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Effect of Processing Methods on Proximate Composition and Sensory Properties of "Ugba" (Pentaclthra Macrophylla Benth) an African Oil Bean Product

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Abstract: *The prepared seed slices of African oil bean (Pentaclthra macrophylla Benth) were subjected to different fermentation periods and dried using different drying methods to produce 'ugba' slices and were milled to obtain flour. The flour from different "Ugba" samples were analysed for proximate composition. Sensory evaluation using a 9 – point hedonic scale carried out by 20 – man panel. Result showed that there were significant difference (P<0.05) in the moisture content and crude fiber content of different "Ugba" samples. There were no significant difference (P>0.05) in the sizes of Ugba. The crude fiber content ranged from 0.22 – 2.15% showed no significant different. The ash content of the samples showed that, there were significant difference among them (P<0.05). The ash content ranged from 0.25 – 0.65%. Sensory analysis showed that there were no significant different (P>0.05) in terms of taste, texture, flavor and general acceptability of the "Ugba" samples.*

I. Introduction

The African oil bean tree (Pentaclethra Macrophylla Benth) is a large leguminous woody plant that belong to the subfamily of mimosarde (Keay, 1989) it is commonly referred to as the oil bean tree" is a module forming multipurpose tree species of probable African Origin. It grows wild in rain forest and in farm lands where it has carefully conserved by farmers alongside their crops (Abbiwo, 1990). It is frequently cultivated in forest areas with about eight (8) flat glossy brown edible seeds per pod. The raw seed is a potential source of edible protein and calories containing the twenty essential amino – acids and essential fatty acids make up more than 80% of fatty acids in the oil (Enujiugha and Agbede 2000; Ikediobi; 1981).

The problem of widespread prevalence of protein energy malnutrition (PEM) has resulted in high morbidity and mortality rates, especially among infants and children in low-income groupings in the third world, including Nigeria. The reliance on starchy roots and tubers and protein –deficient cereals as main staples result in consumption of stodgy monotonous, non-nutritious diets (Enujiugha et al, 2003). Africa oil bean are edible after roasting or boiling for 12 hours, though more as a condiment than food. In Liberia, because to Tropical West Africa they are eaten wrapped in leaves after roasting or boiling for 12 hours.

Fermented foods are consumed by a large number of people in different parts of the world (Steinkraus, 1983). In the developing countries in particular, "Ugba" plays a major role by providing essential nutrients and variety in the diet.

The fermentation of the African oil bean seed effects better nutrient availability and digestibility with significant softening of the cotyledons (Enujiugha and Akanbi, 2002). The fermented "Ugba" can then be consumed as a snack or used as a condiment in soup mixes and local porridges.

Pentaclethra macrophylla is planted by the use of its seed or by the plant growing naturally on its own. After planting, the plant grows for up to five years before it starts fruiting, harvesting is done when plant fruit matures (Enujiugha and Agbede 2000). Harvesting should be done early and when the fruits have been noticed to be matured to avoid explosion of the pods which causes scattering of seeds and regeneration of wild uncultivated crops.

The processing of ugba is achieved traditionally by boiling the mature seeds for 5 – 8 hours, after which the seed coats are removed. The edible endospem is sliced and the slices boiled for 45 – 60mins. They are now drained and salt added (1.0g per kg sample). Following salt addition, the samples are wrapped in blanched banana leaves or other suitable leaves and fermented for three days (Achinewhu, 1982). "Ugba" is a low – acid food, a product of alkaline fermentation, and it is expected that the application of heat to maintain commercial sterility could bring about changes in the nutritious and antinutritional status of the product as well as its functional characteristics. Therefore, it is necessary to examine the chemical composition of the processed "ugba" to ensure preservation of its nutrient potentials. (Enujiugha, 2003)

Objectives

Studing the effects of different processing methods and sizes of "ugba" on the proximate composition and sensory properties of "ugba".

II. Materials Of Methods

Collection of speed samples.

African oil beans seeds (pentaclethra macrophylla) used for this study were purchased from Umuahia market, Abia State. Soon after collection, the extraneous materials, broken beans, unwanted seeds and materials were removed.

