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Effect of organic and inorganic diet in the growth of *Clarias gariepinus*

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ABSTRACT

Twelve weeks (three months) experiment was conducted in the Department of Biological Science at University of Abuja Main Campus to monitor the study of the effect of organic and inorganic diet on the growth of Clarias gariepinus. It was conducted between October to December, 2012 using circular tanks of diameter 63 cm, radium 3.5 and circumference 198 cm with water retention capacity of 70 litres. 30 fingerlings of Clarias gariepinus of mean weight 0.8 g and mean length 0.59 cm were divided into three tanks A, B, C, with each tank having 10 fish. The fishes in Tank A where fed with organic diet (Coppens) with proximate analysis of 42% crude protein, 13% crude fibre, and 6.79% ash. 50% of organic diet (chicken dropping) in Tank B with a proximate analysis of 12.57% of moisture, 30% of crude protein, 15.10% of fats, 2.35% of crude fire and 5.6% of ash together with a combination of organic and inorganic diet in Tank C (with proximate analysis 4.2% crude protein, 13% of crude fibre and 6.7% of ash) were fed at 4% body weight twice daily.

Key word: *Clarias gariepinus,* Formulated Feed, organic and inorganic diet

INTRODUCTION

Clarias gariepinus also known as the African sharp tooth catfish was introduced to the world in the eary 1980s for aquaculture purpose and is therefore found in countries for outside its natural habitat like Brazil, Vietnam, and Indian. In African, this catfish is second in size only to the vundu of Zambesian water (Rochas, 2008). Clarias species are recognised by their long based dorsal fins, which gives them rather eel-like appearance. These fish have a slender body, a flat bony head, and a broad terminal mouth, and four barbels. They also have a large accessory breathing organs composed of modified gills and arches. Clarias gariepinus is species of great economic importance in both fisheries and fish culture (Teugel et al., 2001). It is one of the sixty species recognised in the genus clarias. Clarias species are fresh water fishes that are commonly found in Nigeria and most Nigeria rely on fish as their main sources of protein (Ayoola, 2010a). Fish do not only provide food for immediate consumption but people rely directly or indirectly on fishing for their economic survival and sources of job (FAO, 1996). The act of fish culture has existed for long and for over two decades, domestic supply of fish has been inadequate, hence animal protein in diet of Nigeria is affected from its normal recommended 40% protein level (Wokoma, 1986). Nigeria aquaculture industries is affected or faced with problem of inadequate supply and prohibitive cost of quality feeds (Fagbearo et al., 2003; Omotoyin et al., 2005) reported increase in the attempt to develop practical diet for farmed fish in Nigeria. However most farmers particularly in the rural area still depend on Agricultural waste including organic diet (chicken dropping) for feeding fish. It was noted that Nigeria produces large quantity of Agricultural and Agro-industrial by-products, which serves as alternative feed sources to conventional feed (Aderemi et al., 2004). Organic diet (chicken dropping) has been considered to have some nutritional values containing about 25.75% crude proteins (Lovell, 1980). It has been noted that the concept of utilizing organic diet is highly desirable since it will not only eliminate the problems of waste disposal, but also provide cheap fish feed cost. Different species of fish have been fed with chicken droppings and other forms of non-protein nitrogen with different result. However organic diet is an unconventional fed that is now widely used in commercial fresh Aquaculture in order to reduce cost (Ayoola, 2010b). However, the health implication of the use of organic diet (chicken dropping) has not been investigated; therefore there is a need to know the merit and demerit effect of the waste on fish.

