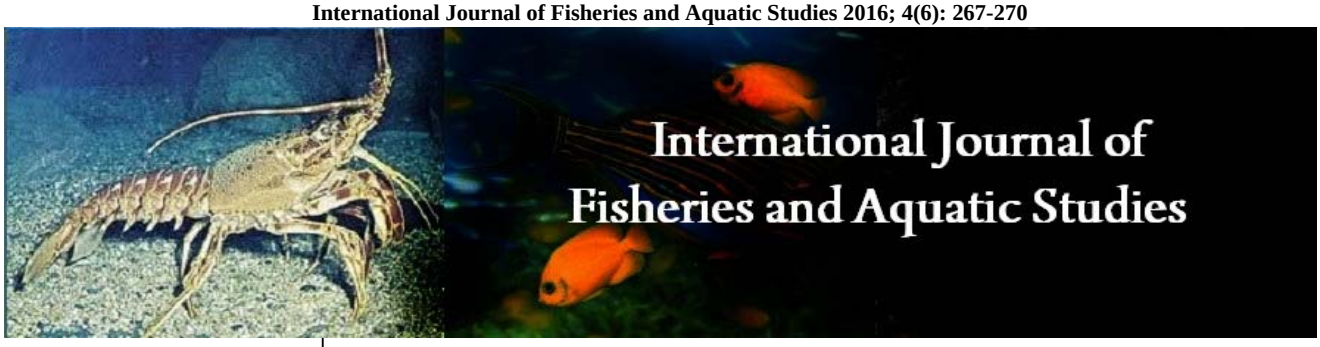

ISSN: 2347-5129
(ICV-Poland) Impact Value: 5.62
(GIF) Impact Factor: 0.549
IJFAS 2016; 4(6): 267-270

www.fisheriesjournal.com
Received: 07-09-2016
Accepted: 08-10-2016

BS Aliu
Department of Fisheries, University of Benin, Benin-City, Nigeria

E Ikoko
Department of Fisheries, University of Benin, Benin-City, Nigeria

Correspondence
BS Aliu
Department of Fisheries, University of Benin, Benin-City, Nigeria

Growth responses of Clariid catfish (*Clarias gariepinus)* fingerlings to dietary decorticated Bambara groundnut (*Voandzeia subterranea*)

BS Aliu and E Ikoko

Abstract
Ground decorticated toasted Bambara groundnut (BG) was incorporated as a non-conventional feedstuff at 0,10,20,30 and 40% levels and fed to *Clarias gariepinus* fingerlings in plastic aquaria twice daily to satiation. Partial replacement of soyabean with varying levels of *Von deaza subterranean* seed meal at 10%, 20%, 30% and 40% were fed to *Clarias gariepinus* fingerling for 70 days. One hundred and ten (110) fingerlings with an initial mean weight of 2.0g were allotted at random to five treatments in triplicate groups with each treatment tank having five fingerlings and were fed with isocaloric and isonitrogenous diets containing 40% crude protein (CP). The protein efficiency ratio was not significantly different (P>0.05) among all the treatment while feed conversion ratio and percentage weight gain was significantly different (P>0.05) among all the treatment. Although, the percentage weight gain of fish, and feed conversion ratio was highest in treatments 40% (22.09) and 10% (3.17) respectively, feed conversion ratio was lowest in treatment 40% (1.69). Protein efficiency ratio, specific growth rate, mean weight gain of fish, feed intake were all lowest in treatment II. Survival rate among treatments slightly varied significantly with treatments 30% and 40% being highest. Net Protein Utilization (NPU) at the end of the experiment was significantly different with treatment 40% being the highest and control diet lowest.

Keywords: Clariid catfish, *Clarias gariepinus*, fingerlings growth, Bambara groundnut diet

