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Research Paper

Proximate analysis of *Clarias Gariepinus* fed with three local formulated fish feed

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Proximate analysis and growth performance of African catfish *Clarias gariepinus* fed with Opa (Bambara nut) and *Glycine max* fish meal investigated along with Coppens commercial fed as control for three months. A group of 60 fishes were stocked in three circular tanks labelled A, B and C. Tank A (Coppens) (moisture 8.67%, crude protein 48.1%, crude fiber 6.8%, Ash 8.67%, and Ether 30.37%). Tank B (Opa) (moisture 8.53%, crude protein 46.36%, crude fiber 7.23%, Ash 9.38%, and Ether 28.50%) and Tank C (Soya) (moisture 8.07%, crude protein 45.64%, crude fiber 8.13 %, Ash 8.53 %, and crude lipid 29.63%). The fishes were fed normally with their body weight taken into consideration (length is 0-10 cm while weight is 0-20 g), 7am-8am in the morning and 5pm-6pm in the evening. The fingerlings were stocked with their length and weight known. The result however showed Tank A (Coppens) having the highest growth rate of (145.9 g) followed by Tank B (Bambara nut) (135.2 g) and Tank C (*Glycine max*) having the lowest value (122.7 g). There was a significant difference ($p<0.05$) in mean growth rate, weight gain, growth rate, and specific growth rate. Based on these findings, Opa and not Soya is recommended as alternative on the bases of affordability as a substitute for Coppens commercial feed for the feeding of *Clarias gariepinus*.

Keywords: African catfish *Clarias gariepinus,* Bambara nut, *Glycine max*

INTRODUCTION

Clarias gariepinus is the most commonly cultured fish species in Nigeria being more desirable for culture by the farmers than any other fish species. One of the main constraints in the production of the species is feed coming from the high cost of imported commercial feed, lack of locally formulated feed which are nutritionally optimal and acceptable to the fish and affordable to the farmers. Fish feed has been projected to account for at least 60% of the total cost of production of the species (Gabriel *et al*., 2007).

In an attempt to find cheaper, affordable, available alternative fish feed to imported commercial fish feeds, various local fish feeds have been formulated from different varieties of sources. This has led to the emergence and proliferation of many fish feed industries in Nigeria manufacturing and selling all sorts of fish feed with bogus and questionable formulation, nutrients composition and production. Most fish farmers opt for this cheaper local feed without knowing the proximate composition, formulation and processing of the feeds. A good *C. gariepinus* feed should contain essential nutrients such as protein, lipids or fats, ash (minerals), fiber, moisture, NFE (nitrogen free extract or carbohydrates) and vitamins in the right proportion and formulated in a balanced ration which will be acceptable, palatable and durable to the fish for its optimum growth. According to Ayuba and Iorkohol, (2012), there is paucity of information on the nutrient content of fish feed produced by different feed companies in Nigeria and no reliable published information on chemical composition of commercial feed and feed ingredients. Shyong *et al*., (2008) also reported the dearth of information on the evaluation of nutrient contents of commercial feeds. This makes the farmers to rely only on the proximate composition of feed given by the manufacturers. Such feed are often alled local, home or farm-made fish or

aqua feed. Very few studies have actually looked and compared the growth response of fish to these local feeds and the standard commercial feeds. Mollah *et al*. (2010) compared local feeds and commercial feeds on the growth and survival of riverine catfish Rita rita, Shapawi *et al*. (2011) compared the growth performance and body composition of humpback grouper *Cromileptis altivelis* fed on farm made feeds and commercial feeds and Ekanem *et al*. (2012) compared the growth performance and food utilization of *C. gariepinus* fed on local Unical aquafeed and coppens commercial feed.

Natural distribution

They are found throughout Africa and the Middle East, and live in freshwater lakes, rivers, and swamps, as well as human-made habitats, such as oxidation ponds or even urbanized sewage systems. The African sharp tooth catfish was introduced all over the world in the early 1980s for aquaculture purposes, so is found in countries far outside its natural habitat, such as Brazil, Vietnam, Indonesia, and India (De Silva and Anderson, 2009).

