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Sterculia setigera seeds as food for Tilapia Fish (*Oreochromis niloticus*) Finger lings

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Abstract:

From this study, the protein content is higher in seeds of Sterculia setigera than those of seed cake, the values were 19.25% and 14.00% respectively. The major minerals namely K ,Na, and Ca were higher in seeds than those of seed cake, and their values were 93.33, 5.00, and 1.4 mg\L respectively in seeds and 78.52, zero, and 1.2 mg\L in seed cake.

The growth rate was higher for fishes fed seeds mixed with wheat bran (1:1 w\w) than those fed with seed cake mixed with wheat bran (1:1 w\w).

Key words: *Sterculia setigera, Oreochromis niloticus,* fish feeding, fish growth,protein, minerals.

In developing countries, there is need for a constant search of new food resources to alleviate hunger, which arises from increasing population, shortage of fertile land and non mechanization of the farming system, Recently , there have been reports in literature on the nutritional and industrial potentials of seeds from edible fruits, some of which were

hitherto, discarded (Adesomoju,1987, Idigo,1989, Ukhun and Uwatse, 1989).Most reports on some lesser- known and conventional crops indicate that they could be good sources of nutrients and many have the potential of proadening the present narrow food base of the human species,(Van Etten Aladetimi, 1989).

Sterculia setigera is an multi-purpose savanna tree which spreads naturally in central and Southern Sudan.The species is the main source of the internationally accepted gum karaya in Sudan.

Seeds of *Sterculia setigera* contain 25.65%. fibre, 3.45% ash, 11.12% carbohydrates, 24.10% protein and 25.25% crude oil. (El Khalifa 2007).

Scientific classification of Sterculia setigera:-

Kingdom: Plantae
Order: Malvales
Family: Malvaceae
Subfamily: Sterculiaceae
Genus: Sterculis
Species: setigera
English name: karaya gum tree; Local names: tartar, faider and telieh, posemporgo (Mooré), kongosira (Bambara)

Distribution and habitat:-

The species is widespread in tropical Africa and is common locally. The natural distribution range stretches from Senegal to Cameroon in West Africa, eastwards to Eritrea, and southwards to Angola. It grows in Savannah type vegetation on a variety of soil types, thriving on poor soils as well as on hilly/stony sites.

Uses:-

The wood is white and very soft, which makes it unsuitable for fuel wood and charcoal. It is therefore used for non timber

forest products (NTFP). It is used for insulation and concealed items in carpentry.The tree produces a water-soluble gum (karaya).This can be tapped and used in cooking as an emulsifier, stabiliser and viscosifier; the gum is used medically as a laxative, diuretic and tranquilliser,and technically as an adhesive and for glazing pottery.

The bark is used for rope making and the bark sap can be made into a refreshing drink. In local medicine the bark is also used to treat snake bites, leprosy, syphilis, coughs, bronchitis, rickets and insanity.

The seeds can be eaten and contain an edible oil, while the leaves are used as fodder for cattle.

The deep-purple coloured ellipsoid seeds are 10-14 mm in length, and have a mean thousand seed weight of 350 g. Each seed has a small yellow-brown aril at the base where it attaches to the fruit. The seed contains 26% oil. Sacandé, and Sanon (2007).

Literature Review

The significance of seed legumes in the diets of animal and man in the developing countries is well documented (Oke *et al*., 1995, Agbede 2000). They are rich in nutrients such as digestible proteins with good array of amino acids and minerals (Ologhobo 1980). The percentage crude proteins of most legumes ranged from 20 to 50g/100g dry weight (Apata, 1990, Igene 1999) and have been judged as good sources of minerals (Oke *et al*., 1995). Leguminous seed have been reported to be excellent sources of energy (Del Rosario *et al*., 1981, Oke *et al*., 1995) in animal and human diets. This explains why considerable research has been directed to harnessing the potential of the seed in animal and human diets.

There is little information on the nutritional and chemical compositions of *Sterculia setigera* seed.

