagwu E.N., (1978). The effect of simple processing on the cyanide content cassava chips. Journal of food Technology 13:307-328.
8. Ejiofor, M.A.N. and Okafor, N; (1984). Comparison of pressed and unpressed cassava pulp for garri making. In tropical root crop research strategies.Otawa Canada. IDRC. PP 164-168.
9. Okafor N. (1983). Processing of Nigeria indigenous food.A chance for innovation.Nigeria food journal, 33-132.
10. A.O.A.C. (1990). Official methods of Analysis Association of Official Analytical Chemist, Washington D.C. U.S.A
11. Steel R.G.D. and Torrie J.H. (1960); principles and procedures of statistics, MC graw comp. inc. New York.
12. Standard organization of Nigeria (Son), (1985). Nigeria food standards.
13. Onabolu, O.A. Oluwole S.A. Bakanga, M. and Rosling (2001). Ecological variation of intake of cassava food and dietary cyanide load in Nigeria commodities, international institute of tropical Agriculture (IITA), Ibadan Nigeria. Pg26
14. Ukpabi U.J. and Ndimele C. 1990). Evaluation of the quality of garri produced in Imo State Nigeria J.8; 105-110.
15. Iwuoha C.L, Banigo E.OI.,Okwulum F.C., (1997). Cyanide content and sensory evaluation of cassava Root tuber flour as affected by processing food chemistry.Elsevierscience Ltd, pp285-288
16. AsegbeLoyin J.N. and Onyimonyi A.E., (2005). The effect of fermentation Time and variety on the cyanide content of cassava (ManihotesculentaCrantz). Proceedings of the 30th Annual conference of the Nigeria Society of Animal production, pp 199-200
17. Onyimonyi A.E., (2002). Nutritional evaluation of cassava (Manihotutilisimapohl) peel and Bambara (Vandzeiasubterrena Thomas) waste in pig Diets. Ph.D. Thesis, University of Nigeria Nsukka. publishers Abuja, pg7-10.
18. Ibgeka , J.C. (1985). Mechanization of tuber (cassava) peeling.Processing international symposium on mechanization of harvest and subsequent processing of agricultureal product in tropical Africa and the manufacturing or relevant agricultural implements, Yaounde, CIGR 111 PP410-422.
19. Enwerem, N.J., (1998). Roots and tubers. Food of plant origin.Afrobits publications Ltd. Nsukka Nigeria.PP 137

Assessment of Nutritional Vulnerability of the Elderly Using Mini Nutritional Assessment (MNA) Tool and Malnutrition Universal Screening Tool (MUST)

Nzeagwu O.C., and Ebere U.C.
Michael Okpara University of Science and Technology, Umudike, Abia State, Nigeria.

Abstract
Context: Life expectancy is increasing, population becomes older, quality of life becomes a critical important concept in healthcare. Much work has not been done on free living elderly.
Aims: Assess the nutritional vulnerability of the elderly using Mini Nutritional Assessment (MNA) and Malnutrition Universal Screening Tool (MUST), evaluate their nutritional status using anthropometry; identify the relationship between nutritional vulnerability status using the two tools.
Settings and Design: Cross sectional survey using multi-stage random sampling technique.
Methods and Material: Three hundred subjects (≥65years) were randomly selected from four clans with two communities each. Structured validated pretested questionnaire was used to elicit information on socio-economic and demographic status and food frequency. MNA and MUST questionnaires were used to assess nutritional vulnerability. Anthropometric measurements were assessed.
Statistical Analysis Used: Data was analyzed using statistical package for social sciences (SPSS) version 20. Descriptive statistics was used to analyze socioeconomic and food frequency data. In MNA subjects were stratified as "well nourished" MNA ≥24, "at risk of malnutrition" 17-23.5 and "malnourished" < 17. MUST as "low risk of malnutrition" zero, "medium risk" one, "high risk" ≥2. Pearson correlation was used to determine the relationship between MNA and MUST.
Results: About 69% were at risk of malnutrition using MNA and 68% at high risk with MUST. Only 8% were underweight in BMI, majority (83% males, 89% females) had normal MUAC while 78% males and 89% females were at risk of cardiovascular disease using waist – hip ratio. Significant correlation ($p<0.01$) existed between MNA and MUST.
Conclusion: Greater percentage was nutritionally vulnerable to malnutrition despite the majority classified as normal in the anthropometric parameters.
Key words: Nutritional, vulnerability, elderly, MNA, MUST.

Key Messages : More than half of the subjects were at risk of malnutrition using MNA and MUST though within normal range in anthropometric parameters. More than three - quarter of subjects were at risk of cardiovascular disease with waist - hip ratio. MNA correlated significantly with MUST.

INTRODUCTION:

The world's elderly population is growing rapidly, both in its absolute number and its percentage, relative to younger population[1]. Nutritional vulnerability has been defined as the presence of risk factors for malnutrition[2]. One of the most serious problems of the elderly today is their nutritional risks, psychological problems and their physical aspects of suffering. With increasing age, people become more vulnerable to malnutrition for many reasons such as isolation, bereavement, poverty, taste changes, reduced appetite and other factors such as trauma, illness, drug therapy which may compromise dietary intake of the elderly and further alter their nutrient intake[3]. In an earlier study in Nigeria it was observed that the overall nutritional vulnerability score was significantly higher in females ($P < 0.05$) than in males which were traced to the socio-economic and cultural environment, where the mean income is higher for males than females[4]. Out of the three vulnerable groups which include pregnant women, infants and the older persons that face nutritional and public health threats, the older persons have been somewhat neglected[5]. Malnutrition is a widespread but largely unrecognized problem in the older persons, more so as it is a contributing factor to the increased morbidity and mortality in this age group[6].
As people age, multiple changes occur that affect nutritional status of such individuals. Sacopenia or the loss of lean muscle mass can lead to a gain in body fat that may not be apparent by measuring body weight but may be more noticeable by loss of strength, functional decline, and poor endurance[7]. In an earlier a study carried out in Umuahia North and Ikwuano Local Government Areas of Abia State a greater percentage (75%) of the subjects (older persons) were nutritionally vulnerable to malnutrition which is not commendable[8]. Also, a study carried out on the socio-demographic and nutritional assessment of the elderly Yorubas in Nigeria discovered that (50%) of the subjects, irrespective of sex were moderately vulnerable to malnutrition and 46% females were highly vulnerable to malnutrition[4].
Therefore, due to the problems identified above, if becomes imperative to carry out this project on the assessment of nutritional vulnerability of older persons in another local government area of Abia State to assess the situation.
The Mini Nutritional Assessment (MNA) is a tool that can be used to identify older persons who are at risk of malnutrition. It is a clinician-completed instrument with two components: Screening and Assessment. A score of 11 or less on the screening part indicated a problem and the need for a completion of the assessment portion. The assessment score is then added to the screen score; if the total score on both parts totals 17-23.5, there is risk of malnutrition, while a score of <17 indicated existing malnutrition. A score of 27 or higher have been associated with "successful aging" and lower rates

of osteoporosis[9]. Malnutrition Universal Screening Tool (MUST) is a five – step screening tool used to identify older adults who are malnourished, at risk of malnutrition (under nutrition), or obese[10].

The objectives of this study include; to assess the nutritional vulnerability of the elderly using Mini Nutritional Assessment (MNA) tool, to asses those at risk of malnutrition using Malnutrition Universal screening Tool (MUST), to evaluate their nutritional status using anthropometry, to identify the relationship between the nutritional vulnerability statuses using the two tools.

Subjects and Methods: Study Design: This is a cross sectional survey of randomly selected older persons. Multi-stage random sampling technique was used in selecting the older persons for the study.

Area of Study: The study was conducted in Umuahia South Local Government Area of Abia State, situated in the Eastern part of Nigeria. Majority of residents are farmers, business men and women. A smaller proportion is made up of civil servants. It occupies a land mass of 140 square kilometers. It is made up of six notable clans namely; Olokoro, Old Umuahia, Omaegwu, Umuokpara, Ubakala and Nkwoachara. The area is situated between 200m and 600m above the sea level in the central part of Abia state. It lies approximately at latitude 15^0 23' N and longitude 7^0 19' E of the equator. The average temperature is 27^0C.

Population of the Study: The study was carried out among the older persons (male and female) $\geq$ 65years who are residing in randomly selected communities of Umuahia South.

Sample Size: The sample size was calculated based on the report of our previous study were 75% of the older persons studied were nutritionally vulnerable to malnutrition[8]. The extended proportion formular for determination of the sample size was used to get the sample size[11]. The formular is as follows: Sample size (n) = $Z^2 P(100-P) / X^2$

Since the sample was large n > 30, an acceptable margin of error (Z) of 1.96% confidence interval was used and approximated to 2.

P= Prevalence of nutritional vulnerability to malnutrition in older persons (75%) in Umuahia North and Ikwuano LGA

100 –P = Percentage of older person that are not nutritionally vulnerable.

X = Width of confidence interval or required precision level taken to be 5% of probability.

$$n = \frac{2^2 \times 75(100-75)}{25}$$

$$n = 300$$

Subjects: A total of 300 elderly males and females $\geq$65years drawn from four clans from the study area with two communities each making a total of eight communities were randomly selected. Preliminary Activities: Prior to the commencement of the study for data collection, the traditional rulers and the village heads of the various communities selected for the study were paid a visit to get their consent to use their subjects. After wards, the addresses of those selected were obtained from the traditional rulers and the village heads. They were visited in their homes, market places and churches for their individual informed consent and for data collection. Four research assistants were trained and used for the research

Data Collection: A well structured validated and pretested questionnaire was used to elicit information on socio-economic and demographic characteristics, food/ dietary intake of the subjects; MNA which was modified to suit the condition of the study area. The tool (MNA) was designed to collect 18 items that combined objective and subjective data. These data included- simple anthropometric measurements (height, weight, calf circumference, mid upper arm circumference), general assessment items, a brief dietary assessment (number of meals, food and fluid intake and autonomy of feeding) and self-assessment of health and nutrition perception. Each answer has a numerical value and contributes to the final score which has a maximum of 30. Another tool developed to identify older adults who are malnourished, at risk of malnutrition (under nutrition), or obese known as Malnutrition Universal Screening Tool (MUST), a five-step screening tool was also used. Other important aspects of the questionnaires included- the food frequency questionnaire (FFQ) used to determine how frequent they consume foods from each food group comprising starchy roots and tubers, cereals, legumes, starchy fruits, green leafy vegetables, non-leafy vegetables, fruits, meat and meat product, dairy products, bakery products, fats and oil, insects and pasta. The questionnaire was distributed among the literate subjects to read, follow the instructions and fill in the answers. However, for the illiterate ones, the questions in the questionnaire were interpreted for them to give their answers.

All the anthropometric measurements were carried out using the methods described by WHO[12]. Weight was measured using the portable Hanson model bathroom scale and the reading was taken to the nearest 0.1kg. The subject was made to stand without shoes and wearing light clothes. Locally produced stadiometer was used for measuring height for those without kyphosis, done by using a constructed vertical wooden rod with measuring tape and a head board measured to the nearest 0.1m. In the subjects that had kyphosis, non-stretch flexible fibre tape was used to measure their arm span which was used as proxy for height. The calf circumference was measured when the subject was standing with feet apart, the tape positioned horizontally around the calf and moved up and down to locate the maximum circumference in a plane perpendicular to the long axis of the calf. The measurement was taken to the nearest 0.1cm. The Waist Circumference was measured as the subjects were made to stand with the feet about 25-30cm apart. The measurement was taken midway between the upper hip bone and the uppermost border of the right iliac crest. The tape was placed around the abdomen at the level of the mid way point and a reading taken when the tape is snug but does not compress the skin and underlying soft tissues. The circumference was measured to the nearest 0.1cm at the end of normal expiration. Three measurements were taken and the mean calculated. The hip circumference was measured when the subject was standing erect with arms at the sides and feet together. The tape was placed around the buttocks in a horizontal plane. The tape was snug against the skin but did not compress the soft tissue. The measurement was recorded to the nearest 0.1cm with the subject wearing light dressing around the hip. The body mass Index (BMI) was calculated as ratio of weight in kg and height in m^2. The mid-upper Arm circumference (MUAC) was measured half way down the arm between the tip of the acromion process of the scapular and the olecranon process of the ulna with the arm hanging relaxed at the side and the reading recorded to the nearest 0.1cm

Anthropometric data were analyzed using the standards as documented by different authors – BMI[13], MUAC[14], Waist

Circumference[15], waist – hip ratio[16]. MNA scores were stratified as follows - MNA of 17-23.5 (risk of malnutrition), MNA of < 17 (malnourished), MNA of ≥24 (well nourished) [17]. MUST score of 0 = Low risk of Malnutrition, MUST score of 1 = medium risk of malnutrition. MUST score of 2 or more = High risk of malnutrition[10]. The scores from the steps 1, 2 and 3 were added together to obtain overall risk of malnutrition.

Statistical Analysis: The data obtained was analyzed using the statistical package for social sciences (SPSS) version 20. Descriptive statistics such as frequency, percentage was used to determine the socioeconomic, food intake, food frequency of the subjects. Pearson correlation coefficient[18] was used to determine the relationship between MNA and MUST.

RESULTS: Demographic and socioeconomic characteristics of the subjects are presented in Table 1. More women (63.67%) participated in the study than men (36.33%). About half of the respondents 150 (50%) comprised of males (55.01%) and females (47.12%) were aged 60-69 years. A smaller proportion (27%), made up of about (27%) and (28%) of females and males respectively were aged 70-79 years. About 13% were aged 80-80 years. Only about (10%) made up of (about 10% females and 8% males) were found at the age range of 90-99 years. Two hundred and seventy (90%) were married; few (17.43%) were widower while only (5.76%) were widowed.

Table 1: Socioeconomic and Demographic Chara cteristics of respondents according to gender.