The feeding of formulated feed to fish has become extravagant for the average Nigeria farmers. This has therefore called for a sustainable Aquaculture feed development. Such package must as of necessity include integrating fish farming with other Agricultural production like livestock. Integration of fish with livestock has been found to make Aquaculture and animal husbandry a sustainable husbandry. Sustainable venture for common man and his family. Such integration involves recycling of livestock waste processing by-product as manure and or indirect food for fish, such as common carp, channel fish, African catfish Clarias gariepinus (Oladosu et al., 1990) and gold fish (Auratus), (Lu and keven, 1975). The gap between the demand and supply of organic fertilizers is increasing day by day due to intensive cropping of high yielding varieties of cereals. Biodegrading livestock waste can be used as manure in pond fertilization. Fish pond is frequently located in a manner that waste from chickens, raised in suspended battery cages drop directly into the pond. For cattle, pigs, sheep or goat, may be more practical to transport the manure from cattle farm to the fish ponds. Nitrogenous waste from these farms efficiently influenced the pond water productivity as its supplies the planktons with essential nutrient needed for multiplication and growth. Planktons are life food organism for fish and fish organism. The waste also serves as direct fed to fish in pond. Livestock manure contains considerable quantities of nutrient for fish production among which is non-digested feed metabolic excretory products and residue resulting from microbial synthesis (Falayi, 1998; Fashakin et al., 2000). This can be utilized to replace reasonable decrease in fish feed production cost. Meyer, (1977) also confirmed that Chinese utilized about 95% of the valuable ingredients in poultry manure and that catfish and tilapia also have enormous potentials for direct manure consumption. Cow dung or big faeces are also eaten by certain fish in raw condition. The application of animals manure either fresh/untreated or after composing it in pit for some time. The application of fresh, untreated animals waste to fish pond is common in Asia and this practice has given high yield but excessive amount can kill fish due to oxygen depletion in the water. Such oxygen depletion could be predicted from biological oxygen demand (BOD) measurement in manure pond. The (BOD) can also be estimated from the percentage dry matter content of manures. Hepher, (1979) reported that manure is applied to pond at daily rate of more than 1.5 mt/ha under Israeli condition. Central Institute of fisheries technology (CIFT, 1972) recommended an estimate of 154 kg weight poultry manure per hectare of fish pond/week. The mechanism of manure fish recycling is as illustrated by (Heut, 1975). The chain or cycle of natural fish production includes the following link: (mineral nutrient, plant production, intermediate animal consumption, and production) leading to final product which is the fish and reduction. The origin of cycle lies in the mineral nutrient of water which comes from soluble substance carried to water by exogenous detritus (animal waste) and also by rainfall. By means of photosynthesis, the green vegetation transforms the inorganic substance into organic matter which forms vegetable tissue (higher and lower plants). Living or dead plants are consumed by numerous small animals organism. These then serves as food for larger water animals' organism. These then serves as food for larger water animals, also certain type of vegetation which are in turn both living and dead, eaten by fish. The last stage is the reduction brought about by bacteria's. Bacteria's by mineralization mechanism permit the return in solution of all dead component of organic matter, vegetable and minerals and their re-integration into the biological cycle. Fish is the final result of the biological complex cycle. The productivity of a fish pond depends on the final analysis, on the production of vegetable which in turn is dependent on the nutrient found in the pond. The vegetable growth of the fish pond can thus be increased by the introduction of animals manure. Experiments conducted in an open pond, the fish having access to the feed pellet (decayed product) gave result such that feed containing as high as 30% manure produced fish growth equal to the growth obtained with conventional fish feed pellets. Nitrogenous manure input in pond clearly influenced the pond water productivity as its supply the plankton with essential nutrient needed for multiplication and growth of food organism which are natural food for newly hatched baby fish (Ovie, 1996). In the United States (Collins and Smitterman, 1978) reported that the growth of Tilapia culture in manure pond compared favourable with the one fed with commercial pellet. Although the yields from manure pond are significant lower than pellet fed pond, the profitability of the farmer was higher since manure is available at a nominal cost. In all cases, the use of such organic waste resulted in large increase in the yield of fish per unit area of the pond and sharp decrease in the use of supplementary feeds, an indication that achieves reasonable growth under fish cum pig integration without addition of supplementary feeds. Research has shown that fish cultured under integrated chicken fish farming system are fit for human consumption according to (Pudadera et al., 1986) pathological examination of such fish prior to harvest showed that they are not infected by any micro-organism that render them unfit for human consumption. Also Yingxae et al. (1986) observed that the nutrients of the fish fed on pelleted fish diet is not better than the fish fed on chicken manure, grains and on fish meals enriched pellets showed that concentration of 6, 20, and 15% respectively (Kausar, 2009). There is no significant difference in the taste and texture of flesh of fish grown in manure pond and those fed on commercial diet. Hepher, (1979) reported that fish from pond receiving well-treated domestic wastes taste as good, as or even better than fish grown in waste free ponds.