Processing Methods

The seeds were washed in a basin of tap water and freed from dust and other foreign materials. The traditional natural fermentation method practiced in Nigeria was carried out as described by Njoku and Okemadu (1989). The seeds were boiled in an aluminum pot with a lid for 3hrs and the hard coats were peeled off the cotyledons by hand. The cotyledons were cooled for 10 – 25min and then cut into different slices ranging from 2.0mm for small size 2.5mm for medium size and 3.5mm for large size with a serile knife and washed with water. The slices were measured with a basic scientific instrument called caliper. The slices were then boiled for 2hours cooled and soaked in distilled water for 10hrs Thereafter, the slices were drained in a basket lined with blanched banana (Musa Sepretum) leaves for 12hours and further wrapped in blanched banana leaves and incubated at room temperature for 0, 12, 24 and 36 hours. The first sample was referred to as the zero hour (h) sample was collected immediately before the slices were wrapped in blanched banana leaves. These samples were dried with different drying methods such as oven drying at 68^0C, sun drying for 7 days and room temperature for 14 days ($X^{0C} \pm 27^{0C}$). African oil bean product were stored in haematic plastic container for 3 months at room temperature and then packaged for export.

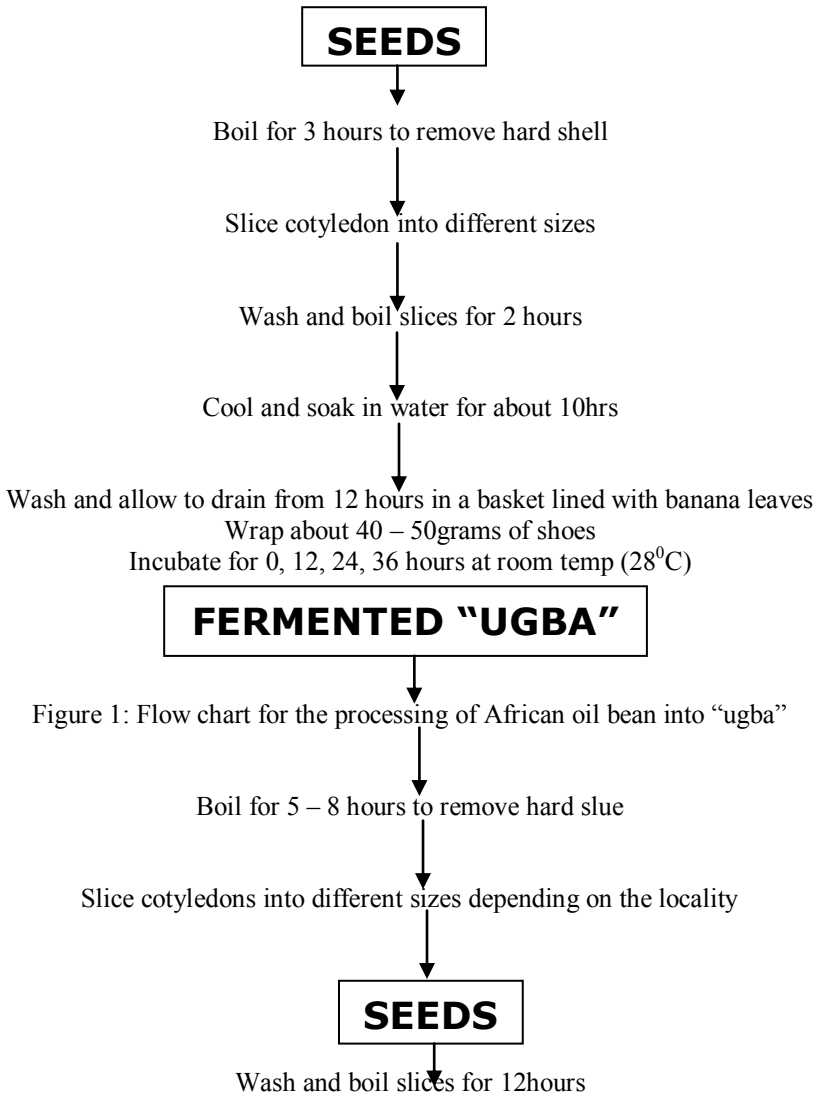

Figure 1: Flow chart for the processing of African oil bean into "ugba"