1. Introduction
Clariid catfish (*Clarias gariepinus*), an important freshwater tropical food fish is a candidate species for high density culture due to its ability to utilize artificial feeds at all stages of growth (Huet, 1972) [10]. Fish feed play very vital role in fish production, inadequate food prolific breeding are known to cause growth in natural waters (Lowe, 1982) [13]. In Nigeria, the high cost of conventional feedstuff underscores the need to develop adequate but relatively inexpensive feed formulations from readily available materials (Aliu and Okolie, 2005) [2]. Several practical diets have been formulated for African catfish using a wide range of non-conventional feedstuffs. This includes pigeon peas, cotton seed, housefly, maggots and poultry hatchery wastes (Aliu *et al.,* 2014) [3].
Bambara nut is herbaceous legume from the family Fabaceae and is of African origin. Bambara nut is grown all over Africa primarily for human consumption (Obizoba and Egbuna, 1992) [15]. Bambara nut meal is made from Bambara nut after removal of bambara nut sievates (Onyimonyi and Ugwu, 2007) [17]. Bambara nut has high amount of essential amino acids lysine, cystine and methionine (Dakora and Muofhe, 1995) [8]. The crude protein content of Bambara nut is 24–28% (Obizoba and Egbuna, 1992, Dakora and Muofhe, 1995) [15, 8], and the lipid content is 12–18%. Bambara nut lipids feature majorly linolenic, linoleic, palmitic acids and stearic acids (Minka and Bruneteau, 2000) [14]. It contains about 60% fat and 21-24% crude protein (Oyenuga, 1968 and Olomu 1995) [19, 16]. The present study was carried out in order to evaluate the effect of various levels of dietary Bambara groundnut inclusion on the growth and survival of clariid catfish *Clarias gariepinus* fingerlings.

2. Materials and Methods
Experimental diets: fishmeal (Anchovy), soyabean seed, healthy Bambara groundnut seeds, bone meal and vitamin premix were bought from retail outlet in Benin City, Nigeria.

The shells of the Bambara groundnut were removed manually and the endosperm was toasted on a well heated pot for ten minutes to minimize the effect of toxins and protein inhibitors. All ingredients were finely ground in a domestic blender. The resultant flour was subsequently passed through a 0.34mm sieve in the Fisheries departmental laboratory in the University of Benin. The composition of the experimental diets are shown in Table 1

Table 1: Composition of the experimental diets

Ingredients	Treatments				
	Diet I	**Diet II**	**Diet III**	**Diet IV**	**Die TV**
% Substitution of Bambara seed meal	0%	10%	20%	30%	40%
Fishmeal (65.5% CP)	25.00	25.00	25.00	25.00	25.00
Soya bean (38.8% CP)	42.00	32.00	22.00	12.00	2.00
Bambara ground nut	0.00	10.00	20.00	30.00	40.00
Blood meal	2.00	5.00	9.25	12.76	16.01
Maize (9.5% CP)	18.00	15.00	10.75	7.24	3.99
Bone meal	4.00	4.00	4.00	4.00	4.00
Palm oil	8.00	8.00	8.00	8.00	8.00
Vitamin E gel	0.60	0.60	0.60	0.60	0.60

After the addition of palm oil, each dietary component was thoroughly mixed homogeneity. The constituent yellow corn meal in each diet was gelatinized (boiled in water) to serve as binder in the pelleted feed ingredients *Clarias gariepinus* fingerlings (initial mean body weight of 1.5±0.3g) were obtained from outdoor fish tanks of the Department of Fisheries, University of Benin, Benin City

2.1 Feeding Trials: The experimental design consist of five (5) dietary treatments with three (3) replicates each. Diet 1 with 0% BG inclusion serves as control. This was conducted in 15 aerated aquaria (60 X 45 X 30cm). Clariid catfish fingerlings from the same brood stocks were stocked randomly at five (3) fingerlings per aquarium in 40 litres of domestic water of university of Benin in the laboratory. The fingerlings were fed crumbled 2.0mm size pellet of experimental diets twice daily to satiation between 8.00-9.00 hrs. and 15.00-16.00 hrs. Feeding was monitored for each unit to ensure that fishes were not underfed or overfed. Experimental units were cleaned daily while changing of total water. Weekly weight gain and feed consumption were monitored for 10 weeks. The data on weight gain; feed conversion ratio and survival rates for the dietary treatments were analyzed by one way ANOVA (Analysis of variance). The differences in mean were compared by Duncan Multiple range Test.

3. Results

Temperature of water ranged from 27-29 ºC and PH of 7.3-7.6.

Table 2: shows mean weight gain (g), relative weight gain (%), feed conversion ratio and percentage survival of fingerlings maintained on various experimental diets for 10 weeks.

Parameters	Treatment					
	I 0%	**II 10%**	**III 20%**	**IV 30%**	**V 40%**	**SEM**
Mean weight gain(g)	4.33^{b}	2.58^{c}	4.39^{b}	4.82^{b}	3.70^{a}	1.06
Feed intake(g)	6.35^{bc}	4.88^{c}	6.23^{bc}	7.25^{ab}	8.85^{a}	0.90
Relative weight gain (%)	17.73^{ab}	13.84^{b}	16.48^{ab}	17.30^{ab}	22.09^{a}	3.35
Feed conversion ratio	1.47^{ab}	1.89^{b}	1.42^{ab}	1.50^{a}	1.15^{a}	0.50
Survival rate %	92.00%	92.00%	92.00%	92.00%	92.00%	-