	Male		Female		Total	
Parameters	N	%	N	%	N	%
	109	36.33	191	63.67	300	100.00
Age range						
60-69	60	55.01	90	47.12	150	50.00
70-79	30	27.52	51	26.70	81	27.00
80-89	10	9.17	30	15.71	40	13.33
90-99	9	8.26	20	10.47	29	9.67
Above 100	0	0.00	0	0.00	0	0.00
Total	109	100.00	191	100.00	300	100.00
Marital status						
Single	0	0.00	0	0.00	0	0.00
Married	90	82.57	180	94.24	270	90.00
Divorced	0	0.00	0	0.00	0.00	0.00
Widowed	0	0.00	11	5.16	0.00	0.00
Widowers	19	17.43	0	0.00	30	10.00
Total	109	100.00	191	100.00	300	100.00
Place of residence						
Urban	10	9.17	20	10.47	30	10.00
Rural	99	90.83	171	89.53	270	90.00
Total	109	100.00	191	100.00	300	100.00
Educational Status						
Primary	70	64.22	50	26.18	120	40
Secondary	20	18.35	13	6.81	33	11
Tertiary	10	9.17	8	4.19	18	6
No formal education	9	8.26	120	62.83	129	43
Total	109	100.00	191	100.00	300	100.00
Occupation						
Farmer	50	45.87	90	47.12	140	46.66
Trader	30	27.52	60	31.41	90	30.00
Pensioner	4	3.68	16	8.38	20	6.67
Unemployed	15	13.76	20	10.47	35	11.67
Civil servant	10	9.17	5	2.62	15	5.00
Total	109	100.00	191	100.00	300	100.00
Average monthly income(₦)						
Less than N10,000	70	64.22	150	78.53	220	73.33
10,000-20,000	15	13.76	20	10.47	35	11.67
20,000-30,000	10	9.17	16	8.39	26	8.67
30,000-40,000	10	9.17	5	2.63	15	5.00
40,000-50,000	4	3.68	0	0	4	1.33
Above 50,000	0	0	0	0	0	0
Total	109	**100.00**	**191**	**100.00**	**300**	**100.00**
Weekly food expenditure(₦)						
Less than N2,000	70	64.22	130	68.10	200	66.67
2,100-3,000	15	13.76	30	15.71	45	15.00
3,100-4,000	10	9.17	16	8.36	26	8.67
4,100-5,000	10	9.17	10	5.24	20	6.66
Above 5,000	4	3.68	5	2.63	9	3.00
Total	109	100.00	191	100.00	300	100.00
Source of income						
Selling of fire wood	30	27.52	60	31.41	90	30
Bricklayer	4	3.68	0	0.00	4	1.33
Petty trading	50	45.87	100	52.36	150	50.00
Assistance of children	15	13.76	31	16.23	46	15.33
Possession of Investment	10	9.17	0	0.00	10	3.33
Total	109	100.00	191	100.00	300	100.00
Degree of financial Dependence						
Fully dependent	15	13.76	31	16.23	46	15.33
Moderately dependent	5	4.59	5	2.63	10	3.33
Slightly dependent	19	17.43	5	2.63	24	8.01
Not dependent	70	64.22	150	78.53	220	73.33
Total	109	100.00	191	100.00	300	100.00
Living condition						
Live with spouse	90	82.57	180	94.24	270	90.00
Live alone	0	0.00	5	2.62	5	1.67
Live with children	9	8.26	6	3.14	15	5.00
Live with house help	10	9.17	0	0.00	10	3.33
Total	109	100	191	100.00	300	100.00

Data on educational status revealed that more than half of the respondents (57%) received some levels of formal education ranging from primary to tertiary. More males (92%) had formal educational than the females (37%). However, about 40% (50% males and 26% females) had primary education. About (47%) were farmers, thirty (30%) were traders, about (7%) were pensioners, (11.67%) were unemployed and just (5%) were civil servants. The average monthly income of the respondents showed that about (73%) made up of (78.53% females) and (64.22% male) had less than N10, 000 monthly incomes on average. A smaller proportion (13.67%) had N10, 000 – N40, 000 monthly incomes. Food expenditure revealed that about (67%) spends less than N2, 000 weekly and this could be as a result of the low average monthly income of all the subjects studied. Only (3%) made up of (2.63% females) and (3.68% males) spends above N5, 000 on food weekly. Source of their income showed that half comprised of (52.36% females) and (45.87% males) came from petty trading probably from the selling of some of their farm produce. Thirty (30%) had their source of income through the selling of firewood. Information on the degree of financial dependence revealed that about (15%) were fully dependent on others for financial assistance as (15%) had their source of income from assistance from children. The living condition of the subjects revealed that (90%) lived with their spouses, (5%) lived with their children, about (27%) lived alone and (3.33% lived with house helps).

Distribution of nutritional vulnerability according to Mini Nutritional Assessment (MNA) (Table 2)
Table 2: Distribution of Mini Nutritional Assessment (MNA) by Gender.

	Males		**Females**		**Total**	
MNA category/ scores	N	%	N	%	N	%
< 17 points: Malnutrition	18	16.51	35	18.32	53	17.63
(17-23.5 points):At risk of malnutrition	75	68.81	181	68.68	206	68.67
Well nourished (24-30 points)	16	14.68	25	13.00	41	13.70
Total	109	100.00	191	100.00	300	100.00

A greater population of the respondents (68.67%) made up of (68.68%) females and (68.51%) males fell within the MNA score of (17-23.5) points indicating that they were at risk of malnutrition. Few (17.67%) comprised of (18.32% females) and (16.51% of males) had MNA score of <17 points indicating that they were malnourished. Those who were well nourished or not at risk of malnutrition with the MNA score of (24-30 points) were (13.70%) made up of (13% females) and (14.68% males).
The nutritional vulnerability according to Malnutrition Universal Screening Tool (MUST) is in Table 3.
Majority (68%) of the subjects comprised of the males (61.47%) and the females (71.73%) had a MUST score of 2 or more indicating a high risk of malnutrition. About (30.33%) had a MUST score of 1 comprised of (26.70% females) and (36.70% males) indicating a medium risk of malnutrition while a smaller portion (1.67%) made up of (1.57% of females) and (1.83% males) were found to be at the MUST category of low risk of malnutrition with a MUST score of O.

Table 3: Distribution of Malnutrition Universal Screening Tool (MUST) by Gender.

	Males		Females		Total	
MUST Category/ Scores	N	%	N	%	N	%
Low risk of malnutrition (score 0)	2	1.83	3	1.57	5	1.67
Medium risk of Malnutrition (score 1)	40	36.70	51	26.70	91	30.33
High risk of Malnutrition (score 2 or more)	67	61.47	137	71.73	204	68.00
Total	109	100.00	191	100.00	300	100.00

Table 4 revealed the relationship between the use of MNA and MUST to detect those at risk of malnutrition. The result revealed a negative significant correlation between the MNA and MUST with ($P<0.00$, $r = -0.855$). The correlation also revealed a mean score value of 1.9867 and 19.4217 for MUST and MNA respectively.

Table 4: Correlation of Mini Nutritional Assessment and Malnutrition Universal Screening Tool

	Score	Pearson's corre.	(P-value)
MUST	1.9867		P<0.00
		-0.855	
MNA	19.4217		

Table 5 reflected the anthropometric status of the respondents. The body mass index (BMI) of the respondents revealed that about (47%) made up of (47.12%) females and (45.87%) males were in the normal BMI range. A smaller portion of the subjects (8.33%) were found to be underweight and few (38.33%) were overweight comprised of (41.87% females) and (32.11% males) while about (7%) were obese. The waist-hip ratio revealed more than half (57%) of the females had a waist hip ratio of > 0.80cm.

Table 5: Distribution of respondents using anthropometric measurements.

	Males		Females		Total	
Parameters	N	%	N	%	N	%
BMI (Kg/m^2)						
<18.49 underweight	15	13.7	10	5.23	25	8.33
18.50 - 24.99 Normal	50	45.87	90	47.12	140	46.67
25.00 - 29.99 Overweight	3	32.11	80	41.87	115	38.33
30.00 – 39.99 Obesity	9	8.26	11	5.78	20	6.67
>40.00 Morbid obesity	0	0.00	0	0.00	0	0.00
Total	109	100.00	191	100.00	300	100.00
MUAC (cm)						
≥23 Normal for men	90	82.57	0	0.00	85	28.33
<23 Malnourished	19	17.43	0	0.00	24	8.00
≥22 Normal for women	0	0.00	170	89.01	170	56.67
<22 Malnourished	0	0.00	21	10.99	21	7.00
Total	109	100.00	191	100.00	300	100.00
Waist-Hip Ratio (cm)						
>0.90 at risk for men	85	77.98	0	0.00	85	28.33
≤0.90 safe level	24	22.02	0	0.00	24	8.00
>0.80 at risk for women	0	0.00	170	89.01	170	56.67
≤0.80 safe level	0	0.00	21	10.99	21	7.00
Total	109	100.00	191	100.00	300	100.00
Calf Circumference (cm)						
≥31 Normal	81	74.31	160	83.77	241	80.33
<31 At risk	28	25.69	31	16.23	59	19.67
Total	109	100.00	191	100.00	300	100.00

The mid-upper arm circumference (MUAC) revealed that about (57%) of the females had a MUAC score of ≥22cm making them normal while (30%) of the men were also normal with MUAC value of ≥23cm. The calf circumference showed that (80.33%) of the respondents had a normal calf circumference of ≥31cm.

Data on the skipping of meals (Table 6) showed that just (10%) skipped their meals while (90%) do not. About (23%) indicated that they do not feel hungry (loss of appetite) and 53.33% said it is a normal habit as their reasons for skipping meals.

Table 6: Meal skipping habits of the respondents by gender.

	Males		Females		Total	
	N	%	N	%	N	%
Parameters						
Skipping of meals						
Yes	20	18.35	10	5.24	30	10.00
No	89	81.65	181	94.76	270	90.00
Reason for skipping meals						
No one to cook	0	0.00	2	20.00	2	6.67
Don't feel hungry	5	25.00	2	20.00	7	23.33
Cannot afford it	5	25.00	0	0.00	7	16.67
Like starving	0	0.00	0	0.00	0	0.00
Normal habit	10	50.00	6	60.00	16	53.33

Table 7 revealed the food frequency consumption of the respondents. More of the food items from the starchy roots and tubers (97%) were consumed daily. Also daily consumption of these food groups' fats and oils (95.67%), green leafy vegetables (95.67%), meat and meat products (78%) were high. The food that was not usually abundant such as the termites had a low daily frequent consumption of about (13.67%). Starchy fruits had a low frequent daily consumption

Table 7: Food Frequency Consumption of the Respondents.

Food groups	**Daily**		**Weekly**		**Monthly**		**Rarely**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Starchy roots	291	97.00	51	17.00	23	67.00	14	4.67
Cereals	175	48.33	96	32.00	112	3.67	55	18.33
Legumes	55	18.33	87	29.00	287	95.67	265	88.33
Starchy fruits	66	22.00	89	28.67	255	85.00	71	23.67
Green leafy Vegetables	287	95.67	219	73.00	99	33.00	33	11.00
Non leafy Vegetables	230	76.67	241	80.33	167	55.67	44	14.67
Fruits	51	17.00	97	32.33	187	62.33	293	97.67
Meat and meat product	234	78.00	183	61.00	51	17.00	61	20.33
Dairy products	73	24.33	98	32.67	194	64.67	277	92.33
Bakery products	43	14.33	88	29.33	131	43.67	233	77.67
Fats and Oil	287	95.67	211	70.33	102	34.00	6	21.33
Insects	0	0.00	0	0.00	74	24.67	2	92.33
Pasta	41	13.67	52	17.33	35	11.67	251	83.67

DISCUSSION: More females were involved in the study than males probably because more women survive to old age than men. This observation had been reported in other studies[19,20,21].The more males that had one form of education than the females could be as a result of the historical gender discrimination that is seen in Africa as well as in Nigeria which consequently affects the socioeconomic status of women[22]. The greater proportion of the subjects that were farmers may be because; farming is the major occupation of the people of Umuahia south. Furthermore, a greater percentage (90%) of the respondents resided in the rural part of the study area and this might have consequently stimulated them on becoming farmers.

Only (1.33%) had a monthly income >N40, 000 and this was seen from the men (3.68%). This indicates that, majority of the older persons in Umuahia South are poor. An earlier study on the socioeconomic and nutritional vulnerability of the elderly Yoruba's in Nigeria revealed that (88%) of the subjects studied had lowest income per month and that this proportion of the subjects all came from the rural area[4]. Also, It was reported that in Africa, some older people in developing countries enter old age after a lifetime of poverty and deprivation[2]. Furthermore, another study carried out on the nutritional vulnerability of the elderly in Ikwuano and Umuahia North Local government area of Abia State showed that (66.67%) of the subjects studied had an average monthly income of less than N12,000[8]. Thus, the income condition of the respondents may be due to the occupation of the subjects studied where some (42%) were farmers that practiced subsistence agriculture without implements. It has been reported that individuals with low income and insufficient food are at great risk of consuming diets that do not meet the dietary guidelines and recommendations for several nutrients[23]. The family size showed that ninety (90%) had a family size of two and this could be traced back to the living condition where (90%) were living with their spouse.

The high risk of malnutrition especially in the females might be due to the low socioeconomic status especially in terms of income and their food intake. Vulnerability to malnutrition have been identified as a problem in the elderly in Nigeria with (50%) being moderately vulnerable and (46%) being highly vulnerable [24]. A similar result had been reported with more than three-quarter either malnourished or at risk of malnutrition[20]. The high vulnerability to malnutrition as

identified in this study might be due to the low socioeconomic status of the subjects. Furthermore, the following factors have been identified as risk factors to malnutrition- environmental health, food or dietary intake, food security, family life, psychological situation, economic situation, social condition (bereavement), health status and functional capacity[24]. It should be noted that a score of ≥24 points on the MNA depicts successful aging or not at risk of malnutrition while a score in MUST of ≥2 or above depicts high risk of malnutrition which could be the reason for the negative relationship between the two tools. The result having revealed that a greater portion of the respondents were at high risk of malnutrition with a MUST score of 2 or more indicated that malnutrition is a problem associated with these elderly and this was also supported by the MNA result which revealed (68.67%) being at risk of malnutrition.

The percentage that had normal BMI could be traced to their food habit where majority (90%) reported that they do not skip meals. In an earlier study, it was reported that more than half of the population studied were within the normal nutritional status range with (63% males) and (58% females)[4]. A smaller portion of the subjects were found to be underweight and this could be as a result of the smaller group that skipped meals. Another study had also reported on a smaller proportion (16%) being under weight[25]. The waist-hip ratio revealed more than half (57%) of the females had a waist hip ratio of > 0.80cm. This implies that the females store more fat in their abdominal region[26]. The high increase in fat due to loss of fat free mass has been shown to increase adipose tissue of the elderly[27]. The normality in the anthropometric measurements of the subjects could be as a result of increase in average body fat associated with old age[26]. The average body fat in men increases from about (15%) from about 20 years to (25%) at the age of 60 years. In women, it increases from (18%) to (23%) when young to (32%) at the age of 60 years and these changes in body fat can be attributed to less intense physical activity and to an alteration in testosterone and growth hormone production that affects anabolism and lean tissue growth[26]. A greater percentage that does not skip meals may have reflected on the body mass index (BMI) of the respondents where many had normal BMI and few were overweight. Loss of appetite and formed habit were major reasons for skipping meals. It has been reported that anorexia is one of the major causes of malnutrition (underweight) in the elderly[28].

The high consumption of the starchy root and tubers could be as a result of the fact that, it is one of the staple foods of the respondents and mostly cultivated in their locality. The greater consumption of the food items in fats and oil especially red oil could be because of their daily inclusion in preparation of meals such as soup and sauces which were mostly consumed with the staple foods. This is also revealed in the dietary intake of the respondents where about (90%) of the whole respondents indicated that they sell their fruits either to purchase other food items or to increase their income. The foods from the green leafy vegetables were consumed highly on daily basis. This could also be as a result of the seasonal availability of the food items during the period of the survey and also their inclusion in most of the daily prepared meals. Also, vegetables are usually added to the soups and sauces for the staples. The nutrients and fiber in these foods can help reduce high blood pressure, lower risk of heart disease, stroke and certain cancers, stave off eye and digestive problems and also satisfy hunger[29]. It has also been noted that fruits contain indigestible fiber which promotes good digestion and may help prevent diverticulosis[30].

CONCLUSION: More females were involved in the study than males probably because more women survive to old age than men. Almost three-quarter of the respondents had average monthly income that was less than N10, 000. The MNA and MUST placed more than half of the respondents at risk of malnutrition and as such, nutritionally vulnerable. This is dangerous as these older persons may easily slip into the malnourished group.

