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Comparative Effect of Replacement of Guinea Corn Meal With Yam Peel Meal on the Growth Performance of Clarias Gariepinus

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Abstract: *A feeding trial was conducted to assess the replacement value of yam Discorea rotundata peel as a dietary replacement for guinea corn meal in the diet of Clarias gariepinus. All 5 diets were prepared to be iso-caloric diets. (35% crude protein). Yam Peel Meal (YPM) were used to replace Guinea Corn Meal (GCM) at the rate of 0% (YPM 1), 25% (YPM 2), 50% (YPM 3), 75% (YPM 4), and 100% (YPM 5). The performance of the varying levels of yam peel meal-based were compared to fish fed guinea corn meal-based control diet containing 35% crude protein while guinea corn meal itself has 10.80% crude protein. Ten (10) Clarias gariepinus fingerling per replicate with mean body weight of 13+-29g were stocked. The fingerling were fed at 5% of their body weight per day for 56 days. The was no significant difference (P>0.05) in the Mean Weight Gain (MWG), Feed Conversion Ratio (FCR), but there was significant in the Specific Growth Rate (SGR). The highest (MWG) was recorded in DT2 (33.45g), and the lowest was recorded in DT3 (16.99g), the highest (FCR) was recorded in DT2 (2.23g) and the lowest was recorded in DT3 (1.46g), as the best FCR was DT3 (1.46). The SGR showed significant difference (P>0.05) in DT1 (16.99g). This study showed that Yam Peel Meal (YMP) can effectively replace Guinea Corn Meal (GCM) up to 100% in the diet of Clarias gariepinus for optimum growth performance.*

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I. Introduction

Fish are the group of cold-blooded animal typically with gills and fins and are primarily dependent on water as a medium to live. Fish are the most numerous among the vertebrates consisting of about 20,000 species compared with birds 2,500 (Balogun, 2006). The African catfish is a species of catfish of the family Clariidae and its scientific name is Clarias gariepinus which was named by Burcell in 1822. Adebayo and Daramola (2013). This species are found in lakes, streams, rivers, swamps and flood plains, many of which are subject to seasonal drying (FAO,2010). African sharptooth catfish Clarias gariepinus is a typical air breathing catfish with ascale-less, bony elongated body with dorsal and fins, and a helmet like head. Colour varies dorsally from dark to light brown and is often mottled with shades of olive and grey while the underside is pale cream to white (Skeleton,2001). It can grow very large with a maximum reported of 170cm (IGFA, 2001) and weight of 60kg (Robins et al,1991). Population growth is accompanied by increasing demand for fish, with direct human consumption of fish reaching an estimated 103million tons in 2003. (World Fish Center, 2007).Fish is the main source of animal protein for a million of people worldwide, as well as providing a valuable protein complement to the starchy diet common among the global poor, fish is an important source essential vitamins and fatty acids. (World Fish Center, 2007). The developing global marine catch over the last few years together with the increased percentage of overexploited fish stocks and the decreased proportion of non-fully exploited species around the world convey the strong message that the stage of world marine fisheries is worsening and has a negative impact on fisheries production. FAO (2012). Based on FAO statistics for 1950-2006, the first overview of the marine fisheries resources by country confirmed that, globally, the maximum average level of bottom fishes and small pelagic fish production has being reached with the final decade, (FAO, 2012). Fisheries and aquaculture are source of income for 55million people. The livelihood of 12% of the world's population depends directly or indirectly on them, Fisheries and aquaculture give an important contribution to security and nutrition. They are the primary sources of protein for 17% of the world population and nearly a quarter in low income food deficit countries, (FAO, 2012). Basically, fisheries seems to be the hope of large number of people in the world but considering the declining state of global marine catch over the last few years reported by FAO (2012), all attention may be focusing on aquaculture. The aquaculture industry, in the last years has contributed significantly to reduce hunger and malnutrition worldwide. (Amagliani et al, 2009, Crisafi et al, 2001). Capture fisheries and aquaculture supplied the world with about 142 million tons of fish in 2008. Of this, 115 million

was used as human food, providing an estimated apparent capital supplied of about 17kg (life weight equivalent) which is an all-time high. Aquaculture accounted for 46% of total food fish supply. FAO (2011). Conventional feed source are the feed stuff that are regularly used in the formulation of fish feed, examples include wheat bran, groundnut cake and rice bran. Some are animal based, for example (fish meal, blood meal shrimp meal), Gabriel et al (2007). Omole et al (2011) reported that conventional feed ingredients are expensive hence there is need to look for alternative feed resources that are readily available at affordable price. A lot of studies have been concluded in the use of agro-industrial by products (AIBS) such as cassava peel, brewer dry grains, rice bran and maize cobs of feed, (Hamzat, 2004; Tewe, 2004; Iyaji, 2008, Kehinde, 2009). Yam peel, Discorea rotundata is another feed resource that can be used as an alternative ingredient. This study determine the effect of replacement of guinea corn meal with yam peel meal on the growth of performance of Clarias gariepinus.