Mean values with the same superscript on the same row are not significantly different (P>0.05)

Table 3: Gross Proximate Composition (%) of Experimental Diets

Proximate Composition	Treatment				
	I	**II**	**III**	**IV**	**V**
Moisture content (%)	11.0	9.5	6.5	9.5	10.0
Protein content (%)	23.13	33.75	32.00	19.25	21.88
Ether extract (%)	10	19	15	14	12
Crude fibre (%)	5.2	4.6	6.0	5.4	6.2
Ash (%)	13.0	12.0	8.0	13	13
NFE (%)	36.67	21.15	32.5	38.85	36.92

(**Source**: Field Survey, 2016)

Table 4: Carcass composition (%) of *Clarias gariepinus* fingerlings fed varying levels of *Von deaza subterranean.* seed meal based diets for 75 days

	Initial carcass	**TSF I**	**TSF II**	**TSF III**	**TSF IV**	**TSF V**
Moisture content	6.00	6.20	5.7	6.10	6.00	6.10
Fat	23.0	25.0	23.0	24.0	25.0	27.0
ash	5.5	6.6	10.0	12.0	10.0	8.0
Crude protein	50.5	50.6	54.2	52.9	56.0	58.8
NFE	15	11.6	7.0	5.0	3.0	0.1

TSF = *Test fish carcass composition*
(**Source**: Field Survey, 2016)

The proximate composition of experimental diet (Table 3.0) shows that crude fat is highest at treatment II (19%) and lowest at treatment I (10%), crude fiber content was highest in treatment in treatment V (6.2%) and lowest in treatment II (4.6), moisture content was highest in treatment I (11.0%) and lowest at treatment III (6.5%), Crude protein value was highest in Treatment II (33.75%) and lowest in Treatment V (21.88%), Ash content value was recorded to be highest in Treatment IV and V having similar value of (13.0%) and the lowest in Treatment III (8%). Nitrogen Free Extract (NFE) was highest in Treatment IV (38.85%) and lowest in Treatment II (21.15%).

Proximate composition of test fish (Table 4) shows that moisture content was highest in fish fed with diet I at 6.20% and lowest in fish fed with diets II at 5.7%. Crude protein level was irregular been highest in fish fed the test diets with 58.8% in diet V and lowest at 50.6% in diet I. The fat content were irregular with diet V been the highest at 27.0% and diet II being the lowest at 23.0%. Ash content of test fish was highest in fish fed with diet III at 12% and lowest in diet I at 6.6%. Carcass fed with diet V had the highest crude protein value (58.8% CP) and carcass fed with diet I had the lowest value (50.6% CP). When compared with the initial value (50.5% CP), treatments II, III, and IV increased with 54.2% CP, 52.9% CP, and 56.0% CP respectively, with no reduced CP value recorded. Lipid value also varied with treatments

been highest in treatment V (27%) and lowest in treatment II (23%).

The growth response and nutrient utilization data evaluated displayed a regular trend with almost all substitution levels. At all levels of substitution, the weight gain was almost in all the treatments. The highest weight gain was recorded in treatment 5 (7.704) that was fed with diet containing 40% Bambara seed meal. This treatment was significantly different (P<0.05) from treatment I, II, III, IV. The control treatment which had 0% inclusion level of bambara (treatment I) was not significantly different from treatment II, III, IV, which had an inclusion level of 10%, 20% and 30% respectively with treatment II (2.581) having the lowest weight gain.

Feed intake in treatment I and III was not significantly different (P>0.05) from each other but both were significantly different from Treatment II, IV, and V which were also significantly different from one another, with treatment II having the lowest feed intake (4.8g) and treatment V having the highest feed intake (8.4g). This result indicates that the best intake of feed containing Bambara nut was at 40% inclusion level and that with decreasing levels from 30%, there were similar feed intake as there was no significant difference between treatment I, and III, at inclusion levels of 0% and 20% respectively with treatment II having the least feed intake at 10% inclusion level.

Percentage weight gain showed no significant difference (P>0.05) between treatments I, III and IV, Treatment V was significantly different being the highest (22.09%) and treatment II was significantly different from all treatments having the lowest value of (13.84%).

There was no significant difference (P>0.05) in the feed conversion ratio of treatments IV and V indicating that food was converted to flesh at different rate, no significant difference (P>0.05) between treatment I and III. FCR was lowest in treatment V (1.15) and highest in treatment II (i.89). The FCR was uneven with increasing inclusion levels.

Survival rate was same in all treatments 92.00%.