References

1. Saeidlou SN, Merdol TK, Mikaili P (2011). Assessment of the nutritional status and affecting factors of the elderly people living at six nursing home in Urmia, Iran. Int J Acad Res 2011; 3: 173 - 81.
2. Ismail S. Assessing nutritional vulnerability in older people in developing countries. Nutrition and Healthy ageing. ACC/SCN 1999; 19: 18- 20.
3. Anderson AL, Hans TB, Frances A, Tylarky P E S, Houston DK, Hue FT, et al. Dietary patterns and survival of older adults. J Acad N u t r Diet 2011; 111:84 – 91.
4. Olayiwola IO, Ketiku AO. Sociodemographic and nutritional assessment of the elderly Yorubas in Nigeria. Asia Pac J Clin Nutr 2006;15: 95-101.
5. Ojofeitimi EO, Ijandonola KT, Jegede VA. Nutritional status and p h y s i c a l a c t i v i t y relation to cognitive function in elderly population in Ilesha township, Osun state, Nigeria. J Nutr Elderly 2002; 22: 49-60.
6. Bonnefoy M, Jauffret M, Kostka T. Usefulness of calf circumference measurement in assessing the nutritional state of hospitalized elderly people. Gerontol 2002; 48: 162-9.
7. Tabloski PA. Nutrition and ageing. Gerontolological Nursing NJ: Pearson Prentice Hall; 2006. p. 110 - 46.
8. Nzeagwu OC, Uwaegbute AC (2010). Assessment of nutritional vulnerability of the elderly using Mini Nutritional Assessment (MNA) Tool. Nig J Nutr Sci 2010; 31: 40-46.
9. Elaine BF. Nutrition in the later years. Hand- b o o k of Nutrition and Food. LLC: CRC Press; 2002. p. 319-36.
10. Todorovic V, Russell C, Stratton R, Ward J, Elia M. The 'MUST' Explanatory Booklet: a guide to the 'Malnutrition Universal Screening Tool' (MUST) for adults. British Association for Parenteral and Enteral Nutrition.2003.
11. Areoye MO. Research methodology with statistics for health and social sciences. Nigeria: Nathadex publishers; 2003. p. 117 – 19.
12. WHO (World Health Organization). Physical status: T h e u s e a n d i n t e r p r e t a t i o n o f anthropometry. WHO Technical Report Series 1995; 854: 375 - 09.
13. Wardlaw GM, Hampl JS, Di Silveston AR. Nutrition during adulthood. In: Perspectives in nutrition, 6th ed. New York: McGraw Hill

Higher Education; 2004. p. 647 - 80.
14. Golden MHN, Golden BE. Severe malnutrition. In: Garrow JS editor. Human Nutrition and Dietetics, 10th ed. UK: Harcourt Publishers Ltd; 2001. p. 515 - 26.
15. Lee RD, Nieman DC. Nutritional Assessment. 3rd ed. New York: McGraw-Hill Company; 2003. P. 164 -67.
16. Pazhoohi F, Liddle JR. Identifying feminine and masculine ranges for waist – hip ratio. J Soc Evol Psychol 2012; 6:227 – 32.
17. Vellas B, Anthony P. The MNA 20 years of research and practice in the field of malnutrition and intervention in the elderly. J Nutr Health and Aging 2006; 10: 455.
18. Onuh MO, Igwenna AA. Applied statistical techniques for business and basic sciences. Owerri: CRC Publication ltd; 1998. p. 263.
19. Asiedu SM, Pelenah JM, Amao BB, Dahguah A O . The nutritional situation of the elderly in Ghana. A case study. Asian J Med Sci 2010; 2:95 – 103.
20. Nzeagwu OC, Okorocha CG. Assessment of nutritional vulnerability of hospitalized elderly in university of Nigeria teaching hospital(UNTH) Enugu and federal medical center(FMC) Umuahia, Abia state. J Diet Assoc Nig 2012; 3:21 – 35.
21. Nzeagwu OC, Uwaegbute AC. Assessment of the nutritional status of the elderly in two local government areas of Abia state, Nigeria. Nig J Nutr Sci 2013; 34:63 - 72.
22. Ogwumike FO, Adoderin I. Exploring the links between old age and poverty in Anglophone West Africa: evidence from Nigeria and Ghana. Gen Rev 2005; 15:7 – 15.
23. Sasser K, Contreras M, Taylor G. Health and nutrition status of elderly food stamp participants. J Nutr Elderly 2002; 22: 1-14.
24. Abidemi RA. Elderly family care situation, daily activities, housing and physical well being in Nigeria. Paper presented at the International Union for the Scientific study of Population (IUSSP/NIESPP) 2005; xxv.
25. Bakare EO, Ojofeitimi EO, Akinyemi A. Nutritional assessment and health status of the elderly in South Western Nigeria. Paper presented at the union for Africa population science. African conference on ageing Johannesburg, South Africa; 2004.
26. Rossman I. Anatomic and body composition changes with ageing. In: Finch CE editor. Handbook of the biology of ageing, New York: Van Nostrend Reinhold; 1997. p. 189 -21.
27. Launer L J, Barendregt JJ. Shift in body mass index distribution due to height loss. Epidemiol 1995; 6:98-99.
28. Wakimoto P, Block G. Dietary intake, dietary patterns and change with age: An epidemiological perspective. J Gerontol Med Sci 2001; 5665: 65-80.
29. Krisha F. Studies on nutrient and fiber that reduces old age complications. Afri J Biotech 2014; 8:4211 – 16.
30. Ruby A. An assessment of nutritional value of fruits that help promote good digestion and prevent diverticulosis. Nutr Reports Inter 2014; 36:1071 – 92.

ANTHROPOMETRIC INDICES AND RISK FACTORS OF MALNUTRITION AMONG ELDERLY IN IBIASOEGBE COMMUNITY, ORU WEST LOCAL GOVERNMENT AREA, IMO STATE

Oly-Alawuba N.M and Anamazobi A.E
Department of Nutrition And Dietetics
Faculty of Health Sciences
Imo State University, Owerri

ABSTRACT
Objective: The study assessed the anthropometric indices and risk factors of malnutrition among elderly in Ibiasoegbe community, Oru west local government area of Imo State, Nigeria.

Materials and methods: In a cross sectional study, a total of 370 elders were randomly selected from the compiled list of elders, aged 60years and above, who resides in Ibiasoegbe community of Oru west Local Government Area of Imo State. A validated, pre-tested and self administered questionnaire was used to obtain information on bio-data, educational level, feeding habit and disease conditions. Their anthropometric measurements of weight, height, waist and hip circumstance were also determined. Body mass index (BMI) and waist hip circumstance ratio (WHR) were classified using recognized standards. Data was analyzed using frequencies, percentages, means, standard-deviation and chi-square test.

Results: The result of the study showed that most (81.4%) of the female respondent were within the age group of 60 – 70 years compared to 69.2% of their male counterpart. More than one quarter of the respondents were overweight (29.3% and 23.1% in males and females).
Most elderly within the age range of 71 – 80 years were at risk of abdominal fat accumulation (x^2=16.490; p=0.002). A total of 15.4% females and 11.2% males respondents were diabetic, 18.6% and 30.8% of the males and females respondents were hypertensive. There was a positive significant association between waist hip ratio, BMI and age ($p<0.05$).

Conclusion: Females were more overweight and hypertensive than males, hence there is need to address poor dietary habit and isolatory lifestyle of the elderly through nutrition education.

Keywords: Malnutrition, Risk factor, Elderly.

INTRODUCTION

Nutritional status can be described as the condition of health of a person that is influenced by the intake and utilization of nutrients. When the nutrients provided in the diet is inadequate or not proper, it results in a state of imbalance in the body. There are two types of malnutrition, these include the condition of health of a person that results due to lack of one or more nutrients, known as undernutrition and over-nutrition, which results when one consumes food more than what the body requires. Thus, the condition of malnutrition covers both the states of under-nutrition and over nutrition [15]. People who eat energy rich foods in amounts, more than what is required by their bodies become fat or obese. [6] The goal of health for the elderly in the society may not be that of freedom from diseases but the possibility of having a good life despite illness and decreasing capacities [13,14]. Like in many developing countries, the health system of Nigeria is inadequate to promote, support and protect the health and social wellbeing of the elderly due to lack of human and financial resources [9]. Elder people spend less energy as a result of lower metabolic rates and changes in lifestyle with increased levels of sedentary behavior resulting in weight gain. [7] The elderly have reduced ability to conserve water. They are less attained to their thirsty and may avoid drinking fluids because of overactive bladder problems. As people age there are significant changes in their body composition [5]. There is an increase in fat mass and a reduction in lean body mass (usually muscle). This is accelerated after the 75th year [8]. The reduction in muscle mass (known as sarcopenia) is primarily a result of losses from skeletal muscles and these losses significantly compromise functional ability and strength [10]. This loss in muscle mass and function also has an impact on a person's ability to chew food properly (particularly in frail older people) thus limiting food choice and contributing to an inadequate and poor dietary intake [4]. Older people have fewer of their own teeth with only 35% of people over 75 having many teeth of their own [2].

The social and physical factors which affect food choice and eating patterns and thus nutritional status include: budgeting skills, cultural and religious beliefs, education, nutritional knowledge, cooking facilities, food preference, time, previous food experiences, social isolation, depression and bereavement [2].

The level of social support and degree of social interaction older people have can greatly affect their health and well-being [12]. Those who live alone eat fewer meals per day, have lower daily intake of protein, fruits and vegetables, experience a loss of appetite and tend to be thinner than those living with family [12].

Materials and Methods

Study Design
This study was a descriptive cross-sectional design.

Study Area
The study was carried out in Ibiasoegbe town, Oru west Local Government Area of Imo State, Nigeria. In the month of October, 2015. Oru west has a population of 117,492 at the 2006 census, the local government area has 22 autonomous communities one of in which Ibiasoegbe is among them. Its headquarter is in the town of Mgbidi. This community has 13

schools (primary and secondary), health centres, markets, Ibiasoegbe customary court and palace of his royal highness.

Table 4.1: Personal characteristics by gender of respondents

	Males		Females		Total	
Variables	n	%	N	%	N	%
Age of the respondent						
60-70yrs	153	(81.4)	126	(69.2)	279	(75.4)
71-80yrs	21	(11.2)	21	(11.5)	42	(11.4)
Above 80yrs	14	(7.4)	35	(19.2)	49	(13.2)
Total	188	(100.0)	182	(100.0)	370	(100.0)
Marital status						
Married	167	(88.8)	105	(57.7)	272	(73.5)
Single	7	(3.7)	0	(0.0)	7	(1.9)
Widowed	14	(7.4)	77	42.3)	91	(24.6)
Total	188	(100.0)	182	(100.0)	370	(100.0)
Religion						
Christian	174	(92.6)	161	(88.5)	335	90.5)
Pegan	14	(7.4)	21	(11.5)	35	(9.5)
Total	188	(100.0)	182	(100.0)	370	(100.0)

Table 4.2 shows the socio-economic characteristics of respondent, in which 18.6% and 14.9% of male respondents had tertiary and secondary education respectively compared to 3.8% and 7.7% of female counterpart who also had tertiary and secondary education respectively. Less than half (44.7% and 42.3%) of male and female respondents respectively were farmers by occupation while only 7.4% and 15.4% of male and female respondents respectively were pensioners and 74.5% and 57.1% of male and female respondents respectively earned a monthly income of less than N5000 per month.

Table 4.2 Socio-economic characteristics by gender of respondents.

	Males		Females		Total	
Variables	n	%	N	%	n	%
Educational qualification						
No formal education	14	(7.4)	70	(38.5)	84	(22.7)
Primary	11	(59.0)	91	(50.0)	202	(54.6)
Secondary	35	18.6)	7	(3.8)	42	(11.4)
Tertiary	28	(14.9)	14	(7.7)	42	(11.4)
Total	188	(100.0)	182	(100.0)	370	(100.0)
Occupation						
Trader	76	(40.4)	70	(38.5)	146	(39.5)
Farmer	84	(44.7)	77	(42.3)	161	(43.5)
Civil servant	21	(11.2)	21	(11.5)	42	(11.4)
Retired	7	(3.7)	0	(0.0)	7	(1.9)
Others	0	(0.0)	14	(7.7)	14	(3.8)
Total	188	(100.0)	182	(100.0)	370	(100.0)
Pensioner						
Yes	14	(7.4)	28	(15.4)	42	(11.4)
No	174	(92.6)	154	(84.6)	328	(88.6)
Total	188	(100.0)	182	(100.0)	370	(100.0)
Monthly income						
Less than 5000	140	(74.5)	56	(57.1)	196	(68.5)
5000-10,000	35	(18.6)	21	(21.4)	56	(19.6)
10,000-20,000	13	(6.9)	7	(7.1)	20	(7.0)
Above 20,000	0	(0.0)	14	(14.3)	14	(4.9)
Total	188	(100.0)	182	(100.0)	370	(100.0)

Table 4.3 Shows health related problems. More than half (52.1%) and 30.8% of male and female respondents respectively had joint pain, 29.3% and 15.4 of male and female respondents respectively had poor vision 18.6% and 30.8% of male and female respondents respectively were hypertensive, 11.2% and 15.4% of male and female respondents respectively were diabetic and 18.6% and 7.7% of male and female respondents respectively had tooth ache with only 3.7% of male respondents who had ear problem.

Table 4.3 Health related problems of respondents

	Males		Females		Total	
Variables	n	%	N	%	n	%
Diabetes	21	(11.2)	28	(15.4)	49	(13.2)
Hypertension	35	18.6)	56	(30.8)	91	(24.6)
Constipation	7	(3.7)	0	(0.0)	7	(1.9)
Joint pain	98	(52.1)	56	(30.8)	154	(41.6)
Poor vision	55	(29.3)	28	(15.4)	83	(22.4)
Ear problems	7	(3.7)	0	(0.0)	7	(1.9)
Tooth ache	35	(18.6)	14	(7.7)	49	(13.2)

Table 4.4 shows risk factors of the respondents. Approximately 15% of male respondents each feel depressed and worry respectively while 15.4% and 19.2% of female counterparts also feel depressed and worry respectively. About 4% and 8% of male and female respondents respectively feel tired. More than half (53.8% and 44.7%) of female and male respondents had difficulty in eating and 11.2% and 53.8% of male and female respondents had denture problems respectively.

Table 4.4 Risk factors

	Males		Females		Total	
Variables	N	%	N	%	n	%
Feelings of the respondent						
Well	125	(66.5)	105	(57.7)	230	(62.2)
Worried	28	(14.9)	35	(19.2)	63	(17.0)
Depressed	28	(14.9)	28	(15.4)	56	(15.1)
Tired	7	(3.7)	14	(7.7)	21	(5.7)
Total	188	(100.0)	182	(100.0)	370	(100.0)
Difficulty in eating	84	(44.7)	98	(53.8)	182	(49.2)
Eat alone	83	(44.1)	98	(53.8)	181	(48.9)
Eating pattern						
Always hungry	42	(22.3)	35	(19.2)	77	(20.8)
Not hungry	21	(11.2)	28	(15.4)	49	(13.2)
Method of food preparation	35	(11.6)	14	(7.7)	49	(13.2)
Likeness for food	28	(14.9)	28	(15.4)	56	(15.1)
Dislike food	55	(29.3)	21	(11.5)	76	(20.5)
Denture problem	21	(11.2)	98	(53.8)	119	(32.2)

Table 4.5 shows the nutritional status of the respondents by gender, more than one quarter 29.3% of male respondents were overweight compared to 23.1% of female counterpart who were also overweight, 19.2% of female respondents were obese compared to 14.8% of male counterpart who were also obese, 3.8% of female respondent were underweight while none among male respondents were underweight. There were significant ($P<0.05$) association between body mass index of the male and female respondent. All 100% of female respondent were at risk of waist hip ratio compared to 44.7% of their male counterpart. There was a significant ($p<0.05$) association of waist hip ratio between male and female respondents

Table 4.5 Nutritional status of the respondents by gender

	Males		Females		Total		x^2 value	p-value
Variables	n	%	N	%	N	%		
body mass index	0	(0.0)	7	(3.8)	7	(1.9)	31.895	0.000
Normal	105	(55.9)	98	(53.8)	203	(54.9)		
Overweight	55	(29.3)	42	(23.1)	97	(26.2)		
obese I	14	(7.4)	35	(19.2)	49	(13.2)		
obese II	14	(7.4)	0	(0.0)	14	(3.8)		
Total	188	(100.0)	182	(100.0)	370	(100.0)		
waist hip ratio								
at risk	84	(44.7)	182	(100.0)	266	(71.9)	37.000	0.000
not at risk	104	(55.3)	0	(0.0)	104	(28.1)		
Total	188	(100.0)	182	(100.0)	370	(100.0)		

Table 4.6 shows that the wife of the male does their shopping of food compared to 11.5% of the husband of the female counterpart who does shopping. 11.2% and 38.5% of shopping of meal of the male and female respondents was done by their children, 3.7% and 30.8% of the male and female respondents respectively does shopping for themselves. 7.4% and 34.6% of the male and female respondents prepares meal themselves while 73.9% wife of the male respondent prepares their meal compared to 11.5% of female whose husband prepares their meal, 18.6% and 38.5% preparation of meal of the male and female respondents is done by the children. 3.5% and 11.5% of the respondents eat once per day, 63.3% of male respondents eat twice per day compared to 30.8% of the female counterpart who eat more than 3 times per day. 27.8% and 42.9% of the male and female respondents skip breakfast, approximately 67% of the male respondent skip lunch meal compared to 50.0% of the female counterpart. 5.6% and 7.1% of the respondents skip dinner meal. 11.2% and 30.8% of the respondents forbids food due to cultural belief while 11.2% and 7.7% is of the male and female respondent is due to religious belief mostly 40.4% and 42.3% of the respondents forbids food due to individuals preference, 26.1% of the male respondent is because of health reason. 11.2% and 19.29% of the male and female respondents forbids food because of its cost.

