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ASSESSMENT OF LEAF-TYPE AND NUMBER OF LEAVES USED IN WRAPPING ON THE QUALITY OF "*UGBA*" (FERMENTED *PENTACLETHRA MACROPHYLLA* BENTH SEED)

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ABSTRACT: *Assessment of leaf-type and number of leaves used in wrapping on the quality of Ugba (fermented Pentaclethra macrophylla Benth seeds) was studied. Ugba is a delicacy commonly consumed by people of South Eastern states of Nigeria. Raw African oil bean seeds were boiled, dehulled, sliced, reboiled, washed and steeped in cold water for 10h and washed again, drained and wrapped with different leaves [plantain leaves (Musa paradisiaca), cocoyam leaves (Xanthosoma sagittifolium) and Okpopia leaves (Alchornea laxifora Benth leaves)] and fermented for 72h. The samples were wrapped with different number of leaves ranging from 1-5. The sensory evaluation and proximate analysis of the fermented samples were carried out. Statistical analyses of both were determined using Fisher's Least Significant Difference at P≤0.05 confidence between the samples. The composition of Ugba wrapped in Okpopia leaves (Alchornea laxiflora), cocoyam leaves and plantain leaves had different levels of moisture content (44.3%, 52.83%, 47.04%) respectively. Protein ranged from (6.77% - 8.59%), fibre content ranged from (17% - 39%), carbohydrate content range from (35.23% - 44.57%), fat content ranged from (6.5% - 12%) and ash content ranged from (13% - 33%). There were significant differences (P≤0.05) among all the samples in protein, fibre, carbohydrate, fat and ash contents respectively. The highest protein and carbohydrate, least fat, moisture and ash contents were from samples A (Okpopia leaves wrapped with five layers), suggesting best wrapping material. Organoleptic characteristics of the samples showed that the wrapping materials influenced the sensory attributes and the best wrapping material was shown to be Okpopia leaves with five layers, according to the panelists.*

KEYWORDS: Assessment, Leaves, Quality, Ugba, Wrapping

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INTRODUCTION

Packaging (wrapping) is the science, art and technology of enclosing or protecting a product for distribution, storage, sale and use. Packaging equally refers to the process of design, evaluation and production of packages (Robertson, 2005). Packaging can also be described as a co-ordinated system of preparing goods for transport, warehousing, logistics and sales (Fielder, 1995). Packaging play vital role in food production, this includes physical protection, barrier protection from oxygen and water vapour, reducing security risk during shipment and creating convenience in distribution, handling sales, opening, use and re-use (Robertson, 2005). Product attraction to consumer could be as a result of proper or quality packaging material in the sense that the type of packaging materials used in such products help in defining the quality of the product goods (IFT, 1991).

Traditional packaging system cannot be forgotten in the sense that product cannot be normally packaged without the use of the traditional packaging material such as wine skin, wooden boxes, woven bags and leaves in packaging products such as vegetable, pepper, cereal, grains and legume seed. Leaves play vital role in the traditional packaging of food products with regards to their packaging properties such as aroma, taste. In the traditional packaging of "*Ugba*" a fermented product of oil bean (*Pentaclethra macrophylla benth*) seeds, various leaves are used. Proper fermentation of the oil bean seed could be as a result of the use of the right kind of wrapping material for the food product.

Fermented foods are food substrates that are invaded or overgrown by edible microorganisms whose enzymes particularly amylases, protease, lipases, hydrolyze the polysaccharides, proteins and lipids to non-toxic products with flavours, aromas and textures pleasant and attractive to the human consumer (Steinkraus, 1996). Fermentation makes food palatable by enhancing its organoleptic properties; aroma, texture, taste and flavour (Chelule *et al*, 2010). These organoleptic properties make fermented foods more popular than the unfermented ones in terms of consumer acceptance (Osungbaro, 2009). Fermentation plays important roles in food processing such as enrichment of the human dietary through development of a wide diversity of flavours, aromas and textures in food, preservation of food through production of acids, enrichment of foods with vitamins, proteins etc, detoxification of food and a decrease in cooking times and fuel requirements. Indigenous fermented foods were developed through traditional technologies which were preserved over the years in order to maintain their uniqueness and identity. Seed of legumes may account for 80% dietary proteins which are commonly used in fermented forms as condiments to enhance the flavour (Oniofiok *et al*, 1996).

