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Phytochemical and proximated analysis of unfermented and fermented walnut kernel and walnut shell

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ABSTRACT

Comparative photochemical and proximate composition of unfermented and fermented walnut kernel and walnut shell of (*Tetracarpodium conophoroum*) were carried out using *Aspergillus niger* to facilitate fermentation. Photochemical and proximate analysis was carried out based on [AOAC standard official methods of analysis of association of analytical chemist 13th edition Washington]. Values obtained for fermented kernels as against unfermented kernel at 95% confidence level was: unfermented kernel: Ash (4.00 $\pm$0.02), moisture (7.00$\pm$0.02), protein (26.30$\pm$0.02) , crude fibre (6.81 $\pm$ 0.01) fat (4.61$\pm$0.02) and CHO (51.27$\pm$ 0.02) . unfermented kernel: moisture (5.00$\pm$0.02) , protein (24.06$\pm$0.02), ash (4.70$\pm$ 0.53) , crude fibre (6.69 $\pm$ 0.02) , fat (5.04 $\pm$ 0.02), dry matter (95.00 $\pm$ 1.00) , and CHO (54.19 $\pm$ 0.02). the result obtained for the walnut shell was: fermented shell: Moisture (12.00$\pm$2.00) , Protein (1.52 $\pm$ 0.02) , Ash (2.06$\pm$ 0.57) , Crude fibre (15.90$\pm$0.20) , Fat (0.61$\pm$ 0.02) , Dry matter (88.00$\pm$2.00) , and CHO (64.47$\pm$0.02) . for the unfermented shell; Moisture (10.00$\pm$0.02) , Protein (1.06$\pm$0.02) , Ash (1.50 $\pm$ 0.20) , Crude fibre (16.13$\pm$0.15) , Dry matter (90.00$\pm$2.00) , Fat (0.90$\pm$0.20) , and CHO (71.77$\pm$2.32) . The result obtained showed that fermentation reduces the photochemical in the kernel and enhance the level of bio nutrient majorly protein and Crude fibre. Reducing sugar and alkaloid were completely eliminated through fermentation; this provides an appreciable development in medical and pharmaceutical research.

Introduction

Walnuts are revered since ancient times as a symbol of intellectuality, since their kernels have convoluted surface inside the shell resembling that of brain. The nuts are enriched with many health – benefiting nutrients, especially Ω-3 fatty acids that are essential for optimum health. The nuts are edible kernels of the fruits from tree belonging to *juglandacae* family, in the genus: *Juglan juglan* specie plants. They are medium sized, semi tropical, deciduous trees believed to be originating in the mountain ranges of central Asian or southern Europe region. There are at least 30 varieties of walnut cultivars. The three popular are the English or Persian walnut *(Juglans, regia),* the black walnut (*Juglans nigra)*, and the white or butternut walnut (*Juglans cinerea).*

Commercially, the nuts are being cultivated in the united states of America, Romania, France, turkey and china. After plantation the tree takes approximately four years until it produces its first major crop. Apart from the English walnut *(juglandacae*), there is also the Africa walnut (*euphorbiaceac*) and (*olacaceae*). In Nigeria, *Tetracarpidium conophorum* (family euphorbiaceac) is found. *Tetracarpidium conophorum* is a climbing shrub 10-20 ft long, it is found in the forest regions (oke, 1995, petrova, 1980). The nut is popularly called asala in Yoruba, Ekporo by the efiks and ibibios of cross river and Akwa – ibom states in Nigeria.

Walnut is a crop of high economic interest to the food industry: the kernel is consumed, fresh or toasted, alone or in other edible products, such as confectionaries, pastries or sauces. Walnut is cultivated in Nigeria mainly for the nuts which are cooked and consumed as snacks (Oke, 1995). It is globally popular and valued for its nutritional, health and sensory attributes. Walnut kernels are a nutrient-dense food mainly owing to their high fat content and protein, vitamin and mineral profits. Also walnut kernels serves as a good source of a wide variety of flavonoids, phenolic acids and related polyphenols (Martinez et al 2010) Walnut has- characteristic bitter taste which is observed upon drinking water immediately after eating the nuts.

This could be attributed to the presence of chemical substances such as alkaloid (Ayodele 2003). Walnut leaves contain high amount of tannins and are potential source of antioxidants for food, cosmetics and pharmaceutical industries (Ghasemi et al 2011). The processing of walnut yields several by- products: walnut oil meals (or walnut cake) is the product of oil extraction and is often called walnut meal. In California, small kernels pieces are accumulated during the manufacturing process are also called walnut meal (federal register 2010). A fibrous products called muller meal is marketed in the USA, is possibly a mixture of kernel particles and ground shells.

