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Nutritional evaluation of some non-conventional oil seeds on different processing techniques

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ABSTRACT

A trial was conducted to assess the nutritional composition of some nonconventional oil seed ingredients on different processing methods such as boiling, soaking, toasting and raw. The oil seed ingredients include calabash seed, pumpkin seed and cotton seed. The result on pumpkin seed composition shows that the soaked pumpkin seed was significantly ($p<0.05$) higher in percentage crude protein (28.46±0.93) followed by toasted, boiled and raw samples but boiled samples was significantly ($p<0.05$) higher in lipid composition (35.27±0.47) followed by raw, soaked and toasted sample respectively. However, the crude protein composition of calabash seed was significantly ($p<0.05$) higher in soaked calabash samples (40.74±0.00) followed by raw (37.75±0.00), toasted (36.75±0.00) and boiled (35.10±0.00) respectively but boiled calabash sample was significantly ($p<0.05$) higher in lipid composition (43.33±0.28) compares to other processing methods. Furthermore, the result also revealed that the cotton seed protein composition

was significantly ($p<0.05$) higher in toasted cotton seed sample (29.73±0.02) followed by raw, boiled and soaked cotton seed samples respectively but boiled cotton seed sample was significantly ($p<0.05$) higher in lipid composition (31.49±0.59) followed by soaked, raw, and toasted sample respectively. The result of this study shows that all the aforementioned oil seed samples ingredients possessed an appreciable quantity of all dietary elements requirements for growth, function and other metabolic activities tested for which, more or less could make them partial or complete substitutes for other conventional feed ingredients from conventional types. Therefore, the utilization of these ingredients needs to be encouraged. It's recommended that soaking was the best processing techniques of calabash and pumpkin seed meal while for cotton seed meal is toasting because of their nutrient content availability.

***Key words*:** Nutritional values, oil seed, Non- conventional plant, processing techniques

1. INTRODUCTION

In recent times, due to high cost of fish meal, Non-conventional Feed Ingredient or Resources (NCFRS) are incorporated into feed to substitute for some of the protein requirement in the feed (Devendra, 1988). Typically examples of such are calabash seed, cotton seed, pumpkin seed, maggots, termites, mollusk, frogs, toad, animal entrails and leaves of plant, agricultural by-products (Devendra, 1988). Their main role in fish feed is to hasten fish growth and increase production while reducing feed cost (Devendra, 1988). Calabash seed, pumpkin seed, cotton seed maggot, termites, mollusk, frogs, toad, and animal entrails are dried and ground before incorporating in feed (Ovie, 2010). The entire aforementioned ingredient can be recycled to improved their value if they are economically justifiable and technological means for converting them into useable products because some are by product already. Non-conventional feed resource are feedstuffs that that are not consumes or utilize by human and are utilize by animals for continuous metabolisms such growth, reproduction, respiration, digestion and maintenance activity in the body system (Ovie, 2010). In general, Non-conventional feed resources (NCFRS) are feeds that are not usually common in the markets and are not the traditional ingredients used for commercial fish feed production (Devendra, 1988, Madu *et al*, 2003, Sogbesan and Ugwumba, 2007). NCFRs are credited for being non-competitive ion terms of human consumption, very cheap to purchase, by product or waste from agriculture, farm made feeds and processing industries and are able to serves as a farm of waste management in enhancing good sanitation (Devendra, 1988, Madu *et al*, 2003, Sogbesan and Ugwumba, 2007).

The nutrient quality of feed ingredients is one of the major prerequisite apart from availability (which some time is a function of cost and season) for production of good quality feeds (Zeiter *et al*., 1984). The basic nutrient that cannot be compromised in the choice of ingredient for feed formulation is protein (Zeiter *et al*., 1984). Hence it became impressive to research into the nutrient composition of some of the easily culturable animal protein sources (Sogbeasan 200).