Idu *et al* (2008) studied the nutritional evaluation of *Sterculia setigera* seeds and pod and found that the crude protein was found to be 21.40% in the seed sample and 4.36% in the pod sample .the result, though higher than earlier report on the same species (Ighodalo at al, 1993) is comparable to 22.86,23 and 29% reported on seeds of *Teramnus labialis* shelled rubber and *vigna unguiculata sp*. Culindrical (Viswanathan *et al*, 1999 ,Ukhun Uwatse, 1989 ,Thangadurai, 2005), respectively. The basic role of protein in nutrition is to supply adequate amount of a mino acids therefore ,the seed of *Sterculia setigera* has a considerable promise as protein source. The levels recorded for macro minerals (calcium,potassium,magnesium,sodium and iron) in the seed sample are 108.0,105.0, 59.0and 28,41 mg\100g dm and 27.12ppm ,respectively .Similiarly,21.0, 11.0 and 17.0 mg\100g dm , 0,41 and 0.33 ppm were estimated in the pod sample for calcium, potassium, sodium and iron. For the trace elements (manganese, zinc and copper), 19.66 ,18.74 and 8.69 ppm . respectively were estimated in the seed sample and 0.49 , and 0.14 ppm estimated for the food sample for the heavy metals (Lead, chromium,nickel,cadmium and cobalt), only trace quantities were measured in the seed and pod samples. It is interesting to note that the proximate composition macro and trace elements content of the seed is by far higher than that of the pod, but the heavy metal content of the two samples are comparable.

This study was carried out to evaluate the nutrient composition of *Sterculia setigera* plant seeds in order to determine the suitability of its useas food for *Oreochromis niloticus* fingerlings.

Materials and Methods

The fish used was *Oreochromis. niloticus* supplied from Fisheries Research Center at Al-Shagara 10 km South of Khartoum. The experiment was carried out in the Faculty of

Science and Technology, Omdurman Islamic University, where a series of glass aquaria measuring 80cm X40cmX40cm fitted with the necessary aeration facilities and tubing for siphoning were used. Adequate light and room temperature were maintained. The aquarium was stocked with 20 fry and their length range was 4.5-10cm,and weight range was 2- 13g.

Prior to introduction to the aquarium the fishes were measured and weighed initially and recorded as pre-requite to final weighing after the termination of the experiment. This phase is followed by the calculations of the increment in growth rate.

Fishes were acclimatized in laboratory condition, for 7 days fed with wheat bran and procedure for experiment was done. After that fishes were fed with *Sterculia setigera* seed cake for aquarium (I) (1:1 w\w) and for aquarium (II) the fish were fed with mixture of seeds without extraction of oil after grinding the seeds and wheat bran (1:1 w\w), aquarium (III) fed with wheat bran and kept as control .The experiment proceeds for three weeks, and after the end of each week the total length and weight was measured.

The fish were weighed and measured at the beginning and progressively at week interval in order to access their growth performance.

During the experiment the adopted feeding rate was 5% of the fish body weight. The fishes were fed twice a day throughout the experiment period, three weeks The ration was adjusted every week when new mean weights of fish for the various experimental units were determined. Leftover feed and faeces in each aquarium were siphoned out each day, the water in the aquaria was also changed every day.

Data on fish growth characteristics were recorded at the end of every week. The weight of individual fish was determined with an electronic scale balance. The total length was determined with a measuring board.

As regards calculations, the terms commonly used like average net gain, percentage increment, conversion ratio and percentage conversion efficiency are given below:

1- Average net gain (increment)=
Average final weight - average initial weight

2- Percentage increment=

$$\frac{\text{Average final weight - average initial weight}}{\text{Initial weight}} \times 100$$

3- Conversion ratio=

$$\frac{\text{Weight of food given (g)}}{\text{Net gain (g)}} \times 100$$

4- Percentage conversion efficiency =

$$\frac{\text{Average net gain}}{\text{Weight of food given}} \times 100$$

(Becker, Schreiber, Angoni and Blum 1999).

