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Research Paper

Effect of the growth rate on *Clarias gariepinus* using corn chaff mixed with grind Tilapia fish

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ABSTRACT

The efficacy of corn chaff with fish meal as an ingredient in the diet of the African catfish, *Clarias gariepinus*, of mean weight 40.18±0.51g was evaluated over a 60-days growth period. Four experimental diets were formulated at 0% (control), 25%, 50% and 75% inclusion levels of corn chaff and fish meal. A control diet of corn chaff with fish meal serving as the only protein source was formulated. The 60-days feeding experiment was conducted in plastic container. Fish fed 25% of corn chaff with fish meal recorded the best growth performance in body weight gain and Specific Growth Rate (SGR), although the best Feed Conversion Ratio (FCR) was recorded for fish fed on the control diet of 0% corn chaff with fish meal. There were no significant differences between fish fed the control diet and the other experimental (P>0.05). The study demonstrated that corn chaff with fish meal may be included in the diets of *Clarias gariepinus* at inclusion levels of up to 50% but it is efficacious and cost effective at 25% inclusion level. It is, therefore, recommended that corn chaff with fish meal be used partially to replace the expensive and imported fish meal.

Key word: Corn chaff, Tilapia fish, formulated feed

INTRODUCTION

Fish is any member of a paraphyletic group of organisms that consist of all gill-bearing aquatic craniates animals and also contain tetra pod that lack limbs with digits such as amphibians, reptile, birds and mammals which descend from within the same ancestry (Goldman, 1997).Fish is consumed as a food by many species, including humans. It provides a good source of high quality protein and contains many vitamins, minerals and other nutrients for humans throughout recorded history. In culinary and fishery contexts, the term fish can also include shellfish, such as molluscs, crustaceans and echinoderms, over 32,000 species of fish have been described, (Fish base, 2011) making them the most diverse group of vertebrates. It may be classed as either whitefish, oily or shellfish, Research shown that the nutrients and minerals in fish, and particularly the omega-3 fatty acids found in pelagic fishes, are heart-friendly and can make improvements in brain development and reproduction. This has highlighted the role for fish in the functionality of the human body.

Fish has continued to be the source of hope toward solving global problem of malnutrition due to its richness in nutritive values above other animal sources of protein (Delgado *et al*., 2003; Fasakin, 2007). The expansion and intensification of aquaculture production has been recommended towards ensuring increase in food fish production in order to meet up with the global demand since capture fisheries have continued to be on the decline over decades (*Delgado et al*., 2003).Over the decades aquaculture has grown in leaps and bounds in response to an increasing demand for fish as a source of protein globally (Akinrotimi *et al*., 2007). This is because production from capture fisheries has reached its maximum potential possible, as the catch is dwindling with each passing day (Gabriel *et al*., 2007). According to FAO (2006), Fish supplies from capture fisheries will therefore, not be able to meet the growing global demand for aquatic food.

Aquaculture sector is growing fast worldwide, this rapid development largely depends upon fish meal, which is considered as the most desirable animal protein ingredient in aquaculture found because of its high protein content, balanced amino acid profile, high digestibility and palatability, and as a source of essential n-3 polyenoic fatty acids (Hardy *et al*., 2002) Global fish meal production is approximately 6-7 million tonnes per year. The continuous increasing demand for fish meal used in animal feed especially in aqua feed has resulted in fish meal becoming difficult to obtain and very expensive. Therefore, the search for alternatives to fish meal is a global research priority (Chamberlain, 1993).The increase cost of fish meal and concerns regarding its future availability have made it imperative for the aquaculture industry to reduce or eliminate fish meal with less expensive animal and plant protein sources.