The ultimate goal of any fish industry is the attainment of sustainable fish production with minimum cost in the shortest time possible (Eruvbetine *et al*, 2012). This has proved difficult in the developing nations because of the dependency on some conventional ingredients that are either imported or expensive where they locally exist for instance; fish meal an essential dietary animal protein component of fish feed is usually imported from Demark, America, and some European countries (Ardon *et al*., 1998). Soya beans meal, groundnut cake and some other plant protein source have also become too expensive (Ojewola and Udom, 2005). This is as a result of then excessive demand for them, this leading disproportionate increase in the cost of fish feed (Ojewola, 2005). It is also known fact that in the face of teaming population of the developing nation the conventional protein and energy ingredient being used in feed production or fish respondent products that are better taken adequate of in human nutrition (Ardon *et al*, 1998).

2. MATERIALS AND METHOD

2.1. Experimental Location

This research was carried out in Agriculture Chemical laboratory in Usmanu Danfodiyo University Sokoto. Sokoto has a land mass of 26,2648,481km^2 and located between longitude 11^{0}30'' to 13^{0}50''E and latitude 4-6^0. It is bordered to the north by Niger Republic, to the East by Zamfara and Kebbi to the south West (SSD, 2000). The vegetation, falls within the savanna Zone with semi-arid climate. Open tsetse fly's free grassland suitable for cultivation of grains and animal husbandry. Rainfall starts late May and ends early September with mean annually rainfall from 500-1300mm (SSD, 2000).

2.2. Sample collection

The pumpkin was sourced from Sokoto, Kasuwar Dankure market, calabash seed were sourced from Gumi Local Gov't Area, Zamfara State and cotton seed were obtained from Funtua, Katsina state.

2.3. Processing methods of feed stuffs (ingredients)

Pumpkin seeds processing

The pumpkin seed was processed into four (4) processing techniques. The sample was divided into four different samples. First sample was processed by boiling, latter dried, grinded, named as boiled sample and finally subjected to analysis. Second sample was processed by soaking inside the water for 8hrs which latter removed, dried, grinded, named as soaked sample and finally subjected to analysis (Yogitrition, 2016). Third sample was processed by toasting for 8mins at 60^0C, which latter removed, dried, grinded named as toasted sample and latter subject to analysis. The last sample was processed by drying, grinded, named as Raw sample and which was then subjected to analysis.

Calabash Seed

4kg was obtained and processed into four different processing methods. The sample was divided into four sample namely; First sample was processed by boiling, which lettered removed and dried, grinded, named as boiled sample and which was then subjected to analysis. Second sample were process by soaking for 8hrs which lettered removed, dried, grinded, named as soaked sample and lettered subjected to analysis. The third sample was process by toasting which lettered removed, dried, grinded, named as soaked sample and lettered subjected to analysis. The last sample was process by drying and grinded, named as Raw sample and lettered subjected to analysis.

Cotton Seed

4kg cotton seed was obtained and processed into four different processing methods. The sample was divided into four different portions. First sample was process by boiling, which lettered removed, dried, grinded, named as boiled sample and lettered subjected to analysis. Second sample was processed by soaking which lettered removed, dried, and grinded named as soaked sample and lettered subjected to analysis. The third sample was processed by toasting which lettered removed, dried and grinded, named as toasted sample and lettered subjected to analysis. The last sample was process by dried and grinded named as Raw sample and which was subjected to analysis.

2.4. Proximate composition analysis

The proximate composition analysis of feed stuffs was being done by following the procedures of (AOAC, 1990).