Protein content:

Protein content of the seeds and seed cake was determined by the Micro – Kjeldahl method, and applying the factor 6.25 to the nitrogen content of the sample, as described by AOAC (1990). The protein percentage was given by the following formula:

$$\text{Protein \%} = \frac{(V_2 - V_1) \times N \times 14}{1000 \times Wt.} \times 100 \times 6.25$$

Where:

V_1 = Volume of HCl used in titration.

V_2 = Volume of HCl used in blank titration.

N = Normality of HCL used in titration.
14/1000 = Conversion ratio from ammonium sulphate to nitrogen.
Wt. = Weight of sample.
6.25 = Conversion factor from nitrogen to protein.

Minerals content:

Minerals for seeds and seed cake were determined by further analysis of ash following the method described by Koddebush (1988).

Results

Minerals are essential nutrients, which are said to be present in small amounts in the body or in several parts per million (Gafar and Itodo, 2011). They are essential because they each play important role in metabolic processes of the body and their absence can cause deficiency symptoms in animals (Gafar and Itodo, 2011; McDonald *et al.,* 1995). The essential mineral elements of nutritional importance are macro (major) elements such as Ca, K, Na, and Mg. The micro (trace) elements are Fe, Mn, Zn and Cu (AOAC 1999).

The values of protein in seeds and seed cake and those of minerals are shown in table (1) and figures (1, 2 and 3).

From table (1) and figure (1) it is clear that the protein content is higher in seeds than seed cake, the values where (19.25 and 14.00 respectively) .

Table (1): Protein content(%) and minerals values (mg\L) in both seeds and seed cake of *Sterculia setigera*.

Sample	Protein(%)	K(mg\L)	Na(mg\L)	Ca(mg\L)	Co(mg\L)	Pb(mg\L)
seeds	19.25	93.33	5.00	1.40	0.033	0.028
Seed cake	14.00	78.52	0.00	1.20	0.046	0.043

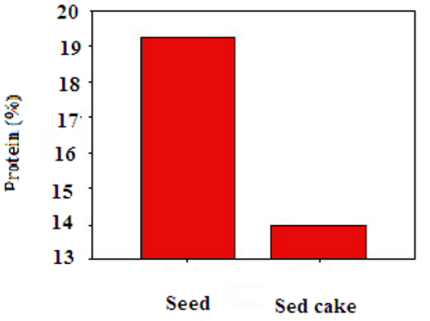

Figure (1) Protein content(%)in both seeds and seed cake of *S. setigera*.

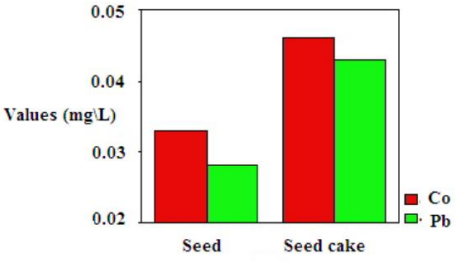

Figure (2) Value of Cobalt and Lead (mg\L) in *S. setigera* seeds and seed cake

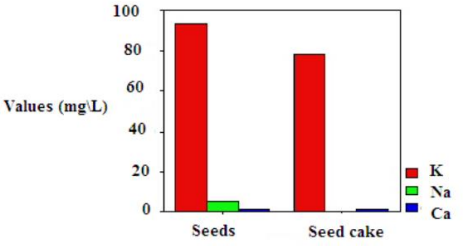

Figure (3) Value of K,Na and Ca (mg\L) in *S. setigera* seeds and seed cake

From table (1) it is clear that protein,(K), (Na), and (Ca)were higher in seeds ,while (Co) and (Pb) were higher in seed cake.

As regards growth calculations the fishes were divided into different length groups and their mean weight were calculated as shown in tables (3,4,5),the increment, percentage increment, conversion ratio, and percentage conversion efficiency for the different aquaria that fed with S. setigera seed cake, seeds were shown in tables (6,and 7), and figures 7 and 8) respectively.

