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Research Paper

Growth rate of *Clarias gariepinus* fingerlings fed with millet chaffs

TAIWO I. N., *SOLOMON, R. J. AND DAN-KISHIYA A. S.

Department of Biological Sciences, Faculty of Science, University of Abuja, Abuja, Nigeria.
*Corresponding author E-mail: johnsol2004@yahoo.com.

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ABSTRACT

The study was carried out to determine the effect of millet chaffs as feed on the growth rate of *Clarias gariepinus* fingerlings. Sixty fingerlings were used in the study. 10 fingerlings were randomly selected and placed in transparent aquaria with dimensions (10 cm diameter x 20 cm depth) each. The initial lengths and weights of the selected fingerlings were recorded for replicate. The millet chaffs meal was mixed thoroughly with other feedstuffs to produce three isoproteic (CP 3: 40%). The treatment diets at 40% crude protein were prepared as Diet 0, Diet 1and Diet 2. Diet 0 contained only millet chaffs (MC). Diet 1 contained coppens supplements of 50 kg of millet chaffs and 50 kg of coppens and Diet 3 contains only coppens. Fingerlings were fee twice daily (07.00 and 18.00 h) at 10% body weight for 72 days. No significant differences were observed in the Weight gain, Gain in Length, Specific growth rate and Condition factor of *C. gariepenus* fed with the varying diets (P>0.05). The highest initial weight was recorded in the 30% millet chaff fed fishes with 6.08 g followed by 50% millet chaff fed fishes with 6.06 g. The lowest initial weight was recorded in group fed the control diet with 5.91g. Highest final weight was recorded in the 50% millet chaff fed fishes with 22.37 g followed with the group fed with coppen with 21.8 g. In terms of total weight gain, 50% millet chaff fed fishes gave the best growth (16.31 g) followed by control treated group (15.89g), while 30% millet chaff fed fishes had the lowest weight gain with (4.65 g).

Key words: Formulated feed, millet chaff, growth rate.

INTRODUCTION

Early catfish producers depend primarily on natural pond productivity to provide nutrients for fish growth. Fish production was enhanced by the addition of fertilizers to pond water to stimulate the growth of natural food organism (Robinson and Li, 1999) but as aquaculture developed and expanse, supplementary feeding became an important part for higher productivity, and now accounts for at least 60% of the total cost of fish production in Africa, hence, it determines the viability and profitability of fish farming enterprise (Jamu and Ayinla, 2003).

Feed ingredients that are rarely consumed by human are highly competed for by the livestock sector (Obun, 2008). The high cost, scarcity and insufficient supply of soybean meal has necessitate the need for a search for alternative plants protein ingredients.

Feeding in fish farming takes 60% of the operating cost as said above. In formulating suitable nutritive feed for fish, fish meal is the major component. This has made the cost of growing fish over a period of time to be very high. In order to seek for alternative to fish meal suitable plant protein has been investigated over the years (Lim

and Dominy, 1990; Shiau *et al.,* 1990). Fish meal forms the major protein source in fish feed because of its high nutritive value and palatability. Studies have shown that high levels of plant protein in fish diets or complete substitution of animal proteins has resulted in poor growth and feed efficiency in feed (Dabrowski et al., 1989; Lim, 1992).

Poor growth in such studies have been attributed to anti nutritional factors or toxic substances; improper balance of essential nutrients such as amino acids, energy and minerals, high amount of fibre and carbohydrate, decrease in palatability of the feed; and reduction of pellet quality especially water stability (Lim and Dominy, 1989). Fish require a well – balanced mixture of essential and non essential amino acids. The most effective, economical source of these amino acids is a proper combination of high quality natural proteins in feedstuffs.

In Aquaculture, fish feed is conventionally formulated to contain high amount of fishmeal (32-40%) (Richard and Chapman, 2007). Fish meal is very expensive thus increasing the cost of fish production. Also, it competes with man (focus consumer) for fish (food product of Aquaculture). Groundnut cake is alternative protein source. It is deficient in some vital amino acids (such as lysine and methionine) that are present in fishmeal (Eyo, 1995). Its amino acid quality improves in artificial diets when reinforced with lysine and methionine.