Determination of Moisture Content

2g of sample was obtained from already pounded samples and was then dried oven at 105^0C. The sample was then cooled in dissectors. Further analysis was done using the same procedure until a constant weight was observed in the sample and moisture content were determined through the following.

$$\% \text{ Moisture} = \frac{W1-W2}{W1-W0} \times 100$$

Where W_0 = Weight of empty crucible
W_1 = Initial weight of sample
W_2 = Final weight of sample

Determination of Ash

Two (2g) of each sample was be obtained from already pounded specimen which are then ash in the thermal furnace at 600^0C for 3hrs, after which the sample was be cooled in the dissectors. The ash content was determined through the formula.

$$\% \text{ Ash} = \frac{W2-W0}{W1-W0} \times 100$$

Where W_0 = Weight of empty crucible
W_1 = Initial weight of sample before ashing
W_2 = Final weight of sample after ashing

Determination of Crude Fat (Ether Extract)

Two extraction flasks each with capacity of 350ml were oven dried at 105^0C for 10mins, and allowed to gradually cool in the desiccators. 2g each from already powdered samples was placed in the thimble at their opening stiff with cleaned white cotton wool and the placed in the previously dry flask, each containing 200ml of petroleum ether. This was then placed in the extraction units for extraction. The extraction flask containing the oil or fat is then remained and oven dried at 105^0C for 1hr and then cooled in the desiccators and weight to obtained the weight of the Crude fat.

$$\% \text{ Crude Fat} = \frac{W2-W1}{2g} \times 100$$

Where W_1 = Weight of thimble and powdered sample

W_2 = Weight of empty extraction flask

Determination of Crude Fiber

This was being done using (AOAC, 1990) methods. The principle of the method is based on loss of crude fiber when ignited after being digested with acid and base. 2g of each sample will be defatted as described in lipid determination. The defatted sample was then transferred into 600cm^3 beaker into which 200ml of 1.25% H_2SO_4 was added. The content was boiled for 30mins on hot plate. After boiling, the mixture was cooled and filtered through poplin cloth. The residue was then washed with hot distilled water and drained. The drained residues were then quantitatively returned to the original beaker and 200ml of 1.25 NaOH was added also. The content was then boiled for 30mins, filter as above and washed with hot distilled water. Finally, the residue in the poplin cloth was then putted in crucible for drying in the oven and the contents quantitatively put in pre-weighed crucible and reweighed. The crucible was then ignited at 600^0C for two hours, cooled and reweighed. The crude fiber content was calculated by the following formula below:

$$\% \text{ Fiber} = \frac{W1-W2}{2g} \times 100$$

Where $W_{1\ =\ Dry}$ weight

$W_{2\ =}$ Ash weight

Crude Protein Determination

The crude protein of each sample was been determined using the macro kjeldhal method (AOAC, 1990). The principles of the method were based on the conversion of protein nitrogen and that of other compounds than nitrate in to ammonium sulphate by acid digestion with strong acid usually H_2SO_4 to give ammonium sulphate $(NH_4)_2SO_4$, the ammonium is then digested using sodium hydroxide. The solution was then distilled and collected into boric or sulphuric acid solution in form of ammonium ion. The nitrogen content was then estimated by titration of the borate formed with standard acid (H_2SO_4 and HCL) using Methyl orange indicator.

The protein present is then calculated by multiplying the nitrogen concentration by conversion factor, usually 6.25 (equivalent to 16g N/100 protein). 0.5g of sample was weighed into kjeldhal digestion flask. 0.5g of kjeldhal digestion table (Copper Catalysts) and 10cm^3 of Conc H_2SO_4 acid were added. The content was then heated in kjaldhal digestion until it digested clearly (approximately 2hrs). After the digestion had been completed, the flask was cooled, diluted with 10cm^3 of distilled water and filtered into 100cm^3 volumetric flask and made up of the mark with distilled water. 10cm^3 of homologous aliquot solution was pipette into distillation flask and 20cm^3 of 45% NaOH solution was added. The content was diluted to about 200cm^3 with distilled water and distilled into on receiving flask containing 20cm^3 boric acid indicator solution.