Habitat

It is a nocturnal fish like many catfish. It feeds on living, as well as dead, animal matter. Because of its wide mouth, it is able to swallow relatively large prey whole. It has been known to take large water birds such as the common moorhen. It is also able to crawl on dry ground to escape drying pools. Further, it is able to survive in shallow mud for long periods of time, between rainy seasons. African catfish sometimes produce loud croaking sounds, not unlike the voice of the crow (Erfanullah and Jaffri, 2008).

Rearing

The rearing of the African aquaculture sharp tooth catfish in Africa started in the early 1970s in Central and Western Africa, as it was realized to be a very suitable species for aquaculture, as:

1. It grows fast and feeds on a large variety of agriculture byproducts
2. It is hardy and tolerates adverse water quality conditions
3. It can be raised in high densities, resulting in high net yields (6–16 t/ha/year).

In most countries, it fetches a higher price than tilapia, as it can be sold live at the market

4. It matures and relatively easily reproduces in captivity
5. It tolerates difficult conditions in aquaculture

According to De Silva and Anderson (2009), the quality of a feed is a function of how well that feed meets the nutrient requirement of a fish. The good growth performance of fish fed with coppens is an indication that the feed contained well balanced nutrients as seen in the proximate composition of the feed as well as its high digestibility and nutrient utilization. The very low percentage composition of crude protein, lipid and ash and very high percentage composition of NFE or carbohydrate and crude fiber in the local feed were responsible for the poor growth performance of *C. gariepinus* when fed with the feed with protein being most significant and limiting the growth. It has been shown by various workers that fish growth is significantly influenced by the level of protein in the feed (Degani *et al*., 2009; Buttle *et al*., 2009; Siddiqui *et al*., 2008; Giri *et al*., 2010; Ali and Jauncey 2004a; Goda *et al*., 2007; Keremah and Beregha 2014; Corn´elio *et al*., 2014) with 40% dietary protein promoting maximum growth of C. gariepinus (Henken *et al*., 2008; Van Weerd 2015). Mollah and Alam, (2009) reported negative effect of carbohydrate on growth of *C. batrachus* fry when levels were maintained at more than 15% in the diet. Similarly, Tan *et al*., (2007) reported that carbohydrate in the diet of *Clarias* species should not exceed 20%, if it thus, FCR and PER begins to decrease. Ali and Jauncey, (2004b) observed that CHO:L ratios ranging from 1.70 to 3.40 produced significant improved growth performance and feed utilization in *C. gariepinus*. Erfanullah and Jaffri, (2008) showed that imbalance with respect to non-protein energy sources and their inclusion levels may have direct effect on the growth, feed conversion, nutrient retention and body composition, with fish fed lowest or highest CHO:L ratio produced lower growth and feed conversion efficiencies. High FCR on account of reduction in feed intake observed in the tanks gave rise to a lot of uneaten feed thereby deteriorating the water quality with water pH becoming low (acidic) and carbon dioxide increased and dissolved oxygen decreased. Similar scenario has been reported by Tan *et al*., (2007).

High level of fiber content in feed has been observed to slow the growth of *C. gariepinus* fingerlings (Adewolu *et al*., 2010, Agbabiaka *et al*., 2013). High level of fiber content in feed has been observed to slow the growth of *C. gariepinus* fingerlings (Adewolu *et al*., 2010, Agbabiaka *et al*., 2013). The aim of this study is to determine the growth performance of African catfish *Clarias gariepinus* fed with Opa (Bambara nut) and *Glycine max* fish meal.