All these products contain highly variable amount of protein, fat and fibre depending on the technology and it is

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difficult to categorize them properly. Despite the beneficial importance of most species of the walnut, some of them like the black walnut (*Juglans nigra*), an America walnut species, produces a toxin called juglons capable of stunting or even killing susceptible plants', including grasses, alfalfa and members of apple and tomato family. *Juglan regia* dos not produce juglons but can become problematic when grafted on *Juglan nigra* (Heimann et al, 1997). Regardless of these, Walnut still remains one of the most essentially rich plants. The use *Tetracarpidium conophorum* seed and processing waste in livestock feed formulation has been reported (Okafor B.B 1988). The amino acid and fatty acid component of the nut and the use of its leaf juice for the treatment of prolonged and constant hiccups has been reported (Oyenuga VA 1997). Walnut is considered to be an herb in traditional Chinese medicine. They are said to tonify kidneys, strengthen the back and knees, moisten the intestine and move stool. (Ayoola et al 2011). It is believed to stop asthma but not for acute asthma. It is used for elderly as constipation cure.

Fermentation process employed in this research work has been used in various food technological processes which include cheese making, yoghurt making and in the production of pap popularly called "ogi" in Yoruba area of Nigeria. Momoh et al (2011) reported the anti-bacterial activity of fermented form of beni seed (*Sesamum indicun linn*). Traditional technologies that employ fungal flavoring of foods such as in the production of miso, ragi and shoju (soy sauce) using *Aspegillus oryzae*, *Rhizopus* sp and mixed – cultures of mucous and *Rhizopus* sp respectively (wain wrght, 1992) had been reported. The use of fungi in agricultural biotechnological is presently largely devoted to technologies aimed to inhibit or reduce some of their anti-nutritive factors, enhance bioavailability and utilization.

Though many works on various treatments on plants including fermentation have been reported however hardly is there any on fermented walnut. This makes it pertinent that this research be carried out so as to determine the nutritional values of such treatment.

AIM

To study the phytochemical and proximate composition of unfermented and fermented walnut kernel and walnut shell of *Tetracapidium conophorum*

Material and methodology

Materials

3 pure culture plates of *Aspergillus niger*, hot air oven detol antiseptic 400 walnut seed, electric blender, hot air oven, hand gloves, nose mask, Petri dish, cotton wool, pick pins, polythene bag, aluminum foil, paper tape, autoclave, methylated spirit, hypo chloride (hypo) distilled water, potato, dextrose agar, absolute ethanol, electric weighing balance.

Substrate collection and preparation

The raw walnut seed was purchased from mile12 market, mile 12, Kosofe local Government Area of Lagos state. The seeds were transported in a polythene bag to the environmental biology laboratory, Yaba College of Technology Yaba. They were washed with distilled water and the shell were broken. The released kernels and the shell were separately crushed with a sterilized hand greater into smaller pieces dryness and were dried in a hot air oven at 40^0C for 24hours. The dried samples of the kernels and the walnut shell were stored in two different air tight container for use.

Preparation of aspergillus Niger

30 plates of pure culture of *Aspergillus niger* culture were aseptically prepared using 3 pure culture plates obtained from the environmental biology laboratory. The plates were then incubated for one week at room temperature.

Fermentation

Aspergillus niger spores produced after seven days were washed using sterilized distilled water into the bowl containing the dried kernel/ shell The mixture was gently mix so as to have a thick paste .The setup was sealed and placed in black polythene bag and was kept under room temperature for fermentation. After 3weeks the fermented sample was removed and dried at 40^0C for 24hours. The dried fermented samples was them taken for phyotochemical and proximate analysis..

Phytochemical analysis

Test for Phlobatannin

The extract (filtrate) was boiled with 2% of Hcl solution, a red precippiate showed the presence of phlobatannin

Test for flavonoids

The extracts were added to diluted Nash & Hcl concentration. A yellow solution turns colorless. Indicates the presence of flavonoids.

Test for Steroids

2ml of acetic analydide was added to extract with 2ml of H2SO4 added. The color change from violet to blue or green is some sample indicating the presence of steroids.

Test for Glycosides

5ml of each extract was treated with 2ml of glacial actre acid containing one drop of Terri chloride solution. This was underplayed with 1ml of concentration H2So4. A brown ring of the interface indicates a deoxysugar characterizers of cardenolides.