Table (2) Length range and mean weights of *O. niloticus* fed *S. setigera* seed cake and wheat bran (1:1) at Different periods of experiment.

Duration	Length (cm)	No. of fishes	Mean total weight(g)
At the beginning	5.5	7	3
	7.5	4	7.1
	9.5	4	11
	Mean total weight		7.03 (g)
After one week	5.5	7	2.7
	7.5	4	7.5
	9.5	4	11
	Mean total weight		7.07
After two weeks	5.5	5	2.8
	7.5	3	6.6
	9.5	4	10.5
	Mean total weight		6.63(g)
After three weeks	5.5	5	2.8
	7.5	3	6.0
	9.5	4	10.7
	Mean total weight		6.5 (g)

Table (3) Length range and mean weights of *O. niloticus* fed *S. setigera* seeds and wheat bran (1:1) at Different periods of experiment.

Duration	Length (cm)	No. of fishes	Mean total weight(g)
At the beginning	5.5	12	2.92
	7.5	8	6.38
	Mean total weight		4.65 (g)
After one week	5.5	11	2.6
	7.5	6	3.0
	Mean total weight		2.8

After two weeks	5.5	7	4.5
	7.5	4	8.3
	9.5	1	8.0
	Mean total weight		6.9(g)
After three weeks	5.5	5	2.2
	7.5	5	6.2
	Mean total weight		4.2 (g)

Table (4) Length range and mean weights of *O. niloticus* fed wheat bran only at different periods of experiment (Control).

Duration	Length (cm)	No. of fishes	Mean total weight(g)
At the beginning	4.5	12	2.0
	6.5	8	3.25
	Mean total weight		2.625 (g)
After one week	4.5	15	2.3
	6.5	5	4.5
	Mean total weight		3.4
After two weeks	4.5	17	2.2
	6.5	3	3.8
	Mean total weight		3.0(g)
After three weeks	4.5	16	2.06
	6.5	4	3.8
	Mean total weight		2.93 (g)

Table (5) Increment, percentage increment, conversion ratio and percentage conversion efficiency of *O. niloticus* fed *S. setigera* seed cake and wheat bran (1:1) at different periods of experiment.

Period	Increment	Percentage increment	Conversion ratio	Percentage conversion effeciency
After one week	0.04	0.569	1.55	0.65
After two weeks	0.44	5.69	1.06	9.46
After three weeks	0.53	7.54	7.08	14.13

Table (6) Increment, percentage increment, conversion ratio and percentage conversion efficiency of *O. niloticus* fed *S. setigera* seeds and wheat bran (1:1) at different periods of experiment.

Period	Increment	Percentage increment	Conversion ratio	Percentage conversion efficiency
After one week	1.85	39.78	167.57	14.52
After two weeks	2.25	48.39	133.33	75
After three weeks	0.45	9.68	600	16.67

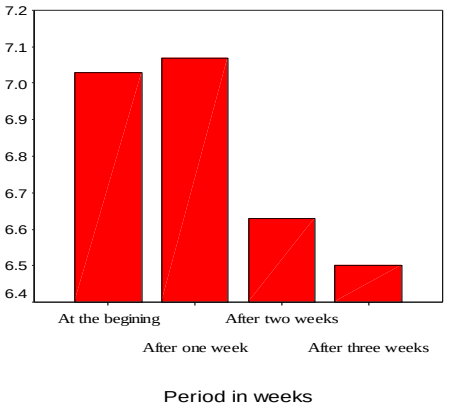

Figure (4) Increment of *O. niloticus* fed *S. setigera* seed cake and wheat bran (1:1) for different periods intervals.