Aquaculture in Nigeria is in the development stage because it has not been able to meet the demand and supply of the ever-increasing populations. It is acknowledged as the efficient means of providing food which is rich in protein (Milla, 2003). Ojotiku (2008) noted that interest in fish culture is growing very rapidly in Nigeria but the scarcity of fingerlings of culturable fish such as *Clarias gariepinus* tends to constitute a major constraint to the rapid development of fish farming in Nigeria. This is supported by Akinsanya and Otubayo, (2006) who confirmed that *C. gariepinus* from the family Clariidae is generally considered as one of the most important tropical catfish species for aquaculture in West Africa. Early catfish producers depend primarily on natural pond organisms to provide nutrients essential for fish growth. Prepared feeds, mixtures of feed processed into various forms were used to supplement natural productivity. Supplemented feeds were largely steam-pelleted feeds that provide protein, energy, but were generally deficient in micronutrients such as vitamins, minerals and essential amino acids.

There has been a competition to the use of animal protein both by the feed producers and the populace due to growing interest in fish farming. Richard and Chapman, (2007) stated that aquaculture feeds characteristically contain a higher percentage of protein than feeds used for poultry, swine's and cattle. A typical commercial production diet formulated for tilapia or catfish contain approximately 32%-40% proteins, while on a commercial grower diet formulated for most terrestrial animals rarely exceeds 20% in total protein.

Millets are a group of highly variable small-seeded grasses, widely grown around the world as cereal crops or grains for fodder and human food. They do not form a taxonomic group, but rather a functional or agronomic one. Millets are important crops in the semi-arid tropics of Asia and Africa (especially in India, Nigeria, and Niger), with 97 percent of millet production in developing countries (Crawford, 1983). This study was designed to determine the effect of millets chaff on growth performance and survival of *Clarias gariepinus.*

MATERIALS AND METHODS

Study area

Gwagwalada is located at about 55 km southwest of the capital city, along Lokoja-Kaduna road. The town which is the second largest settlement within the FCT, as at the time of creation of the territory in 1976, is situated between lat.8˚ 55˚ and 8˚ 60' North and 7˚ 05' and 7˚ 11' East. Gwagwalada town, with an aerial extent of about 118 sq/km and has an elevation between 142.2 m and 213.3 m as in the southern and northern part of the town respectively. The town has recorded mean annual temperature that range from 30 degree Celsius to 37 degree Celsius and total annual rainfall of about 1650 mm. Relative humidity range from about 25% to 50% in the dry and rainy season respectively (Figure 1).

Experimental design and feeding trials

Clarias gariepinus fingerlings of similar sizes were reared in six transparent aquaria (10cm diameter x 20cm depth) at 10 fingerlings per replicate (aquarium). Initial total lengths and weights of randomly selected fingerlings were recorded for each replicate. Fingerlings were fed two times daily (07.00 and 18.00 h) at 10% body weight for 72 days. Water renewal were done regularly before each feeding to remove uneaten feeds and to prevent fouling and about 80-90% of the culture water will always be replaced every morning. The survival of *Clarias gariepinus* fingerlings were determined everyday by counting and recording the mortalities (Davies and Ezenwa, 2010).

Sampling collection and processing

The test ingredients (Millet chaffs) to be used for this study were collected from a local processor in Gwagwalada. The Millet chaffs were sundried for 48 h and packaged in an air-tight polythene bag and were kept in the refrigerator at –4°C prior to the experiment.

Figure 1: Google map showing the study area (google map, 2015).

Formulation and preparation of experimental diet

The millet chaffs meal were mixed thoroughly with other feedstuffs to produce three isoproteic (CP 3: 40%). The treatment diets at 40% crude protein were prepared as Diet 0, Diet 1and Diet 2. Diet 0 contained only millet chaffs (MC). Diet 1 contained coppens supplements of 50 kg of Millet chaffs and 50kg of coppens and Diet 3 contains only coppens (Table 1). The feed were ground into powder and sieved to suit the fingerlings. It was air-tight packaged in small plastic container, labelled accordingly and kept in the fridge (Sahoo *et al*., 2004). Table 2 shows the proximate analysis of the experimental diets.