Table 4.6: Food habits of the elderly

	Males		Females		Total	
Variables	N	%	n	%	n	%
Who does the shopping						
Wife	118	(62.8)	7	(3.8)	125	(33.8)
Husband	0	(0.0)	21	(11.3)	21	(5.7)
Children	21	(11.2)	70	(38.5)	91	(24.6)
Relation	35	(18.6)	28	(15.4)	63	(17.0)
Neighbours	7	(3.7)	0	(0.0)	7	(1.9)
Self	7	(3.7)	56	(30.8)	63	(17.0)
Total	188	(100.0)	182	(100.0)	370	(100.0
Preparation of meal						
Self	14	(7.4)	63	(34.6)	77	(20.8)
Wife	139	(73.9)	21	(11.5)	160	(43.2)
Husband	0	(0.0)	21	(11.5)	21	(5.7)
Children	35	(18.6)	70	(38.5)	105	(28.4)
Neighbor	0	(0.0)	7	(3.8)	7	(1.9)
Total	188	(100.0)	182	(100.0)	370	(100.0
Frequency of meal per day						
Once	7	(3.7)	21	(11.5)	28	(7.6)
Twice	119	(63.3)	77	(42.3)	196	(53.0)
Three time	55	(29.3)	56	(30.8)	111	(30.0)
More than three times	7	(3.7)	28	(15.4)	35	(9.5)
Total	188	(100.0)	182	(100.0)	370	(100.0)
Skipping of meal						
Breakfast	35	(27.8)	42	(42.9)	77	(34.4)
Lunch	84	(66.7)	49	(50.0)	133	(59.4)
Dinner	7	(5.6)	7	(7.1)	14	(6.3)
Total	126	(100.0)	98	(100.0)	224	(100.0)
Reason for forbidden food						
Cultural belief	21	(11.2)	56	(30.8)	77	(20.8)
Religious belief	21	(11.2)	14	(7.7)	35	(9.5)
Individual preference	76	(40.4)	77	(42.3)	153	(41.4)
Health reasons	49	(26.1)	0	(0.0)	49	(26.1)
Cost of food	21	(11.2)	35	(19.2)	56	(15.1)
Total	188	(100.0)	182	(100.0)	370	(100.0)
Snacking						
Yes	160	(85.1)	119	(65.4)	279	(75.4)
No	28	(14.9)	63	(34.6)	91	(24.6)
Total	188	(100.0)	182	(100.0)	370	(100.0)
Intake of alcohol						
Yes	112	(59.6)	70	(38.5)	182	(49.2)
No	76	(40.4)	112	(61.5)	188	(50.8)
Total	188	(100.0)	182	(100.0)	370	(100.0)

DISCUSSION

This work assesed the anthropometric indices and risk factors of malnutrition among elderly in Ibiasoegbe community in Oru-west L.G.A of Imo State.

The study showed co-existence of underweight and overweight/obesity among the elderly in Ibiasoegbe community. Underweight was significantly ($P<0.05$) higher in female than in the male elderly, while overweight/obesity was slightly more in male compared to female. This could be accounted to loss of appetite, Isolation and poor dietary habit of elderly in this study. [12], quoted that nutrition is concerned with social, economic, cultural and psychological implication of food and eating.

It was also found that about 100% of female were at risk of developing diet related chronic diseases such as diabetes, hypertension, stroke, heart diseases and cancer compared to about 44.7% of their male counterpart who were also at risk using waste-hip-ratio. This implies that central and upper part obesity is more in female compared to male. This could lead to diet related chronic diseases.

This study found a strong significant ($P<0.05$) relationship between BMI and Age of the elderly as 14.3% of elderly aged, 80 years and above were underweight while 22.6% of those aged 60-70 years were obese and 33.3% overweight. This finding implies that, underweight was more among the elderly, 80years and above, compared to other age groups. This could be related to poor nutrition and physiological changes in body composition with age. [5] quoted that there is an increase in fat

mass and a reduction in lean body mass (usually muscle). This process is accelerated after the age of 60 years of age and fat mass continues to increase until around the age of 75 years. It was also found that elderly respondent, above 80 years were more at risk compared to other age groups. There was a significant ($P<0.05$) relationship between waist hip ratio and age of the elderly respondent.

This observation showed that, the risk of developing diet related chronic diseases is increased as one, advances in age. However, waist circumference (WC) was more because abdominal fat tend to accumulate with age and elderly weight loss may be attributed to the loss of muscle mass but not fat reduction quoted by [1].

This study found that, elderly respondents feels depressed, experience loss of appetite, live alone, had difficulty in eating and skip meals. This could be attributed to the risk factors which predisposes the elderly to poor nutritional status.

This study also discovered among others, the prevalence of joint pain 41.6%, hypertension 24.6%, poor vision 22.4%, Diabetes, 13.2% and several tooth problems. These health problems increased due to poor dietary supplement intake and life style pattern. [3] quoted that large amounts of vitamin and mineral supplements will either prevent or treat health problems or even slow the ageing process.

Also, [16] quoted that eating a well balanced diet, engaging in physical activity, not smoking, moderate alcohol consumption and appropriate use of medications are behaviours that can prevent or delay the onset of chronic diseases, functional and mental decline as well as increase quality of life.

It was also observed that more than half 53% of elderly eat twice per day but mostly skipped lunch. Most of the elderly reported that they forbid food based on individual preferences, cultural belief and health reasons. This implies that there is still food taboo system practiced among the elderly respondent. Most 75.4% of elderly respondent consume snacks and approximately half of the elderly consume alcohol. There was an observed isolation as most of the elderly do their food shopping and prepares meal themselves. This could affect their psychological status and loss of appetite which consequently contribute to malnutrition among the aged.

CONCLUSION

This study observed the co-existence of underweight and overweight/obesity among elderly. Approximately 54% of the elderly eat alone, 45% have difficulty in eating and approximately 54% suffers from denture problems. As a result, they are at risk of chronic diseases like diabetes, stroke, hypertension, etc. There is need to address poor dietary habit and isolatory life style of the elderly in the communities through nutrition education, mass media and other Governmental and non Governmental agencies.

REFERENCES

1. Clinpract v. (2007) Abnormalities of Water Homeostasis in Aging. Endocrinology & Metabolism Clinics of North America. 34 (4):1031 – 1046.
2. De Boe, Frizelle, F. and Barclay, M. (2013) Constipation in adults. BMJ Clinical Evidence. BMJ Publishing Group Limited
3. Dzidor, J.V.A and M.M. Rahaman:(2010). The assessment of the amount of fat in human body from measurement of body mass index (BMI). Br.J. Nutri,21:68-82.
4. Finch, S., Doyle, W., Lowe, C., Bates, C.J., Prentice, A., Smithers, G., and Clarke, P.C. (1998) Report of the Diet and Nutrition Survey. National Diet and Nutrition Survey: People Aged 65 Years and Over. London. The Stationery Office, Vol. 1. Food and drug interaction: consequences for the nutrition/health status. Annals of Nutrition and Metabolism. 52(s1)29-32
5. Kyle, U.G., Genton, L., Hans, D., Karsegard, L., Slosman, D.O. and Pichard C. (2001) Age-related differences in fat-free mass, skeletal muscle, body cell mass and fat mass between 18 and 94 years. European Journal of Clinical Nutrition. 55:663 –672.
6. Lawton W (2002) Food and drug interaction: consequences for the nutrition/health status. Annals of Nutrition and Metabolism. 52(s1)29-32
7. Okaka, 2002. The Elderly Has Reduced Ability To Conceive Water.
8. Payette, H., Hanusaik, N., Boutier, V., Morais, J.A. and Gray-Donald, K. (1998) Muscle strength and functional mobility in relation to lean body mass in free-living frail elderly women. European Journal of Clinical Nutrition. 52(1):45-53.
9. Phillips F (2003) 'Nutrition for healthy ageing', Nutrition Bulletin, 28(3) : 253-63.
10. Mioche, L., Bourdiol, P. and Peyron, M. (2004) Influence of age on mastication: effects on eating behaviour. Nutrition Research Reviews. 17:43–
11. Schenker, S. (2003) Undernutrition in the UK. Nutrition Bulletin. 28(1):87-120.
12. Srilaksmi (2008) Nutritional factors, cognitive decline, and dementia. Brain Research Bulletin. 69(1):1-19.
13. Soyombo, O. (1996) `Writing a Research Report' in Ahonsi, B. & Soyombo, O. (eds.) Readings in Social research Methods and Applications. Ibadan. Caltop Publications Linited.
14. Soyombo, O. (1996) `Writing a Research Report' in Ahonsi, B. & Soyombo, O. (eds.) Readings in Social research Methods and Applications. Ibadan. Caltop Publications Limited.
15. UNSCN (2004) "The Essence of Nutritional Education to The Society" journal p. 56
16. World Health Organisation (2002) Keep Fit for Life. Meeting the nutritional needs of older persons. Geneva: WHO.

EVALUATION OF THE NUTRITIONAL CONTENT OF COMMONLY SOLD INSTANT NOODLES IN NIGERIAN MARKETS

Onyechi, U.A., Ibeanu V.N., Eme, P.E., Ani, P. and Nwankwo, A. I.
Department of Home Science Nutrition and Dietetics, University of Nigeria, Nsukka

ABSTRACT

Background: Composition of instant noodles appears to have limited attention and there is little data available on nutritional value of noodle products.

Objective: The study was undertaken to evaluate the nutritional content of commonly sold instant noodles in Nigerian Markets.

Methods:
Moisture, Ash, fibre, protein and fat content were determined using AOAC (2005) methods.The total carbohydrate was obtained. This difference was done by subtracting the percentage values of all the other food contents from 100 percent. Energy was calculated from protein, fat and carbohydrate values, using Atwater conversion factors; 4kcal of Carbohydrate, 4kcal of Protein and 9Kcal of Fat. All the vitamins (Beta-carotene, Vit. B1, Vit. B2, Vit. B3, Vit. B6, Folic acid, Vit C) and minerals (Calcium, Potassium, sodium, magnesium, phosphorus and zinc) were determined using AOAC (2005) standards.
Statistical analysis:

The data obtained from the work were coded into the computer and analysis were done using the computer software, statistical product for the service solution version 21. Mean and standard deviation of the results will also be calculated. Analysis of Variance (ANOVA) were used to test the level of significance. Duncan's multiple range tests were used to compare the means.

INTRODUCTION

Instant noodles, a steamed and deep-oil fried noodle that is also known as ramen in Japan and ramyon in Korea, originated in Japan in the 1950s and are currently produced in over 80 countries (12). Instant noodles have now become more widely adopted for everyday use because instant noodles are convenient, easy to cook, low cost and have relatively long shelf-life (2). They can be made from wheat, rice, buckwheat, and starches derived from potato, sweet potato, and pulses. Flour of hard wheat (Triticum aestivum L.) is the main primary ingredient (14). Noodles based on wheat flour are prepared mainly from three basic ingredients; flour, water, and salt, other ingredients may be incorporated into the formulations in order to enhance the structure, texture and flavour (14).

Instant noodles are widely consumed throughout the world and it is a fast growing sector of the noodle industry (5). As of 2008, approximately 93.6 billion servings of instant noodles have been consumed worldwide (13). Market research has indicated that global consumption reached more than 65 billion units (instant noodle) in 2003 and was estimated to reach 100 billion units in 2010 (14). The popularity of instant noodles has been expanding very rapidly during recent decades due to their convenience and reasonable price (14).

A study carried out in Awka showed that among one hundred and twelve (112) participants, about 33% consumed instant noodles every day, 39% were reported to consume the food stuff at least 2 or more time in a week, 20% were found to eat the food product once in a week while less than 9% of the total were discovered to dislike the food products. This showed that at least 91% of the 112 persons consume instant noodles at least once in a week (3).

Instant noodles are often criticized as unhealthy (12). A single serving of instant noodles is usually high in carbohydrates but is low in fiber, vitamins, and minerals (12). The author(s) surveyed the literature and found that instant noodles are made from starches from different food sources. The study was undertaken to evaluate the nutritional content of commonly sold instant noodles in Nigerian Markets.

MATERIALS AND METHODS

The five different brands of instant noodles were bought from Ogige market in Nsukka local government area of Enugu state, Nigeria. All the samples were in 120 g packets.

Proximate analysis

Moisture, Ash, fibre, protein and fat content was determined using AOAC (2005) methods. The total carbohydrate was obtained by subtracting the percentage values of all the other food contents from 100 percent.

Energy was calculated from protein, fat and carbohydrate values, using Atwater conversion factors and expressed in terms of Kilocalorie (Kcal) or Kilojoules (KJ) (FAO,WHO,UNU 1985).

All the vitamins (Beta-carotene, Vit. B1, Vit. B2, Vit. B3, Vit. B6, Folic acid, Vit C) and minerals (Calcium, Potassium, sodium, magnesium, phosphorus and zinc) were determined using AOAC (2005) standards.

Statistical analysis:

The data obtained from the work were coded into the computer and analysis were done using the computer software, statistical product for service solution version 21. Mean and standard deviation of the results were calculated. Analysis of Variance (ANOVA) were used to test the level of significance. Duncan's multiple range tests were used to compare the means.

Table1: Proximate composition of different brands of instant noodles

Samples	Fibre	Fat	Ash	Moisture	Protein	Carbohydrate
V	...	17.13±0.31	1.93±0.12	3.07±0.23	2.03±0.04	74.64±0.20
W	5.33±0.31	15.87±0.12	1.67±0.12	5.73±0.23	2.20±0.15	69.19±0.62
X	4.33±0.12	13.40±0.20	1.13±0.12	4.33±0.12	1.38±0.26	75.10±0.10
Y	5.27±0.23	12.53±0.31	1.47±0.12	4.33±0.12	1.26±0.24	75.21±0.25
Z	4.80±0.00	13.93±0.31	1.27±0.12	2.13±0.12	2.93±0.28	74.94±0.66

Mean ± S.D of three determinationsTable 1.1 shows the proximate composition of different brands of instant noodles. The fiber content of sample W (5.33%) was the highest while Sample V (1.07%) had the least fiber content. The fat content of sample V (17.13%) was the highest while that of sample Y (12.53%) had the least. Sample V had the highest ash content of 1.93%, while sample X had the lowest ash content of 1.13%. The moisture content (5.73%) of sample W was the highest while that of sample Z (2.13%) was the lowest. Sample Z had the highest protein content of 2.93% and sample Y had the lowest with 1.26%. Sample Y had the highest carbohydrate content of 75.21% and sample W had the lowest of 69.19%.