Fermented African oil bean seeds, *Ugba* in Igbo, South-Eastern Nigeria are prepared from plant materials, using processes in which microorganisms play active roles in the physical, nutritional and organoleptic modification of the starting materials (Aidoo, 1994). Legume seeds have

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continued to make significant contribution to human nutrition (Nwosu and Ojimelukwe, 1993). *Ugba* production is locally produced through mixed wild bacteria fermentation; unprocessed African oil bean seeds are bitter and posses anti-nutritional factors which includes cyanide, oxalates, saponin, phytic acid and tannins (Enujiugha, 2003). Microbial proliferation of *Ugba* is introduced through the air, water, utensils, leaves used in wrapping them. Food packaging has emerged as a key factor that determines consumer dietary behaviour. Food wrappers (packaging) are meant to preserve, extend shelf life, retain nutrients and present food for consumption to the end user, amongst other uses. The earliest food packaging materials were probably leaves from higher plants. Traditionally, during keeping of fermented African oil bean, some local leaves are used to package the product and allowed to ferment for some days (about 3-5 days), depending on the location and locality. Examples include Banana/Plantain leaves i.e. *Musa sapentium, Musa paradisiaca, Cola nitida* and *Thaumatococcus danielli* leaf, Akwukwo *Ugba* (*Alchornea laxiflora Benth* leaves), ororompo leaves (*Mallotus oppitifolus Mull*), cocoyam leaf (*Xanthosoma sagittifolium*). The use of these leaves are very ancient way (traditions) of the peoples, the basis of which cannot be easily ascertained, but a cursory look at these leaves revealed that they all have large surface area, i.e. can and are used to hold/package/wrap large volumes of foods, low cost and ease of obtaining and their property of not transferring pigments or colour to wrapped food.

Since the type of leaves used in wrapping "*Ugba*" may vary from place to place, it implies that different microorganisms maybe responsible for the fermentation. Lactic acid bacteria and yeast are responsible for most of these fermentation (Adenike *et al*, 2007; Adeleke and Abiodun, 2010), thus resulting in different flavours and aroma. The weight of microorganisms in the food is usually small, but their influence on the nature of the food, especially in terms of flavour and other organoleptic properties is profound.

African oil bean seed has been known to be a good source of edible protein and high energy calories. It is then prepared as snacks or used as condiments in soup preparation and local porridge. It is rich in mineral (calcium, phosphorus etc) needed for body functions such as bone formation, blood coagulation, nervous co-ordination and muscle activities (Okechukwu *et al*, 2012).

There has been a challenge posed by incomplete wrapping of *ugba* whereby fewer/less numbers of leaves are used for packaging leading to poor handling which often allows maggots to develop on the product as a result of eggs laid by flies that gained entry into the poorly wrapped product.

Therefore, the objectives of the study are to investigate the effect of leaf-type and number of leaves used in wrapping "*Ugba*" on its organoleptic properties and to identify the best wrapping method and number of leaves which will give the product the acceptable organoleptic characteristics.

METHODOLOGY

The materials (African oil bean seeds, leaves, local metal, kitchen knife, chopping board) used in this study were sourced locally from markets within Owerri metropolis, Imo state Nigeria. The

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work was carried out in the food processing laboratory of Federal University of Technology, Owerri. Equipment used were obtained from the Department of Food Science and Technology, Federal University of Technology, Owerri Nigeria.

Identification and Collection of the Wrapping Material

The wrapping/packaging materials [cocoyam leaves (*Xanthosoma saggitifolium; ede uhie)*, plantain leaves (*Musa paradisiaca*), *Alchornea laxiflora Benth* leaves- "*okpopia leaves*] used in this study were identified and collected at Umuchulu Community in Ngor Okpala L.G.A, Owerri, Imo State, Nigeria.

Preliminary Preparation of the Wrapping Leaves and Raw African oil bean seeds

The wrapping materials such as "*okpopia*" leaves, cocoyam leaves and plantain leaves were washed and allowed to drain and the plantain leaves blanched to avoid tearing during wrapping and to further reduce the microbial load. The African oil bean pods were broken in order to obtain the seeds and the seeds were sorted manually, washed in order to remove spoilt seeds, dust and extraneous materials from wholesome seeds (Plate 1).