II. Materials and Methods

One hundred and fifty fingerlings of Clarias gariepinus with average mean weight of 13.29 +1.61g, were obtained from Saminu Fish Farms, New Bussa, Niger State. The fish were transferred to the laboratory and acclimatized for about one week. They were starved for about 24hours before being fed with the experimental diets.

III. Preparation of Diets Fed to the Fish

Five (5) treatments diets with 35% crude protein were formulated to contain Yam Peel Meal (YPM) at 0% (YPM 1), 25% (YPM 2), 50% (YPM 3), 75% (YPM 4), and 100% (YPM 5). Feed ingredients included fish meal, soybeans meal, guinea corn meal, yam peel meal, vegetable oil, bone meal, salt, lysine, methionine, vitamin premix. The formulation was based on proximate composition of the ingredient. The yam (Discorea rotundata) were peeled and the peels were collected together and dried under ambient temperature for about two weeks to ensure proper dryness. All the feed ingredients were milled, mixed, and pelletized to give required quality and quantity of diets.

IV. Experimental System

The feeding trial experiment was conducted using plastic bowls (40litres) at the Fish Biology Laboratory of Federal College of Freshwater Fisheries Technology, New Bussa, Niger State. The bowls were filled to 2/3 of its volume with water supplied from the tap very close to the laboratory. Aeration was done in order to ensure good and sustainable aeration, the water was introduced into the bowls in splash and as aerator were used for perfect aeration; also the water was changed and replaced with fresh water once in two days.

Table 1: Percentage Composition of Experimental Diets

Ingredients	Diet 1(0%)	Diet 2 (25%)	Diet 3 (50%)	Diet 4 (75%)	Diet 5(100%)
Yam peel	0	6.75	13.50	20.25	27.00
Guinea corn	27.00	20.25	13.50	6.75	0
Fish meal	32.50	32.50	32.50	32.50	32.50
Soya beans	32.50	32.50	32.50	32.50	32.50
Vit. Premix	1.00	1.00	1.00	1.00	1.00
Bone meal	1.50	1.50	1.50	1.50	1.50
Methionine	1.00	1.00	1.00	1.00	1.00
Lysine	1.00	1.00	1.00	1.00	1.00
Vit.C	0.50	0.50	0.50	0.50	0.50
Veg.Oil	1.00	1.00	1.00	1.00	1.00
Starch	1.50	1.50	1.50	1.50	1.50
Fat	0.50	0.50	0.50	0.50	0.50
Total	100	100	100	100	100

V. Experimental Procedure

At the commencement of the feeding trial, the acclimatized fish being deprived of feed as reported earlier for 24 hours, were sorted randomly, 10 each in 15 bowls (that is five (5) treatments and three (3) replicates each of 10 fish with initial mean weight of 13. 29 + 1.61g were randomly stocked. The experiment lasted 56 days (that is 8weeks) and the fish were feed with experimental to times at 5% of their body weight between the hours of 7am in the morning and 6pm in the evening. Each bowl was equipped with aerators in order to supply the fish with sufficient Dissolved Oxygen (DO). The initial weight of fish being taken and recorded weekly. The weight was obtained using an electronic weighing balance (METTER TOLEDO, PB602 weigh balance [3000 x 0.1g]. The water was completely changed once in two days and as bowls were properly washed before replacing it with a fresh water and also fish mortality was monitored.

VI. Monitoring Water Quality

Some of the water quality parameter such as Temperature, Dissolved Oxygen and PH level, etc, measured. (Boyd, 1979).

VII. Growth Parameters

Fish Growth Parameters MWG =W2-W1

SPG = lnlogw2 –lnlogW1x100

T Brown (1975)

%SR = lnitial number of fish stocked mortality x 100

Initial number of fish stocked

FCR = Feed consumed (g)

Weight gained Omitoyin (1995)

Water quality parameters Boyd 1979

Analysis of variance (ANOVA) Steel and Torrie 1960.

VIII. Results

Proximate Composition Of Yam Peel Meal (YPM)

The proximate composition of yam peel meal (YPM) used in the formulation of diets fed to Clarias gariepinus fingerlings with the crude protein value of 14.39% presented in Table 2.