Table 2: Vitamin Composition of different brands of instant noodles

Samples	Vit.A	Vit. C	Vit. B1	Vit.B2	Vit. B3	Vit. B5	Vit. B6	Vit. B7	Vit. B9	Vit. B12	Vit. D	Vit. E
V	2.597	0.122	0.059	0.539	0.416	0.015	0.457	0.014	0.007	0.166	1.436	0.048
	±0.40	±0.03	±0.01	±0.10	±0.10	±0.01	±0.23	±0.01	±0.01	±0.12	±0.22	±0.01
W	2.649	0.130	0.044	0.564	0.449	0.016	0.386	0.018	0.007	0.175	1.391	0.040
	±1.30	±0.06	±0.01	±0.23	±0.21	±0.01	±0.21	±0.01	±0.01	±0.23	±0.31	±0.01
X	2.681	0.153	0.046	0.628	0.399	0.013	0.508	0.016	0.006	0.163	1.443	0.020
	±1.34	±0.02	±0.01	±0.34	±0.13	±0.01	±0.24	±0.01	±0.01	±0.22	±0.20	±0.01
Y	2.860	0.137	0.039	0.563	0.417	0.015	0.474	0.018	0.007	0.181	1.569	0.044
	±0.97	±0.02	±0.01	±0.30	±0.22	±0.01	±3.57	±0.01	±0.01	±0.23	±0.21	±0.01
Z	2.592	0.170	0.043	0.593	0.442	0.014	0.776	0.016	0.006	0.184	1.485	0.042
	±1.30	±0.02	±0.01	±0.12	±0.21	±0.01	±0.12	±0.01	±0.01	±0.24	±0.20	±0.01

Mean ± S.D of three determinationsTable 2.2 shows the vitamin composition of the different brands of instant noodles, Sample Y had the highest value of vitamin A with a percentage of 2.860 ug/100g. while sample Z had the lowest percentage with 2.592 ug/100g. For Vitamin C, sample Z (0.170 mg/100g) was the highest, while sample V(0.122 mg/100g) was the lowest. Sample W (0.449 and 0.016) mg/100g had the highest value of vitamin B_3 and vitamin B_5 while samples V and X (0.416 and 0.013) mg/100g had the lowest values. For vitamin B_1, sample V (0.059mg/100g) had the highest while sample Y (0.039mg/100g) was the lowest. Sample X (0.628mg/100g) had the highest value for Vitamin B_2 and the lowest was sample V (0.539mg/100g). For vitamin B_6 and B_{12}, Sample Z (0.776 and 0.184)mg/100g had the highest values while Sample W (0.386mg/100g) and sample X (0.163mg/100g) had the lowest values. Vitamin D and E had samples Y (1.569mg/100g) and V (0.048mg/100g) with the highest values and Samples W (1.391 mg/100g) and X (0.020 mg/100g) with the lowest values. For vitamin B_7, Samples W and Y had the highest value of 0.018 mg/100g and the lowest was sample V(0.014 mg/100g). Vitamin B_9 had samples V,W,Y(0.007mg/100g) with the same and highest value and sample X (0.006mg/100g) had the lowest value.

Table 3: **Mineral composition of different brands of instant noodles**

Samples	Potassium(mg/100g)	Calcium (mg/100g)	Iron (mg/100g)	Zinc (mg/100g)	Phosphorus (mg/100g)	Magnesium (mg/100g)	Sodium (mg/100g)
V	0.021 ±0.01	11.98 ±0.03	0.057 ±0.03	0.092 ±0.02	2.209±0.04	0.031±0.10	2.007 ±0.10
W	0.022 ±0.01	14.96 ±0.04	0.071 ±0.03	0.091 ±0.01	2.505±0.01	0.036±0.10	2.287 ±0.20
X	0.021 ±0.01	15.11 ±0.04	0.068 ±0.03	0.094 ±0.02	2.415±0.04	0.038±0.02	2.407 ±0.30
Y	0.024 ±0.01	12.11 ±0.03	0.072 ±0.03	0.093 ±0.04	2.481±0.02	0.031±0.10	2.720 ±0.30
Z	0.023 ±0.01	15.96 ±0.04	0.065 ±0.03	0.098 ±0.04	2.436±0.03	0.039±0.20	2.173 ±0.20

Mean ± S.D of three determinationsTable 3.3 shows the mineral composition of the different brands of instant noodles. For potassium, sample Y(0.024mg/100g) was the highest and sample V(0.021mg/100g) was the lowest value. Calcium had sample Z(15.96mg/100g) with the highest value and sample Y (12.11mg/100g) was the lowest. Sample W (0.071mg/100g) had the highest value of Iron while sample V (0.057mg/100g) had the lowest. Zinc had sample Z (0.098mg/100g) as the highest value and sample W (0.091mg/100g) as the lowest. Phosphorous had Sample W (2.505mg/100g) with the highest value and sample V (2.209) with the least value. Magnesium had sample Z (0.039mg/100mg) as the highest and samples Y and V (0.031mg/100g) as the lowest. Sample Y (2.720mg/100g) had the highest sodium content while sample V(2.007mg/100g) had the lowest.

DISCUSSION

Composition of instant noodles appear to have limited attention and there is little data available on nutritional value of these products (1). Moreover, some reports even claimed that instant noodles lack other essential nutritional composition such as dietary fiber, vitamins (especially B group vitamins) and minerals which are lost during processing (11). Thus, this work evaluated the nutritional content of instant noodles. The relative low amount of moisture content in these noodles is in line with the common knowledge that the higher the moisture content of a food sample, the lower its shelf life because of its high susceptibility to bacterial attack (7). Hence, these noodles which are expected to have at least a year between date of manufacture and expiration are left with as little moisture as possible to limit rate of bacterial attack (7) . The Ash content of these selected noodles ranged between 1.13% (Sample C) and 1.93% (Sample A). The ash content of a food sample gives an insight into the inorganic (mineral) content of the sample (7). The fat content of these samples ranged between 12.53% (Sample D) and 17.13% (Sample A). The implication of this is that the sample that had more fat had more energy than the one that had less fat, however this might pose a health risk as frequent consumption of these noodles as witnessed today would lead to the development of more fatty acid in the adipose tissue and would contribute to the cholesterol level in humans with their associated health implications such as obesity and the risk of heart disease. The low protein content (1.26% - 2.93%) of these noodle samples showed their deficiency in supplying adequate amount of dietary protein needed for growth and development especially in children (7). Therefore, caution should be taken in the over dependence on instant noodles as a source of protein. Other protein sources such as egg, meat, fish etc could be incorporated while serving these noodles in other to augment this noted deficiency. Crude fiber content of these noodles which range between 1.07% - 5.33% on its own is perceived to be of acceptable level as crude fibers are not of definite or unique nutritive benefits but simply helps in bowel movement. The level of crude fiber in all these samples could be seen as permissible. The high carbohydrate content with the range of between 69.19% and 75.21%, indicates a high presence of carbohydrates and consequently a good source of energy (given the raw material (wheat flour) for their production) for normal cell functioning. (7). All processes in the body, from movement to digestion to breathing to thinking involve a long list of vitamins and minerals (11). The results from the vitamin and mineral analysis showed that excess consumption of this product will lead to a deficiency in micronutrients which are of essential health benefit to the body. Food is supposed to provide us with a daily top up of these substances. When diet does not provide enough, the body is able to compensate for a while by drawing from its stores (11). Potassium is critical for stomach acid formation. Low stomach acid leads to bacterial growth in the human bowel, thus causing all sorts of health implications such as heartburn, irritable bowel syndrome, bloating and constipation (11). Magnesium is critical for the relaxation of blood vessels, a deficiency in magnesium causes elevated blood pressure (hypertension) (11). This research showed that instant noodles do not contain sufficient amount of minerals and a deficiency could drive multiple diseases processes. It is well established that milling extraction rates directly affect the content of vitamins and other nutrients in white flours (8, 9, 10).

CONCLUSION

Virtually everybody consumes instant noodles but with varying degree. The result of this work is relatively comparable with similar work reported as regards the fact that instant noodles are high in carbohydrates and fat and low in fiber, vitamins and minerals. This study revealed that consuming instant noodles may lead to an excessive intake of calories, fats, and sodium, thus predisposing consumers to diseases like obesity, hypertension and obesity. It is hoped that this work might form the basis of further studies on instant noodles, ultimately leading to the enhancement of their

nutritional value. It appears that much remains to be done to ensure adequate nutrition for our expanding world population.

Acknowledgment
The researcher is thankful to all those who contributed to the success of this work in one way or the other.

REFERENCES

1. Waliszewski, K.N., Aparicio, M.A., Bello, L.A. and Morroy, J.A. (2003). Changes of banana starch by chemical and physical modification. Carbohydr. Polym. 52:237-242.
2. Fu, B.X. (2008) History, Classification, Raw materials and Processing. Food Research International, 41, 888-890. http://dx.doi.org/10.1016/j.foodres.2007.11.007.
3. Omuku, P.E., Onwumelu, H.A. and Alisa, C.O. (2014). Comparative analysis of selected heavy metals in green leafy vegetables and instant noodles sold in Eke-Awka market, Awka, Anambra state. Journal of Environmental Science and Water Resources, ISSN 2277 0704 Vol. 3(9), pp. 209 - 213.
4. Cho, H.S., Ahn, M.S. (1993). A survey on the consumption patterns of ramyon by high school students in a part Chun-nam area. J Living Cult Res. 1993;7:43–55.
5. Owen, G. (2001). Cereal Processing Technology. Cambridge: Woodhead Publishing.
6. AOAC (2005). Official Method of Analysis. 19th Edition, Association of Official Analytical Chemists, Washington DC.
7. Onyema, C.T., Ekpunobi, U.E., Edowube, A.A., Odinma, S. and Sokwaibe, C.E. (2014) Quality Assessment of Common Instant Noodles Sold in Nigeria Markets. American Journal of Analytical Chemistry, 5, 1174-1177. http://dx.doi.org/10.4236/ajac.2014.517124
8. Ranhotra, G.S. (1994). Wheat: Contribution to world food supply and human nutrition. In: Bushuk W, Rasper VF, editors. Wheat production, properties and quality. 1st ed. Glasgow: Black Academic and Professional, p 12-24.
9. Fujino, Y., Kuwata, J., Mano, Y. and Dhnishi, M. (1996). Other grain components in cereal grain quality. In: Henry RJ, Kettlewell PS, editors. 1st ed. London: Chapman and HaU. p 289-310.
10. Gregory, J.F. (1996). Vitamins. In: Fennema OR, editor. Food chemistry. 3rd ed. New York: Marcel Dekker. p 532-610.
11. Onwugbenu, E. (2014). How instant noodles destroy our health. Natural Nigerian Newspaper.
12. Juyeon, P., Jung-Sug, L., Young, Ai. J., Hae R.C. and Jeongseon, K. (2011). A comparison of food and nutrient intake between instant noodles consumers and non-instant noodle consumers in korean adults. Journal of Nutrition research and practice 5(5): 443–449.
13. National Trends in Instant Noodles Demands. World Instant Noodles Association (WINA), 2009 http://instantnoodles.org/noodles/expanding-market.html.
14. Vijay, J., Peggy, L., Syed, M. and Nasar-Abbas. (2008). Development and quality evaluation of lupin-fortified instant noodles. Food Science and Technology, School of Public Health, Curtin University of Technology, Perth, Australia.

CHEMICAL COMPOSITION OF SOME LESSER KNOWN FRUITS AND VEGETABLES; WALNUT (Tetracarpidium Conophorum), AFRICAN ELEMI (Canarium Schweinfurthii), UTAZI (Gongronema Latifolium) AND PUMPKIN FRUIT (Cucurbita Pepo). IN IHITEOWERRI- ORLU, IMO STATE, NIGERIA.

Oly-Alawuba N.M and Ekwe, H.C
Department of Nutrition And Dietetics, Faculty of Health Sciences,
Imo State University, Owerri.

ABSTRACT

Objective.

This study identified some of the lesser known fruits and vegetables in Ihiteowerri community, of Orlu local Government Area, in Imo state, Nigeria and also determined the nutrient and anti-nutrient content of the samples; Walnut (Tetracarpidium conophorum), African Elemi (Canarium schweinfurthii), Utazi (Gongronema latifolium) and Pumpkinfruit (Cucurbita pepo).

Materials and Methods

The samples were identified and bought from fruits and vegetable vendors in Orie amino market in Ihitte Owerri Local Government Area of Imo State, Nigeria. through the assistance of an elder from the community. Samples were washed with clean water and stored in a polythene bag to avoid contamination. The dry mass (DM) of the samples were prepared and labelled (sample A = Walnut, sample B = African Elemi, sample C = Utazi and sample D = pumpkin fruit). The samples were sent to Laboratory for analysis. The proximate composition was determined using the standard methods of the association of analytical chemist AOAC (2000) while the mineral content was determined using atomic absorption spectrophometer (AAS). The vitamins A, E and C were determined by the Meyer spectrophotometric method of motion (1942), tannin was determine using Folin Dennis spectrophotometric method.

Result

The proximate analysis showed 19.98%, 60.55%, 45.05% and 28.13% of carbohydrate for samples A, B, C, and D respectively. Iron, iodine and zinc were analyzed and the result indicated that walnut had the highest value for iron (110.10%). Vitamins A, E and C were also investigated and the result showed that Utazi contain higher quantity of vitamin C. Vitamin E was found highest (122.58mg) in sample A.

Conclusion

The samples contained appreciable quantities of vitamins and minerals which are of great biological and health importance and should be encouraged for regular consumption so as to promote, and sustain good health.

Key words : Lesser known fruits and vegetables, Anti-Nutrients, proximate Dry mass,

INTRODUCTION

Fruit is the part of a plant that develops from a flower. It is also the section of the plant that contains the seeds. The other parts of the plants are considered vegetables. These include the stems, leaves, roots and the flower bud (1).Vegetables are less sweet or more savory and are served as part of the main dish. Fruits are more sweet and tart and are more often served as a dessert or snack. Both fruits and vegetables can be made into juice for a refreshing beverage. Some fruits are grains or nuts or seeds and are served accordingly (1). Fruits are generally lower in calories and fat but higher in fiber. Fruits and vegetables also contain health enhancing plant compounds such as antioxidants. They are loaded also with vitamins and mineral (2). Eating at least 400g or 500g portions of fruits and vegetables per day reduces the risk of non communicable diseases and help ensure an adequate daily intake of dietary fiber (3). Nutritional composition of food refers to the nutrients (chemical substances) that the food is made up of in varying amounts (4). Phytochemicals are those chemicals found in food that when consumed, has or provides additional health benefits beyond the traditional nutrients present in the food (5). Anti-nutritional factors in food are those components of food that interferes with digestion, absorption or some other aspect of metabolism of nutrient or nutrients contained in those or other food in a nutshell, Anti- nutritional factors represent a considerable number of different chemical compounds showing a wide range of metabolic effects (6).

Lesser known fruits and vegetables refers to those fruits and vegetables that are not commonly consumed by a large population of the world. This study is carried out to determine the nutrient and anti-nutrient contents of Walnut, African elemi, utazi and pumpkin fruit.

MATERIALS AND METHODS

SAMPLE COLLECTION

The fruits and vegetables were bought from fruits and vegetable vendors in Orie amagu market in Ihitte Owerri Local Government Area of Imo State, Nigeria. Samples were washed with clean water and stored in a polythene bag to avoid contamination.

SAMPLE PREPARATION
The leaves of G. latifolium ("utazi), fruits pulp of C. pepo

27.48±0.01 to 1.83+0.01. The highest value for fiber was 6.28±0.03 while the lowest was 1.03+0.01 while the value for fat ranges from 38.75±0.07 to 4.28±0.01.the table indicated also that there was significant difference all through among the samples for each column.

Table 1: Proximate composition of walnut, African elemi, utazi and pumpkin fruit. (%)

Samples	Moisture % $\overline{X} \pm$ SD	Ash% SD	Carbohydrate $X \pm$ SD	Protein % $\overline{X} \pm$ SD	Fiber % $\overline{X} \pm$ SD	Fat % $\overline{X} \pm$ SD
A	$41.77^{d} \pm 0.04$	$5.26^{b} \pm 0.01$	$19.98^{a} \pm 0.03$	$7.34^{b} \pm 0.01$	$5.91^{c} \pm 0.02$	$4.28^{a} \pm 0.01$
B	$8.44^{b} \pm 0.01$	$6.17^{c} \pm 0.02$	$60.55^{d} \pm 0.01$	$1.83^{a} \pm 0.01$	$1.89^{b} \pm 0.01$	$29.61^{c} \pm 0.01$
C	$15.18^{c} \pm 0.04$	$1.33^{a} \pm 0.04$	$45.05^{c} \pm 0.07$	$15.85^{c} \pm 0.07$	$6.28^{d} \pm 0.03$	$16.05^{b} \pm 0.07$
D	$5.41^{a} \pm 0.01$	$6.51^{d} \pm 0.00$	$28.12^{b} \pm 0.02$	$27.48^{d} \pm 0.01$	$1.03^{a} \pm 0.01$	$38.75^{d} \pm 0.07$
LSD(P<0.05)	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

Mean scores in the same column with different supper-scripts shows Significant difference (P<0.05) LSD= Least significant difference.
Key:
Sample A= walnut (Tetracarpidium conophorum)
Sample B= Afrincan Elemi (canarium schweinfurthii)
Sample C= Utazi (Gongronema latifolium)
Sample D= pumpkin fruit (Cucurbita pepo)

TABLE 2: The mineral Content of the samples show that iron values ranged from 110.10 ± 0.01 (sample A) to 0.09 ± 0.01 sample C. Iodine value for the samples ranged from 0.09 ± 0.01 to 0.02 ± 0.00 (sample B). The highest values for zinc were 40.05 ± 0.07 while the lowest was 0.01 ± 0.00 (sample C). Values in the same column for iron shows significant difference all through but there was no significant difference in sample B and C for zinc and samples A and D for iodine.