Production of Fermented African Oil Bean Seeds (*Ugba*)

The *ugba* samples were produced using the traditional method according to Njoku and Okemadu (1989) as shown in fig.1. Two kilograms of raw African oil bean seeds were washed with clean water and then put in the pot covered with water and boiled with occasional stirring for 45min. The heating was discontinued and the seeds were removed in batches and dehulled while hot. After dehulling, a local metal (called nkwoo) designed to slice *African oil bean* seeds was used to slice the seeds. Then a chopping board (small neat wood) was placed on top of a neat sac bag spread on a working bench. The sliced seeds were then cut into desired sizes with a neat sharp kitchen knife. The seeds came out in shreds. Then the shreds (shredded seeds) were poured into a covered pot of boiling water and stirred at 5min intervals for 30min. The boiled shreds were poured into sterile sieve to drain out the hot liquor. Water was sprayed on the shreds to completely remove the hot liquor and to cool the shreds.

Then the shreds were washed three times, drained of wash water and steeped in distilled water in a pot and covered. The shreds were steeped for 10h. At the end of steeping, the shreds were vigorously stirred and poured into a sterile sieve (which has been autoclaved at a temperature of 121^0C and pressure of 16psi) to completely drain the steep water from the shreds. Then the shreds were poured into a sterile sieve lined with steam heated and cooled *okpopia* leaves and covered with the leaves, and kept in a warm environment (37^0C, ambient temperature) to initiate fermentation.

After 5h, the fermenting shreds (Plate 2) were aseptically taken, weighed and wrapped in sterile *leaves*, according to leaf-type and number of leaves (starting with *okpopia* leaves ranging from 1-5 layers of same leaf, same was done for both cocoyam and plantain leaves). The wraps were

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packed and put in sterile pot, kept at ambient temperature and fermented for 3 days (72h) (Plate 3).

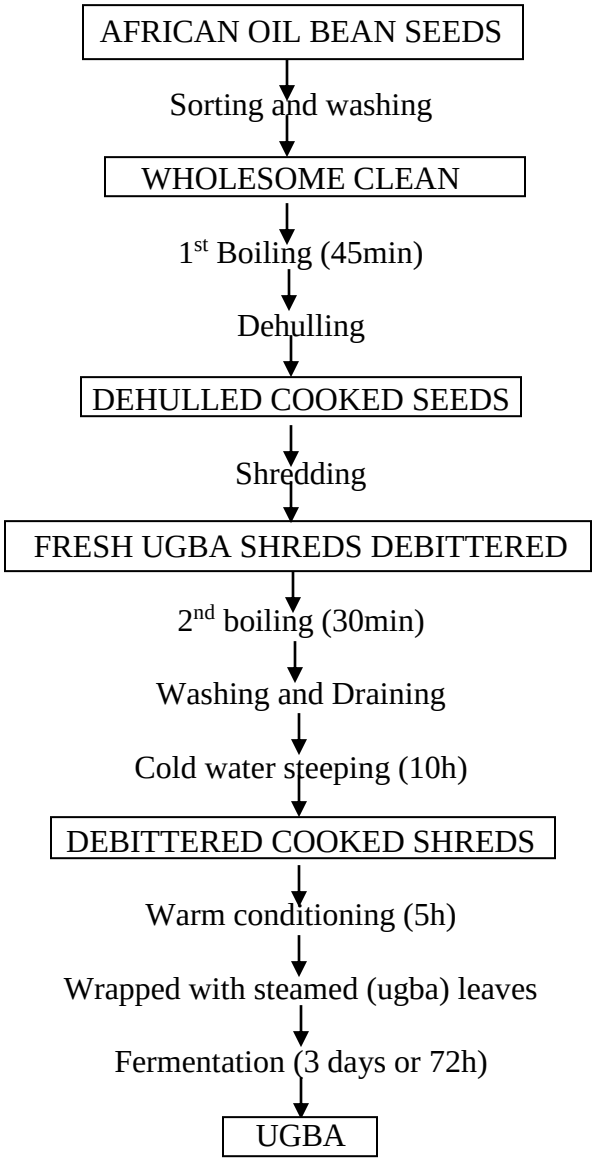

Fig.1: Flow Chart Diagram showing the production of "*Ugba*" (Fermented *Pentaclethra macrophylla* Benth seeds*)* (Njoku and Okemadu, 1989).