MATERIALS AND METHOD

Study area

Gwagwalada (which accommodates the University of Abuja Main and Mini Campuses both at Gwagwalada and Giri which are under Gwagwalada local government area

council) is one of the six Local Government Area Councils of the Federal Capital Territory of Nigeria, together with Abaji, Kuje, Bwari, Kwali; and the Abuja Municipal Area Council (AMAC). Gwagwalada is also the name of the main town in the Local Government Area, which has an area of 1,043 km² and a population of 157,770 at the 2006 census. It is located at an elevated of 210 meters above sea level. Its coordinates are 8°56'29" N and 7°5'31" E in DMS (Degree Minutes Seconds) or 8.94139 and 7.09194 (in decimal degrees). Its UTM position is KQ98 and its Joint Operation Graphics reference is NC32-13 (Wikipaedia, 2016).

Sample collection

Collection and preparation of feeds

Fish meal, *Glycine max*, maize bran, rice bran and Bambara nut (Opa) were collected for the preparation of the feed.

Collection of *Clarias gariepinus*

60 healthy African cat fish (*Clarias gariepinus*) was bought from Gwagwalada and transported in sterile and oxygenated water and polythene bag to the main campus for analysis.

Preparation of collected samples

Preparation of local feed meal

The *Glycine max* and Bambara nut (Opa) was grinded while maize bran and rice bran were sieved and fish that was collected in powdered form were mixed together using pap as binder and pellet machine reset the formulated feeds.

Preparation of *Clarias gariepinus*

Clarias gariepinus (Juvenile) was measured to be about 0-10 cm and 0-20 g, total average of the Juvenile was calculated, known and recorded. The African cat fish were fed with the different feeds for 12 weeks (3 months) to determine the effect of the various feed on their growth buy adequately and constantly measuring both their weight and length. Their response, reflex and agility to touch was also observed and recorded. The water in the sterile rubber container was frequently changed to maintain a healthy environment that will help growth.

Methodology for proximate analysis

According to Omeru and Solomon, 2016 proximate analysis is a method for the quantitative analysis of the different macronutrients. It is also the portioning of compounds in a feed into categories based on their chemical properties. This categories includes lipid and nitrogen free extracts (digestible carbohydrates).

Moisture

This is essential for controlling moisture in powdered food aid sample to avoid contamination during storage.

Crude lipids

This is applicable for the determination of crude fat in dried storages and mixed feeds.

Crude Protein

This is applicable to fish, fish products and fish by products. It is used to determine the protein level in food.

Ash

This consists of oxidizing all organic matter in a weighed sample of the material by incineration and determining is the weight of the products and other materials with low carbohydrate content.

Growth parameters

Mean weight gain %

Calculated as

$$MWG = \frac{\text{Final mean weight x 100}}{\text{Initial mean weight}}$$

Mean length gain %

Calculated as

$$MLG = \frac{\text{Final mean length x 100}}{\text{Initial mean length}}$$

Specific growth rate

Calculated as

$$SGR = 1Nwt - LnWt \times 100/T$$

Where WT = Final Weight
Wt = Initial weight
T = Time interval
Ln = Natural log

Food conversion efficiency

Calculated as

$$FCE = \frac{\text{Weight gain x } 100}{\text{Feed intake}}$$

Mean growth rate computed using standard equation

$$MGR = W2 - W1 \text{ x } 100 \text{ x } 1/0.5\,(W1\ W2)$$

Where W1= initial weight, W2= final weight
t = period of time
0.5 = constant

Survival rate (SR)

This was calculated by the total amount of fish stocked and total amount of fish harvested in percentage.

SR= total number of fish harvested x 100 /Total number of fish stocked

Length – weight relationship

W = aLb…… (1)
Log W= Log a + b Log L…… (2)
Where W = weight of the fish (g)
L = Standard length of Fish (cm)
a = Constant
b = an exponent.

Condition factor

$$K = Wx\ 100/L \ldots\ldots 3$$

Where k = condition factors
W = weight (g)
L = standard length (cm).

Statistical analysis

One way ANOVA will be used to compare the effect of the different feeds on African cat fish (*Clarias gariepinus*).