Test for Terpenoids

5ml of each extract was mixed with 2ml of chloroform and concentration H2So4 (3ml) was carefully added to form a larger. A reddish brown color of the fare was formed to show moisture result for the presence of Terpenoids.

Test for Reducing Sugar

The extract was shaken with distilled H20 and filtered. The filtrate was boiled with drops of tehlings solution A&B for some minutes. An orange red precipitation indicates the presence of reducing sugar.

Test for Alkaloids

The extracts was warmed with 2% H2So4 for 2minutres. Filtered and few drops of Dranglndroft reagent was added orange red precipitation indicates the presence of alkaloids.

Test for Antraquione

The extract was boiled with 10% Hel for few in a water bath. It was filtered and allowed to cool equal volume of ccl3 was added and heated filtrate. Few drops of 10%

Proximate Analysis

Moisture content was determined by drying to constant weight at 60-80^0C in an oven, ash content by ignition at 550^0C in a muffle furnace for 4hr, fat content by soxhlet extraction with hexane as solvent, protein by the kjeldahl method, and crude fiber by the acid and alkaline digestive methods, and crude fiber by the acid and alkaline digestive methods (AOAC, standard official methods of Analysis of Washington D.C 1980).The carbohydrate content was estimated by difference, subtracting the sum of water, protein, fat, crude fibre and ash percentages from one hundred. Dry matters was calculated by subtracting the moisture content valve from one hundred

From table 1, Moisture (fws) gave (12.00 ± 2.00) as against Moisture (Ufws) which was recorded as Protein (fws) gave (1.52^a ± 0.02) while Protein (Ufws) gave (1.06a ± 0.02). Ash (fws) gave (2.06 ± 0.57) while Ash (Ufws) gave (1.50 ± 0.20)

while Crude fibre (fws) gave (15.90 ± 0.20) while Crude Fibre (Ufws) gave (16.13 ± 0.15). Fat (fws) gave (0.61 ± 0.02) while Fat (Ufws) gave (0.90 ± 0.20). Dry matter (fws) gave (88.00^a ± 2.00). CHO (fws) gave (64.97 ± 0.02) as against CHO (Ufws) recorded as (71.77 ± 2.32).

Result

Table 1: Proximate Result For Fermented And Unfermented Shell

PARAMETER	MEAN s± S.D
Moisture (fws)	12.00 ± 2.00
Moisture (Ufws)	10.00 ± 0.02
Protein (fws)	1.52^a ± 0.02
Protein (Ufws)	1.06 ± 0.02
Ash (fws)	2.06 ± 0.57
Ash (Ufws)	1.50 ± 0.20
Crude fibre (fws)	15.90 ± 0.20
Crude fibre (Ufws)	16.13 ± 0.15
Fat (fws)	0.61 ± 0.02
Fat (Ufws)	0.90 ± 0.20
Dry matter (fws)	88.00^a ± 2.00
Dry matter (Ufws)	90.00^a ± 2.00
CHO (fws)	64.97 ± 0.02
CHO (ufws)	71.77 ± 2.32

KEY:

Fws: Fermented walnut shell

Ufws: Unfermented walnut shell

a: The correlation and it cannot be computed because the standard error of difference is 0.02

Table 2: Significance of paired parameter difference at 95% confidence interval for fermented and unfermented walnut shell

N = 3

PAIRED PARAMETER	MEAN ± S.D	SIGNIFICANCE
Moisture (fws) – Moisture (Ufws)	2.00 ± 2.02	0.228
Ash (fws) – Ash (Ufws)	1.16 ± 0.60	0.080
Crude fibre (fws) – Crude fibre (Ufws)	–0.23 ± 0.35	0.3789
Fat (fws) – Fat (Ufws)	–0.29 ± 0.22	0.150
CHO (fws) – CHO (Ufws)	–6.80 ± 2.30	0.036

All parameters significance were evaluated at 0.05 significant level with parameter outcome less than 0.05 regarded as statistically significant while those higher are insignificant or not significant. From table 2, 0.228 was recorded for significance between Moisture (fws) – Moisture (Ufws). 0.379 ws recorded for significance between Crude fibre (fws) – Crude fibre (Ufws). Fat (fws) – Fat (Ufws) has a significance equal 0.150. The significance of CHO (fws) – CHO (Ufws) was recorded as 0.036.