Growth Experiment/Trials

Clarias gariepinus fingerlings used for the feeding trials were starved for 72h for acclimatization to experimental diets before starting the feeding trials. The experiments were conducted in tanks with water of about 80%. The fingerlings were randomly distributed into the tanks at 10 fish per tank and fed twice daily at 10% body weight between (7.00 am and 6.00 pm) for 72 days. Each experiment was replicated twice. Weighing of the fishes during the trials was done weekly and the mean weight data were used to assess the growth performance (Castel and Tewis, 1980).

Measurement of weights and lengths

At seven days interval, fingerlings were randomly sampled and weighted in each tank. The total lengths were measured using a meter ruler. Daily food ration requirement was adjusted according to weight. The fingerlings were put on a filter paper and the lengths of the head to the end of the tail were marked on the paper and this was measured with a ruler calibrated to 0.1cm. For weighing, each fingerling was carefully siphoned out from the plastic containers. They were put on a filter paper to absorb much of the water on the body before weighing in aluminum foil whose weight has been determined earlier. The weights were recorded using electronic digital balance model LE180 provided with + 0.0001g accuracy (Davies and Ezenwa, 2010).

Water quality measurement

Water temperature (°C) was measured daily with a mercury in glass thermometer, while pH was monitored weekly using an electric pH meter. Conductivity was

determined using WPACM 35 conductivity.

Growth performance

In the growth performance the following are calculated; Body weight gain, Average daily gain, Specific growth rate and Condition factor.

Body weight gain = W2 – W1

Where:
W2 = Final body weight
W1= Initial body weight
Average daily gain = (W2 – W1) / period in day
Specific growth rate (SGR) = $\frac{\log W_2 - \log W_1}{T_2 - T_1} \times 100 \times 100$
W2 = weight at time T2 (days)
W1 = weight at time T1 (days)

Condition factor (K) = [weight (g) / length3 (cm)] xl00

Survival rate

This was done by counting the number of fish in the tanks forth-nightly.
The numbers of mortality observed were recorded.
Survival Rate (%) = N1 /N0 x 100
Where:
N1 = Total number of fish survival in pond at end of experiments.
N0 = Total number of fish in tank at the beginning of experiments.

Statistical analysis

Data were subjected to analysis of variance (ANOVA), Duncan Multiple Range and descriptive statistics. Data on performance such as body weight changes, specific growth rate, feed conversion ratio and feed intake were subjected to one-way analysis of variance where significant difference occurred, means were separated by Duncan multiple range test. All statistical relationship was analysed using statistical package for social sciences (SPSS) version 20.

RESULTS

No significant differences were observed in the Weight gain, Gain in Length, Specific growth rate and Condition factor of *C. gariepenus* fed the varying diets (P>0.05) (Table 1-3). The highest initial weight was recorded in the 30% millet chaff fed fishes with 6.08g followed by 50% millet chaff fed fishes with 6.06g. The lowest initial weight was recorded in group fed the control diet with 5.91 g.

Table 1: Percentage composition of Millet chaffs based diets fed African catfish (C. *gariepinus*).

Ingredients	100%	50%	30%
Millet chaffs	100	50	0.00
Coppens	0.00	50	100
Total	100	100	100

Table 2. Proximate analysis of experimental diet.

Chemical analysis of diet	Millet chaffs	Coppens
Moisture	10.39	8.10
crude protein	42.0	42.00
crude fiber	0.25	1.90
Ash	8.7	9.50

Source: Davies and Ezenwa, (2010) and Moshood *et al.,* (2014).