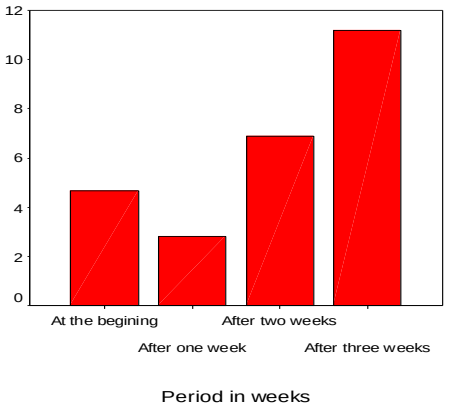

Figure (5) Increment of *O. niloticus* fed *S. setigera* seeds and wheat bran (1:1) for different periods intervals.

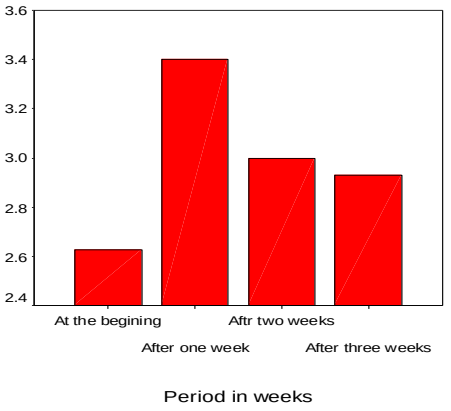

Figure (6) Increment of *O. niloticus* fed wheat bran for different periods intervals (Control).

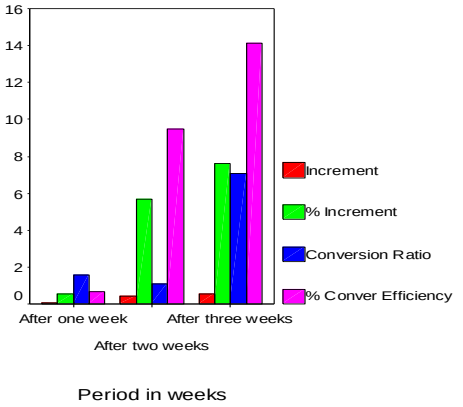

Figure (7) Percentage increment and percentage conversion efficiency of *O. niloticus* fed S.setigera seed cake and wheat bran (1:1) for three weeks.

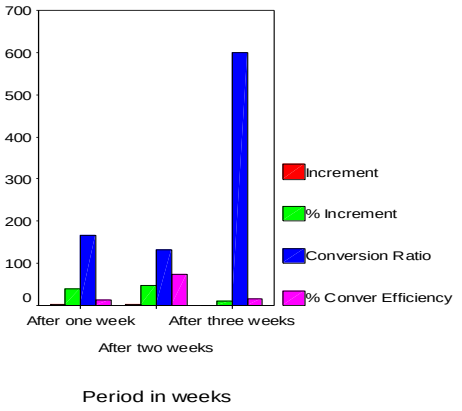

Figure (8) Percentage increment and percentage conversion efficiency of *O. niloticus* fed S.setigera seeds and wheat bran (1:1) for three weeks.

Discussion and Conclusion

Sodium and potassium take part in ionic balance of the body and maintain tissue excitability. Because of the solubility of salts, sodium plays an important role in the transport of metabolites. Potassium is of importance as a diuretic. Calcium constitutes a large proportion of the bone, blood and extracellular fluid; it is necessary for the normal functioning of cardiac muscles, blood coagulation and milk clotting, and the regulation of cell permeability. It also plays an important part in nerve-impulse transmission and in the mechanism of neuromuscular system. (Gafar and Itodo, 2011).

There was a progressive increase in growth with increasing dietary protein and this was in agreement with that of Hafedh (1999) findings.The *S. setigera* seed cake and seeds has the potential to make considerable contributions to growth of *O. niloticus* .

This study has demonstrated that, in general, *S. setigera* seed cake and seeds could be included in *O. niloticus* diets without any negative effects on the growth. *S. setigera*

seeds are locally available and can be obtained throughout the year.

Experiments with the same feed formulations under natural earthen pond conditions are recommended for future study to elucidate growth performances under natural conditions.