Table 3: Correlation of paired parameters for fermented and unfermented walnut shell

PAIRED PARAMETER	CORRELATION
Moisture (fws) & Moisture (Ufws)	–1.000
Ash (fws) & Ash (Ufws)	0.017
Crude fibre (fws) & Crude fibre (Ufws)	–0.986
Fat (fws) & Fat (Ufws)	–1.000
CHO (fws) & CHO (Ufws)	0.868

From table 3, –1.000 was recorded for correlation between Moisture (fws) & Moisture (Ufws). 0.017 was recorded for correlation between Ash (fws) & Ash (Ufws). The correlation between Crude fibre (fws) & Crude fibre (Ufws) was recorded as –0.986. Fat (fws) & Fat (Ufws) was recorded as –1.000 in correlation while CHO (fws) & CHO (Ufws) gave 0.868 in correlation.

Table 4: Proximate result for fermented and unfermented walnut kernel

PAIRED PARAMETER	MEAN ± S.D
Moisture (fwk)	7.00 ± 0.02
Moisture (Ufwk)	5.00 ± 0.02
Protein (fwk)	26.30 ± 0.20
Protein (Ufwk)	24.06 ± 0.02
Ash (fwk)	4.00 ± 0.02
Ash (Ufwk)	4.70 ± 0.53
Crude fibre (fwk)	6.81 ± 0.01
Crude fibre (Ufwk)	6.69 ± 0.02
Fat (fwk)	4.61 ± 0.02
Fat (Ufwk)	5.04 ± 0.02
Dry Matter (fwk)	93.00 ± 2.00
Dry matter (Ufwk)	95.00 ± 1.00
CHO (fwk)	51.27^a ± 0.02
CHO (Ufwk)	54.19^a ± 0.02

a: The correlation and significance cannot be computed because the standard error of the difference is 0.

fwk: fermented walnut kernel

Ufwk: unfermented walnut kernel

From table 4, (7.00 ± 0.02) was obtained for Moisture (fwk) as against (5.00 ± 0.02) for Moisture (ufwk). (26.03 ± 0.20) was obtained Protein (fwk) as against (24.06 ± 0.02) for Protein (ufwk). Ash (fwk) gave (4.00 ± 0.02) as against Ash (ufwk) obtained as (4.70 ± 0.53). Crude fibre (fwk) gave (6.81 ± 0.01) as against Crude fibre (ufwk) obtained as (6.69 ± 0.02). Fat (fwk) obtained as (5.04 ± 0.02). Dry matter (fwk) was recorded as (93.00 ± 2.00) as against Dry matter (ufwk) recorded as (95.00 ± 1.00).

CHO (fwk) was obtained as (51.27^a ± 0.02) as CHO (ufwk) obtained as (54.19_a ± 0.02).

Table 5: Significance of paired parameter difference at 95% confidence interval between fermented and unfermented walnut kernel

PAIRED PARAMETER	MEAN ± S.D	P VALVE
Moisture (fwk) – Moisture (ufwk)	2.00 ± 0.02	0.01*
Protein (fwk) - Protein (ufwk)	2.24 ± 0.22	0.003*
Ash (fwk) - Ash (ufwk)	0.70 ± 0.53	0.153
Crude fibre (fwk) – Crude fibre (ufwk)	0.12 ± 0.00	0.001*
Fat (fwk) - Fat (ufwk)	0.43 ± 0.03	0.002*
Day matter (fwk) – Day matter (ufwk)	- 2.00 ± 0.57	0.074*

*Significant (Since P value is less than 0.05 but any P > 0.05 is not significant).

From result on table 5, P value obtained for Moisture (fwk) – Moisture (ufwk) is 0.01, Protein (fwk) – Protein (ufwk) gave 0.003 P value, Ash (fwk) – Ash (ufwk) gave 0.153, Crude fibre (fwk) – Crude fibre (fwk) – Crude fibre (ufwk) gave 0.001, Fat (fwk) – Fat (ufwk) gave 0.002 P value and Dry matter (fwk) – Dry matter (ufwk) gave 0.74 P Value.

Table 6: Correlation of paired parameters for fermented and unfermented walnut kernel

PAIRED PARAMETER	CORRELATION
Moisture (fwk) &Moisture (ufwk)	0.500
Protein (fwk) &Protein (ufwk)	-1.000
Ash (fwk) & Ash (ufwk)	0.019
Crude fibre (fwk) & Crude fibre (ufwk)	0.987
Fat (fwk) & Fat (ufwk)	-0.500
Day matter (fwk) &Day matter (ufwk)	1.000

Table 7: Phytochemical screening for fermented and unfermented kernel

Sample	Phlobatanin	Flavonoid	Steroids	Glycoside	Terpenoid	Reducing sugar	Tannin	Alkaloid	Saponin	Anthraq unione
Fermented walnut kernel (fwk)	-	-	-	+	-	-	-	-	-	-
Unfermented walnut	-	-	-	++	+++	+	-	+	-	-