Highest final weight was recorded in the 50% millet chaff fed fishes with 22.37 g followed with the group fed with coppen with 21.8 g. In terms of total weight gain, 50% millet chaff fed fishes gave the best growth (16.31 g) followed by control treated group (15.89 g), while 30% millet chaff fed fishes had the lowest weight gain with (4.65 g) (Table 1). In terms of Average Daily Gain, the 50% millet chaff fed fishes still had the highest (2.718 g) followed control treated group (2.65 g).

The highest Specific Growth Rate (3.817) was obtained in *C. gariepinus* fed 50% millet chaff followed by control treated group (3.74). The highest initial standard length was recorded in the control group with 8.42cm followed by the 30% millet chaff fed fishes with 7.98cm. Highest final standard length was recorded in the 50% millet chaff fed fishes with 14.99 cm followed with control group with 12.36cm. In terms of total standard length, the 50% millet chaff fed fishes gave the best growth (9.72 cm) followed by control group (3.94 cm), (Table 1).

30% millet chaff Diet showed lower length, weight, relative growth rate, relative weight gain and specific growth rate. it also indicated insignificant growth and feed utilization while those fed 50% millet and control group had the best values of growth and feed utilization parameters. The both treatments showed a uniform increase in weight within the period of this research. Survival rate of 100% was recorded for 50% millet and control group while 30% millet recorded 80%. The K (condition factor) ranged from 1.924 for 50% millet Diet treated group to 1.08 for control group. The body condition factor (K) was best for fish fed 50% millet Diet treated group followed by that fed 30% millet Diet treated group.

The fish fed 50% millet Diet treated group showed the best growth and food conversion. The replacement of coppens by 30% millet in this diet did not have an outstanding change on the fish. Fifty percent inclusion of millet chaffs in this study seems to be favourable in the

Table 3: The growth ,feed utilization parameters and survival rate of *C. gariepenus* under the different diets.

Parameters	Treatment diets (%)		
	50	30	Control
Initial weight (g)	6.06	6.08	5.91
Final weight (g)	22.37	10.73	21.8
Weight gain (g)	16.31	4.65	15.89
Average Daily Gain (g)	2.718	0.78	2.65
Initial Length (cm)	5.27	7.98	8.42
Final Length (cm)	14.99	9.8	12.36
Gain in Length (cm)	9.72	1.82	3.94
Specific growth rate	3.817	0.99	3.74
Condition factor	1.924	1.17	1.08
Mortality rate (%)	100.00	80.00	100.00

diet of *C. Gariepenus (*Table 3*)*.

Figure 2 shows the scattered graph for 50% millet Diet treated group which showed a highly positively correlated length/weight relationship (r^2 = 0.968). The correlation was significant at 0.05. The equation for the graph was
Y = -0.28 + 1.4X.

Figure 3 showed the scattered graph for 30% millet Diet treated group which showed a highly positively correlated length/weight relationship (r2 = 0.745). The correlation was significant at 0.05. The equation for the graph was
Y = -1.95 + 3.0 X.

Figure 4 shows the scattered graph for control group which showed a highly positively correlated length/weight relationship (r2 = 0.995). The correlation was significant at 0.05. The equation for the graph was
Y = -2.45 + 3.5 X.

DISCUSSION

The results of this work showed that the nutrient content of 30%, 50% millet and the control group were sufficient for the growth and survival of *C. gariepinus*. This experiment yielded quite acceptable growth results for the 50% millet diet and higher specific growth rate when compared to the control diet. The results obtained for this study agreed with the growth improvement reported by Lim *et al .,* (2001), Pie *et al .,* (2004) and it confirms the suitability of the diets since there was no record of adverse effects on the growth and survival rate. The fish on the experimental diets showed satisfactory diet acceptance even at low (30%) inclusion levels.