Table 2: Mineral composition of walnut, African elemi, utazi and pumpkin fruit

Samples	Iron (mg/100g)	Iodine (mg/100g)	Zinc (mg/100g)
A	$110.10^{d} \pm 0.01$	$0.09^{c} \pm 0.01$	$40.05^{c} \pm 0.07$
B	$43.05^{c} \pm 0.07$	$0.02^{a} \pm 0.00$	$0.03^{a} \pm 0.00$
C	$0.09^{a} \pm 0.01$	$1.05^{b} \pm 0.01$	$0.01^{a} \pm 0.00$
D	$3.95^{b} \pm 0.01$	$0.04^{c} \pm 0.01$	$14.41^{b} \pm 0.01$
LSD(P<0.05)	0.000	0.000	0.000

Mean scores in the same column with different superscript are significantly different ($p < 0.05$). LSD = Least significant difference.
Key:
Sample A= walnut *(Tetracarpidium conophorum)*
Sample B= Afrincan Elemi *(canarium schweinfurthii)*
Sample C= Utazi (*Gongronema latifolium)*
Sample D= pumpkin fruit (*Cucurbita pepo)*

Table 3: Shows the Vitamins Values of the Selected Samples. A,B,C and D. The table indicates that the values for Vitamin A ranges from 236.50 ± 0.14 (Sample D) to 4.16 ± 0.01 (Sample A), Vitamin E ranges from 154.62 ± 0.02 (sample B). To 21.3 ± 0.04 (Sample D). While Vitamin C ranges from 290.31+0.01 (Sample C) to 4.16+0.01 (Sample A). The table indicated also that there was significant difference all through for the all the samples in all the columns.

Table 3: Vitamin composition of walnut, African elemi, utazi and pumpkin fruit

Samples	Vitamin A(mg)	Vitamin E(mg)	Vitamin C(mg)
A	$4.16^{a} \pm 0.01$	$122.58^{c} \pm 0.01$	$4.16^{a} \pm 0.01$
B	$21.31^{b} \pm 0.02$	$154.62^{d} \pm 0.02$	$46.91^{c} \pm 0.01$
C	$120.20^{d} \pm 0.28$	$45.01^{b} \pm 0.01$	$290.31^{d} \pm 0.01$
D	$236.50^{c} \pm 0.014$	$21.03^{a} \pm 0.04$	$11.436^{b} \pm 0.01$
LSD(P<0.05)	**0.000**	**0.000**	**0.000**

Mean scores in the same column with different superscript shows significantly different.
Key:
Sample A= walnut *(Tetracarpidium conophorum)*
Sample B= Afrincan Elemi *(canarium schweinfurthii)*
Sample C= Utazi (*Gongronema latifolium)*
Sample D= pumpkin fruit (*Cucurbita pepo)*

Table 4: Shows the antinutrient content of the selected samples, A,B,C and D. The Table reveals that the highest values for Oxalats was 26.02 ± 0.02 (Sample B) while the lowest was 0.00 ± 0.00 (Sample C), the values for phytate ranges from 162 ± 0.14 (sample B) to 0.00 ± 0.00(sample C) while the highest value for tannin was 240.02 ± 0.02 (sample B). And the lowest was 0.00 ± 0.00 (Sample D). All the samples show significant difference for phytate and tannin while samples C and D show no significant difference for oxalate.columns.

Table 4: Antinutrient composition of walnut, African elemi, utazi and pumpkin fruit

Samples	Oxalate (mg)	Phytate (mg)	Tannins (mg)
A	$4.76^{b} \pm 0.01$	$0.33^{b} \pm 0.01$	$0.09^{b} \pm 0.00$
B	$26.02^{c} \pm 0.02$	$162.10^{d} \pm 0.14$	$240.02^{d} \pm 0.02$
C	$0.00^{a} \pm 0.00$	$0.00^{a} \pm 0.00$	$110.11^{c} \pm 0.14$
D	$0.02^{a} \pm 0.01$	$38.08^{c} \pm 0.02$	$0.0^{a} \pm 0.00$
LSD(P<0.05)	**0.000**	**0.000**	**0.000**

Mean scores in the same column with different superscript are significantly different.
Key:
Sample A= walnut (Tetracarpidium conophorum)
Sample B= African Elemi (canarium schweinfurthii)
Sample C= Utazi (Gongronema latifolium)
Sample D= pumpkin fruit (Cucurbita pepo)

DISCUSSION

Pumpkin fruit (C.pepo) is a good source of protein. Its protein content (27.48±0.01) is quite high and compares favourably with protein values reported for chickpea (24.0%), cowpea (24.7%), lentil (26.1%), green pea (24.9%, Tamarindus indica (24.3%), mucuna flagellipes (24.9%),Hibiscus esculenta (23%) and parkia biglobosa (20.9%)(7,8,9,10).

The crude fat content of G.latifolium(16.05%)compares favourably with percent DM values reported for vegetables like Capisicum annum (14.0%), Piper nigrum (12.%) (11) a child consuming 100g of Cucurbita pepo would be injesting approximately 16.0g fatty acid which is equivalent to 144kcal of energy (12). Apart from providing energy, the fat fraction of C-peso contains modest but useful amounts of fatty acids. G.latifolium is also a good source of vitamins(vitamins A=1200mg,vitamin E=45mg and vitamin C =290mg)but very poor in minerals and anti-nutrient with the exception of tannin (110.1mg). Tetracarpidium conophorum and Gongronema latifolium are good sources of protein(7.34% and 15.8% respectively)with the exception of African elemi(1.83%). Tetracarpidium conophorum, aside the CHO content (19.98%) is also high in dietary fiber (5.91%0 and crude fat of 4.28%. A high iron content of 110mg and zinc(40.05mg)but contains a trace amount of iodine,it is also a good source of vitamin E(122.58mg)but very poor in vitamins A and C (4.16mg and 4.16mg respectively)this result also conforms with that of Enemor et al (13) where they deduced the vitamin content of T.conophorum to be (vitamin E=130.6mg,vitamin A=5.2mg and vitamin C=5.7mg respectively).Tetracarpidium conophorum in this study is a high carier of the antinutrient oxalate(4.77mg but low in phylate and tannin(0.33 and 0.09 respectively)The result of this study therefore suggest that Tetracarpidium conophorum has low antinutrient properties which makes it safer for human consumption as it has low nutrient inhibition properties.

The proximate composition of African elemi shows the moisture content to be 8.44%, Ash 6.17%, CHO 60.55%, protein 1.85%, fiber 1.89% and fat 29.61. This result is in conformity with that of Okon et al.,(14) where moisture content was found to be 8.12%, Ash 5.6% CHO 64.72%, protein, 2.12%, fiber 1.96%, and fat 30.67%. This result therefore suggests that African elemi is a good source of carbohydrate (60.55%) and fat (29.62%). The mineral analysis deduced that it has an iron content of 43.05mg but a trace amount of iodine and Zinc. The result also found out that it is rich in vitamins (vitamin E= 154.62mg vitamin A= 21.31mg and vitamin C 46.91mg). African elemi is relatively high in antinutrients especially phytate and tannin (162.10 and 240.02mg respectively).

CONCLUSION

This study has shown the proximate, vitamins, minerals, and antinutrients composition of tetracarpidium conophorum (walnut), Canarium schweinfurthii (African elemi), Gongronema latifolium (utazi) and Cucurbita pepo (pumpkin fruit).

It has also shown that C.schwienfurthii contributes immensely in the provision of dietary energy need. This research has also revealed that these fruits and vegetables can be used in the management of micronutrient deficiencies except for iodine where it's contents were found low in the fruits and vegetables.

REFERENCES

1. Jennifer N:(2012), introduction to fruits and vegetables; Fruits and vegetable. PP7-19
2. Katherine, S., M. Catherine and F. Rachel, 2006. Mycotoxins Explained Food Safety and Hygiene. A Bulletin for the Australian Food Industry.
3. WHO (2015). Promoting fruit and vegetable consumption around the world. A WHO Publication Bulletin.
4. Thompson, A.K. (2015). Fruits and vegetables : Handling, Harvesting and storage. Wiley Publication. Vol. 1, Third Edition Pg. 1-14.
5. Escott-Stumps S.(2008): Nutrition And Diagonise And Diagnoisi Related Care :U.S.A Lippicot Press.
6. Obiakor P.N(2014) :Antinutrient and Toxicants in plant foods in: Basis in food Management ,Austrop printing and publishers int ltd pp (38-49).
7. Glew, R.S., B. Amoako-Atta, G. Ankara-Brewoo, J. Presly, L. Chuang, M. Millson and R. Smith, 2009. Non cultivated plant foods in West Africa: nutritional analysis of the leaves of three indigeneous leafy vegetables in Ghana. Food, 3: 39-42.
8. Neverke E.(2011):The many uses of pumpkin seed(cucurbita pepo)from Arthritis to prostate health.p97-110
9. Ajayi, M.T. (2005). Impact of Training on adoption of Improved Farming Practices among Cassava Farmers in South –West, Nigeria. International Journal of Agriculture and Rural Development (IJARD) Vol. 6, Pg. 34-38.
10. Iqbal , A.I (Ascorbic acid contents of Pakistani fruits and vegetables. Pak J Pharm Sci. 19(4):282-5 · November 2006
11. Awsi Jan,Er. Dorcus M(2012):Development and Quality Evaluation of Pineapple Juice Blend with Carrot and Orange juice in: Journal of Environmental Science,Toxicology And Food Technology,Volume 4,issue:p22-24
12. Igwilo I.(2014):Nutritional Composition and antioxidant activity of African walnut, Tetracarpidium conophorum, in: The journal of applied Biochemistry.pp6-14
13. Essien, J.P., Akpan, E.J., Essien, E.P. (2005). Studies on mould growth and biomass production using waste banana peels, Bioresource Technology, 19: 361-363.
14. Garriguet, Didier. 2007. "Canadians' eating habits." Health Reports. Vol. 18, no. 2. Statistics Canada Catalogue no. 82-003. p. 17–32. http://www.statcan.gc.ca/pub/82-003-x/2006004/article/habit/9609-eng.pdf.
15. Okon, P.B., Uko, A.E. and Amalu, U.C. (2004). Handling and storage of leafy vegetables. LEISA, September 2004, Vol. 20, No. 3. p29.

Knowledge, Attitude and Practice (KAP) of Food Consumption Pattern among Patients Attending Out-Patients Diabetic Clinic, Federal Medical Centre (FMC), Asaba.

BY

Odenigbo C.U., Aniekwensi E.U., Odo C.C.

Department of Internal Medicine, Federal Medical Centre (FMC), P.M.B 1033,
Asaba, Delta State, Nigeria.
Corresponding author:perrinmekus@yahoo.com

ABSTRACT

Background: Diet, a lifestyle behaviour has been reported as a management domain with very low compliance among diabetes.

Objectives: To determine the Knowledge, Attitude and Practice (KAP) of food consumption pattern among patients attending out-patient diabetic clinic in Federal Medical Centre, Asaba, Delta state.

Materials and Methods: The data for the study were generated by interviewing 200 subjects who attended out-patient clinic within the month of September, 2012 to February, 2013. The survey instrument was a carefully structured and validated questionnaire. The data obtained were on the subjects` demographic make-up, health status, knowledge, attitude, practice (KAP) on food consumption pattern.The data was analyzed using Epi-info 7. Frequencies and percentages were the statistical methods adopted to separate and compare mean values.

Results:Results showed that 59.5% of our respondents were females while the remaining 40.5% were males. The study showed that 90.5% agreed that fruits are allowed in the diets for diabetic patients, 97.55% agreed that vegetable is allowed respectively. A reasonable number of the patients (48%) studied were not counselled (on Medical Nutrition therapy) on one on one basis at all and among those that were counselled, only 37.5% were counselled by dietitians.

Conclusion:The study showed that the patients had improved and good Knowledge, Attitude and Practice (KAP) of food consumption pattern, though a reasonable number of the interviewed subjects have not been counselled at all let alone be dietitian. Health care providers are encouraged to refer Diabetes mellitus patients to Dietitians for Medical Nutrition Therapy (MNT) and followed up should be maintained.

Keywords: Diabetes mellitus, Knowledge, Attitude and Practice, Health status, Dietary counselling.

INTRODUCTION

Diabetes mellitus is a group of metabolic disease characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both (1). It may be reflected on three levels: as a defectives secretion of insulin from the pancreas, as a cellular resistance of insulin, and as a defective secretion of glucose from the liver. It is an important non-communicable disease and undoubtedly a rising condition.

Two hundred and eighty five million people are estimated to have diabetes mellitus world-wide and this figure is expected to reach three hundred million in the year 2025, if the global trend continues (2, 3). About 18 million people die every year from cardiovascular disease, for which diabetes is a major predisposing factor. In Nigeria, the national prevalence of diabetes mellitus is put at about 2.2% and this continues to be on the increase (4).

The management of diabetes mellitus involves the use of diet alone, diet and insulin, or diet and hypoglycaemic drugs (5). When diabetes mellitus is not properly managed, complication will occur and some of them include diabetic ketoacidosis, retinopathy, nephropathy, retinopathy, nephropathy, neuropathy, sexual dysfunction, skin complication, and other infections.

When disordered eating behaviour are culturally accepted and performed with significant frequency by a variety of groups, it can lead to the perception that this behaviour are normal which can be detrimental to the prevention and treatment of diabetes.

Education is the cornerstone of diabetes mellitus care and because of lack of education/awareness; most patients suffer from diabetes complications. And education is likely to be effective if we know the characteristics of the patients in terms of their Knowledge, Attitude and Practice to Diabetes mellitus.

Diet; a lifestyle behaviour has been reported as a management domain with very low compliance among diabetes (6).Nutritional intervention is an integral part of diabetes management and self-care education, aiming at the attainment and maintenance of optimal metabolic outcome, prevention and treatment of medical complications and the improvement of general health addressing nutritional needs (7).

In Nigeria, the national prevalence of diabetes mellitus is put at about 2.2% and this continues to be on the increase (4). Sadly, the majority of the people with diabetes in developing countries are within the productive age range of 45 to 65 years and these are the same individuals who are expected to drive the economic engines of these countries in order to achieve the agreed international development goals (8).The poor results recorded in the management of diabetes mellitus could be that the patients' efforts are not in the appropriate directions or that they receive confusing and contradicting advice from a variety of sources (health professionals, Media, Social contacts, etc.).

There is the need to understand what happens in our own locality vis-à-vis diet and diabetes mellitus, thus the origin of this study.

The study was aimed atdetermining theKnowledge, Attitude andpractice (KAP) of food consumptionpattern among patients attending out-patients diabetic clinic, Federal Medical Centre (FMC), Asaba.