Similarly, Meyer, (1977) reported good flesh colour and intramuscular fat level for fish grown in intensive manure pond. Chicken, pigs, and cattle manure are substrates for production of housefly (Musca domestica) maggot which are in turn used as fish feed, or as supplement to fish meal in fish feed formulation. Maggots are readily available and are accredited for its high nutrients value with an amino acid profile with biological value exceeding that of soybeans and groundnut. This organism can be harvested, processed into meal that can be used to substitutes or replace fish meal like some other non conventional feedstuff such as periwinkle; frog etc.

Sogbesan et al. (2006) reported that 25% replacement of fish meal in feed of hybrid catfish, cultured with maggot gave comparative growth and profitability to that of fish meal base diet.

The aim of this work is to investigate the growth rate of Clarias gariepinus fingerling fed with inorganic feeds (coppens) and organic (chicken dropping).

The culture system

Because of the cannibalistic nature of Clarias gariepinus, multiple sorting is essential. For outdoor fry/ fingerlings rearing, screening of tanks with mosquito nets is recommended to prevent dragon fly and other predatory insect from breeding in the pond. Poly-cultured of Clarias gariepinus integrated with poultry with some supplementary feeding had been shown to be viable.

Culture system modification

In the view of (Oresegun et al. 2007), it was stated that early fish farmers in Nigeria raised their fish in burrow pit, abandoned minefield, and in earthen ponds on extensive production system. The introduction of concrete tanks allows through system and supplement feeding thus allowing for high fish yield. The advent of indoor water recirculatory system (WRS) has ushered in a new prospect for Aquaculture. The introduction of (WRS) has created a point in the production of catfish in Nigeria.

Fish fed development

Fish is one of the inputs in Aquaculture production. It is one of the fundamental challenges facing the development and growth of aquaculture. According to Hetch, (2000), it is that the research on the inexpensive feed ingredients has not contributed greatly to Aquaculture development and suggested that more research on how best plant protein can be used as fish feed is required. Development and management of fish feed play very vital role in Aquaculture growth and expansion, it is a major factor that determines the profitability of Aquaculture venture. Ayinla and Jamu, (2003) reported that feed account for at least 60% of total cost of fish production which at a large extent determines the viability and profitability of fish farming enterprise. Fish production involves both the intensive and semi-intensive system of production for any Aquaculture venture to be viable and profitable; it must have a regular and adequate supply of balanced artificial diet for the cultured fishes. This is so because the dissolved nutrient that promote primary and secondary production in the natural environment are seasonal and might be sufficient or may not occur in required proportion to meet the nutritional demand of cultured fishes. There is therefore the need to develop and encourage fish farmers to make use of ideal pond fertilizers; non\convention feed resources, processing, refinement, and formulation that take cognizance of the requirement of the various species and their stages (Ibiyo and Oluwasegun, 2004). Fish feed is very important in the efficiency and overall performance of fish. This is why any attention towards the production of effective and cheap feed will benefit farmers.

Conventional feed source

Many of these are cheap and readily available in very large quantity. Example include wheat barn, groundnut cake and rice bran. Some are animal based (for example, fish meal, blood meal, shrimp meal) whereas others are plant based (for example, maize, soybean meal, cotton seed meal). Generally these materials are relatively cheap and available throughout the year. However, Falaye, (1992) pointed that the effectiveness of a feed preferred is a determinant rather the cheapness. Hence balance is needed for Agriculture to be profitable. Fish also contain amino acid needed that are not found in plant protein relative to that provided by livestock and also provide carbohydrate, lipid, and vitamins required for normal body functioning. The feed ingredient that are rarely available for human consumption are also being competed for by livestock and fisheries (Falaye, 2007) has confirmed that for intensive Aquaculture feed represent 40%-60% of the operation cost and about 60-80% of management in Aquaculture.