The ammonium in sample liberated into boric acid color of the solution changed from pink to green. The sample collected with ammonia was then titrated against 0.01m HCL to end point, which gave the amount of ammonia content in the sample. The color changed from green to pink at the point and then titer value recorded was recorded.

$$\% \text{ Nitrogen} = \frac{TV \times 0.01M\ OF\ HCL \times 14.5}{Sample\ weight \times moles\ of\ Aliquot} \times 100$$

TV= Titre Value

NA = Normality of Acids= 0.01m HCL

Atomic mass of Nitrogen = 14

The concentration of H^+ (mole) required to reach the end point is equivalent to the concentration of nitrogen in the sample. The protein present was calculated by multiplying the nitrogen concentration by conversion factors of 6.25 9equivalent 16Gn/100g protein) as in the following equation:

Crude Protein (%) = %N × 6.25

Determination of Nitrogen Free Extract (Carbohydrate)

The Nitrogen Free Extract (N.F.E) referred to as carbohydrate is not determined directly, but obtained as difference between the total dry the sum ash, protein, crude fat, and fiber subtracted from 100

NFE = 100 – (% Ash + % Crude Fiber + % Crude lipid + % Crude protein)

2.5. Statistical analysis

Complete Randomized Design (CRD) was adopted for the experiment. The data obtained were subjected to analysis of Variance (ANOVA) and means were separated using Duncan's Multiple Range Test (DMRT) (Duncan, 1995) using Statistical package for Social Science (SPSS) Version 16.o for window.

3. RESULTS

3.1. Proximate composition of pumpkin seed meal

The results for proximate composition of pumpkin seed meal subjected to different processing methods such as boiling, toasting, soaking and raw were presented in table 1. The result shows that there was no significant ($p>0.05$) difference in moisture content of toasted sample (3.78±0.06) and soaked pumpkin seed sample (3.95±0.12) but differed significantly ($p<0.05$) from raw (4.23±0.09) with the highest value followed by boiled sample (3.43±0.21). The ash composition result differed significantly ($p<0.05$) from boiled sample (9.08±0.29), raw sample (8.07±0.19), soaked (6.68±0.16) and toasted sample (3.98±0.11) as presented in table 1. Higher crude fiber value was recorded in soaked (28.97±0.11) with significant ($p<0.05$) difference followed by boiled and raw (27.06±0.19) and (26.88±0.10) respectively. Toasted pumpkin recorded the least value (25.86±0.07) and differed significantly.

The lipid content of the boiled sample pumpkin seed meal recorded the highest value (35.27±0.47) with a significant difference ($p<0.05$) from other processing methods, this closely followed by raw, soaked and toasted with no significant ($p>0.05$) different. The soaked sample recorded the highest value of crude protein (28.46±0.93) and significantly ($p<0.05$) differed from other processing techniques. The lowest value was recorded in raw pumpkin (24.50±0.00) and significantly ($p<0.05$) differed from other processed samples the boiled and toasted samples did not differed significantly in table 1. The highest value of NFE was recorded in toasted processing method (33.15±0.57) followed by Raw pumpkin (29.93±0.85) with significant ($p<0.05$) difference. The lowest value was recorded in boiled and soaked samples (26.07±0.49 and 27.36±0.29) which did not differ significantly (table 1).

Table 1 Proximate composition of pumpkin seed on different processing methods

Processing methods	Moisture%	Ash%	Crude fiber%	Crude lipid%	Crude protein%	NFE%
Boiled pumpkin	$3.43±0.21^c$	$9.08±0.29^a$	$27.06±0.19^b$	$35.27±0.47^a$	$26.14±0.00^b$	$26.07±0.49^c$
Soaked pumpkin	$3.95±0.12^b$	$6.68±0.16^c$	$28.97±0.11^a$	$32.55±0.16^b$	$28.46±0.93^a$	$27.36±0.29^c$
Toasted pumpkin	$3.78±0.06^b$	$3.98±0.11^d$	$25.86±0.07^c$	$32.45±0.27^b$	$26.30±0.00^b$	$33.15±0.57^a$
Raw pumpkin	$4.23±0.09^a$	$8.07±0.19^b$	$26.88±0.10^b$	$33.28±0.65^b$	$24.50±0.00^c$	$29.93±0.85^b$

Values column donated by the same latter show no significant different ($p>0.05$)