As the need to augment fish production from the wild heightens due to increasing demand for fish, there is increased in global attention on aquaculture (Owodeinde *et al*., 2010). According to (El-Saidy and Gaber, 2003; Siddhuraju and Becker, 2003; Wu *et al*., 2004), aquaculture has become the fastest-growing food production sector in which fish meal is a primary protein source in fish diets. In aquaculture, feeding of culture fish is one of the most important factors that must be considered. Fish like other animals have a requirement for essential nutrients in order to grow properly. Nutrient requirements for fish encompass proteins, lipids, carbohydrates, vitamins and minerals. Fish meal constitutes the main protein source of commercial fish diets and its cost and restrictive availability have been a matter of concern to fish nutritionist for over a decade, presumes that knowledge of its requirement for fish species was essential for the formulation of a balanced diet. (Johnson, 2004) reported that fishmeal has always been the commonest and most popular source of protein for commercial fish feed production. However, the high cost incurred in feed formulation. Among the plant protein sources in aquaculture diets, soybean meal is the most widely used ingredient. It was used for the replacement of fish meal at various rations due to their high-protein content and relatively well balanced amino acid profile, (Koumi *et al*., 2009).

Fish meal constitutes the main protein source of commercial fish diets and its cost and restrictive availability have been a matter of concern to fish nutritionist for over a decade. The current world production of fishmeal is estimated at approximately 6-7m tone annually, According to New and Wijkstrom (2002), this level is expected to remain stable for the next decade. The cost of feed ingredients including fishmeal is expected to be competitive due to the increasing global requirement for animal protein (FAO 2007).The consequences of these, according to Tacon (2007), are the limited expansion and profitability of aquaculture, especially in a third-world state like Nigeria, where small-scale aquaculture contributes to over 70% of the domestic local fish production. This level of fish farming depends on readily available ingredients with less restriction cost.

However, the increasing prohibitive cost of this commodity has necessitated the need to search for an alternative source of energy. Corn chaff is the dry, scaly protective casings of the seeds of cereal grain, or similar fine, dry, scaly plant material such as scaly parts of flower, or finely chopped straw. Chaff is indigestible by humans, but livestock can eat it and in agriculture it is used as livestock fodder, or is a waste material ploughed into the soil or burnt (Daniel *et al*., 2006). The primary ingredients in catfish feed in which corn can account for up to 32.1% and soya bean meal up to 41.6% of total feed ingredients (Li et al., 2006). Corn has been a traditional energy source in formulated feeds.

Despite the fact that fish farming started in Nigeria over fifty years ago, it is not until very recently that aquaculture made substantial contribution to domestic fish supply. After many years of dormancy, the fisheries and aquaculture sector in Nigeria has been brought to the fore front of the national development agenda. Apart from ongoing activities of the presidential initiative on fisheries and aquaculture development, Nigeria also hosted the NEPAD "Fish for All summit" in Abuja in August 2005. This summit was a major success with the participation of 30countries and international organizations. It is worthwhile to note the active participation and exhibition mounted by CAFAN at the summit which concluded by adopting the "Abuja Declaration" on sustainable fisheries and aquaculture development for Africa and the NEPAD plan of action.

The role of fishing in realizing food security in Nigeria cannot be overstated. It accounts for a major source of food protein. For example, fishery products domestic consumption provides approximately 22% of the protein requirement in Nigeria. It also generates employment for 36million people directly through aquaculture. This means that any attempt to neglect fishing by the government maybe to our own peril (FAO, 2003).

Interestingly, demand for fish has continued to increase, not only in Nigeria but also worldwide. Despite that, marine capture historically still accounts for over 80% of the world fish supply, however the capture fisheries have not been able to meet up with the growing demand due to increased fishing pressure and the resultant over-fishing syndrome (FAO, 2003).

It has been postulated by FAO, that if Nigeria is to bridge the serious fish supply gap, the country must invest heavily in modern systems of aquaculture as well as poly-culture for rural communities, while providing enhanced capacities for capture fisheries development. There is no doubt that Nigeria possesses a good environment rich enough to stimulate growth in aquaculture given the right attitude by the government.