Table 2: Proximate Analysis of Yam Peel Meal

Moisture content %	5.8
Ash content %	4.2
Crude fibre %	4.88
Crude protein %	14.93
Crude fat %	3.34
NFE %	66.87

IX. Proximate Composition of Experimental Diets

The proximate composition of diets fed to Clarias gariepinus fingerlings are presented in Table 3. The crude protein content varied from approximately 28.75% in Diets 2 to 36.05 in Diets 5. Crude fibre ranged between 3.95% in Diet 4 to 4.51% in Diet 3. Moisture content between 3,95% in Diet 3 to 8.8%. Crude fat ranged between 7.41% in Diet 4 to 12.27% in Diet 3, Ash content ranged 5.35% in Diet 1 to 7.78% in Diet 3 while Nitrogen Free Extracts (NFE) ranged between 37.48% in Diet 3 to 43.04% in Diet 5.

Table 3: Proximate Analysis of the Experimental Diet Fed to Clarias gariepinus

	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5
Moisture content %	7.09	8.8	7.10	6.89	9.76
Ash content%	5.35	5.94	7.78	6.73	7.1
Crude fiber%	4.1	4.34	4.51	3.95	4.2
Crude protein %	32.23	28.75	30.86	34.1	36.95
Crude fat %	9.88	11.59	12.27	7.41	9.86
NFE %	42.37	40.59	37.48	40.93	43.04

X. Water Quality

Water quality parameters observed were: Temperature, DO, (Dissolved Oxygen) and PH. Water temperature was monitored using a Mercury-in-glass Thermometer calibrated in degree Celsius (^{0}C). The PH of each treatment was observed using a JENWAY 3015 pH Meter. Dissolved Oxygen was also taken periodically using HORIBA water checker U-10. Some of the water qualities monitored during the experiments are presented in Table 4. The performance of the experimental fish was best when the temperature was 27.11-28.60^{o}C, dissolved oxygen 5.98-6.88 mg/litre and pH was 7.6 -7.16.

Table 4: Mean Water Quality Parameter Monitored At Weekly Interval during The Experiment

Weeks	Temperature (^{0}C)	Dissolved Oxygen (mgl)	PH
1	27.08	6.21	7.6
2	27.10	5.96	7.2
3	28.60	5.98	2.1
4	27.00	6.33	7.4
5	27.09	4.72	7.3
6	28.08	4.68	7.1
7	27.11	6.8	7.16

8	27.04	6.92	7.2
Mean	27.39	5.96	7.35

XI. Growth Performance

The growth performance of Clarias gariepinus fingerlings fed the experimental diets in terms of Weight Gain (WG), Specific Growth Rate (SGR), Feed Conversion Ratio (FCR), Survival Rate (SR) are presented in Table 5. There were positive response of the experimental fish Clarias gariepinus to the experimental diets. The initial weight of the experimental fish (Clarias gariepinus) ranged between 13.00g and 13.89g in the treatment T5R1 andT4R3 respectively. The final weight of the experimental fish Clarias gariepinus showed no significant difference (P>0.05) among the various diets fed to TRT1,TRT2, TRT3, TRT4, TRT5, weight range was between 24.45g in TIR1 and 64.34g T4R3 respectively, mean weight gain (MWG) was highest in DT2 (33.45g), and lowest in DT3 (16.99g). The specific growth rate has the highest value in DT2 (46.77g) and DT1 is the lowest with the value of (3.25g). The specific growth rate showed significant difference (P<0.05) in DT1 (16.99g) compared with DT4 (45.68g), DT5 (42.51g) and DT2 (46.77g). The growth rate of the experimental fish showed a significant difference (P>0.05) in all the diets that was fed with, as the growth rate were; DT1 (21.94g), DT2 (28.81g), DT3 (20.80g), DT4 (26.50g) and DT5 (24.44g). Feed conversion ratio (FCR) ranged between 1.46g in fish fed DT3 and 2.23g in fish fed DT2. There was no significant difference (P>0.05). The best feed conversion ratio is DT3 (1.46) and the poorest is DT2 (2.23). The survival rate (SR) showed no significant difference as DT1 was 86.67%, DT2, 96.67%, DT3, 83.33%, DT4, 93.33%, DT5, 90.00%.