3.2. Proximate composition of calabash seed

The result of the proximate composition of calabash seed meal subjected to different processing method such as boiling, soaking, toasting and raw were presented in table 2. The highest value of moisture composition was recorded in soaked calabash seed meal (4.03±0.02) with significant difference from other processing methods, this is followed by boiled and toasted samples (3.54±0.13

and 3.70±0.06) with no significant difference. The lowest moisture content value was recorded in raw calabash seed meal sample (2.37±0.06). The ash composition result shows no significant ($p>0.05$) different between toasted (3.11±0.41), raw (3.07±0.05) and boiled (3.05±0.05) as the highest value recorded samples but significantly ($p<0.05$) differed from soaked of the lowest value (2.06±0.05). The highest value of crude fiber was recorded in raw sample (5.59±0.73) which did not differ ($p>0.05$) significantly from other processing methods. The boiled samples of calabash seeds recorded the highest value of lipid (43.33±0.28), the lowest value was observed in toasted sample (40.17±0.09) with a significant ($p<0.05$) difference from other processing methods employed. The crude protein content of the soaked samples of the calabash seed recorded the highest value (40.74±0.00) with significant ($p<0.05$) from other processing methods, this closely followed by raw, and toasted (37.25±0.00 and 36.73±0.00) with significant different. The lowest value of crude protein content was recorded in boiled calabash seed meal (35.00±0.00). Raw and toasted calabash seed sample recorded the highest value of NFE (16.03±0.12 and 16.28±0.17) with no significant different, these is followed by boiled sample (15.07±0.43) with significant ($p<0.05$) difference. The lowest value of NFE was recorded in soaked sample (10.89±0.09) with significant different (table 2)

Table 2 Proximate composition of calabash seed on different processing methods

Processing method	Moisture%	Ash%	Crude fiber%	Crude lipid%	Crude protein%	NFE%
Boiled calabash seed	3.54±0.15^{b}	3.05±0.05^{a}	5.02±0.06^{a}	43.33±0.28^{a}	35.00±0.00^{d}	15.07±0.43^{b}
Soaked calabash seed	4.03±0.02^{a}	2.06±0.03^{b}	5.02±0.11^{a}	42.27±0.07^{b}	40.74±0.00^{a}	10.89±0.09^{c}
Toasted calabash	3.70±0.06^{b}	3.11±0.14^{a}	4.17±0.05^{a}	40.17±0.09^{d}	36.73±0.00^{c}	16.28±0.17^{a}
Raw calabash	2.37±0.06^{c}	3.07±0.05^{a}	5.59±0.73^{a}	41.28±0.10^{c}	37.25±0.00^{b}	16.03±0.12^{a}

Values donated by the same letters are not significant different ($p>0.05$)

3.3. Proximate composition of cotton seed

The result for proximate composition of cotton seed meal subjected different processing method such boiling, soaking toasting and raw were presented in table 3. The result showed that that there was a significant ($p<0.05$) difference between in moisture content of boiled (7.95±0.05) which recorded the highest value, closely followed soaked (7.13±0.14), raw (6.08±0.02) and toasted (1.18±0.16) samples. The highest value of ash content was recorded in raw cotton seed sample (6.36±0.02) which did not differ ($p>0.05$) significantly from other processing methods. The raw and boiled cotton seed samples recorded the highest crude fiber (18.93±0.12 and 18.10±0.08) with significant ($p<0.05$) different from other processing methods. The lowest crude fiber was recorded in both soaked and toasted samples (17.27±0.24 and 17.99±0.11) with significant ($p<0.05$) different. Boiled sample of the cotton recorded the highest crude lipid (31.49±0.59), this closely followed by soaked sample (29.39±1.24) with no significant ($p<0.05$). The lowest values of crude lipid were reported in toasted and raw samples with significant difference. The crude protein content of the toasted sample of the cotton seed recorded the highest value (29.73±0.02), this followed by boiled and raw samples (26.33±0.81 and 26.33±0.81) which do not differ significantly ($p>0.05$) but from significantly differed ($p<0.05$) toasted sample (24.50±0.00). The toasted cotton seed meal samples recorded the highest value of NFE (38.48±0.30) with significant difference ($p<0.05$) from other processing methods, this followed by soaked and raw sample (33.72±0.30 and 33.49±0.63) with no significant ($p>0.05$) different. The lowest value of NFE was recorded in boiled cotton seed sample (29.03±042) with significant difference from other processing methods.