The present study showed that 50% millet and the control group had better growth performance and feed utilization compared to 30% millet diets. Previous works of Fagbenro *et al.* (2010) showed the need to use plant meal in combined form to produce the cheapest and required nutrient for fish and this formed the basis of this research work. The replacement of coppens by alternate sources of protein has met with varied degree of success, depending on the nature, composition of ingredients, inclusion level and method of processing. This study agrees with the findings of Fagbenro *et al.* (2010) who conducted a study on the nutritional evaluation of sunflower and sesame seed meal in *Clarias gariepinus*: An assessment by growth performance and nutrient utilization This result shows that millet chaffs can be conveniently used in the replacement of coppen as a source of dietary feeds in *C. gariepinus* without experiencing negativity in the growth. In general, the results obtained showed little or no negative effects on growth of the African catfish when coppen was replaced by millet chaffs.

The growth exponent 'b' value for 50% millet chaff (1.4) treatment reported in this study is lower to that reported for *P. pardalis* in Malaysia peninsula (2.53) by (Samat *et al*. 2008) while the 30% millet chaff concentration and the control diet was higher with 3.0 and 3.5 respectively. The difference can be attributed to contrast in weather conditions between Nigeria and Malaysia. The correlation coefficient was all positive with 50% millet chaff concentration and control diets having higher values which indicated that length increased with an increase in weight of the fishes in these treatments. This is in agreement with previous studies on different fish species from various water bodies. The value for 'b' in the 50 and 30% millet chaff concentration is termed allometric as it is less than three while the control group is termed isometric as it was greater than three. However, similar results like that in 50 and 30% millet chaff concentration is the work of Shinkafi and Ipinjolu, (2010) who reported allometric growth pattern for *A. occidentalis* in River Rima, North-western Nigeria. Similar results with the control group in Nigeria is the Isometric growth pattern reported for *C. auratus* (Ikomi and Odum , 1998) and for *C. nigrodigitatus* (Fafioye and Oluajo, 2005). Results of this study have indicated that millet chaff at 30% and 50% inclusion can be tolerated by African catfish fingerlings without adverse effect on the

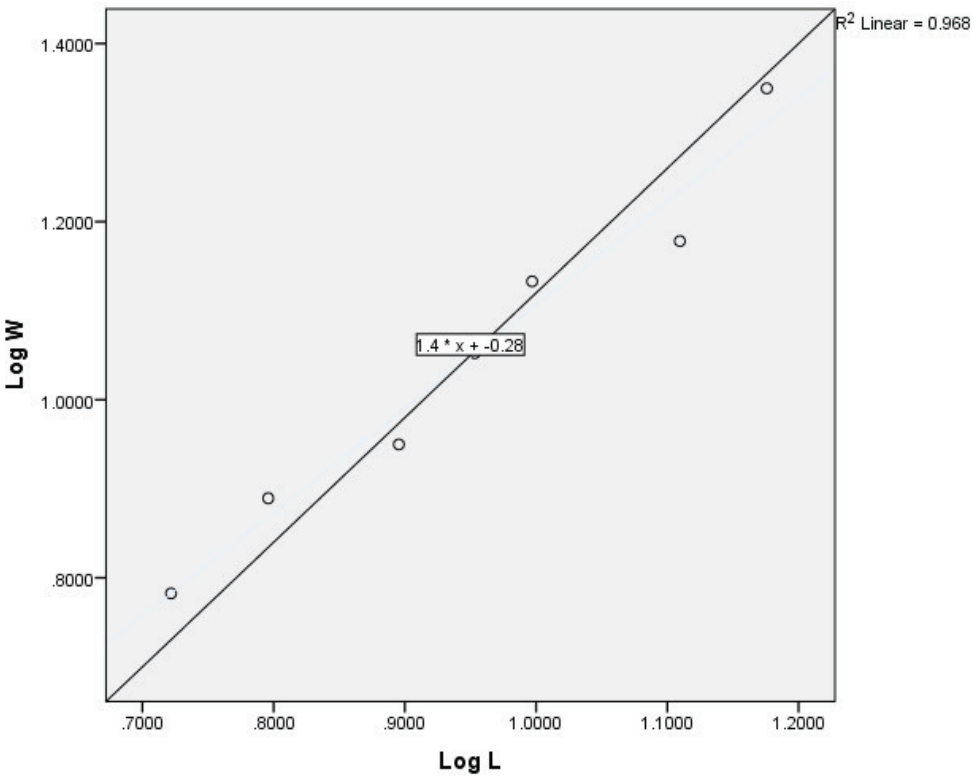

Figure 2. The scattered graph for 50% millet Diet treated group.