The underdeveloped aquaculture sector has the potential of 0.65 to 1.2million tonnes of fish production annually in Nigeria. But it is presently producing 16.619 to 25.264 tonnes annually and it is produced mainly from outdoor, dugout extensive fish ponds, and it is basically 3% of the country's fish production potentials. Outdoor dugout pond farming has always been misconstrued as cheap and easy to operate due to lack of solid infrastructural requirements, low maintenance cost and low feeding costs. According to the Nigerian institute of oceanography and Marine Research, the country has 1,000,000 hectares in fresh water of swamp suitable for aquaculture. This sounds as good news for fish farmers, however, the exploitation of this potentials remains minimal. For instance, an estimated area dedicated to fish farming in 1998 was given as about 5,000 hectares in fresh water and 230 hectares in brackish water. Production estimate was put at 1 tonne per hectare per year for small scale ponds and 2-4 tonnes per hectares per year for commercial farmers. This production was however achieved by using low semi-intensive fish farming culture level. The development of semi-intensives fish farming in Nigeria lays in the establishment of fish culture projects; such projects would increase fish production by 656:815 metric tonnes yearly. Due to the location of the fresh water swamps and the mangrove swamp in Niger delta, the rudimentary level of aquaculture development in Nigeria and particularly in Niger delta region is of great concern, especially when the potential for its development remains attractive. The study aim to determine the growth rate of *Clarias gariepinus using corn chaff* mixed with grind tilapia fish.

MATERIALS AND METHODS

The growth of *Clarias gariepinus* fingerlings using corn chaff meal as protein source in the diets with fish meal. *Clarias gariepinus* were obtain from Jeremiah Oseni Fish Farm Gwagwalada and transported to Biological Science Department, University of Abuja permanent site between 7-9 am, to avoid mortality due to high temperature. The fingerlings were acclimatized for eight days and fed with coppens.

Methodology

The following materials were used to formulate the experimental feeds; corn chaff, dried tilapia fish, soya beans, vegetable oil and Salt. The materials were procured from Gwagwalada Market and Kado fish market for the fish meal. These ingredient Vitamin oil, soya beans and oil were added to the diet in other to make up for their deficiency in the diet. Individual weights of the ingredients were then milled, mixed and produced into pellets. The moist pellets were sun dried for 10 h, packaged in tagged air-tight polytene bags and stored in a cool dry place at room temperature (Table 1).

Experimental design

The experiments were carried out in four plastic containers with a capacity of 40 litres of water each were used for the experiment, the containers was thoroughly rinsed with clean water and completely drained. They were filled with water supplied (25 litres) from the running tap water at senate building of the University. In order to maintain optimum water conditions for proper growth and survival of the fingerlings, the water in each tank were renewed at intervals of four days, during the periods of water renewal; all experimental tanks were cleaned by scrubbing. To sustain optimal environment and to preclude primary productivity, the water was introduced in a splash for better aeration.

Specimen

Seventy five (75) *Clarias gariepinus* fingerlings of mixed sexes (lengths; 0 – 10 cm and weights; 0 – 20 g) were used for the study and at the end of the acclimatization period, the fingerlings were randomly selected and assigned to four different containers. The containers were covered with mosquito net to prevent the fingerlings from jumping out, instruction of insects and other foraging bodies. The fishes were starved for 24 h to empty their gut content and prepare them for the experimental diets; this practice also helps to make the fishes hungry and thus more responsive to the new diet.

Feeding procedure

The fishes were fed 4% of their gross body weight per tank. Corn chaff has (9.12% protein content) was replaced by Fish meal (Tilapia fish) with (62% Protein content) at 25% in diet A, 50% diet B, and 75% diet C. The formulation was based on the experimental diets. The entire feed ingredients were obtained from different area of Gwagwalada and Kado Fish market, complete randomize experimental design was used. The fishes were fed twice daily, between 9.00 am and 4.00 pm. The ration was adjusted every two weeks when new mean weights of fish for the various experimental units were

Table 1. Composition of experimental diets with varying inclusion levels of Corn chaff with Fish Meal.

Parameters	Diet 1	Diet 2 (25%)	Diet 3 (50%)	Diet 4 (75%)
Corn chaff	9.12%	13.82	25.0	24.91
Fish meal	62%	32.37	7.34	4.91
Soya bean	45%	11.37	7.34	13.99
Vegetable oil	1.0	20.99	29.99	27.99
Salt	0.5	21.43	30.2	28.17
Total	99.99	99.99	99.99	99.99

Table 2. The measurement of the standard length (cm) of the African catfish recorded throughout the experiment.