MATERIAL AND METHODS

Area of study

Table 1: Age and sex distribution of the subjects

Age	Females	%age	Males	%age
20-29	1	0.84	0	0
30-39	10	8.40	5	6.17
40-49	23	19.33	13	16.05
50-59	44	36.97	17	20.98
60-69	31	26.05	31	38.27
70&above	10	8.40	15	18.52
Total	**119**	**100**	**81**	**100**

x2= 11.59, P= 0.04

Table 2: Level of Educational qualification (n=200)

level of education	frequency	%age
Nil	22	11
Primary school	75	37.5
Secondary school	33	16.5
Tertiary school	70	35

Table 1 shows the Age and Sex distribution of the subjects. Itshows that majority of the subjects were above 40years with a peak of 36.97% (females) and 38.27% (males) in the 50-59 years and60-69 years age range respectively. A total of 119 females and 81 males were studied. Table 2 shows the level of educational qualification of the subjects. Majority of the subjects had only primary school education (37.5%) followed by 35% of them that had tertiary education qualification

Table 3:How long they have been diagnosed of having diabetes mellitus (n=200)

Years	Frequency	%age
<1 year	20	10
1---4 years	86	43
5---9 years	50	25
10 years and above	44	22

Table 4: Family history of diabetes mellitus (n=200)

Response	frequency	%age
Yes	89	44.5
No	111	55.5

Table 5: What they think cause Diabetes mellitus (n=200)

Response	frequency	%age
Diet lifestyle alone	57	28.5
Hereditary alone	36	18.0
Diet + hereditary	12	6.0
Spiritual	1	0.5
Stress	1	0.5
No idea	93	46.5

Table 3 shows the response of the subjects as regards the how long they have been diagnosed of having diabetes. Majorityof the subjects (43%) said that they were diagnosed as having diabetes since 1 to 4 years. Table 4 shows that 44.5% had family history of diabetes mellitus while 55.5% did not.Table 5 shows majority of the subjects (46.5%) have no idea about the cause/s of diabetes mellitus.

Table 6 : Regular exercise, fruits, vegetables allowed in diabetes mellitus management

Exercise (response)	frequency	%age
Yes	172	86
No	28	14
Fruits(response)		
Yes	181	90.5
No	19	9.5
Vegetables(response)		
Yes	195	97.5
No	5	2.5

Table 7: have you been counselled on dietary management of diabetes mellitus

Response	Frequency	%age
Yes	104	52
No	96	48
Who gave the counselling (n=104).		
Doctor	15	7.5
Nurse	14	7
Dietitian	75	37.5
Pharmacist	0	0

Table 8: Where they go for treatment (n=200)

Response	Frequency	%age
Hospital only	188	94
Hospital & church	7	3.5
Hospital & traditional herbal home	5	2.5

Table 6 shows their response on whether exercise, fruits and vegetables are allowed in the management of diabetes mellitus. More than half of the subjects(86%) agreed that regular exercise is allowed, 9.5% said that fruits are not allowed and majority of the subjects (97.5%) agreed that Vegetables are allowed.Table 7 shows that majority (52%) of the subjectshave been counselled on dietary management of diabetes while 96 (48%) have not been counselled. Out of the 104 subjects that were counselled, 7.5% were counselled by Doctors, 37.5% by Dietitians, and 14% by Nurses.Table 8 shows that majority of the subjects (94%) go to hospital only for treatment, 7% use hospital and church while the remaining (2.5%) use hospital and traditional homes.

Table 9: How do you manage diabetes mellitus (n=200)

Response	Frequency	%age
Diet alone	39	19.5
Diet and drug	102	51
Diet, exercise & drug	35	17.5
Diet, drug & insulin	21	11
Drug alone	3	1.5

Table 10: Frequency of feeding daily and meal skipping (n=200)

Response	Frequency	%age
Once	1	0.5
Twice	18	9
3 Times	160	80
3 Times & above	21	10.5
Meal skipping (response):		
Yes	51	25.5
No	149	74.5

Table 11: Snacks (in-between meals), and artificial sweeteners usage (n=200)

Snacks(Response)	Frequency	%Age
Yes	147	73.5
No	51	25.5
No response	2	1
Artificial Sweetener		
Yes	13	6.5
No	187	93.5

Table 12: Use of fresh leaf extract and herbal medication (n=200)

Fresh Leaf (Response)	Frequency	%Age
Yes	41	20.5
No	159	79.5
Herbal medication (response).		
Yes	12	6
No	188	94

Table 9 shows the subjects` response on how they manage diabetes mellitus. More than half of the subjects (51%) said that they use diet and drug alone, while 19.5% said Diet alone, and 17.5% said Diet, Exercise and Drug, and 1.5% said Drug alone. Table 10 shows the subjects` response on frequency of feeding and meal skipping. Majority of them (80%) said that they eat 3 times daily. On the level of meal skipping, 74.5% said that they do not skip meal while 25.5% said they skip meals.Table 11 shows the subjects` response on whether they take snacks in-between main meals and the use of artificial sweeteners. Majority of them (73.5%) takes snacks in-between meals, while 1% gave no response. More than half of the sample studied (93.5%) make use of artificial sweeteners while 6.5% do not. Table 12 shows that 20.5% of the subjects use fresh leaf extract while 79.5% do not make use of it. Majority of the subjects (94%) do not use herbs while the rest (6%) make of it.

DISCUSSION

Globally, diabetes is the top priority chronic disease(9),and good Knowledge, Attitude and Practice (KAP) of food consumption among diabetes patients is one of the integral therapies in ensuring normoglycaemia, prevention of both acute and chronic complications and ensuring good quality of life.

Majority of the subjects (59.5%) studied were females while the remaining (40.5%) were males.The increase in the prevalence towards females as found in this study really agreed with the report by the World Health Organization (WHO) in 2008 that the lifetime risk of developing diabetes is estimated to be 33% for males and 39% for females (10).

There was an increase in the number of patients with diabetes mellitus from 40 years and above as shown in this study. This supported the study by Franz et al (7) that majority of the people with diabetes mellitus are within the productive age range of 45-64 years.It is equally in agreement with the Public Health Agency of Canada which stated that age greater than 45 years increases the risk of developing Type 2 diabetes (11).And these are the individuals who are expected to drive the economic engines of these countries in order to achieve the agreed international development goals (8).This increase as seen in this age window could be due to increase in risk factors

associated with diabetes mellitusincluding low physical activity level, smoking, alcohol abuse, hypertension, cholesterol number and high fatty intake, obesity and overweight, post-menopausal weight gain, and use of some medications.

It equally showed that large number of the patients (37.5%) attended only primary school while few (11%) did not attend school at all and 35% attended tertiary education.This does not agree with a study done by Odenigbo et al (12) in a tertiary health care centre, Umuahia, Nigeria which showed than half of subjects (52%) studied had tertiary education, while 9.5% and 6.5% had primary and no formal education respectively.It has been shown that higher education is one of the foundations for successful living and is associated with lower levels of negative effects, better health and increased life satisfaction, particularly at the later period of life (13).

Almost half of the patients studied had a family history of the disease. Gordon (14) confirmed that diabetes mellitus runs in certain families indicating a clear genetic link.

The findings equally showed that almost all the subjects apply diet in the management of diabetes. It showed that 19.5% used diet alone, more than half (51%) used diet and drug (anti-diabetic drugs), and 17% used diet, drug and insulin.Majority of the patients agreed that regular exercise, fruits, and vegetables respectively are allowed and essential for management of diabetes mellitus. This buttresses the fact that improving knowledge of the people can improve their attitude towards diabetes and in the long run change their practices to embrace healthier lifestyles such as eating healthy foods, and engaging in physical activity (15).However this does not support a study by Okolie et al (16) in which the percentage that responded positively to the option that they should eat a lot of whole grains, fresh vegetables and fruits was low.

A reasonable number of the patients (48%) studied were not counselled (on Medical Nutrition therapy) on one on one basis at all and among those that were counselled, only 37.5% were counselled by dietitians. The practice here did not follow the Sylvia (1) which says that Medical Nutrition Therapy for people with diabetes mellitus should be individualized with consideration given to usual eating habits and other lifestyle factors and health care providers are encouraged to refer newly diagnosed patents to a dietitian. Moreover, diabetes education, with consequent improvements in knowledge, attitudes and skills, will lead to better control of the disease, and is widely accepted to be an integral part of comprehensive diabetes care.

In other way round, it supported the study by Puepet et al (17) who found a deficiency in knowledge of diabetic among patients (30.2%) with diabetes in Jos, Plateau state, Nigeria.

Those who skipped meals sometimes (25.5%) gave reasons of non-availability, fasting, job demands, no appetite etc. This equally supports the research which said that barriers to dietary adherence include complication with daily life (eating out, social events), temptations, need for food planning, need for constant self-care, poor understanding of diet-disease associations, misinformation, lack of appropriate social support and time constraints (18).

It is also nice to find out from the study that some of the patients (20.5%) use fresh leaf extract and 6% use herbal medication respectively. They need to understand that leaf extract (particularly bitter leaf) contain active substances, which are mitodepressiveand higher concentrations of the extract lead to nuclear disintegration and cell death and this is believed to be due to the presence of the Sequiterpene lactones, Vernodalin and Vernomygdin alkaloids (19). And few of the subjects (6%) studied used herbal medications.This shows evidence of adequate knowledge about the risks associated with the use of unregulated herbal medications in managing diabetes mellitus. This does not agree with a study by Okolie et al (16) in which significant number of subjects (74.0%) studied believed in patronizing patent medicine dealers.

CONCLUSION

Nutritional intervention is an integral part of diabetes management and self-care education, aiming at the attainment and maintenance of optimal metabolic outcome, prevention and treatment of medical complications and the improvement of general health.

The study showed that the patients had improved and good Knowledge, Attitude and Practice (KAP) of food consumption pattern, though reasonable number of the interviewed subjects had not been counselled on dietary management of diabetes mellitus let alone by dietitians.

All in all, good diabetes care requires the team work of the health care practitioners, social workers, Diabetes educators, family members and this might be the only effective way of ensuring effective diabetes care and control.

RECOMMENDATION

Nutrition and diet forms a major and first line step in the successful management of diabetes, a metabolic disorder (5). Thereupon, health care providers are encouraged to refer Diabetes mellitus patients to Dietitians for Medical Nutrition Therapy (MNT) and followed up should be maintained.

This study was institutional based; therefore the finding may not be generalized for other diabetic population in Asaba and Delta state as a whole.Thereupon, there is need for this type of study to be carried out in different major hospitals in Asaba and some parts of Delta state to find out patients` perception and compliance with dietary care in Diabetes.

REFERNCES

1. Sylvia E. (2008). Nutrition and diagnosis, related care (sixth edition). Wolters kluwer/lippincott. Willians and wilkin. New York. London.
2. Ohwovorlole, A.E. (2003). Many Nigeria Above 18 Years May Have Diabetes. Pharmanews; 25(3).
3. International Diabetes Federation (2009). www.idf.org. Accessed June, 2011.
4. UnadikeB. (2013). The burden of diabetes mellitus. The Nation newspaper. March 17.
5. Zainab, U.S. (2005). Non Drug Therapy of Diabetes Mellitus. PharmaHealth Journal (Maiden Edition); 1(1): 15-23.
6. PeyrotM., Rubin R.R. (2005). Psychological problems and barriers to improved diabetes management: Result of cross-national diabetes attitudes, wishes and needs (dawns) study. Diabetes

Med.; 22(10): 1379-1385.
7. Franz M.J., Bantie J.P., Beebe C.A., Brunzell J.D., Chiasson J.L. (2002). Evidence base nutrition principles and recommendations for the treatment and prevention of diabetes mellitus and related complications. Diabetes care;25: 148-198.
8. International Diabetes Federation(2012). Diabetes atlas (4th edition). Brussels, Belgium.
9. Anju G., Dharma N. B., and Umesh R. A. (2015). Diabetes related health knowledge, attitude and practice among diabetic patients in Nepal. BMC EndocrDisord.; 15(25).
10. World Health Organization. Reducing risks and promoting healthy life. Geneva: WHO; 2008.
11. Public Health Agency of Canada. Diabetes fact sheets 2007. (Accessed 25/05/2016). Available from: www.phac.org.
12. Odenigbo M.A. and Inya-Osuu J. (2012). Knowledge, Attitudes and Practices of People with Type 2 Diabetes Mellitus in a Tertiary Health Care Centre, Umuahia, Nigeria. Journal of Diabetes & Metabolism. (Accessed 25/05/2016). Available from: www.omicsonline.org.
13. Jungmeen K.E., Moem P. (2002). Retirement transition, gender and psychological wellbeing: A life course ecological model: The Journal of Gerontology; 57B: 212-222.
14. Gordon M.W. and Margaret W.K. (2002). Perspectives in Nutrition (Fifth edition). McGraw-Hill Companies, New york, NY 10020.
15. Gagliardino J., Gonzalez C., Caporale J. (2007). The diet-related attitudes of health care professionals and persons with diabetes in Argentina. Rev PanamSaludPublica; 22(5): 304-307.
16. Okolie V. U., Ehiemere O. I., Iheanacho N. P. and Kalu-Igwe I. N. (2009). Knowledge of diabetes management and control by Diabetic patients at Federal Medical Center Umuahia Abia State, Nigeria. International Journal of Medicine and Medical Sciences; 1(9): 353-358
17. Puepet F.H., Mijinyaya B.B., Akogu I., AzaraI.(2007). Knowledge, Attitude and Practice of Patients with Diabetes Mellitus Before and After Educational Intervention in Jos, Plateau state, Nigeria. The Journal of Medicine in the Tropics; 9(1): 3-10.
18. Brown S.L., Pope J.F., Hunt A.E., Tolman N.M.(1998). Motivational Strategies used by Dietitians to Counsel Individuals with Diabetes. Diabetes edu.; 24(3): 313-318.
19. Ene-obong H.N. (2001). Eating Right. Zoomterprint Communications Ltd. Calabar.

Nutrient composition and sensory properties of complementary infant foods produced from blends of fermented Guinea-corn *(Sorghum bicolor)*, kersting bean Akidi *(kerstingiella Geocarpa)* & Half-ripe banana flour *(Musa balbaisiana.)*

Oly-Alawuba N.M and Nwaoku C.S
Department of Nutrition & Dietetics, Faculty of Health Science, College of Medicine, Imo State University Owerri, Imo State.

ABSTRACT:
Objectives; The study assessed the nutrient composition, sensory properties and acceptability rate of some complementary weaning foods produced from blends of half ripe banana flour, fermented Guinea corn flour and Kersting bean (Akidi) flour.. **Materials & Methods:** Guinea corn, kersting beans (Akidi) and mature half ripe banana; were purchased from Owerri main market, Imo state. Processing facilities was obtained from food laboratory Department of Nutrition and Dietetics, Imo State University, Owerri. The flours were blended in ratios of (A);90:10:50, (B);80:20:50, (C);70:30:50, (D);60:40:50 (protein basis) of Guinea corn, kersting bean and half-ripe banana. The banana flour was made constant in all blends and homogenized thoroughly with a Kenwood blender. The composites were used to prepare porridges and the porridges were chemically and organoleptically evaluated. The sensory characteristics of color, taste, flavor, mouth feel and general acceptability were evaluated by a twenty (20) semi-trained panelists, who were nursing mothers, using the 9-point hedonic scale. Each panelist was asked to score each coded samples based on the nine point hedonic scale. The nutrient composition of the porridges including the control sample (100% fermented guinea corn flour) were determined and comparisons were drawn. **Result:** The result of the proximate analysis showed that Blend diet D(60:40:50) had highest protein content (16.42%). Carbohydrate level of the products ranged from 61.21-78.04% and fat, from 2.25-7.96%. Blend D had highest calcium 21.17mg, potassium 13.32mg, magnesium 7.20mg, iron 5.15mg and zinc 3.25mg compared to other blends. The organoleptic attributes of the products were generally good. The control diet had higher acceptability rate(8.0)over the formulated food samples, 7.50, 7.14, 7.16 and 7.45 respectively. This could be attributed to the fact that it has been in use and has gained higher popularity. On the other hand, the formulated sample A blend had the highest acceptability rate(7.50) in respect to the other formulated food samples, (B,7.14, C,7.16, D7.45). Conclusion: Judicious combination of legumes, cereals and fruits to produce blends for preparation of complementary foods should be encouraged. The use of locally available and commonly consumed food crops for the formulation of complementary foods should be promoted because, they are nutritious, cost effective and acceptable to both the mothers and children.
Keywords: Nutrient composition, Complementary, Infant, Sensory propertiesIntroduction: In most developing countries like Nigeria, the prevalence of under-nutrition and micronutrient deficiency is high among infants' from 4-59months, which increased the risk of underweight, stunted growth, and death at these ages (1). Ideally, all children in this age range is breastfed, weaned or fed with complementary food. However, when these children progress in growth, the energy and nutrient contribution of complementary food become increasingly necessary for meeting daily requirements. For many infants however, the small quantity of cereal-based porridges commonly fed to them does not contain enough energy and micronutrients to meet daily requirements (2)Production of nutrient-rich complementary food is a major problem in Nigeria and other developing countries, Due to high level of poverty in developing nations, many families cannot afford commercial brands of complementary foods resulting in children being weaned or fed with high starchy gruels, low in protein and other nutrients. The present study considered this nutritional problem by formulating complementary foods from banana flour, fermented guinea corn and kersting bean meal.