Key:
Means not present or detected
\+ Means present in his amount
++ Means present in moderate amount
+++ Means present in appreciate amount

Table 8: Phytochemical screening for fermented and unfermented shell

Sample	Phlobatanin	Flavonoid	Steroids	Glycoside	Terpenoid	Reducing sugar	Tannins	Alkaloid	Saponin	Anthraq unione
Fermented walnut kernel (fwk)	-	+	-	+	+	+	-	+	-	-
Unfermented walnut	-	+	+	+	+	-	-	+	-	-

Key:
fws: fermented walnut shell
ufws: unfermented walnut shell
\- : Not detected
\+ : Detected in low amount

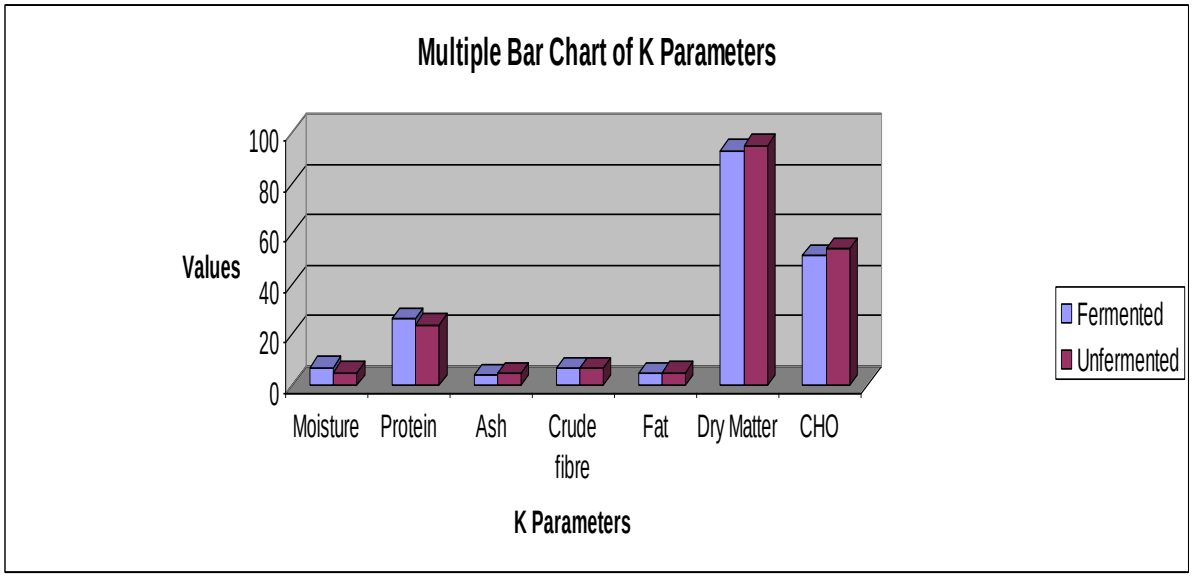

Figure 1: Multiple Bar Chart of Proximate Kernel Parameters

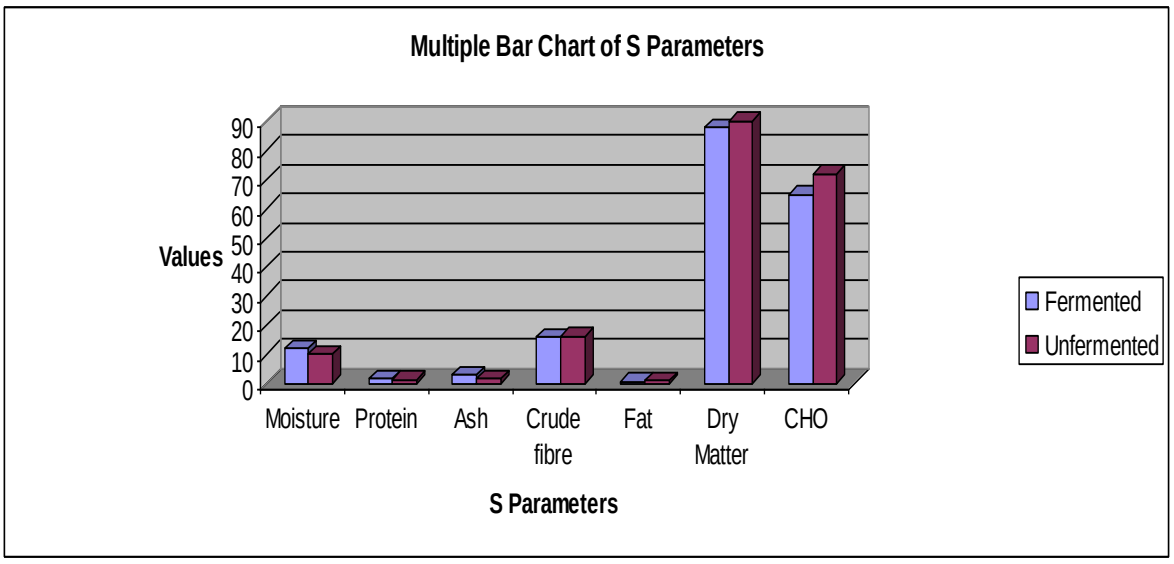

Figure 2: Multiple Bar Chart of Proximate Shell Parameters

From table 6; Correlation between Moisture (fwk) and Moisture (ufwk) gave 0.500, Protein (fwk)& Protein (ufwk) gave -1.000, Ash (fwk) & Ash (ufwk) gave 0.019, Crude fibre (fwk) &Crude fibre (fwk) & Crude fibre (ufwk) was obtained as - 0.587, Fat (fwk) &Fat (ufwk) gave 0.500 and Dry matter (fwk) & Dry matter (ufwk) gave 1.000 value for correlation.

From table 7, for fermented walnut kernel (fwk); pholobatanin was (-), flavonoid was (-) stenoid was (-), glucosides was (+), terpenoid was (++), reducing sugar (-), tannin was unfermented walnut kernel (ufwk); phlobatanin (-), flavoniod was (-), stenoid was (-) glucosides was (++), terpenoid was (+++), reducing sugar was (+), tannin (-), Alkaloid was (+), saponin (-) and anthraquinone was (-).

Table 8, for fermented walnut shell; pholobatanin was (-), flavonoid was (+) glycoside was (-), terpenoid was (+), reducing sugar (+), tannin was (+), Alkaloid was (-), saponin (+), anthnaquinone was (-) and stenoid was (-).

Unfermented walnut shell: phlobatanin was (-), flavoniod was (+), glycosides was (-), terpenoid was (+), reducing sugar (+), tannin ( ), anthnaquinone was (-) and stenoid was (-).

Discussion:

Proximate:

A perfect negative correlation was obtained for moisture between fermented and unfermented shell significantly high at (P>0.05) with Moisture (fwk) obtained as (12.00 ± 2.00) against Moisture (fws) obtained as (10.00 ± 0.02) (table1 and fig 2). Moisture also increased significantly at (p<0.05) for fermented as against unfermented kernel with a positive correlation (table 4) Moisture (fwk) was obtained as (7.00 ± 0.02) while Moisture (ufwk) gave (5.00 ± 0.02).

Increase in moisture due to fermentation was also recorded by (Oseni et al 2011) on the effect of fermentation on phytochemical and proximate properties of the seed of *Jatropha curcas* similar record was obtained by (Momoh, et al 2012).

Protein value recorded for fermented kernel as against unfermented was significantly high at (p<0.05) with a perfect negative correlation. Protein (fwk) and Protein (ufwk) were obtained as (26.30 ± 0.20) and (24.06 ± 0.02) (Table 4 and fig 1).

This result compares well with that obtained by (Oseni et al 2011) on the phytochemical properties and effect of fermentation on the seed of *Jatropha curcas*. Oseni et al obtained (26.67 ± 0.05) for fermented and (24.14 ± 0.05) for unfermented kernel. The high level of protein recorded for fermented kernel may be due to the ability of the microorganism (Arspergillus Niger) to secrete some extra cellular enzymes (proteins) which degrade the materials during fermentation (O.A. Oseni et al 2011). This result is similar to the observations made when pure strain of *Arspergillus niger* was used to ferment maize cobs by Oseni and Ekpein (2007).

Increase in protein content via fermentation had also been attributed to soaking that is involved in the process (Yashin et al 2009) reported that soaking improves protein content of raw seed. (Adebolu 2007 and Olorunfemi et al 2006) reported that fermentation increased the level of protein content in fermenting ogi liquor.

Protein decrease significantly between fermented and unfermented shell. PROTEIN (fws) was obtained as (1.52±0.02) against PROTEIN (ufws) obtained as (1.06±0.02).