RESULTS AND DISCUSSION

According to this research work, (Table 1 and Figure 1) show the feeding response and growth pattern of African cat fish (*Clarias gariepinus*) fed with coppens as follows: the highest and lowest mean final weight is 245.9 and 224.2, the highest and lowest mean weight gain is 4.7 and 3.9 while the highest and lowest specific growth rate is 1.58 and 1.42 respectively. Table 2 and Figure 2, show the feeding response and growth pattern of African cat fish (*Clarias gariepinus*) fed with Opa as follows: the highest and lowest mean final weight is 235.2 and 222.8, the highest and lowest mean weight gain is 2.8 and 2.1 while the highest and lowest specific growth rate is 1.17 and 0.80 respectively. Also (Table 3 and Figure 3) show the feeding response and growth pattern of African cat fish (*Clarias gariepinus*) fed with Soya as follows: the highest and lowest mean final weight is 229.1 and 222.7, the highest and lowest mean weight gain is 4.7 and 1.1 while the highest and lowest specific growth rate is 0.69 and 0.21 respectively. According to the overall results from (Tables 1, 2 and 3), African cat fish (*Clarias gariepinus*) fed with coppens showed the highest mean final weight at 245.9 while those fed with Soya showed the lowest mean final weight at 222.7, 4.7 was recorded as the highest mean weight gain for both African cat fish (*Clarias gariepinus*) fed with coppens and Soya while the lowest 1.1 recorded in the one fed with same Soya, highest specific growth rate was observed and recorded in African cat fish (*Clarias gariepinus*) fed with coppens at 1.58 while the lowest recorded from those fed with Soya at 0.21.

Finally, (Table 4 and Figures 4-6) showed that African cat fish (*Clarias gariepinus*) fed with Coppens still have the highest protein, moisture and ether at values of 8.67%, 48.10% and 30.37% respectively. African cat fish (*Clarias gariepinus*) fed with Opa has the highest Ash at 9.38% while Soya has the highest for crude fibre at 8.13%. African cat fish (*Clarias gariepinus*) fed with Soya has the lowest protein and moisture at values of 8.07% and 45.64% respectively. African cat fish (*Clarias gariepinus*) fed with Soya has the lowest Ash 8.53%, Cppens with lowest Crude fibre at 6.83% and Opa with lowest Ether with 28.50%.

Conclusion

According to this study, Coppens feed is still the best option for African cat fish (*Clarias gariepinus*) farmers but Opa feed can still serve as an alternative in case of non-availability of Coppens feed in the market. Coppens feeds still serve as the highest source of protein, energy and moisture followed by Opa.

Recommendation

(a) Opa feed can be used as an alternative to Coppens compared to Soya feed.
(b) The combination of Opa and Soya feeds might yield a better growth and can also be an alternative to Coppens feed.
(c) Soya feed cannot serve as a good alternative to both Coppens and Opa but can be used in case of non-availability of both.

Table 1. Nutrient utilization and weight-length of *Clarias gariepinus* fed with Coppens feed.

Parameter	Wk1 g	Wk2 g	Wk3 g	Wk4 g	Wk5 g	Wk6 g
MIW	219.7	270	340	450	520	630
MFW	270	340	450	520	630	720
MWG	4.5	3.9	4.7	4.1	4.4	4.6
SGR	1.56	1.42	1.62	1.52	1.50	1.58
Parameter	**Wk1 cm**	**Wk2 cm**	**Wk3 cm**	**Wk4 cm**	**Wk5 cm**	**Wk6 cm**
MIL	59.7	64.2	68.1	72.8	76.9	81.3
MFL	64.2	68.1	72.8	76.9	81.3	85.9
MLG	4.5	3.9	4.7	4.1	4.4	4.6
SGR	1.56	1.42	1.62	1.52	1.50	1.58

Key: MIW, mean initial weight, MFW, mean final weight, MWG, mean weight gain, SGR, specific growth rate. The first MIW is taken as the initial measurement while measurements were taken every 2 weeks., Key: MIL, mean initial weight, MFL, mean final weight, MLG, mean weight gain, SGR, specific growth rate. The first MIW is taken as the initial measurement while measurements were taken every 2 weeks.