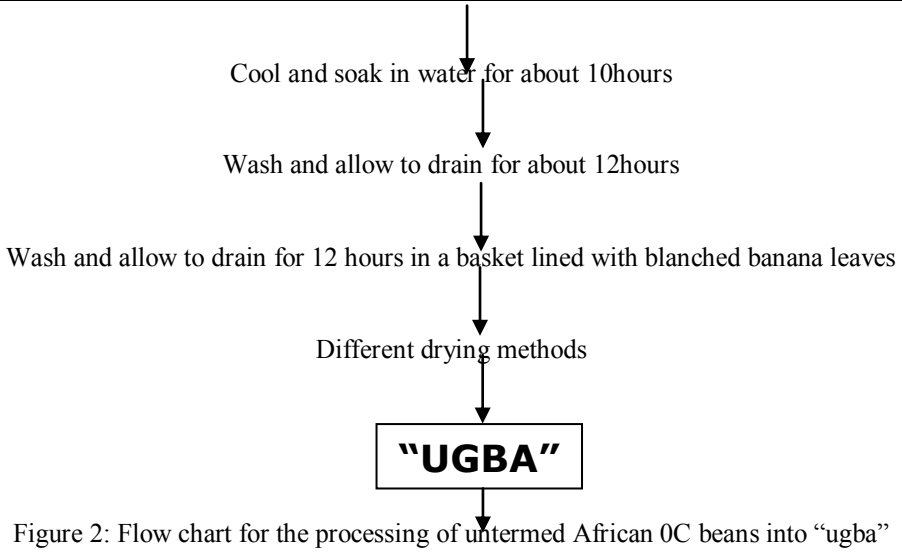

Figure 2: Flow chart for the processing of untermed African 0C beans into "ugba"

Proximate Analysis

Moisture, crude protein, crude fibre, crude fat and ash content of the samples before and after storage were determined according to A0AC (1990). Total carbohydrate contents of the samples were determined by difference. All the values collected were statistically analyzed using MSTAT-C programme Anova (Annon 1988). All determinations were in triplicates.

Moisture Content.

Exactly 5g of the sample was placed in a weighed crucible the sample was dried at a temperature of 105^0C until a constant weight was obtained. The percentage moisture content was calculated as follows % moisture content = $\frac{w_1 - w_2}{w_3}$ X 100 where

W_1 = weight of crucible + sample before drying
W_2 = weight of crucible + sample after drying
W_3 = weight of sample

Ash Content

Exactly 2g of the oven dried sample was placed in a weighed crucible and ashed in a muffle formace at 45^0C for four hours. The sample was ashed for another one hour until a constant weight was obtained. The ash content was given as

% Ash content = $\frac{w_3 - w_0}{w_2}$ X 100

Where w_0 – initial weight of crucible
w_3 = final weight of crucible sample after ashing
w_2 – weight of the sample

Crude Fat

Two gramme (2.0g) of the sample was wrapped with filter paper and place inside the soxhlet extractor. Petroleum either $(60 - 80)^0$C was used to exact the fat for a period of 3 hours and the solvent was dried in a hot oven. The fat content was expressed as percentage of raw material.

% crude fat = $\frac{w_2 - w_1}{w_3}$ X 100

Where
w_1 = initial weight of flask
w_2 = final weight of flask = oil extract
w_3 = weight of sample

Crude Protein

Exactly 0.2g of the sample was digested with a 5ml concentrated sulphuric acid in a kjeldahl flask until the mixture was clear of any haze. The mixture was made up to 100ml with distilled water and aliquots of 5ml takes for absorbed in boric acid and reacted with 0.0N Hcl. The nitrogen crude protein.

Crude Fibre

Two gramme of the defatted sample obtained for crude fat determination was boil under reflux for about 30 minutes with 200ml of a solution containing 1 – 25% of H_2S0_4 per 100ml solution. The solution was filtered through a clean muslin cloth and washed with hot water five times. The residue was transferred quantitatively to a beaker, boiled for 30 minutes with 200ml of a solution containing 1.25% Na0H. The residue was transferred through a clean muslin cloth and transferred into dried weighed crucible after washing with hot distilled water. The extract in the crucible was dried in an oven at 100^0C for 30 minutes before it was transferred into a muffle furnace and incinerated until a white ashy colour was obtained. The crucible was re-weighed and the difference in weighed and the difference in weight was used to calculate the percentage crude fibre.