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Plate 1: Raw African Oil Bean (*Pentaclethra macrophylla* Benth) Seeds

Plate 2: Fermenting Slices of African Oil Bean (*Pentaclethra macrophylla* Benth) Seeds ready for wrapping.

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Plate 3: Wrapped fermenting African oil bean slices.

Sensory Evaluation

The organoleptic evaluation of the "*Ugba*" (fermented African Oil Bean Seeds) samples wrapped in different leaves was carried out for consumer acceptance and preference by 10 panelists (students and staff of the Department of Food Science and Technology, Federal University of Technology, Owerri Nigeria). The panelists evaluated the sensory properties based on aroma, taste, colour, texture and overall acceptability using a nine-point hedonic scale, where 9 represents "Like extremely and 1 Dislike extremely (Ihekoronye and Ngoddy, 1985). Meanwhile, necessary precautions were taken to prevent carryover of flavour during the tasting by ensuring the panelists rinsed their mouth with water after each stage of evaluation.

Proximate Analysis of Product

The proximate compositions were determined according to the standard methods of Association of Official Analytical Chemists (A. O. A. C., 1990).

Samples were analyzed for fatty acids, crude fibre, crude protein, moisture, ash and carbohydrate.

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RESULTS

Table 1: Mean Values of organoleptic properties of "*Ugba*" (Fermented *Pentaclethra macrophylla* Benth seeds) samples wrapped in different materials

SAMPLES	AROMA	TASTE	TEXTURE	COLOUR	OVERALL ACCEPTABILITY
A	$4.8^{bc}\pm1.7$	$6.1^{a}\pm0.9$	$5.6^{fg}\pm1.6$	$4.1^{fg}\pm1.8$	$5.2^{bcde}\pm1.2$
B	$5.4^{abc}\pm1.9$	$6.1^{a}\pm0.7$	$5.8^{abc}\pm1.6$	$5.5^{cdrf}\pm1.8$	$5.5^{abcd}\pm1.4$
C	$6.0^{ab}\pm1.3$	$5.9^{ab}\pm0.9$	$6.4^{a}1.4$	$6.8^{abc}\pm1.5$	$6.6^{a}\pm0.7$
D	$5.4^{abc}\pm1.4$	$5.7^{ab}\pm0.9$	$5.8^{abc}+\pm1.8$	$4.4^{ef}\pm1.3$	$4.8^{cdef}\pm1.6$
E	$6.1^{ab}\pm1.2$	$4.7^{bcde}\pm1.4$	$5.8^{abc}+\pm1.9$	$8.0^{a}\pm0.8$	$6.3^{ab}\pm1.4$
F	$5.4^{abc}\pm2.2$	$3.9^{e}\pm2.0$	$5.7^{abc}\pm1.9$	$6.6^{abc}\pm2.2$	$4.5^{def}\pm2.1$
G	$5.1^{abc}\pm2.2$	$4.9^{abcde}\pm2.1$	$4.4^{cd}\pm2.0$	$2.9^{g}\pm2.1$	$3.9^{ef}\pm2.0$
H	$5.9^{abc}\pm1.4$	$5.3^{abcd}+\pm1.9$	$5.3^{abcd}\pm1.8$	$6.7^{abc}\pm2.0$	$6.3^{ab}\pm1.2$
I	$4.4^{bc}\pm1.5$	$4.3^{cde}\pm1.6$	$4.0^{d}\pm1.8$	$5.1^{def}\pm1.6$	$3.7^{f}\pm1.9$
J	$4.8^{bc}\pm2.4$	$4.1^{de}\pm1.5$	$4.8^{bcd}+\pm1.9$	$7.3^{ab}\pm1.5$	$5.4^{abcd}\pm1.5$
K	$5.8^{abc}\pm1.6$	$6.1^{a}\pm1.4$	$5.9^{ab}\pm1.3$	$6.4^{bcd}\pm1.9$	$6.0^{abc}\pm0.8$
L	$6.1^{ab}\pm1.7$	$6.0^{a}+\pm0.8$	$5.9^{ab}\pm1.4$	$5.6^{cde}\pm1.8$	$5.5^{abcd}\pm1.0$
M	$6.4^{a}\pm1.4$	$5.9^{ab}\pm1.4$	$5.7^{abc}\pm2.0$	$6.8^{abc}\pm1.4$	$6.1^{abc}\pm2.2$
N	$5.6^{abc}\pm2.0$	$6.0^{a}\pm1.3$	$6.4^{a}\pm1.3$	$7.5^{ab}\pm1.4$	$6.6^{a}\pm1.4$
O	$4.8^{bc}\pm1.6$	$5.4^{abc}\pm1.3$	$5.9^{ab}\pm1.4$	$6.9^{abc}\pm0.9$	$6.0^{abc}\pm0.8$
LSD	-	1.24	1.45	1.45	1.32