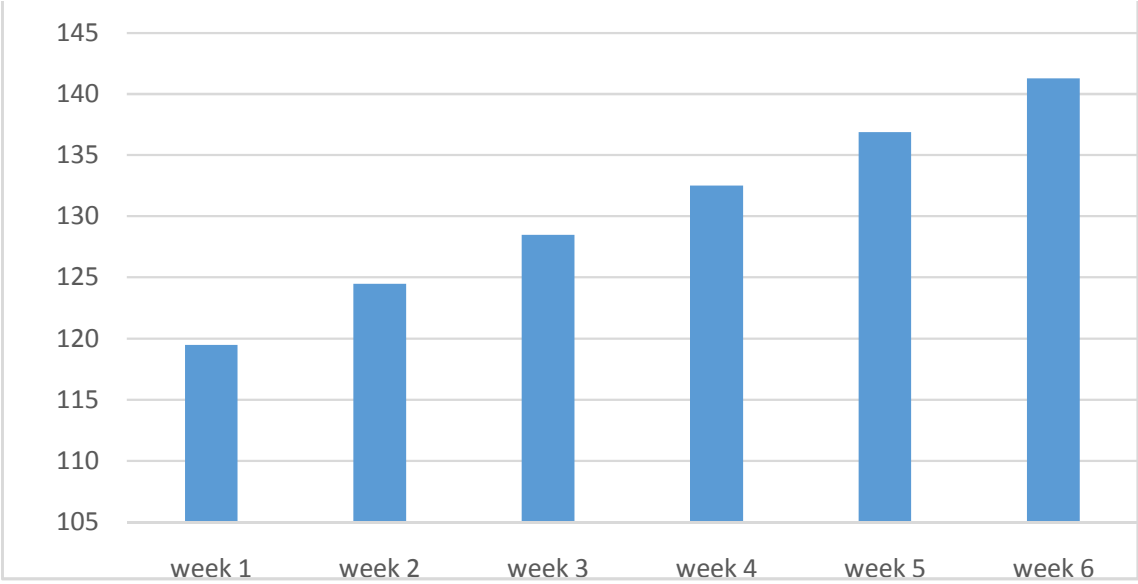

Figure 1. A bar chart representing the growth of clarias gariepinus on coppens

Table 2. Nutrient utilization and weight- length of Clarias gariepinus fed with Bambara nut (Opa) feed.

Parameter	Wk1 g	Wk2 g	Wk3 g	Wk4 g	Wk5 g	Wk6 g
MIW	220.2	222.8	225.6	227.7	230.2	232.5
MFW	222.8	225.6	227.7	230.2	232.5	235.2
MWG	2.6	2.8	2.1	2.5	2.3	2.7
SGR	1.13	1.17	0.80	1.11	0.96	1.15
Parameter	**Wk1 cm**	**Wk2 cm**	**Wk3 cm**	**Wk4 cm**	**Wk5 cm**	**Wk6 cm**
MIL	60.2	62.8	65.6	67.7	70.2	72.5
MFL	62.8	65.6	67.7	70.2	72.5	75.2
MLG	2.6	2.8	2.1	2.5	2.3	2.7
SGR	1.13	1.17	0.80	1.11	0.96	1.15

Key: MIW, mean initial weight, MFW, mean final weight, MWG, mean weight gain, SGR, specific growth rate. The first MIW is taken as the initial measurement while measurements were taken every 2 weeks. Key: MIL, mean initial weight, MFL, mean final weight, MLG, mean weight gain, SGR, specific growth rate. The first MIW is taken as the initial measurement while measurements were taken every 2 weeks.