4. Discussion

Experimental fish also showed a positive response in terms of mean weight gain with treatment V (7.70) been highest, treatment I (4.33), III (4.39) and IV (4.82) showed similar response, however, treatment II had the least positive response with a mean of 2.58. Inclusion level at 40% (treatment V) produced best result, this correlates with Santiago *et al.,* (1986) [21]; Aliu and Okolie (2005) [2], who reported that 40% inclusion levels produced highest mean weight gain and mean increase in length of the fingerlings compared with result obtained from other supplemental feed of tilapia fingerlings. In substituting for fishmeal, Oso *et al*. (2013) [18] have showed no significant difference (P<0.05) between the growth performance (weight gain, % weight gain and specific growth rate) of the fingerlings fed the compounded Bambara nut diets upto 75% supplement and those fed the conventional fish meal, this can be attributed to proper utilization of the compounded BGM, hence, it was able to effect specific growth rate comparable to fish meal. Sadiku and Gana, (2015) [20] have reported that 75% of Bambara nut meal would replace fishmeal in the diet of *Clarias gariepinus* without any adverse effects on its growth and body compositions. Brough and Azam-Ali (1992) [7] have reported that Bambara nut seed makes a balance food as it contains sufficient quantities of carbohydrate, protein and fats with relatively high proportion of lysine and methionine as percentage of the protein. Amarteifio *et al* (2006) [4] have recorded that Bambara groundnut is a good source of minerals and can be helpful in formulating a balanced diet.

Also the feed conversion ratio (FCR) in the present study indicated a highest value at 10% level of inclusion (treatment II), next was the control (0% level of inclusion) (treatment I), 20% inclusion (treatment III), 30% (treatment IV) in that order, with 40% level of inclusion (treatment V) having the lowest value of FCR which tallied with Aliu and Okolie (2005) [2], that recorded that the Bambara groundnut feed gave lower feed conversion levels. According to Uchechukwu *et al* (2014) [23] with increasing level of soybean recorded decrease in FCR catfish larvae which is in contrast to this study which recorded a lower FCR with increasing levels of Bambara, According to Hassan *et al* (2015) [9] when replacing soybean with Boabab seed, reported the best (1.00±0.00) feed conversion ratio recorded for of *C. gariepinus* at 10%. The lower the FCR, the better the feed utilization by the fish (Adikwu, 2003; Shabbir *et al*., 2003; Jabeen *et al*., 2004) [1, 22, 11].

Banyigyi*et al* (2001a) [6] used heat treated (oven toasted) Bambara groundnut (*Von deaza subterranean* verde L.) meal to feed *Clarias gariepinus* juveniles to determine its effect on growth and feed utilization. The results of the study indicated high digestibility of experimental diets which suggests that Bambara groundnut meal have the potential of replacing or competing with soybean in fish feed formulation. Banyigyi *et al* (2001b) [5] have suggested that extension of the duration of heat processing of bambara nut or employment of feed processing methods such as boiling or fermentation may enhance better growth and feed utilization.

5. References

1. Adikwu IA. A review of aquaculture nutrition in aquaculture development in Nigeria. In: Proceeding of the Joint Fisheries Society of Nigeria, National Institute for Freshwater Fisheries Research, FAO-National Special Programme for Food Security and National Workshop on Fish Feed Development and Feeding Practices in Aquaculture held at National Institute for Freshwater Fisheries Research, New-Bussa. (Eyo, A. A. Ed). 2003, 34-42.
2. Aliu BS, Okolie NP. Growth response of Nile Tilapia (*Oreochromis niloticus*) fingerlings to dietary decorticated Bambara groundnut (*Voandzeia subterranea*). Journal of Sustainable Agricultural Research. 2005; 15:24-26.
3. Aliu BS, Okeke ID, Okonji VA. Effects of Total Replacement of Fishmeal with Poultry Hatchery Waste Meal on the growth response of clariid catfish (*Clarias gariepinus)* fingerlings. Nigerian Journal of Agriculture, Food and Environment. 2014; 10(3):28-33.
4. Amarteifio JO, Tibe O, Njogu RM. The mineral composition of Bambara groundnut (*Vigna subterranea* (L) Verdc) grown in Southern Africa. African Journal of Biotechnology. 2006; 5(23):2408-2411.
5. Banyigyi HA, Balogun JK, Oniye SJ, Auta J. Growth Performance and Feed Utilization of Tilapia (*Oreochromis niloticus*) fed diets containing toasted Bambara groundnut (*Von deaza subterranean* Verde L.) meal. Journal of Agriculture and Environment. 2001b; 2(1):121-127.
6. Banyigyi HA, Oniye SJ, Balogun JK, Auta J. Feed utilization and growth of juvenile catfish (*Clarias*