% crude fiber = $\frac{W_2 = W_3}{W_1}$ X 100

Where: W_1 = weight of sample

W_2 = weight of crucible + boiled sample

W_3 = weight of crucible + ash

Total Carbohydrate

This was calculated by difference from other proximate values obtained. Total carbohydrate = 100 - % (moisture, e, fibre + c, fat + ash + c. protein).

Sensory Evaluation

This sensory evaluation was performed using the method of Iwe (2002) A 20 man panel made of student and staff (males and females) of Michael Okpara University of Agriculture, Umudike were used for the sensory evaluation of the "Ugba". The Ugba was evaluated by panelists for taste, appearance texture, flavor and general acceptability. The scoring was based on a 9 – point tiedonic scale ranging from 1 (extremely dislike) to 9 (extremely like and 5 (nether like nor dislike).

The samples were presented in identical containers coded with 3 – digit random numbers with each sample having a different number. The samples were presented all at once. The values obtained from the sensory evaluation were statistically anslyzed using MSTAT – C program (Annon 1988). All determination were in triplicates.

III. Result And Discussion

Table 1: Proximate Compositions Of "Ugba" Samples Fermented At Different Periods

Samnle	Fat	Protein	Ash	Carbohydrates	Moisture	Fibre
2.0 mm oven 0	23.30^{dJ}	22.40^{d}	0.35"	27.8^{CJ}	1.36	1.85
2.0 mm oven 12	23.00^{CJ}	22.75^{dr}	0.50^{fc}	26.90^{kl}	1.28	1.90
2.0 mm oven 24	21.00^{ij}	22.05$^{\%}$	0.45	52.20^{3}	2.44	1.68
2.0 mm oven 36	22.00^{h}-^{J}	22.76^{de}	0.65	25.0^{m}	4.26	1.98
2.5 mm oven 0	22.20-^{J}	22.40^{ef}	0.50	26.60'	3.94	1.34
2.5 mm oven 12	22.10^{h}-^{j}	23.10^{cre}	0.35^{W}	28.20^{hl}	4.46	1.81
2.5 mm oven 24	23.30	24.15^{a}	0.60^{crf}	19.30°	7.65	2.08
2.5 mm oven 36	22.00$^{j\prime\prime J}$	22.05^{fg}	0.33"	25. 0"^{1}	2.14	1.96
3.5 mm oven 0	22.00	22.05^{fe}	0.50^{W}	31.70°	1.38	0.38
3.5 mm oven 12	22.00	24.15^{a}	0.50^{be}	28.10^{h}-^{j}	1.92	1.36
3.5 mm oven 24	22.10^{lvj}	22.05^{fe}	0.45^{a}	29.90^{fg}	5.01	0.40
3.5 mm oven36	22.70^{e}-^{J}	21. 70^{8}	0.53^{crf}	23.90"	4.16	0.90
2.0 mm sun 0	24.50^{CJ}	22.40^{ef}	0.45^{8re}	29.60^{fg}	4.26	1.81
2.0 mm sun12	24.70^{cre}	22.75^{dif}	0.55^{hrc}	29.97	4.68	1.32
2.0 mm sun 24	22. 50"^{8}	24.15^{1}"	0.45^{cir}	29. 30^{8}	5.22	1.38
2.0 mm sun 36	22.90$^{e\prime\prime J}$	22.75^{d}-^{f}	0.45$^{c\prime\prime f}$	29.90^{fg}	3.48	0.42
2.5 mm sun 0	22.10^{h}-^{J}	22.75	0.30^{dih}	30.23^{ef}	4.68	2.01
2.5 mm sun 12	26.30^{CJ}	23.39^{W}	0.30^{d}-"	26.40'	3.54	2.12
2.5 mm sun 24	20.90^{cd}	24.15^{a}	0.45^{c}*^{f}	30.70^{de}	5.60	2.08
2.5 mm sun 36	25.60^{cd}	22.75^{dif}	0.60^{ab}	29.40^{8}	5.88	0.43
3.5 mm sun 0	23.50^{CJ}	22.40^{ef}	0.40$^{di\prime\prime h}$	29.63^{fe}	3.63	0.40
3.5 mm sun 12	26.03^{roj}	22.75	0.40^{d}-^{h}	26.601	2.70	1.20
3.5 mm sun 24	27.03$^{e\prime\prime J}$	24.15^{a}	0.39$^{e\prime\prime}$	24.30"	4.52	1.68
3.5 mm sun 36	25.60^{cd}	23.80^{ab}	0.40^^{h}	37.80^{b}	5.22	0.25
2.0 mm room 0	27.00^{C}	22.75	0.35f'	28.00^{hJ}	10.46	1.40
2. Omm room 12	27.30^{eJ}	22.75^{dif}	0.25'	24.60^{mn}	10.12	2.01
2.0 mm room 24	22.30^{c}-^{h}	22.40^{ef}	0.40^{d}-^{h}	31.70°	10.40	0.45
2.0 mm room 36	25.80^{l}	22.75^{dif}	0.65^{a}	27.46*	8.06	1.76
2.5 mm room 0	20.80^{b}	23.45	0.35^{M}	31.60^{C}	9.06	2.08
2.5 mm room 12	32.67	23.10^{ef}	0.45^{cir}	27.46"	7.12	0.39
2.5 mm room 24	24.10^{crf}	22.75^{dir}	0.44^{CrB}	31.60^{fe}	12.04	0.39
2.5 mm room 36	26.20^{crf}	22.75	0.45^{crf}	23.91^{kl}	12.00	0.23
3.5 mm roomO	22.30^{g}-^{J}	23.10$^{c\prime\prime e}$	0.65^{a}	29.60^{cd}	8.12	0.22
3.5 mm room 12	21.30^{e}-^{J}	22.73	0.35^{f}-^{1}	27.10°	6.34	0.22