WEEKS	CONTROL	25%	50%	75%
1	8.77cm	8.04cm	7.92cm	8.07cm
2	9.38cm	8.24cm	8.00cm	8.09cm
3	9.94cm	8.75cm	8.06cm	8.17cm
4	10.43cm	8.78cm	8.10cm	8.24cm
5	12.47cm	8.96cm	8.39cm	8.21cm
6	13.0cm	9.0cm	8.42cm	8.21cm
7	14.23cm	9.10cm	8.60cm	8.46cm
8	14.76cm	9.20cm	8.80cm	8.66cm

determined. Leftover feed and faeces in each tank were siphoned out each week. The water in the tanks was also changed with pre-conditioned pipe-borne water every week.

Data analysis

Data on fish growth characteristics were recorded every week. Standard length and Total length were determined with measuring board and the weight of individual fish was determined with weighing balance. The experimental containers were inspected daily to remove dead fish, if any. Fish weight gain, feed conversion ratio, specific growth rate were calculated.

Feed evaluation parameters-the Initial and mean weights were recorded per treatment.

Weight= Final weight of fish-Initial weight of fish.

Percentage weight gain (%WG) = $\frac{\text{Final weight-Initial weight} \times 100}{\text{Initial weight}}$

Percentage specific growth rate (%SRG)= $\frac{\text{Loge W2-Loge W1} \times 100}{\text{T2-T1}}$

Where: W2=Weight of fish at time T2 (final).
W1= Weight of fish at time T1 (initial).
T= Period of experiment in days.

Feed Conversion Rate (FCR) = $\frac{\text{Feed consumed}}{\text{Weight gained}}$

Laboratory Analysis were evaluated as body weight gain (BWG), feed conversion ratio (FCR) and specific growth rate (SGR).

RESULTS AND DISCUSSION

Growth parameters

The present study is in agreement with the findings of Alegbeleye et al.(2008) who state that corn flour can use as part of energy supplement on growth and nutrient utilization in *Clarias gariepinus.* The initial body weight per fingerlings, were about the same at the beginning of the experiment. Final body weight on the other hand showed significant differences between treatments, for instance, fingerlings fed 25% recorded the highest final mean body weight (Tables 1-2 and Figures 1-2). Figure 1 shows that the size of the standard length increases in every treatment. Which means the treatment is effective in every week, 25% and Control shows more effectiveness than 50% and 75% culture.

There was little change in week one but from week 2 to week 8 there was a drastic increase in length and weight of the fingerlings. It is favourable in control and 25%.

Figure 2 shows that at week one there was a rapid growth or increase in weight, then from week two to week eight there was a slow increase in weight. From the