The generally accepted recommendations for improving the nutritional status of children in this age group (6-24 months) are to feed children with locally available micro-nutrient rich foods and encourage local production of low cost industrially processed, fortified cereal-based complementary foods (3).

Nutritional status in children is most critical during the early stage in life when both macro and micronutrients are required in sufficient amount to maintain growth and development (4). In Nigeria like in most other developing countries, one of the greatest problems affecting millions of people particularly infants were lack of adequate protein in terms of quality and quantity and ignorance about nutrient value of foodstuff and parasite infections (5).

Result of the 2001-2003 food consumption and nutrition survey showed a step increase in the incidence of child wasting between 6months and above which is the period of complementary feeding for most children. Evidence has shown that protein deficiency is a major nutritional problem among the children and has hindered their health, especially mental capability, school performance and productivity, thus affecting the country's economic growth (6).

WHO recommended the major criteria for a good-quality complementary food to be adequate protein, carbohydrate, high energy value per unit of food volume, soft texture, low fiber content, adequate vitamins and minerals and absence of anti-nutritional factors (7). To this effect, the formulation and development of nutritious complementary foods from local and readily available foods had received considerable attention in many developing countries (8). However, the development of low cost, high protein and micronutrient dense food supplements for infants is a constant challenge for developing countries. This is particularly important in countries like Nigeria, Ghana and ot contain enough energy and micronutrients to meet daily requirements. To this effect, the formulation and development of nutritious complementary foods from local and readily available foods had received considerable attention in many developing countries (8). However, the development of low cost, high protein and micronutrient dense food supplements for infants is a constant challenge for developing countries. This is particularly important in countries like Nigeria, Ghana and sierraleone where malnutrition is still common. Traditional complementary food in Nigeria and in most

developing countries is made from mono cereal gruel such as maize, millet, guinea corn, rice, sorghum and is highly deficient in some of the essential Amino Acids, particularly lysine. Therefore there is need for strategic use of inexpensive high protein sources that complement the protein quality of these staple food crops in order to enhance their nutrition value (9). Traditional complementary foods could be improved upon by combining locally available foods that complement each other in such a way that new pattern of protein and micronutrients qualities can be created by this combination (10).

Sorghum bicolor (L.) Moench, is known under a variety of names: great millet and guinea corn in West Africa, kafir corn in South Africa, dura in Sudan, mtama in eastern Africa, while in the United States of America it is usually referred to as milo or milo-maize (11). In Nigeria guinea corn (Sorghum bicolor) has been given various local names: Yoruba – Oka baba; Ibo-Okili; Hausa Dawa. It is the main staple food crop of northern Nigeria but it is grown as far as south Oyo and Ibadan. Kersting ground bean (Kerstingiella geocarpa Harms) is edible seeds which is a protein-rich food legume that has not been used to an important extent by the human population because its nutritional importance has not been fully determined. This crop is indigenous to tropical Africa and a promising alternative source of high-quality protein for food and feed for the tropics. Kersting groundnut is grown as a minor crop in the savanna areas of West Africa, particularly in Nigeria, Mali, Burkina Faso, Niger, Benin and Togo republic and is eaten boiled or ground into a paste or flour for making food preparations like moi-moi (steamed paste food) or Akara (Fried paste food) in a manner similar to the consumption of cowpea or the seed flour used as soup thickeners, particularly, by low-income groups. This work is aimed towards production and evaluation of nutrients, sensory properties of banana flavoured infants complementary food from combination of fermented guinea corn-and kersting bean blend.

World Health Organization discovered that in developing countries the prevalence of infant mortality due to malnutrition is on the increase due to number of factors which includes poor development among the infants especially during the transition to solid foods (weaning process) and micronutrient deficiencies among others. Various governmental policies have been set-up, affirmative action's has been directed by many institutions on the eradication of malnutrition among infants at their early stage in life. Commercial complementary foods are costly and beyond the reach of people in developing nations added to the high family size. This led to total dependence on traditional gruels prepared from cereals and tuber crops. The nutritive values of some of these foods are grossly inadequate to meet the the needs of a growing child. They contain mainly carbohydrate and are poor in protein and other micronutrients needed to support rapid growth and good health of the babies. Poor hygienic practices by weaning mothers also poses a threat. The thrust of this work therefore, is to formulate diets that promotes growth and supports the growth of infants during weaning periods as demanded by global Alliance for improved Nutrition (GAIN).

Materials and Methods:

Source of raw materials;

Guinea corn, kersting beans (Akidi) and mature half ripe banana; were purchased from Owerri main market, Imo state. Processing facilities were obtained from food laboratory Department of Nutrition and Dietetics, Imo State University, Owerri.

Treatment of samples

Guinea Corn

The procedure for the preparation of fermented guinea corn powder involved soaking of five kilograms guinea corn in portable water for 24h. The water was change at every 6h of soaking. The soaked grains were wet milled using attrition mill to obtain wet thick paste. The thick paste was sieved with muslin cloth in order to get the starch slurry of the guinea corn. Excess water was removed from the starch slurry using hydraulic presser. The starch cake obtained was pulverized and dried. The dried granules of guinea corn starch were milled further using hammer mill and sieved through the aperture of 0.45µm sieve mesh. The fine powder of fermented guinea corn powder was stored using a clean polythene bag.

Kersting Bean (Akidi)

About three kilograms (3kg) of Akidi was soaked for 6hrs in warm portable water. This allowed the beans to soak for easy dehulling. The dehulling was done manually by rubbing the seed between the palms. The dehulled seeds were cleaned and blanched at 65^{o}C for about 30 minutes so as to inactivate lipoxygenase and other anti-nutritional factors. The blanched bean seed was drained and dried at 72^{o}C then, allowed to cool prior to milling using hammer mill. The milled powder was sieved to obtain a fine flour of kersting bean and packaged in clean polythene bag.

Half-Ripe Banana Flour (Musa Balbisiana)

The half ripe banana was processed into flour. The green mature fingers of banana was peeled manually using kitchen knife. The peeled fingers were sliced under water (to prevent browning reaction) into thickness of 2-5mm. The sliced fingers were blanched at 63^{o}C for 10-15min and dried. The dried banana were milled into flour with hammer mill machine. The flour obtained was sieved through the aperture of 0.45µm sieve mesh and packaged.

Formulation of composite flours.

The 24h fermented Guinea corn, 6h fermented Kersting bean and half-ripe banana flours were mixed in various ratios based on protein basis. A kenwood mixer was used for mixing the samples for 2 minutes to achieve uniform mixing as follows:

	Fermented Flour.	Fermented Guinea corn.
Fermented Kersting bean.	**Banana**	
A.	90.	10. 50
B.	80.	20. 50
C.	70.	30. 50
D.	60	40. 50.

The following composites were formulated,

Blend A. (90:10:50). 24 h fermented Guinea corn, 6h fermented Kersting beans and half-ripe banana flours.

Blend B. (80:20:50). 24 h fermented Guinea corn, 6h fermented Kersting beans and half-ripe banana flours.

Blend C. (70:30:50). 24 h fermented Guinea corn, 6h fermented Kersting beans and half-ripe banana flours.

Blend D. (60:40:50). 24 h fermented Guinea corn, 6h fermented Kersting beans and half-ripe banana flours.

Blend E. Control. 100% fermented Guinea corn.

Preparation of porridges

complementary weaning diet. The Blend Diet-A sample was ranked best when compared with other formulated food samples, i.e. Blend Diet-D and Blend Diet-C.the supplementation of up to 60:40% of complementary food was recorded the highest proximate composition and mineral analyzed, calcium had the highest value which was significantly higher in blend diet –D. Nutritionally, the formulated samples were better than Control in terms of mineral.

REFERENCES:

1. UNICEF (2009) Tracking progress on child and maternal nutrition: A survival and development priority. UNICEF, New York, USA, 124 p.
2. Nestel P., Briend A., De Benoist B., Decker E., Ferguson E., Fontaine O., Micardi A., and Nalubola R. (2003) Complementary food supplements to achieve micronutrient adequacy for infant and young children, *Journal of Pediatric and Gastroenterology Nutrition*, 36, 12-22.
3. UNICEF (2012) Infant and young child feeding. Nutrition Section, Programmes, UNICEF New York, USA, 172 p.
4. WHO, (2003). Feeding and Nutrition of infants and young children. Guidelines for the WHO European region with emphasis on the former Soviet Union. WHO Regional Publication European series. 87, 1-296. .http://www.crossref.org/simpleTextQuery.
5. Aboua, F. (1991). Chemical and Physical changes in plantain (*Musa Paradisiaca*) during ripening. And (*Musa* balbisiana) Tropical Science 31. Pp. 183-187.
6. Achigan Dako, E; Vodouh'e S.R. & Kaike, A; (2003). Collecte des resources genetiques du Voandzou (Vigna subterranean (L.verdC.) et du dohi (Macrotyloma geocarpum (harms) Marech.et Baud.all Centre Benin. In: Agossou, A., Amandji, F., Agbo, B.&Trund, ekpon, A. (Editors). Actes de I' atelier Scientifique du centre des recherché Agri coles du centre-save. 18-19 December 2002, passa, Benin. Institute National de Rechers Agricodes du Benin, Cotonou, Benin. PP 93-107.
7. ACC/SCN (United Nations Administrative Committee on coordination- subcommittee on Nutrition) (2000). *Fourth report on the World Nutrition Situation*. ACC/SCN in collaboration with the International Food Policy Research Institute, Geneva, Switzerland.
8. 9. Blum-Kemelor D.M. (2001). Feeding Infants: A Guide for Use in the Child Nutrition Programs Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service.
10. Okafor J.N.C, Ozumba, A.U, Onu, L.I Daodu, A.N, Olatunji O.O (2008). Chemical microbial and sensory properties of weaning foods from blend of

Nigerian food stuff.*J. Int. Res. Technol. 2: 31-36.*
11. FAO, 1995, "Sorghum and millets in human

Table 1 : Proximate composition of Fermented Guinea corn- Kersting bean (Akidi) meal complementary weaning diet

Weaning diet blend sample	Moisture %	Protein %	Fat %	Ash %	Crude fiber %	Carbohydrate %
Blend diet- A	$7.27^{d}\pm0.04$	$6.31^{d}\pm0.03$	$2.25^{d}\pm0.04$	$2.95^{d}\pm0.01$	$3.20^{b}\pm0.02$	$78.04^{b}\pm0.16$
Blend diet- B	$6.84^{e}\pm0.05$	$9.90^{c}\pm0.03$	$5.10^{c}\pm0.02$	$3.18^{c}\pm0.02$	$3.08^{c}\pm0.02$	$71.91^{c}\pm0.04$
Blend diet- C	$7.53^{c}\pm0.03$	$13.32^{b}\pm0.02$	$6.46^{b}\pm0.03$	$3.64^{b}\pm0.03$	$2.84^{d}\pm0.02$	$66.23^{d}\pm0.02$
Blend diet- D	$7.94^{b}\pm0.02$	$16.42^{a}\pm0.02$	$7.96^{a}\pm0.04$	$3.82^{a}\pm0.02$	$2.67^{e}\pm0.02$	$61.21^{e}\pm0.04$
Ref. (SON, 1998)	5-10	14-17	-		≤5	≥50
LSD	0.04359	0.03332	0.03688	0.02510	0.02569	0.09088

Mean scores with different letter along the same column are significantly different ($p<0.05$)

Key

Blend diet- A= complementary diet from mix of 90:10% proportion of fermented guinea corn, kersting bean & half-ripe banana flour meal

Blend diet- B= complementary diet from mix of 80:20% proportion of fermented guinea corn, kersting bean & half-ripe banana flour meal

Blend diet- C= complementary diet from mix of 70:30% proportion of fermented guinea corn, kersting bean &and half-ripe banana flour meal

Blend diet- D= complementary diet from mix of 60:40% proportion of fermented guinea corn, kersting bean & half-ripe banana flour meal

Control diet = 100% guinea corn meal

LSD= Least Significant Different ($p<0.05$)

Table 2: Mineral content of Fermented Guinea corn, Kersting bean (Akidi) , and banana flour complementary weaning diet.

Weaning diet blend sample	Calcium mg/100g	Potassium mg/100g	Magnesium mg/100g	Iron mg/100g	Zinc mg/100g
Blend diet- A	$11.95^{d}\pm0.04$	$7.91^{d}\pm0.03$	$2.80^{d}\pm0.02$	$2.15^{d}\pm0.02$	$1.41^{d}\pm0.04$
Blend diet- B	$13.31^{c}\pm0.03$	$9.08^{c}\pm0.04$	$3.11^{c}\pm0.01$	$2.88^{c}\pm0.02$	$2.23^{c}\pm0.03$
Blend diet- C	$17.19^{b}\pm0.04$	$11.24^{b}\pm0.04$	$4.58^{b}\pm0.03$	$4.34^{b}\pm0.04$	$2.95^{b}\pm0.03$
Blend diet- D	$21.17^{a}\pm0.02$	$13.32^{a}\pm0.01$	$7.20^{a}\pm0.02$	$5.15^{a}\pm0.04$	$3.25^{a}\pm0.05$

Mean scores with different letter along the same column are significantly different ($p<0.05$)

Key

Blend diet- A= complementary diet from mix of 90:10% proportion of fermented guinea corn, kersting bean & half-ripe banana flour meal

Blend diet- B= complementary diet from mix of 80:20% proportion of fermented guinea corn, kersting bean & half-ripe banana flour meal

Blend diet- C= complementary diet from mix of 70:30% proportion of fermented guinea corn, kersting bean &and half-ripe banana flour meal

Blend diet- D= complementary diet from mix of 60:40% proportion of fermented guinea corn, kersting bean & half-ripe banana flour meal

Control diet = 100% guinea corn meal

LSD= Least Significant Different ($p<0.05$)

Table 3: Mean sensory scores of Fermented Guinea corn & Kersting bean (Akidi)meal complementary weaning diet

Weaning diet blend sample	Color	Aroma	Taste	Mouth-feel	Acceptability
Blend diet- A	8.15[a]	7.30[a]	7.55[a]	6.95[a]	7.50[a]
Blend diet- B	7.24[ab]	6.76[a]	6.91[a]	6.90[a]	7.14[a]
Blend diet- C	6.95[b]	6.53[a]	6.68[a]	6.47[a]	7.16[a]
Blend diet- D	7.45[ab]	6.90[a]	7.45[a]	7.05[a]	7.45[a]
Control diet (100%)	7.65[ab]	7.60[a]	7.40[a]	7.55[a]	8.0[a]
LSD	0.40141	0.41229	0.41914	0.46386	0.37704

Mean scores with different letter along the same column are significantly different ($p<0.05$). LSD= Least Significant Different ($p<0.05$)

Key

Blend diet- A= complementary diet from mix of 90:10% proportion of fermented guinea corn, kersting bean & half-ripe banana flour meal

Blend diet- B= complementary diet from mix of 80:20% proportion of fermented guinea corn, kersting bean & half-ripe banana flour meal

Blend diet- C= complementary diet from mix of 70:30% proportion of fermented guinea corn, kersting bean &and half-ripe banana flour meal

Blend diet- D= complementary diet from mix of 60:40% proportion of fermented guinea corn, kersting bean & half-ripe banana flour meal.