Table 3 Proximate composition of cotton seed on different processing method

Processing methods	Moisture%	Ash%	Crude fiber%	Crude lipid%	Crude protein%	NFE%
Boiled cotton seed	7.95±0.05^{a}	5.19±0.16^{b}	18.10±0.08^{b}	31.49±0.59^{a}	26.33±0.81^{b}	29.03±0.42^{c}
Soaked cotton seed	7.13±0.14^{b}	5.26±0.18^{b}	17.27±0.24^{c}	29.39±1.24^{a}	24.50±0.00^{c}	33.72±1.51^{b}

Toasted cotton seed	1.18±0.16[d]	4.91±0.05[b]	17.99±0.11[b]	25.67±0.67[c]	29.73±0.02[a]	38.48±0.30[a]
Raw cotton seed	6.08±0.02[c]	6.36±0.21[b]	18.93±0.12[a]	27.72±0.51[b]	26.33±0.83[b]	33.49±0.63[b]

Values in column donated by the same latter are not significant different ($p<0.05$)

4. DISCUSSION

4.1. Proximate composition of pumpkin seed

The proximate composition of pumpkin seed subjected to different method was showed in table 1. The moisture composition of boiled, soaked, toasted and raw pumpkin seed samples in the present study were similar to those Eyo (2005) reported as 3.4% but lower as reported in Gohari (2011) reported as 5.20% which might be due to processing method, seasonal variation and other environmental factors might be responsible for the variation in moisture content. The ash composition of boiled, soaked and raw pumpkin seed sample in the present study are higher to those reported in Gohari (2011) reported 5.34% but for toasted sample is lower to those reported in Gohari (2011). The ash composition of boiled and raw pumpkin seed sample in the present study is similar to Eyo (2005) who reported a value of 9.08%due to difference in processing methods. The fiber composition of soaked, boiled, raw and toasted pumpkin seed sample in the present study was higher to those reported in Eyo (2005) and Gohari (2011) (5.27% and 2.49% respectively) probably due to processing method, soil type and other environmental factors. The lipid composition of boiled, soaked, toasted and raw pumpkin seed samples was lower to those reported in Gohari (2011) (41.5%) but the composition of boiled pumpkin seed sample (35.27) is similar to Eyo (2005) reported as 35.27%.

The crude protein of soaked pumpkin seed (28.46%CP) was higher to those reported in Gohari (2011) and Eyo (2005) (25.40% CP and 26.14% CP). Similarly, the crude proteins of toasted, boiled and raw pumpkin sample are closely similar to those reported Gohari (2011) and Eyo (2005). All the differences may be due to environmental condition, processing method and quality of ingredients. The Nitrogen Free Extract (NFE) of toasted pumpkin sample in the present study was higher to those reported in Gohari (2011) and Eyo (2005) (25.40% and 28.11% respectively) this might be due to processing methods, seasonal variation and other environmental factors might be responsible for differences but the nitrogen free extract of boiled, soaked and raw pumpkin seed samples are almost falls within range of Eyo (2005) and Gohari (2011) reported as 25.40% and 28.11% respectively.