3.5 mm room 24	23.80^{CJ}	23.80^{ab}	0.40^{dh}	31.10^{fe}	8.30	1.41
3.5 mm room 36	24.80	22.40^{ef}	0.45^{of}	31.80^{h}	8.32	2.15
				• -------- ' ----- : -----		
				---- TTE ----------		
LSD	3.145	0.5823	0.1151	-- 1 ------ ' . . *.*. 0.4717		

*valucs witli same superscript within a column arc not significantly different (P>0.05)

Proximate composition of "Ugba" samples.

The effect of processing methods on the proximate composition of African oil bean seed are presented in Table 1. There were significant differences (P<0.05) in the moisture and crude fiber content of the different "Ugba" sample fermented for different periods. The moisture content of the "Ugba" samples ranged from 1.28 – 12.04% this could be attributed to the sizes of the "Ugba", also the different periods of fermentation of the samples and the methods of drying used.

Njoke and Okemadu (1989) observed that the moisture content of "Ugba" remained fairly steady during fermentation various patterns of moisture have been observed during food fermentations (Odunfa, 1985). However, the practical significance of the steady pattern is that it demonstrates the moisture pattern during the natural fermentation. Any improvement to the process would have to take this into account. A moisture levels are known to affected biochemical changes during solid state fermentation. It appears that in the present system, in which leaves (Ororompo, mailotus oppositiflus mill) are used as wrappings, there are pores that allow for the loss of water through evaporation. In addition, because a pile of leaves is used, it is believed that condensed water molecules are retained within the leaves and not on the fermentating mass. Such factors have been reported to affect the microbiological biochemical and nutritional changes during fermentation (stainkraus, 1983). The crude fibre content ranged from 0.22 – 2.15% and shows no significant difference. The crude fibre content not being affected by the fermentation could probably be due to the inability of the microbial agents to synthesize cellulases and hemicellulases for the hydrolysis of complex polysaccharides in the seeds. The ash content of the samples showed that, there were significant difference among them (P<0.05). The ash content ranged from 0.25 - .065%. Small sliced Ugba sample fermented for 12hours and dried at room temperature had the lowest ash content while the large sliced ugba unfermented at zero time but dried at room temperature had the highest ash content. Enujiugha and Akanbi (2005) explained that cooking and fermentation significantly (P<0.05) reduced the ash content of the oil bean seeds.