A low positive correlation was obtained for ash between fermented and unfermented kernel significantly low at (P>0.05) with ASH (fwk) and ASH (ufwk) obtained as (4.00± 0.02) and (4.70±0.53) [Figure1 and Table 4].Reduction as a result of fermentation recorded in this study is similar to that obtained by (Martin et al 2010) who recorded (3.31) for fermented and (3.82) for raw Napot Leona imperalis seed.

The fall in ash content due to fermentation in this work agrees with the finding that ash decrease with soaking as reported on delichous lablab beans by Osman (2007).

On the contrary, fermented shell increase significantly at (P>0.05) in ash level relative to unfermented shell with a low positive correlation.

A high positive correlation was obtained for crude fibre between fermented and unfermented significantly high at (p<0.05).CRUDE FIBRE (fwk) gave (6.81±0.01) while CRUDE FIBRE (ufwk) gave (6.69±0.02) (Momoh A.O et al 2012) obtained similar result 0n the effect of different treatments on phyotochemical proximate and mineral content of beniseed, obtaining (13.58±0.07) for fresh beniseed as against(7.07±0.06 to 6.06±0.06) for fermented. The slight increase in crude fiber in fermented kernel may be attributed to the production of some dietary fiber rich substance as component part of my protein deposited in the fermented walnut kernel.(Kayode et al 2008).Contrary to the increase in crude fiber due to fermentation in kernel. The level of crude fiber decreased in fermented walnut shell with a high negative correlation with the unfermented shell significantly low at (P>0.05).

A negative correlation significantly low at (P<0.05) was obtained between fermented and unfermented kernel for fat. FAT (fwk) was obtained as (4.61±0.02) as against FAT (ufwk) obtained as (5.04±0.02). Reduction in fat level due to fermentation was recorded by (Momoh et al 2012) for fermentation beniseed. A perfect negative correlation was obtained for fat between fermented and unfermented shell significantly low at (P>0.05).FAT(fws) gave (0.61±0.02) while FAT (ufws) (0.90±0.20).

A perfect positive correlation was recorded for dry matter between fermented and unfermented kernel significantly low I(P>0.05). [fig 1 and table 4] shows DRY MATTER (fwk) gave (93.00±2.00)and DRY MATTER (ufwk) gave (95.00±1.00).A fall in dry matter level was also record for the shell. DRY MATTER (FWS) gave (88.00 + 2.00) against DRY MATTER (ufws) which gave (90.00 $\pm$ 2.00). The value for fermented is low compared to unfermented one walnut shell. CHO also decreased from (71.77±2.32) unfermented to (64.97±0.02) fermented for shell. CHO (ufwk) was obtain as (54.19 $\pm$ 0.02) against (51.27 $\pm$ 0.02) for (fwk). The fall in the level of CHO Dry matter and fat for fermented walnut kernels and shell was as a result of their utilization and transformation by fermentation organism (*Aspergillus niger*) to obtain energy and other cellular activity. Oladele and Oshodi (2008) coroborated that fact.

Phytochemical:

From table 7 Phlobatanin, Flavonoid, steroid, Alkaloid, Tannin, Saponin and Anthraquinone were all absent in both fermented and unfermented kernel. This result is almost similar to that obtained by Ayoola et al, 2011 on chemical evaluation and nutrition value of (*Tetracapidium conophorum*)but differ due to the presence of tannin as contrary to what this study obtained This could be attributed to the mode of preparation of samples.

From the result obtained for the fermented kernel, glycoside was present in low amount as against its presence in moderate amount in the unfermented kernel. Reducing sugar was completely eliminated in the fermented kernel but present in low amount in unfermented kernel. This development is a plus in

medical research as this will be very important in areas of health were low sugar intake in crucial.

Terpernoid was reduced to moderation via fermentation as against its appreciable presence in the unfermented kernel. Alkaloid was completely eliminated from fermented kernel as against its presence in low amount in the unfermented kernel.

Reduction in alkaloid content in fermented kernel annuls the problem of the bitter taste felt when water is drank few minutes after consuming the walnut kernel.

In the walnut shell recorded in table 8; phlobatamin, steroids, glycosides, Alkaloids and Anthraquinnone were all absent in both fermented and unfermented shell while Flavonoid Terpenoid Reducing sugar, Saponin and Tannin were all detected. Tannin has been reported to be poisonous to human and animals (Apata 1990)

Conclusion

It was revealed from this study that fermentation improves the palatability of the walnut kernel by complete elimination of alkaloid and also enhancing the bio nutrient content of the kernel making it more nutritionally rich as a source of food for direct consumption and as an additive or composite in feeds for livestock production. Elimination of reducing sugar is indicative of their use medically and pharmaceutically.