4.2. Proximate composition of calabash seed

The moisture composition of boiled, toasted, raw and soaked calabash seed samples are lower to those reported in Mercy *et al*., (2005) and Chinyere *et al.,* (2009) (6.35% and 7.92% respectively) probably due to processing methods, seasonal variation and condition of soil were seed are cultivated. The ash composition of boiled, toasted, raw and soaked calabash seed samples in the present study is lower to those reported in Mercy *et al*., (2005) (5.74%) but the ash composition of soaked calabash seed samples in almost similar to Chinyere *et al*., (2009) reported as 2.68% and so also the ash composition of boiled, toasted and raw calabash seed samples was higher compare to Chinyere *et al*., (2009) due to processing methods and quality of ingredients. The fiber composition of raw, boiled, soaked and toasted samples of calabash seed in the present study are almost similar to Mercy *et al*., (2011) reported as 5.53% but higher to Chinyere *et al*., (2009) reported as 3.65%. The might be due to processing methods and others environmental factors. The lipid composition of boiled, soaked, toasted and raw samples of calabash seed are lower to those reported Chinyere *et al*., (2009) and Mercy *et al*., (2005) reported as (44.54% and 49.31% respectively) this might be due to processing methods. The crude protein of soaked, raw, toasted and boiled samples of calabash seed in the present study are higher to those reported in Chinyere *et al*., (2009) and Mercy *et al*., (2005) reported as (23.48% CP and 34.47% CP respectively) due to processing of methods of ingredients, soil type, and seasonal variation. However, the Nitrogen Free Extract (NFE) of toasted, raw, boiled and soaked calabash seed samples in the present study was higher to those reported in Mercy *et al*., (2005) and Chinyere *et al*., (2009) reported as (6.96% and 14.22% respectively), this might be due different in processing methods, seasonal variation and other environmental factors.

4.3. Proximate composition of cotton seed

The moisture composition boiled, soaked and raw cotton seed samples in the present study was also close to similar to those reported in Mujahid *et al*., (1962) and Frag (2000) (6.30% and 7.90% respectively) but the moisture content of toasted cotton seed sample (1.18%) was lower to those reported in Frag (2000) and Mujahid *et al*., (1962) (6.30% and 7.90% respectively) due to processing methods and other environmental factors. Similarly, the ash composition of raw, boiled, soaked and toasted cotton seed samples in the present study was higher to those reported in Frag (2000) and Mujahid *et al* (1962) (4.30% and 3.40% respectively) probably due different in processing method, quality of ingredients and environmental factor where experiment carried out. The

fiber composition of raw, boiled, toasted and soaked samples of cotton seed are lower to those reported in Frag (2000) and Mujahid *et al*., (1962) (21.10% and 19.54% respectively) this might be due to processing methods and other environmental factors. The lipid composition of boiled, soaked, raw and toasted samples of calabash seed meal in the present study was higher to those reported Frag (2000) and Mujahid *et al*., (1962) (20.00% and 20.10% respectively), this might be due processing method soil types and other environmental factor.

However, the crude protein of toasted, soaked, boiled and raw samples of cotton seed samples in the present study was higher to those reported in Frag (2000) and Mujahid *et al*., (1962) (20.40% CP and 23.10% CP respectively) probably due to processing method and quality of ingredients. The Nitrogen Free Extract of toasted, soaked, raw, and boiled cotton seed samples in the present study was higher to those reported in Frag (2000) and Mujahid *et al*., (1962) (26.30% and 25.0% respectively) this might be due to processing methods and other environmental factors where experiment carried out.

5. CONCLUSION

Conclusively, the non-conventional oil seed ingredients (pumpkins seed, calabash seed and cotton seed) on different processing methods such as boiling, soaking, toasting and raw contained appropriate quantities of all dietary nutrients requirements for growth reproduction and other metabolic activities. Therefore, the utilization of these ingredient help to reduce the cost of feed production in aquaculture and help to increase the profit margin of the venture.

Recommendation based on this finding for oil seed ingredients, it was recommended that: -

1.The best processing methods of pumpkin and calabash seed ingredients is soaking because they contain promising values of crude protein (28.46%CP and 40.74%CP respectively) for better growth enhancement for fish.

2.It was recommended that toasting is the best processing methods of cotton seed ingredients which contained promising value of 29.73%CP that stimulate fish growth faster.

3.Finely, it was recommended that, this finding could serves as guides in providing nutritional information about the quality of non-conventional oil seed ingredients.

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