There were significant differences (P<0.05) in the crude protein content of the "Ugba" samples presented in table 4. The crude protein content ranged between 21.70 – 24.15% with samples in the table. Samples fermented for 24hrs and sun dried having the highest crude protein content. Fermentation as a processing method lowered the protein content of "Ugba" samples (Enujiugha and Olagundoye, 2001). These have shown that African oil bean seeds have enough nutrients to satisfy protein requirements of populations in the developing countries that rely much on starchy staples.

The slight increases in crude protein value observed during fermentation could be due to the action of extra cellular enzymes produced by the fermenting micro-organisms. It has been established (Fogarty and Griffin, 1973) that Bacillus species implicated in oil bean seed fermentation are important producers of protein. As a result of fermentation. These extra cellular proteases easily hydrolyze complex plant proteins to amino acids and short chain particles thereby causing an increase in total nitrogen content similar or greater increases in crude protein as well as decrease in carbohydrates of fermented Nigerian oil seeds have been reported (Achinewhu, 1986). It has also been reported that the crude protein content of African oil bean seed increased by 26.45% during a 4 day fermentation. During fermentation of African locust bean an increase of 28.23% in crude protein and a decrease in carbohydrate varying between 51.84 and 69.35% have been reported (Achinewhu, 1986). Eka, (1980) also provided information of a decrease in the carbohydrate level between unfermented and fermented locust beans. Carbohydrates in the form of nitrogen-free extracts decreased slightly but steadily throughout the fermentation period because of alteration in fermentation.

The fat content of the sample ranged between 21.00 – 27.30%. There were significant changes in the fat content of the samples. Small sliced Ugba sample fermented for 24hours and oven dried had the lowest fat content while small sized Ugba sample fermented for 12 hours and dried at room temperate had the highest value for fat content. Pentaclethra macrophylla is known for its high oil content with high proportion of unsaturated fatly acids (Enujigha 2003).

Proximate composition of "Ugba" samples fermented at different period after storage.

Table. 2 Proximate Composition Of "Ugba" Samples Fermented At Different Period After Storage

Samples	Fat Protein	Ash	Moisture	Crude Fibre	Cirbohydrate	
2.0 mm Oven 0	20, 38^{V}	21.30'	0.32"	6.22 ^{z}	. -	21.27^{8}
1.0 mm Oven 12	22.34^{B}	21.30'	0.50^{f}	6.86^{h}	1.60^{l}	21.36'
1 0 mm Oven 24	20.92^{3}	21.70'	0.52^{a}	6.34^{y}	1.5*'	22.46^{e}
10mm Oven 36	22.86^{d}	21.70'	0.56^{C}	6.06 ^{r}	•	18.19"
; 5 mm OvcnO	20.42^{s}	21.70'	0.46 ^{h}	6.54 ^{w}		22.97^{C}