Protein requirement

Protein requirement of fishes has been shown to vary on within species of fish but also with life stages (Faturoti and Akinbote, 1986) reported that 40% crude proteins level was optimum for growth and food utilization in fingerlings Micheal and Henken, (1986) When working with purified feed ingredient concluded that Clarias gariepinus required dietary protein content in excess 40% for maximum growth irrespective of dietary energy level while Dangani et al. (1989) reported that 40% crude protein was best for growth performance and protein efficiency ration for Clarias fingerlings when fed with different level of protein. Madu and Tsumba, (1988) found the best growth performance and food utilization parameters for mud fish (Clarias Agularis), were fishes fed with different level protein diets.

Water quality parameters

The important of these environmental factors affecting growth and survival of fish include the availability of nutrients or food organism, the amount of dissolved oxygen present , the roles of pH, Temperature, nature of bottom soil, and also the low or zero level of toxic compound such as Ammonia, Nitrates, and oil, grease (Conuaha, 1991). Andrew, (1973) reported that in the absence of deliberate poisoning; dissolved oxygen is the single most important and critical water quality parameters for fish in pond culture system. The sensitivity of fish to low oxygen concentration differ between species, the various life stages (eggs, larvae, and adult) and the different life style processes such as feeding, growth, and reproduction in general, however a minimum constant value of 5 mg/l were undesirable in fish pond. Temperature has a considerable influenced of the principle and vital activities of the fish such as their breathing, growth, and reproduction. This is because the body temperature of the fish varies with and is almost the same as that of the environment. Ohuaha and Nwadukwe, (1987) stated that the temperature range of 20%-30% is adequate for fresh water fish culture. Charkroffi, (1979) defined pH as the measure of hydrogen ion in water and is measured on a scale of 0-14. If the pH is between 0 and 7, the water is said to be acidic but if it pH is at 7 the water is said to be neutral. pH of 7-14 means the water is basic. Ovie, (1996) states that to maintain a good fish population in water it is necessary to keep the pH between 6.7-8.6. Charkroffi, (1979) also state that fish are very sensitive to low pH or in other words to water which is acidic. Most pond fish will die if the pH falls below 4 for a very long period of time. Ohuaha and Nwadukwe, (1987) states that hardness is the measure of total soluble salt that are dissolved in water. This salt usually calcium (Ca^+) help the fish grow healthy bones and teeth. Water that contains little salt is called "Soft" water hardness and is related to the pH of water but unlike the pH, hardness stays constant throughout the day. According to Charkroffi, (1979) hardness should be between 50 and 300 ppm in the pond for best fish growth. Alkalinity is the measure of carbonate and bi-carbonate in water. Conductivity referred to the total concentration of all dissolved ions in the natural water which is expressed in micro ohms per centimeter. Fishes are very sensitive to sudden changes in conductivity. Fishes living in water at one concentration of conductivity should not be suddenly placed in water with a much higher or lower conductivity. Turbidity is the terms referred to as the decrease in particulate matter ranging in size from colloidal to coarse dispensation in ponds, turbidity and colour may result from colloidal clay particles entering with runoff. Colloidal organic matter originating from decay of vegetation or from abundance of plankton. Turbidity restricts light penetration and limit photosynthesis.

MATERIALS AND METHODS

30 fingerlings of Clarias gariepienus were purchased from Ajima fish farm in kuje area council of Abuja. They were transported to the department of Biological Science University of Abuja, Nigeria in plastic containers covered with mosquito netting.

Experimental design

This consists of three treatments. Treatment A fed with artificial diet (coppen) treatment B fed with organic diet (Chicken droppings) while treatment C (fed with both organic diet). The chicken manure used was obtained from Ajima farm in kuje.