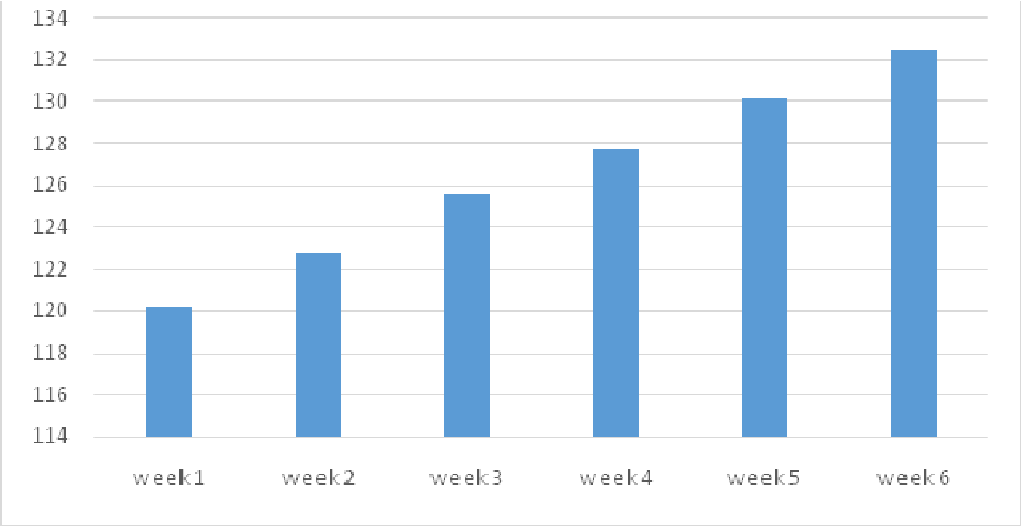

Figure 2. A bar chart representing growth of *Clarias gariepinus* on Bambara Nut (Opa).

Table 3. Nutrient utilization and weight –length of *Clarias gariepinus* fed with *Glycine max* (Soya) feed.

Parameter	Wk1 g	Wk2 g	Wk3 g	Wk4 g	Wk5 g	Wk6 g
MIW	221.2	222.7	223.7	225.5	226.6	228.0
MFW	222.7	223.7	225.5	226.6	228.0	229.1
MWG	4.5	3.9	4.7	4.1	4.4	1.1
SGR	0.65	0.51	0.69	0.60	0.63	0.21
Parameter	**Wk1 cm**	**Wk2 cm**	**Wk3 cm**	**Wk4 cm**	**Wk5 cm**	**Wk6 cm**
MIL	61.2	62.7	63.7	65.5	66.6	68.0
MFL	62.7	63.7	65.5	66.6	68.0	69.1
MLG	4.5	3.9	4.7	4.1	4.4	1.1
SGR	0.65	0.51	0.69	0.60	0.63	0.21

Key: MIW, mean initial weight, MFW, mean final weight, MWG, mean weight gain, SGR, specific growth rate. The first MIW is taken as the initial measurement while measurements were taken every 2 weeks. Key: MIL, mean initial weight, MFL, mean final weight, MLG, mean weight gain, SGR, specific growth rate. The first MIW is taken as the initial measurement while measurements were taken every 2 weeks.