1.5 mm Oven 12	21 .94*	21.46 ^{r}	0.34^{m}	6,76"	1.78=	21.34*
. 5 mm Oven 24	23.52'	21.70'	0.54^{d}	6.02^{1}	x	20.44^{h}
1.5 mm Oven 36	23.08^{C}	21.35*	0.44^{C}	6.40	1.7-	18.19^{11}
3.5 mm OvenO	22.16^{h}	20.65^{h}	0.46$^{1'}$	5.90	136^{C}	23.35^{b}
3.5 mm Oven 12	20.66"	23.45^{b}	0.52^{e}	5.44	1.22^{P}	22.41^{e}
?. 5 mm Oven 24	28.66	21.70'	0.48^{B}	5.90"	0.40^{V}	24.60^{a}
?.5mm Oven 36	22,84^{e}	21.00"	0.48^{e}	6.18^{C}	1 44*	19.60'
:.0 mm Sun 0	20.32^{Z}	22,40^{d}	0.43^{e}	8.20^{q}	1.06°	18.80^{l}
I. Omm Sun 12	20.08*	22.75°	0.56^{C}	8.20^{q}	l.ltf	19.08^{k}
2.0mm Sun 24	20.00^{d}	23.80^{a}	0.42^{h}	8.22'^{l}	1.24°	18.20"
2.0mm Sun 36	21.06o	23.45^{b}	0.42^{h}	8.88"	l.Otf	14.39"
2,5 mm Sun 0	20.86^{b}	21.70*	0.32^{g}	4.08^{r}	1.64^{8}	22.74^{d}
2.5 mm Sun 12	20.24^{X}	22.74^{C}	0.34"'	8.12^{s}	1.04"	18.39'
2.5mm Sun 24	20.12^{y}	23.80^{a}	0.44^{C}	11.06*	1.18^{q}	18,39^{m}
2.5 mm Sun 36	21.12"	23.40^{d}	0.58^{b}	8.06^{C}	l.28^{m}	15.58$^{[}$
3.5 mm Sun 0	20.84^{C}	22.40^{d}	0.46^{h}	5.90^{V}	1.42*	23.35^{b}
3.5 mm Sun 12	20.06^{l}	23.80^{a}	0.4X^{j}	8.06^{C}	1.06^{1}	19.28*
3. 5 mm Sun 24	20.92*	23.45^{b}	Q.38^{k}	9.14"	1 16^{1}	18.23"
3.5 mm Sun 36	21.12"	23,45^{b}	0.46^{h}	8.18^{C}	1.24°	15.58'
2.0 mm room 0	21 .06"	23.45^{b}	0.34^{m}	11-06^{C}	1.24°	14.20^{W}
2.0 mm room 12	28.96	21.70"	0,42^{d}	10.28^{C}	1.18?	14.43'
2.0 mm room 24	21 ,06^{P}	23.80^{a}	0.62^{g}	10.28^{C}	US'^{l}	14.65"
2.0 mm room 36	20.32"	22.40^{d}	0.42^{J}	10.88^{e}	l,68^{e}	15.21^{s}
2.5 mm room 0	21.18"	22.40*	' 0.34^{m}	8.86^{m}	1,24°	21.34*
2^5 mm room 12	22.14^{C}	23.80"	0.38^{k}	9.88^{J}	1.24°	19.15^{k}
2.5 mm room 24	21.06"	23.45^{b}	0.42^{1}	10.12^{m}	1.16^{s}	13.51^{X}
2.5 mm room 36	22.62^{r}	23.45^{b}	0.46^{b}	12.68^{9}	l,66^{f}	14. 37^{1}
3.5 mm roomO	21.12°	21.70'	0.36^{1}	10.14^{8}	1.26°	15.04^{1}
3.5 nun room 12	21 .87^{P}	23.45^{b}	0.42^{J}	9.86^{1}	1.26°	15.93^{q}
3.5 mm room 24	21.82°	23.40*	0.48^{8}	lO.ln^{2}	1.18^{1}	14.36'
3.5mm room 36	23.12^{b}	23. 80^{8}	0.58^{b}	10.08^{C}	1.66,^{f}	11.36^{y}
LSD	0,01605	0.1993	0.01716	0.01716	0.01605	0.07279

*valucs with same superscript within a column arc not significantly different (P>0.05)

In table 2, the fat, protein and moisture content of the African oil bean fermented after storage were reduced. This could be as a result of storage. It is therefore expected that post-processing quality deterioration could affect the shelf life and acceptability of its products (Enujiugha and Akanbi, 2005). This could be due to possible microbial action on the stored food and chance inoculation from the environment.