gariepinus) fed heat treated Bambara groundnut [*Vigna subterranea* Verde, (L)] meal. Journal of Tropical Biosciences. 2001a; 1(1):55-61.
7. Brough SH, Azam-Ali SN. The effect of soil moisture on proximate composition of Bambara groundnut (*Von deaza subterranean* L.) Verdc. Journal of the Science of Food and Agriculture. 1992; 60:197-203.
8. Dakora FD, Muofhe LM. Nitrogen fixation and nitrogen nutrition in symbiotic Bambara groundnut (*Vigna subterranea* (L.) Verdc.) and Kersting's bean (*Macrotyloma geocarpum* (Harms) Marech. et Baud.) In: Hekler J., Begemann, F & Mushonga, J. (eds.), Proceedings of the workshop on conservation and improvement of Bambara groundnut (*Vigna subterranea* (L.) Verdc.), Harare Zimbabwe IPGRI Gatersleben/Department of Research & Specialist Services, Harare/International Plant Genetic Resources Institute, Rome, Italy, 1995, 72-78.
9. Hassan M, Abba A, Wakili UB. Effects of Replacing Soybean Meal with Baobab (*Adansonia digitata*) Seed Meal in the Diets of *Clarias gariepinus* (Burchell, 1822) Fingerlings. Nigerian Journal of Fisheries and Aquaculture. 2015; 3(1-2):42-48, 201, 46.
10. Huet M. Textbook of Fish culture. Breeding and cultivation of fishes. Fishing News Book. 1972, 435.
11. Jabeen S, Salim M, Akhtar P. Study on feed conversion ratio of major carp (*Cirrhinus mrigala*) fingerlings fed on cotton seed meal, fish meal and barley. Pakistan Vetenary Journal. 2004; 24(1):42-46.
12. Kay CE. Crop and product Digest 3: Food legumes. Tropical Products institutes XVL London. 1979, 435.
13. Lowe-Mc Connell RH. Tilapia in fish communities. In Pullin R.S.V. Editor. The Biology and culture of Tilapias. Proceedings of ICLAM conference, Manila Philipines. 1982.
14. Minka SR, Bruneteau M. Partial chemical composition of Bambara pea (*Vigna subterranea* (L) Verde). Food Chemistry. 2000; 68:273-276.
15. Obizoba IC, Egbuna HI. Effect of germination and fermentation on the nutritional quality of Bambara nut (*Voandzeia subterranea* L. Thouars) and its product (milk). Plant Food for Human Nutrition. 1992; 42:13-23.
16. Olomu JM. Monogastric animal Nutrition principle and practice: A Jachem publication, Benin City. 1995, 235.
17. Onyimonyi AE, Ugwu SOC. Performance of laying hens fed varying dietary levels of Bambara (*Voandzeia subterranea* Thouars) offals. International Journal of Poultry Science. 2007; 6:223-226.
18. Oso JA, Edward JB, Ogunleye OA, Majolagbe FA. Growth Response and Feed Utilization of *Clarias gariepinus* Fingerlings Fed with Bambara Groundnut as Protein Source: Journal of Natural Science Research. 2013; 3:86.
19. Oyenuga VA. Nigeria's Foods and Feeding stuffs. Their chemistry and Nutritive value 3rd edition Ibadan University Press Nigeria. 1968, 99.
20. Sadiku SOE, Gana SN. Evaluation of Growth Performance and Body Composition of *Clarias gariepinus* Fingerling Fed Graded Level of Bambara Nut Meal (*Vigna Subterranea*). Journal of Agriculture Food Technology. 2015; 5(3):7-13.
21. Santiago CB, Aldaba MB, Reyes OS. Influence of feeding rate and diet form on growth and survival of Nile tilapia (*Oreochromis niloticus*) fry. Aquaculture. 1986; 64:277-282.
22. Shabbir S, Salim M, Rashid M. Study on the feed conversion ratio (FCR) in major carp (*Cirrhinus mrigala*) fed on sunflower meal, wheat bran and maize gluten (30%). Pakistan Vetenary Journal. 2003; 23(1):1-3.
23. Uchechukwu E, Juhani P, Jouni V. Effects of Substituting Soybean (*Glycine max*) Meal with Bambara nut (*Voandzeia subterranea*) Meal on Growth Performance and Survival of African Catfish (*Clarias gariepinus*) Larvae. International Journal of Fisheries and Aquatic Studies. 2014; 1(3):152-157.