Fish maintenance

Thirty fingerlings of Clarias gariepinus were produced from Ajima farm in kuje area council. These fingerling were collected in an opened plastic rubber with oxygenated water and were transported to the study location by car. After seven days of acclimatization, a group of 10 fishes were stocked in three treatments for each dietary treatment following a complete randomized design (CDR). All groups of fishes were fed to a level close to apparent satiation. The experiment ran for a period of 90 days. Fish were fed 6 days per week (twice daily at 8.00 am and 6 pm) by hand casting. Treatment A (with coppen)Ttreatment B (chicken dropping) while Treatment C (with both coppens and chicken droppings) at the rate of 4% body.

Data collection for basal diet formulation

Nutrient composition of feed ingredient was obtained from proximate ingredient as shown in (Table 1). The organic fertilizer was analysed. Nutrient analysed include: moisture (MO) crude protein (CP), crude fibre (CF), calcium (Ca), phosphorus (P), lysin (LS) and metionine + cysteine (MT). This was done according to the method of (AOAC, 1999). Estimation of Metabolizable energy (ME) of ingredient for the feed was calculated by converting

Table 1. Proximate composition Analysis of Feed Ingredient.

Ingredient	MO	CP	CF	CA	P	LS	MT	ME (Kcalg-1
Fish meal	12.57	66.23	1.08	5.14	2.89	4.85	2.62	2861
Groundnut meal	19.10	41.40	7.74	0.19	0.63	1.59	0.57	2892
Blood meal	15.12	76.20	1.46	0.29	0.09	6.90	1.00	3080
Dried brewers grain	12.89	18.60	20.00	0.20	0.16	0.81	0.98	1980
White maize meal	13.09	9.38	2.31	0.032	0.12	0.07	0.24	3434

(MO) Moisture, (CP) crude protein, (CF) crude fibre, (P) phosphorus, (LS) lysine, (MT) methionine + cysteine, (ME) metabolizable energy.

Table 2. Composition of organic fertilizer and formulated feed used in 90 in Tank A, B and C.

Ingredient	Tank A	Tank B	Tank C
Organic fertilizer	-	50.00	50
Coppens	50.00	-	50
Salt	0.25	0.25	0.25
Fish meal	4.00	4.00	4.00
Groundnut cake	12.90	12.90	12.90
Blood meal	6.00	6.00	6.00
Dried brewers grain	12.95	12.95	12.95
White maize meal	14.90	14.90	14.90

the gross energy using the following equation as described by Miller and Payine, (1959).

Evaluation of fish performance

Fish in each experimental tank were weighed every week to know the growth and health status of the fish and adjust the feeding rate. Data obtained were used for estimation of average weight gained, (final weight - initial weight), mean length increment (final length - initial length), specific growth rate (100XLn final average weight - Ln initial average weight/days), length - weight relationship was calculated using the convectional formulae for calculating the length - weight relationship.

$$W=aL^B \quad (1)$$

The above equation (1) and data were transformed into logarithm before the calculation was made. Therefore, equation (1) becomes:

$$\text{Log } W=\text{Log } a+b \text{ Log } L \quad (2)$$

Where:
W = weigth of the fish (g)
L = standard length of the fish (cm)
a = constant
b = an exponent.

Condition factor

The condition factors "K" were also calculated for individual fish for each month using the convectional formulae by Worthing and Richard (1930).

$$K=WX100/L^3 \quad (3)$$

Where:
K = condition factors
W = Weight (g)
L = standard length (cm).

Water analysis

Water quality parameters of the experimental tank was analysed at every 7 days and recorded for the following minimum and maximum temperature, dissolved oxygen, total alkalinity, pH, and total ammonia nitrogen parameter measured were found to be within acceptable limit for fish growth and health (Boyd, 1990).