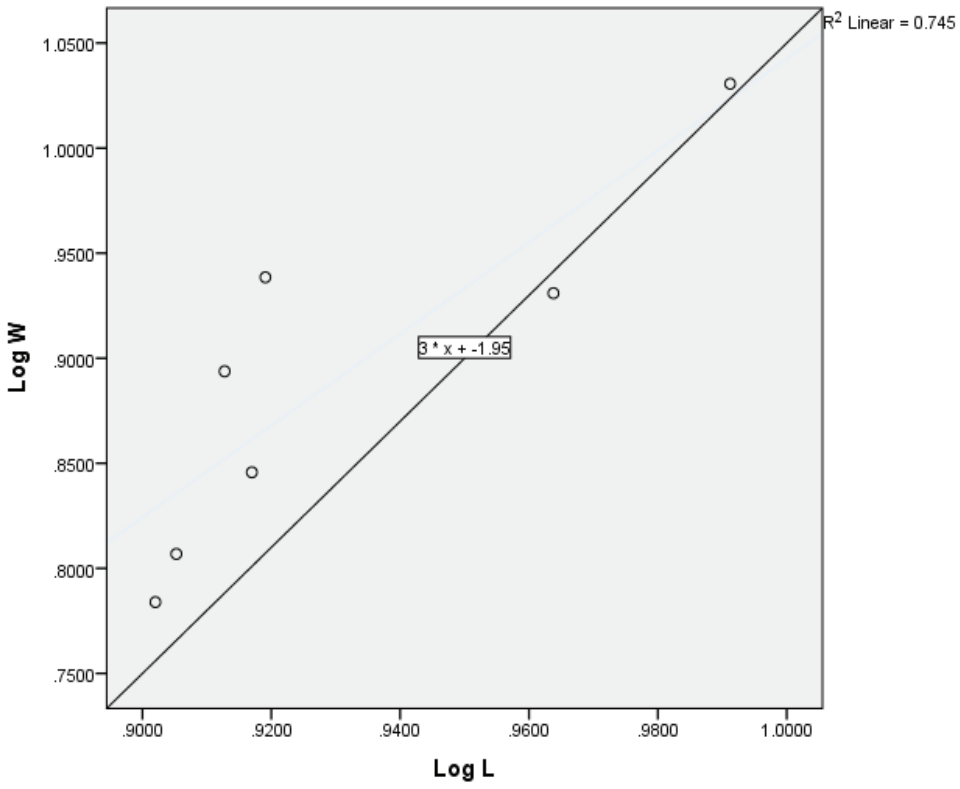

Figure 3. Scattered graph for 30% millet Diet treated group.