Mean in the same column with the same superscripts are not significantly different at $P > 0.05$ and those with different superscripts are significantly different at $P < 0.05$.

Key:
A-E: Ugba wrapped with okpopia leaves ranging from 1-5 layers of leaves
F-J: *Ugba* wrapped with cocoyam leaves ranging 1-5 layers of leaves
K-O: *Ugba* wrapped with plantain leaves ranging from 1-5 layers of leaves

Table 2: Effects of Wrapping Materials on Proximate Composition of "*Ugba*" (Fermented *Pentaclethra macrophylla* Benth seeds)

Samples	Moisture Content	Protein	Fibre	Ash	Fat	Carbohydrate
A	44.33^{c}	8.59^{a}	17^{c}	18.5^{b}	6.5^{b}	44.57^{a}
B	52.83^{a}	7.45^{b}	39^{a}	13^{c}	12a	41.49^{b}
C	47.04^{b}	6.77c	33.5^{b}	33^{a}	12a	35.23^{c}
LSD	0.02	0.02	1.17	2.00	1.64	0.02

Mean in the same column with the same superscripts are not significantly different at $P > 0.05$ and those with different superscripts are significantly different at $P < 0.05$.

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Key:
A-Five layers of *okpopia* leaves
B-Three layers of cocoyam leaves
C-Three layers of plantain leaves

DISCUSSION

Sensory evaluation of fermented African Oil Bean Seeds

Table 1 shows the effect of different wrapping materials on the organoleptic properties of "*Ugba*" Samples - fermented African Oil Bean Seeds (*Pentaclethra macrophylla* Benth seeds).

Aroma

The aroma of the "*Ugba"* samples (fermented *Pentaclethra macrophylla Benth* seeds) were significantly similar from each other and they were "slightly liked" (score approximately 6.0). The aroma of sample wrapped with plantain leaves with three layers was however given the highest score 6.40, which was followed by samples having mean scores of 5.90. The close rating of the samples on aroma could be due to the fact that one mixture was used in their production and the wrapping materials did not impart flavor on the samples.

Taste

The values for taste of "*Ugba"* sample wrapped in K, B, A, N, and L were found to be 6.10, 6.10, 6.10, 6.00 and 6.00 respectively. The tastes of some of the samples were significantly different while some were not significantly different. Even though the panelists seem to prefer sample K, B, A, they found the taste of others to be quite good.

Texture

The texture of all the samples were significantly different and were "slightly liked" (score approximately 6.0) with "*Ugba"* sample wrapped with N and C rated highest.

Colour

Colour is very important parameter in judging properly a food product. This parameter does not only reflect the suitable raw material used for the preparation but also the wrapping material used. The colour of the sample wrapped in E had mean score of 8.00 (i.e liked very much) and was significantly different from other samples. The colour of sample wrapped in G had the lowest mean score of 2.90 and was significantly different from other samples. Generally, the colour of all the samples were either "slightly liked" (score approximately 6.0) or "moderately liked" (score approximately 7.0) though some were significantly different while some were not significantly different as observed by the panelist.

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Overall Acceptability

The overall acceptability of all the samples showed that samples wrapped in N and C were rated highest (scores 6.6 approximately 7.0) and was significantly different from other samples which were "slightly liked" (Score approximately 6.0).

Thus, generally, fermented African Oil Bean (*Pentaclethra macrophylla* Benth seeds) "*Ugba"* wrapped with N was best accepted in all sensory parameters tested except in aroma.

Proximate Composition of fermented African Oil Bean Seeds

Table 2 shows the effect of different wrapping materials on the proximate composition of "*Ugba*" Samples- fermented African Oil Bean Seeds (*Pentaclethra macrophylla* Benth seeds).