Table 3 : Sensory Profile of Different Ugba Sample

Samples	Taste	Texture	Flavour	Colour	G. Acceptance
2. Omm Oven 0	2.45	2.40	2.55	2.00	2.30
2.0mm Oven 12	2.80	2.95	2.30	2.00	3.15
2.0mm Oven 24	2.10	2.70	2.30	2.20	2.35
2. Omm Oven 36	2.85	2.55	2.90	2.55	2.55
2.5mm Oven 0	2.15	2.10	2.95	1.60	1.90
2.5mm Oven 12	2.15	2.95	2.50	2.45	2.40
2. 5mm Oven 24	2.65	2.30	2.45	2.35	2.10
2.5mm Oven 36	2.80	2.75	2.40	2.50	
3.5 mm Oven 0	2.55	2.60	2.55	2.30	2.35
3.5 mm Oven 12	3.35	3.25	3.00	3.00	3.40
3.5 mm Oven 24	3.75	3.50	3.45	4.5	2.85
3.5 mm Oven 36	3.45	3.25	2.00	3.50	2.60
2.0 mm Sun 0	2.55	2.75	2.90	2.05	3.05
2.0 mm Sun 12	2.85	2.50	3.25	1.95	3.05
2.0 mm Sun 24	2.20	2.35	2.60	2.40	2.25
2.0 mm Sun 36	2.70	2.75	2.60	2.40	2.25
2.5mm Sun 0	2.05	2.60	2.35	2.55	2.75
2.5mm Sun 12	3.15	2.65	3.70	2.90	3.40
2.5mm Sun 24	2.75	3.15	3.40	3.05	2.85
2.5mm Sun 36	2.80	2.50	2.70	2.50	2.85
3.5 mm Sun 0	2.50	3.25	2.55	3.05	3.25
3.5 mm Sun 12	2.75	3.40	3.00	2.70	3.30
3.5 mm Sun 24	2.90	2.90	3.45	2.70	3.00
3.5 mm Sun 36	2.20	2.55	2.80	3.50	2.15
2.0 mm room 0	3.70	3.60	4.05	4.40	3.70
2. Omm room12	3.10	2.60 -	2.95	2.75	4.10
2.0 mm room 24	2.35	2.65	2.40	3.90	2.50
2.0 mm room 36	3.40	3.05	3.10	3.15	3.20
2.5 mm room 0	2.70	3.05	3.65	4.15	3.30
2.5 mm room 12	2.40	2.35	3.10	3.55	3.60

2.5 mm room 24	3.65	3.40	3.30	3.45	2.60
2.5 mm room 36	3.45	3.30	3.70	4.05	3.30
3.5 mm room 0	3.65	2.85	3.50	4.95	2.85
3.5 mm room 12	3.35	3.55	3.25	3.55	3.40
3.5 mm room 24	3.20	3.25	2.95	3.45	3.10
3.5 mm room 36	4.00	3.40	3.25	4.30	2.75

*Valucs with same superscript within a column are not significantly different (P>0.05)

The sensory properties of the different "ugba" samples. There were no significant difference (P>0.05) in the taste texture, flavor and general acceptability of the "Ugba" samples. The taste of the "Ugba" sample ranged between 2.05 – 400, which translates to like moderately in the hedonic scale. The texture of the samples were preferred by the members of the panelist.

The flavour of the samples were also liked by the panelists which ranged between 2.00 – 4.05. The result from the colour of the "Ugba" samples showed that there was significant difference (P<0.05) in the colour of the samples. The values ranged from 1.60 to 1.50. The medium sliced oven dried "Ugba" at 62^0C had the best colour followed by small sun oven dried "Ugba". The least preferred of the sample were large "Ugba" fermented for 36 hours under room temperature, small sliced "Ugba" fermented for 0hr and dried at room temperature and large slice oven dried "ugba" after 24hrs of fermentation with values 4.30, 4.40 and 4.50, respectively. The values were more on the preferred range of the hedonic scale which means that the panelist liked the colour of the samples.

The values from the general acceptability showed there were no significant differences (P>0.05) in the samples. The values ranged between 1.90 to 3.40.

IV. Conclusion

In the study of the different processing methods used (fermentation, drying, and sizes of "Ugba", it was discovered that fermentation increased the protein contents of the samples. The different sizes showed that there was no distinct differences in terms of their overall quantity (fat, protein, carbohydrate, moisture, crude fibre, ash) as seen in the proximate analysis table, however the 2.0mm oven dried samples had less moisture compared to those of 2.5mm and 3.5mm owing to the increase in the protein contents of the samples, it is recommended that fermented African oil bean seeds be used as protein source from plant and also to add variety to flavour, increase taste and improve nutrients. It also increases digestibility and reduce antinutrients.

The result of the sensory analysis carried out showed that the samples had low values. This could be attributed to the fact that the samples are meant to be best used when reconstituted and consumed as local dish known as African salad or used as condiment in soup spices and other local porridges.

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