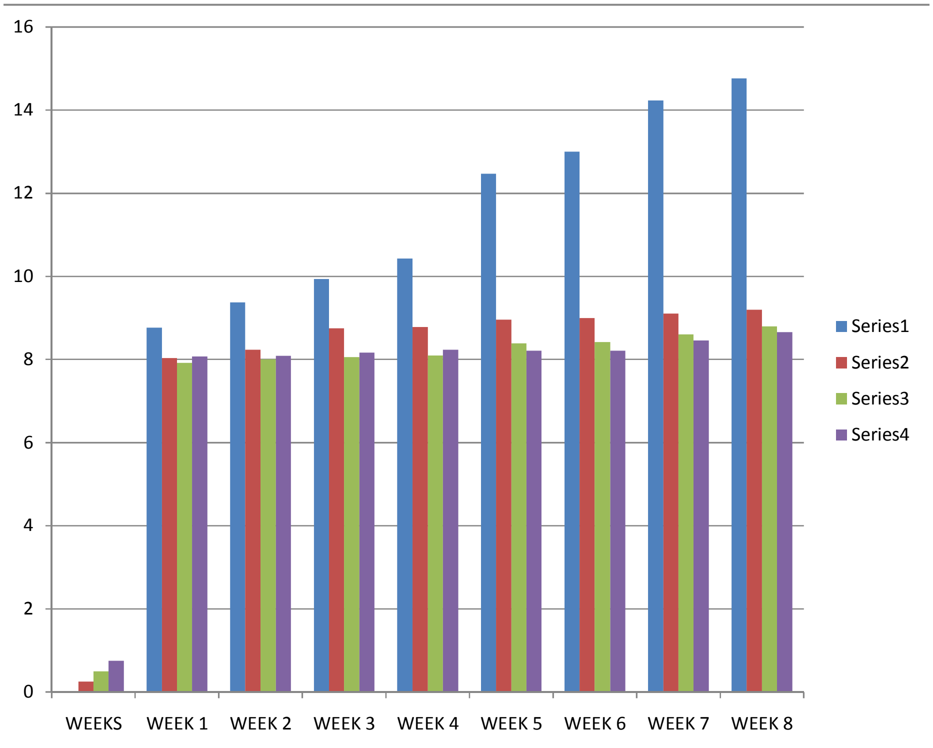

Figure 1. Total length per time.

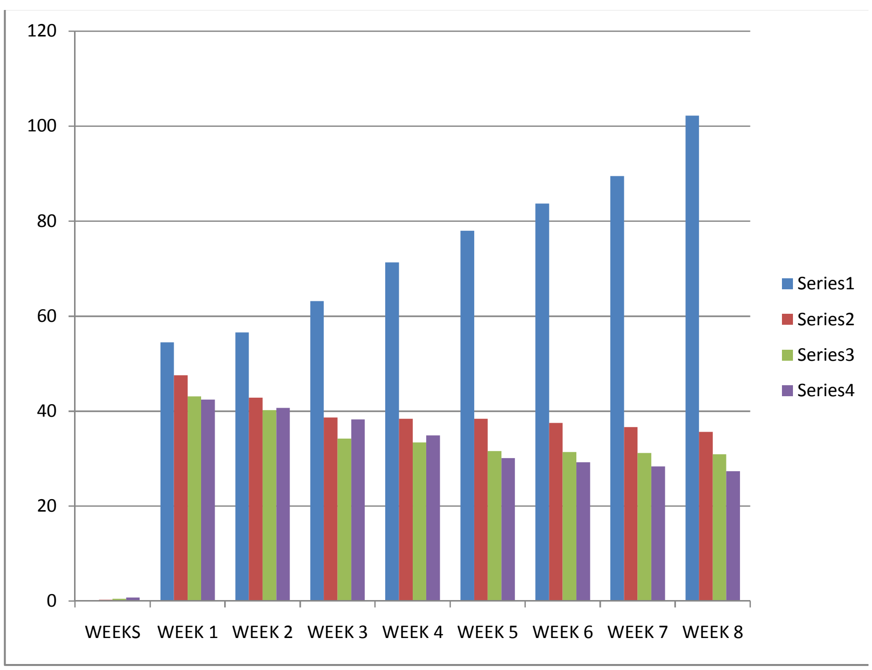

Figure 2. Total Weight per time.

figures we can see that from week to weeks the weight of the fish increase under control and 25%.

The corn chaff meals have the potential to make considerable contributions to growth of the Africa catfish (Gabriel et al., 2017). It also has the potential to partially replace fish meal in a feeding regime and, thereby, reduce feed cost to the fish farmer, whose most important production cost comes from feed. This study has demonstrated that, in general, corn chaff meal could be reduced to 25% level in *Clarias gariepinus* diets without any negative effects on the growth. Corn chaffs are locally available in the corn grinding mill and can be obtained throughout the year. The cost of imported fish meal is very high, whilst it cost little or nothing to collect corn chaff from the mill. It is, therefore, more economical to partly replace fishmeal with corn chaff at the 25% inclusion level without reduction in growth. Experiments with the same feed formulations under natural earthen pond conditions and in re-circulating systems are recommended for future study to elucidate growth performances under natural conditions. It is also recommended that smaller catfish fingerlings, of about 25 g be used in other feeding trial to elucidate response on early growth and the length class sizes that would best respond to growth of the corn chaff meal.

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