Table 5: Summary (Means) of Growth Performance of Clarias Gariepinus Fed with Yam Peel Meal Based Diets

PARAMETER	DT 1 (0%) YPM	DT 2 (25%) YPM	DT 3 (50%) YPM	DT 4 (75%) YPM	DT 5 (100%) YPM
Initial weight(g)	33.28+0.22[a]	13.32+0.28[a]	13.21+0.11[a]	13.21+0.43[a]	13.10+0.10[a]
Final weight(g)	31.45+6.64[a]	46.77+4.37[a]	30.12+6.37[a]	45.68+20.07[a]	42.50+22.4[a]
Weight gain(g)	18.17+6.48[a]	33.45+4.09[a]	16.99+6.38[a]	32.26+19.70[a]	29.41+22.40[a]
Growth rate	21.94+3.06[a]	28.81+2.8[a]	20.70+2.84[a]	26.50+7.27[a]	24.44+5.43[a]
Specific growth rate	3.25+0.94[a]	46.77+4.37[a]	30.12+6..37[a]	45.68+20.07[a]	42.51+22.4[a]
Survival rate	86.67+5.78[a]	96.67+5.78[a]	83.33+15.8[a]	93.33+5.77[a]	90.00+10.0[a]
Food conversion ratio	1.51+0.36[a]	2.23+0.17[a]	1.46+0.39[a]	2.08+0.70[a]	1.95+0.87[a]
Culture period	56	56	56	56	56

XII. Discussions

There was no significant difference (P<0.05) in all the parameters measured for growth and nutrient utilization of Clarias gariepinus fed different inclusion fo yam peel meal, that is at 25%,50%,75%.and 100%. This shows from the observation made that yam peel meal (YPM) can replace guinea corn meal as high as 100% inclusion level in the diets of Clarias gariepinus without compromising the growth performance. The proximate chemical composition of yam peel meal (YPM) cannot be classified as a protein source of feed since the crude content was just about 14.39%, but as an energy source like guinea corn, maize, wheat bran, etc. The crude protein value of yam peel meal was observed to be similar to that reported by Akinmutimi and Onen (2008), Ekenyem et al (2006). The variation or difference that was found in the crude protein value of yam peel meal over time might have resulted from the sources of the yam or the depth of peeling during processing of the yam. Carbohydrate either of cereals or tuber has some influence on the rate of growth of a particular fish being raised if all the physiological requirements are met (Carter et al 2003). The proximate composition of yam peel meal (YPM) showed that it has a crude protein level of 14.93%, which is higher than that of guinea corn meal (GCM), 10.00% for white type and 10.80% for the brown type (Chukwu et al, 2011). The result obtained from the study showed that the inclusion of yam peel meal (YAM) could replace guinea corn meal (GCM) as high as 100% inclusion level. Ekenyem and Madubuike (2006), and Akinmutimi (2008), reported that up to 15% inclusion of yam peel in broiler diet showed in significant (P>0.05) difference in their growth performance, also Olurin et al (2006) reported a replacement of 50% cassava meal for maize without depressing growth in Clarias gariepinus. The highest value of feed intake in treatment 2 followed by treatment 3 could be as a result of low lignin and other complex compounds in yam peels thus making it appreciably digestible.Feed Conversion Ratio (FCR) and feed acceptability did not follow any particular trend that would be attributed to the inclusion of YPM, Carter et al (2003) reported a better feed conversion ratio in control diet in the replacement of maize with cassava in the diet of Atlantic salmon (Salmon scaler). The acceptance of YPM by Clarias gariepinus, shows the indication that the replacement of Guinea Corn Meal (GCM) with Yam Peel Meal (YPM) could in a great deal profit to farmers, because guinea corn meal is more expensive to obtain compared to Yam Peel Meal (YPM) which id regarded at most as waste.The production of yam has increased steadily in the last decades, from 18million metric tons in 1990 to recent estimated of over 39million (FAO, 2002). Ike and Inoni (2006) reported that Nigeria is by far the world's largest producer of yam accounting for over 70-76 percent of the world's

production. This therefore shows that yam is in a great way abundantly available in Nigeria, without a doubt of its scarcity and as reported as by Ezieshi and Olomu (2012). Yam peel meal is obtained in substantial quantities from kitchens, commercial carters and markets, and also from industries where yam is used as a raw material and the peels been discarded (for example Ayoola pounded yam). The high survival rate of the experimental fish with YPM is an indication that it does not have an adverse effect on the fish and does not cause mortality. The good growth of the experimental fish feed with YPM which is good nutrient quality can be traceable to the method of processing that was used. The average range of temperature obtained could possibly be as a result of that the experiment was carried out indoors. The Dissolved Oxygen (DO) level that were obtained during the experiment fell between 4-6mg/litre, Omotayo et al (2006) recommended that the Dissolved Oxygen (DO) should fall between 4-8mg/litre in the pond and the observed Dissolved Oxygen (DO) was within the recommended range,(Boyd,1974).

XIII. Recommendation

It is recommended that the replacement of Guinea Corn Meal (GCM) with Yam Peel Meal (YPM) should be encouraged by the farmers, because guinea corn meal is more expensive to obtain compared to Yam Peel Meal (YPM) which is regarded at most as waste.

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