Recommendation

It is recommended that more research work be engineer into investigating other areas through which this highly valued nutritional fruit could be more useful to men as a source of food and as a raw material in the production of drugs and other chemical additives.

Government and cooperated institution should encourage research works through funding.

References

Ayodele, O.B,(2003), Nutrition in Nigeria Ibadan, Catoon Publisher W. A Hadded, 1977pp

Adebolu T.T (2007), effect of termination duration on the growth inhibitory of maize “Ogi” liquor in common cliarroeal bacteria. *Journal of pure and applied microbiology* 1 (2): 161 – 163

Fila, W.A, Itam, E.H Johnson, J.T., Odey., M.O. Effiong, E. E. Dasodunjo, K. Ambo, E.E.

Ghaseni, K. Ghasemi, Y. Ehteshamnia, A; Nabaia, S.M.; Nabawi, S.F; Ebrahimzabeh, M.A; Pourmorald, F.(2011) influence of environmental factors on antioxidant activity phenol and flavonoid contents of walnut (*Juglans regia)* green husks. *J. med. Plants res*, 5 (7): 1128 – 1133.

Heiman, M.F. Stevenson, W.R. (1997). Walnut and butternut toxicity University of Wisconsin, Extension Coperation extension, A3182.

Martines, M. L., Labuckas, D.O., Lamargui, A.l, Maestri, D. O Lamarque, A.L.. Maestri, D.M., 2010. Walnut(*Juglans regia*) genetic resources, chemistry, by-products. *S.sci. food Agric* 90 (12): 1959 – 1967.

Momoh, A. O Adebolu, T. T abd Ogundare A. O 2012. The effects of different treatments in the phytochemicals proximate, and ,inmeral content of beni seeds (*Sesanum indicumlin*) *Global Advanced journal of biotechnology* vol. 1 (1) . 008-011.pp

Olorunfemi O.B Adeolu T. T and Adetuyi, F.C (2006) Antibacterial Activities of *micrococcus lactus* strain isolated from Nigerian Fermented cheese whey against Diarrhoea causing organisms. *Research journal* of *Biological Science* 1 (1-4). 24 – 27.

O.A. Oseni and A.A. Akundahunsi 2011. Some Phytochemical Properties and effect of fermentation on the seed of *Jatropha curcas . American Journal of food Technology*, 6:158 – 165.

Oseni, A.O and M. Ekpengin, 2007. Studies on biochemical changes in maize waster fermented with *Aspergillus niger. Biokemistri*, 19:75 – 79.

Petrova, U.V., 1980 studies of chemical composition and correlations between chemical characteristics in some walnut varieties. Nwoka publishing Co. ltd ,London, world health organization 1991. International programme on chemical safety (IPCs). Environmental health criteria, 134!321 - 342 . and feed ingredients. Hoard and sons company.

Kayode,R.M.O and Sani A(2008). Phytochemical and proximate composition of mango (*Mangnifera indica*) kernel fermented with monoculture of fungal isolate obtain from naturally decomposed mango kernel,*life science journal* 2008.5; (4):55-63]

Amaeze,O.U. G.A Ayoola,G.A, Sopidiya,M.O, Adepoju – Bello,A.A, Adegoke, A.O, Coker,H.A.B.(2011) Evaluation of Antioxidant Activities of *Tetracarpidium conophonrum* (Misii. Arg) Hutch and daziel leaves.

Oladele, E.P. and A.A Oshodi, 2008. Effect of fermentation on semi chemical and nutrition properties of berlandier netth spurge (*Jatropha cathartical*) and physic nut (*Jatropha* curcas) seed. *Pak. J. Nutr*, 7:292 – 296.

Osman M.A. Effect of different processing methods on nutrient composition anti-nutritional factors and vitro digestibility of delichrous lablab bean (lab lab purpureus (L) sweet). *Pakistan journal of nutrition* 2007, 6:299 – 303

Yashim SM, segun AJ, Abdu SB Duru S, Adamu HY(2009). Effects of duration of soaking of ratth boze seeds (*Crotalalaria retusa* L.) on the level of some chemical composition and minerals. Proceeding of 13th Annual conference of Nigerian Society of Arrival production ; 309 – 311

Apata DF(1990). Biochemical Nutritional and toxicological assessment of some tropical legume seeds. Ph.D Thesis, University of Ibadan, Ibadan. .

AOAC, Standard Official method of Analysis of the Association of Analytical Chemist. 13th Edn. Washington D.C 1980.