RESULTS

Biochemical composition of feed ingredient used in basal diet formation

Ingredient used in the formation of diet (B) include: Fishmeal, Groundnut cake, Blood meal, Dried brewers grains and white maize meal (Table 1) the result of the analysis shows that groundnut cake had the highest (19.10%) moisture content, while fish meal, had the lowest (12.57). In terms of crude protein, blood meal had the highest (76.20%) value while maize meal is recorded the lowest (9.38%). The least of crude fibre is dried brewers grain with the value of (20.00%) while the lowest (1.08%) calcium contents while maize meal had the lowest (0.03%).The composition of organic fertilizer and formulated feed is shown in (Table 2). Phosphorus was very high (2.89%) and very low (0.09%) in blood meal. The highest (4.85 and 2.62%) lysine and methionine

Table 3. Nutrient composition, organic fertilizers, formulated feeds, and coppens used in the culture of Clarias gariepinus for 90 days

Nutrients	Organic fertilizer	Basal diet	Coppens
Dry matter	92.30	90.88	90.092
ME	3126.00	3102.16	3045.30
Methionine	1.66	0.70	0.893
Lysine	2.83	1.93	1.866
Phosphorus	0.80	0.47	0.827
Calcium	0.74	0.52	1.110
Lipids	15.10	7.01	12.50
Crude fibre	2.35	6.30	2.18
Crude protein	30.00	35.00	44.00

Table 4. Physiochemical parameter measurement (Tank A inorganic diet [coppens])

Weeks	°C	Dissolved Oxygen	pH	Conductivity	Ammonia
0	26	6.5	8.1	29.6	0.01
1	26	6.1	7.7	30.6	0.43
2	27	5.5	8.1	31.3	0.55
3	26	5.4	7.9	29.7	0.68
4	27	6.1	7.8	29.4	1.03
5	27	6.2	8.2	30.5	1.42
6	27	6.0	8.0	31.4	1.83
7	26	6.4	8.1	32.5	2.11
8	27	6.5	8.2	30.4	2.15
9	26	6.0	7.8	30.5	1.45
10	27	6.2	8.2	31.4	1.82
11	26	6.4	3.1	32.5	2.11
12	27	6.5	8.2	30.4	2.15

values were observed in fish meal while lowest (0.27 and 0.24%) were seen in white maize need respectively. Metabolizable energy was very high (3434 Kcal kg^{-1}) in white maize meal and lowest (1980 kg^{-1}) value recorded in dried brewer's grains (Table 3).

Tables 4-9 and Figures 1-3 also show the Physiochemical parameter of the tanks.

Statistical analysis for the production parameters data on the tables 1, 2, and 3

Hypothesis:
H_O = There is mean relationship
H_w = There is no mean relationship
The f-table value at 5% level of significant is 1.94

The above statistical analysis shows the results of mean comparison production parameters of the (Tables 1, 2, and 3). At 5% level of significance. Since all the result is not at least equal $F_{0.05,\ 8,\ 81}$ = 1.94 at 0.05 level of significance. H_0 is not rejected; hence we accept H_0 and assert there are mean relationship among observed parameters at 5% level of significance (Tables 10-12).

Physiological parameters

There were also little changes in the pH value recorded it was approximate 7.7. Similarly, the temperature values recorded shows no great variation ranging between 26-27°C. The dissolved oxygen contents of water show very little variation throughout the experiment. It was approximate 6.6 (Tables 13-15 and Figures 4-6).From the analysis, it shows that there are strong relationships between weight and length from the three tables under study. The result shows that there are about 90%, 67%, and 99% relationships between weight and length (Tables 16-18) respectively.

DISCUSSION

The ingredients used in the formulation of the basal diets which was used to fortify each dietary treatment were well utilised by catfishes since they are omnivores (Udo and Umoren, 2011; Udo et al., 2011). According to Bhattacharya and Taylor (1975), has an excreta contain 10-35 crude protein, 14-24% crude fibre, and about 21,000 cal kg^{iw} Metabolizable energy on a dry matter basis. The finding agree with the present study in terms of digestive tract of the poultry, 80% of chicken manure represent undigested feedstuff with as much as 20- 30% of total protein (Chen, 1981) therefore apart from their use as fertilizers, chicken are also valuable as feed and feedstuff (Nash and Brown, 1980). The value of growth performance in treatment B where only organic fertilizers

Table 5. Physiochemical parameters measurement Tank B (Organic diet [chicken dropping]).