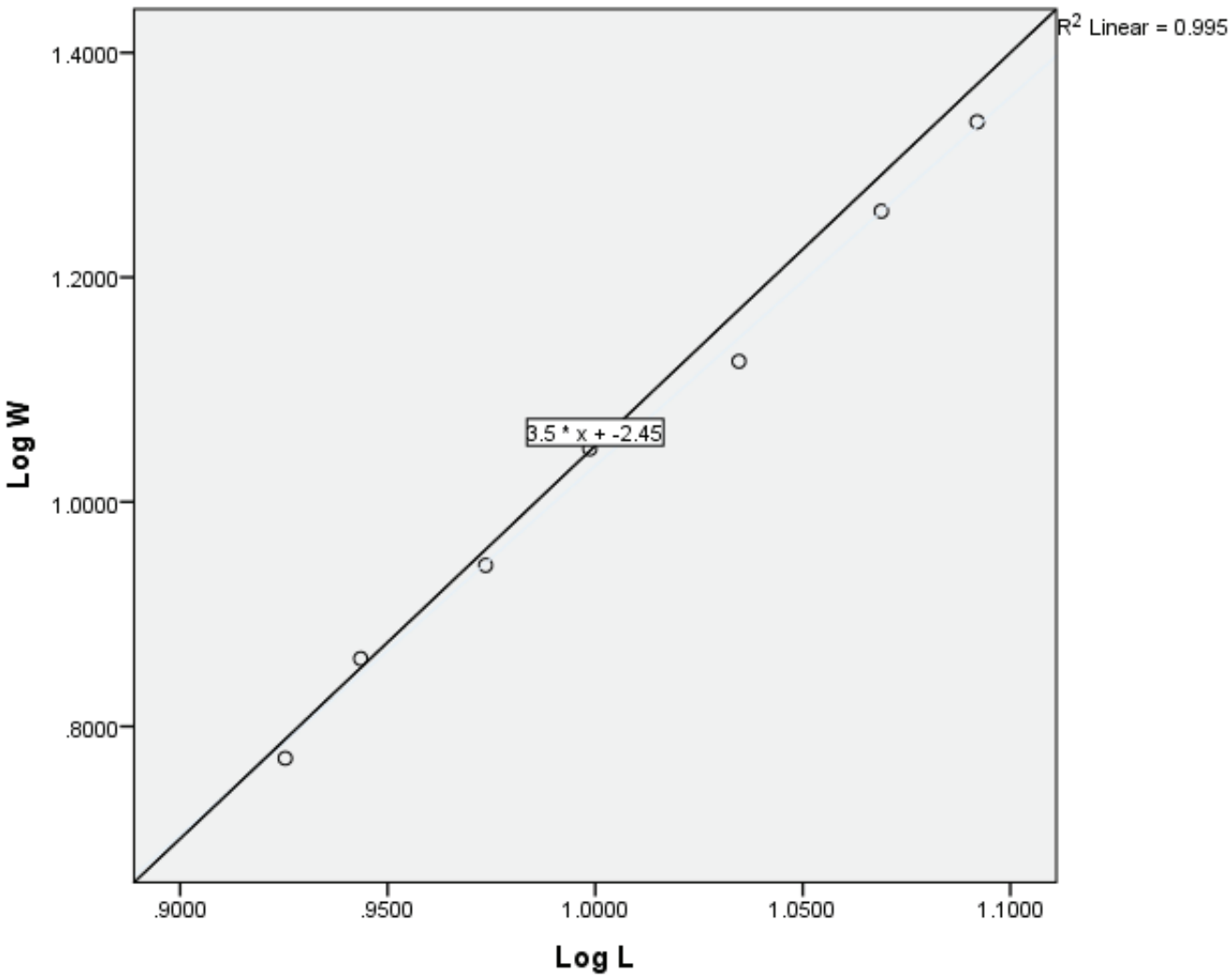

Figure 4..Scattered graph for control group which showed a highly positively correlated length/weight relationship (r^2 = 0.995).

growth and nutrient utilization.

CONCLUSION

Based on the findings of this study, it is inferred that millet chaff meal is rich in nutrient. It can also be inferred that inclusion of millet chaff meal in the diet of fish will improve growth yield of *C. gariepinus*. Though, the millet chaff meal can be included up to 50%, since the fish showed good appetite for all the treatment diets. Growth performance of *C. gariepinus* increases with increase in inclusion level of millet chaff meal in the diet. Inclusion of millet chaff meal in the diet does not have detrimental effect on *C. gariepinus* as revealed by the survival rate. 50% millet chaff meal replacement with coppens meal is optimal for *C. gariepinus* growth performance.

RECOMMENDATIONS

The following recommendations are made based on the result of this study:

50% millet chaff inclusion is safe, affordable, access free and tolerable by *C. Gariepinus.*
Fish farmers can use millet chaff at this concentration to improve quality and quantity in terms of fishes growth and nutrient utilizations.
Further study on other concentration of millet chaff based diets is encourage to enable fish farmers know the best concentration at which this potential feed can be applied.
Public education on the result of the current research is also encouraged to alert the public on the latest on the research to a better feeds to fishes in the country.

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