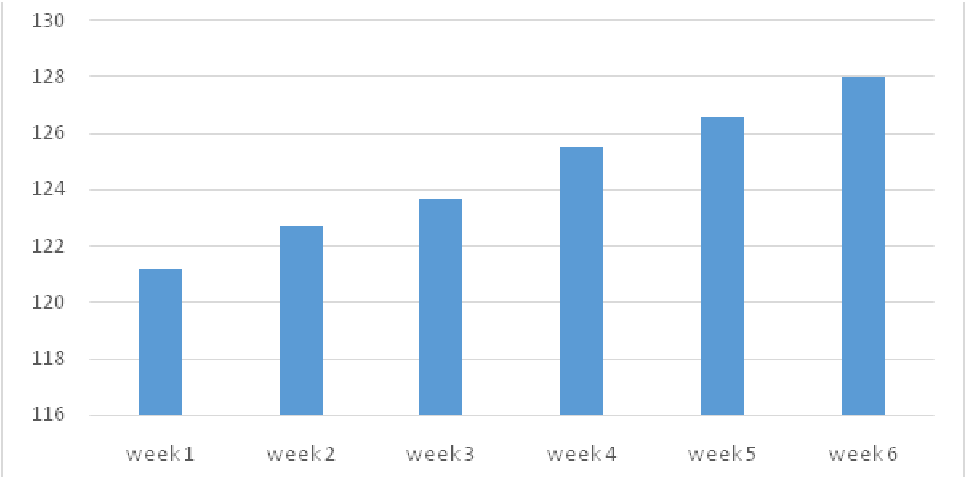

Figure 3. A bar chart representing growth of *Clarias gariepinus* on *Glycine max.*

Table 4. Proximate compositions of the Opa, Soya and Coppens feeds.

Parameter	Bambara nut (Opa)	Glycine max (Soya)	Coppens
Moisturecontent (%)	8.53	8.07	8.67
Protein (%)	46.36	45.64	48.10
Ether extract (%)	28.50	29.63	30.37
Ash (%)	9.38	8.53	8.67
Crude fibre (%)	7.23	8.13	6.83

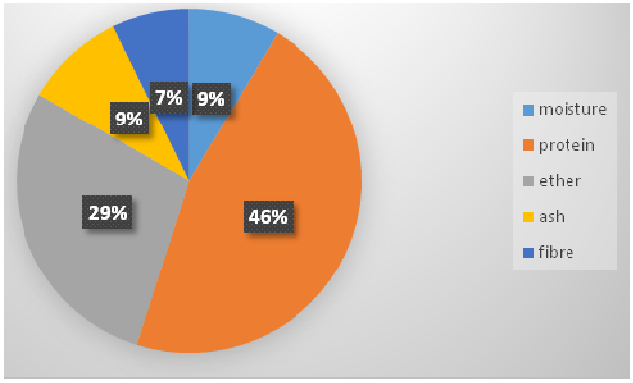

Figure 4. Pie chart representing proximate analysis of Clarias gariepinus on Banbara nut (Opa).

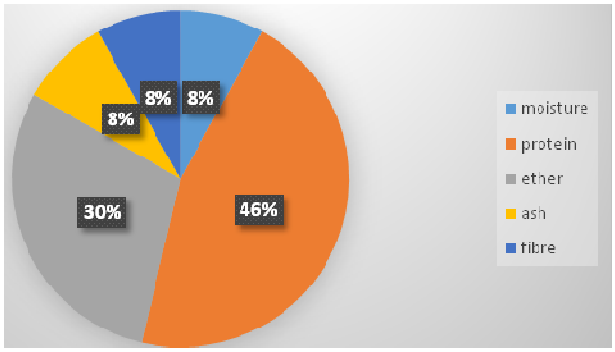

Figure 5. Pie chart representing proximate analysis of Clarias gariepinus on Glycine max (Soya).

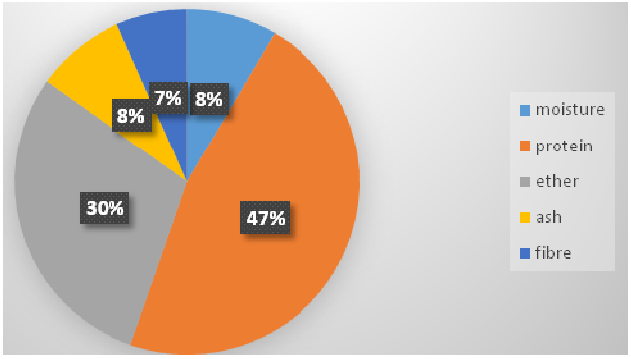

Figure 6. Pie chart representing proximate analysis of *Clarias gariepinus* on Coppens

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