Moisture Content

The table 2 showed that the moisture contents of the samples ranged from 44.33% to 52.83%. Different food materials have different capacity for absorbing or retaining moisture which may exist as absorbed water. The composition of fermented African Oil Bean Seeds wrapped in "*Okpopia*" leaves, cocoyam leaves and plantain leaves had different levels of moisture (44.3%, 52.83%, and 47.04% respectively). The moisture content of fermented beans could reach up to 74% during 5 days fermentation (Pierson *et al*., 1986). Ikediobi, (1981) reported that this difference in moisture content is due to the cooking and fermentation treatment the samples were subjected to. The decrease in moisture content of sample A which is the *Alchornea Laxiflora Benth, okpopia leaves* showed the certainty of prolonging shelf life. Besides, the range of moisture content implied that the leaf (*Okpopia* leaves) had good storage potential, since it was known that moisture and water activity of the product determine greatly the keeping quality of foods. The moisture content in sample A had the lowest mean value of 44.33% while sample B (cocoyam leaves) had the highest moisture content of 52.83%. Since the same sample was used, the sample B must have retained more moisture than the other samples during the cooking period, or the other samples may have lost moisture during cooking. There was significant difference between the samples at $P < 0.05$.

Crude Protein

The values of the protein content of the "*Ugba"* samples, (*Pentaclethra macrophylla* Benth seeds) were 8.59%, 7.45%, and 6.77% for samples A, B and C respectively. The protein contents were significantly different at $P<0.05$, though the sample wrapped with plantain leaves had the lowest percentage of protein content. Mbajunwa (1995) reported that decrease in protein value could be attributed to leaching of soluble proteins into the processing water during *Ugba* production. Generally, the protein content of all the samples were relatively high because fermented African Oil Bean Seeds are good sources of protein.

Crude Fibre

According to Ihekoronye and Ngoddy (1985), crude fibre has no appreciable effect, yet they are valuable component of food. They provide bulk in the diet and the intestine and reduce plasma

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cholesterol in the body (Mbajunwa, 1995). Crude fibre consists mainly of non-digestible carbohydrate such as pectin, hemicellulose and cellulose. The crude fibre content values ranged from 18.5% to 39%. There was significant difference at P<0.05 confidence level. The sample B had higher crude fibre content than samples A and C.

Ash

The ash content of the "*Ugba*" samples ranged from 13% to 33% and there were significant (P<0.05) differences among the samples. Sample C had higher ash content (33%) than sample A (18.5%) and sample B (13%).

Fat

Fat plays a significant role in the shelf life of food products. This is because fat can promote rancidity in foods leading to development of unpleasant and odorous compounds (Ihekoronye and Ngoddy, 1985). The values ranged from 6.5% to 12%. It was observed that the fat content in samples B and C (Cocoyam and Plantain leaves respectively) were higher than that in sample A. Relatively high fat content could be undesirable in food products (Ihekoronye and Ngoddy, 1985). The samples B and C does not differ significantly (P>0.05) and were significantly (P<0.05) different from sample A.

Carbohydrate

Carbohydrates supply quick source of metabolized energy and assist in fat metabolism. Table 2 showed that carbohydrate values for "*Ugba"* ranged from 35.23% to 44.57%. Sample A had the highest value than samples B and C and there were significant (P<0.05) differences among the samples.

CONCLUSION

The organoleptic characteristics of "*Ugba"* samples showed that samples wrapped in *Alchornea laxiflora Benth* (*okpopia*) leaves were best in almost all parameters tested including overall acceptability according to the panelist. The proximate analysis indicates that generally, the different wrapping materials and number of leaves used did not affect the proximate composition of fermented *Pentaclethra macrophylla Benth* (fermented African Oil Bean, "*Ugba"*) as the slight variations were due to differences in number of leaves used. *Okpopia* leaves (sample E, i.e. five number of *Okpopia* leaves) had higher wrapping quality and nutrient value.

RECOMMENDATION

The following are recommended; increased *Okpopia* leaves production and the use of five number of *Okpopia* leaves (*Alchornea laxiflora Benth* leaves) for wrapping fermented African Oil Bean, "*Ugba"* because of the high keeping quality and organoleptic properties.

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