REFERENCES

Adesomoju A.A. (1987). Fatty acid composition of the seed oil of *Chlorophora excelsa.* Bull. Chem. Soc. Nigeria 12:69-71

Agbede, J.O. (2000). Biochemical composition and nutritive quality of the seeds and leaf protein concentration from under-utilized tree and herbaceous legumes. Unpublished Ph.D Thesis, Federal University of Technology, Akure.

AOAC (1999). Official Method of Analysis. 2nd edition, Association of Official Analytical Chemists, Washington D.C., pp.807-928 (1990).

Apata, D.F. (1990). Biochemical, nutritional and toxicology assessment of some tropical legumes seeds. Ph.D. *Thesis*, pp 244-248, Department of Animal science, University of Ibadan, Nigeria.

Becker, K. Schreiber,S. Angoni,C. and Blum,R. (1999) Growth performance and feed utilization response *Oreochromis niloticus* X*Oreochromis aureus* hybrid to 1- carnitine measured over a full fattening cycle under commercial conditions. *Aquaculture*, 174:313-322

Del Rosario, R.R., Lozano, Y. and Noel, M.G., (1981). The chemical and bio-chemical composition of legume seeds. 2, Cowpeas. *Philippines Agriculturist* 64, 49-57.

El Khalifa, A.A. (2007). Domestication of *Sterclia setigera* (L) in Sudan. Ph.D. Thesis, University of Khartoum.

Gafar M.K. and Itodo A.U. (2011) Proximate and mineral composition of hairy indigo leaves. Electronic Journal of Environmental, Agricultural and Food Chemistry, 10(3), 2007-2018.

Hafedh, Y.S.A (1999) Effects of dietary protein on growth and body composition of Nile tilapia *Oreochromis niloticus* L. *Aquaculture Research,*30:385-393..

Idigo M.C. (1989). Potential suitability of some local seed oils for plant alloyresin synthesis. Mig.J. Tech. Education 6:67-73

Idu,M., S Uzoekwe and H.I. Onyibe (2008). Nutritional evaluation of *Sterculia setigera* seeds and pod. Pakistan J. of Biological Sciences 11(1):139-141.

Igene, F.U. (1999). Biochemical, nutritional and physicochemical characteristics of differently processed winged bean seeds (*Phosphocarpus tetragonalobus*). Unpublished Ph.D. Thesis,Department of Animal Science, Edo State University, Ekpoma, Nigeria.

Ighodalo, C.C. Eromosele and O. Eromesele (1993). Studies on the chemical composition and physio-chemical properties of seeds of some wild plants.Plant foods Hum. Nutr. 43:251-258.

Koddebush, L. (1988). Investigations on the Utilization of Different Sources of Phosphorus by Lactating Goats. Ph. D. Thesis, University of Bonn, Germany.

McDonald P., Edward R.A., Greenhalti F.D. and Morgan C.A. (1995). Animal Nutrition, Prentices Hall ,London, 101-122.

Ologhobo, A.D. (1980). Biochemical and nutritional studies of cowpeas and lima bean with particular reference to some inherent anti nutritional factors. Unpublished Ph.D *Thesis*, University of Ibadan,\Ibadan, Nigeria.

Sacandé M. and, Sanon, M (2007). Seed Leaflet, Millinnium seed Bank Project, Senegal.

Thangadurai D.(2005). Chemical composition and nutritional potrntial of Vigna unguiculata sp. Cylindrica (Fabaceae). J. Food Biochm. 29:88-98

Ukhun, M.E. and G.M. Uwatse (1989). Nutritional evaluation of selected Nigeria rubber seed products. A chemical approach. Plant foods Hum. Nutr. 38:309-318.

Viswanathan M.B.D., Thangadurai K. Tamil Vendan and N. Ramesh (1999). Chemical analysis and nutritional assessment of *Teramnus labialis* (L Spreng-(Fabaceae). Plant food Hum. Nutr. 54:345-352.