Weeks	°C	Dissolved oxygen (mg/l)	pH	Conductivity	Ammonia
0	26	6.5	8.1	29.6	0.01
1	27	6.1	7.5	30.6	0.21
2	27	5.4	7.7	31.2	0.25
3	26	5.5	7.2	29.8	0.31
4	26	6.0	7.9	29.5	0.36
5	26	6.2	8.2	30.4	0.40
6	26	6.1	8.0	31.1	0.49
7	27	6.4	8.1	32.0	0.55
8	27	6.6	8.3	30.7	1.58
9	26	6.0	8.2	30.4	0.36
10	26	6.1	8.0	31.1	0.40
11	27	6.4	8.1	32.0	0.55
12	27	6.6	8.3	30.7	1.58

Table 6. Physiochemical parameters in Treatment C (Organic and inorganic diets)

Weeks	°C	Dissolved oxygen (mg/l)	pH	Conductivity	Ammonia
0	26	6.5	8.1	29.6	0.01
1	26	6.2	7.6	30.6	0.43
2	27	5.3	7.5	31.3	0.55
3	27	5.5	7.7	29.7	0.68
4	27	6.1	8.3	29.4	1.03
5	27	6.2	8.1	30.5	1.42
6	26	5.9	8.0	31.4	1.83
7	27	6.4	8.2	32.5	2.11
8	27	6.5	8.1	30.4	2.15
9	26	6.2	8.0	30.5	1.03
10	27	5.9	8.1	31.4	1.42
11	27	5.5	8.1	32.5	1.82
12	27	6.4	8.2	30.4	2.15

Table 7. Production parameters for tank A

Parameters	Wk 0	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10	Wk 11	Wk 12	Total	Mean
Total Weight (g)	13.1	24.3	29.5	35.7	40.2	44.3	49.5	54.7	59.6	64.3	68.9	74.8	80.1	645.00	49.62
Mean Weight (g)	1.91	2.43	2.95	3.57	4.02	4.43	4.95	5.47	5.98	6.43	6.89	7.48	8.01	64.52	4.96
Weight (g)	0	5.2	5.2	6.2	4.5	4.1	5.2	-5.1	4.9	4.7	4.6	5.9	5.3	50.70	3.90
Total length (cm)	10	10.6	10.9	11.4	11.7	12.1	12.13	13.5	13.9	14.8	14.12	15.16	20.19	170.50	13.12
Mean length (cm)	1	1.06	1.09	1.14	1.17	1.21	1.123	1.35	1.39	1.48	1.412	1.516	1.159	16.55	1.27
Length gain (cm)	0	0.6	0.3	0.5	0.3	0.4	0.03	1.37	0.4	0.9	-0.68	1.04	5.03	10.19	0.78
Food conv. Efficiency (%)	0	130	130	155	112.5	102.5	130	-177.5	125.5	117.5	115	147.5	135.5	1223.50	94.12
Specific Growth Rate (cm)	0	1.49	6.41	3.95	1.84	1.21	1.14	-1.62	2.09	5.23	4.28	4.63	1.22	31.87	2.45
Mean growth Rate (cm)	0	3.12	9.64	17.84	44.64	76.02	88.56	127.5	186.2	256.8	337.1	336.3	474.7	1958.40	150.65
Survival rate (%)	100	100	100	100	100	100	100	100	100	100	90	80	80	1250.00	96.16
Total														5421.30	417.02

was applied to attest to this in the study. According to Sogbesan, (1998) fingerlings are always able to convert the protein component in natural meal more efficiently than those found in artificial feed. This observation agrees with that of the present study where organic which enhanced the growth of zooplankton provided adequate protein, lipids, fatty acid, mineral and enzymes for the fingerings. Fasaki et al. (2003) and Ajani et al. (2004) found that fishes reared on qualitative natural meals as that of diets treatment B archive adequate growth. This was because they utilize the nutrient from such feed better and faster than those from artificial feed. This finding claims that fishes fed on artificial diet (coppens) performed better than those that fed on natural feed only. The values of condition factor (K) were also used to compare the condition of fatness of fish based on the hypothesis that the heavier fish of a particular length are in better condition. A comparison of K shows that fishes in treatment B were in worst condition. The high values of condition factors may be due to the richness in oxygen

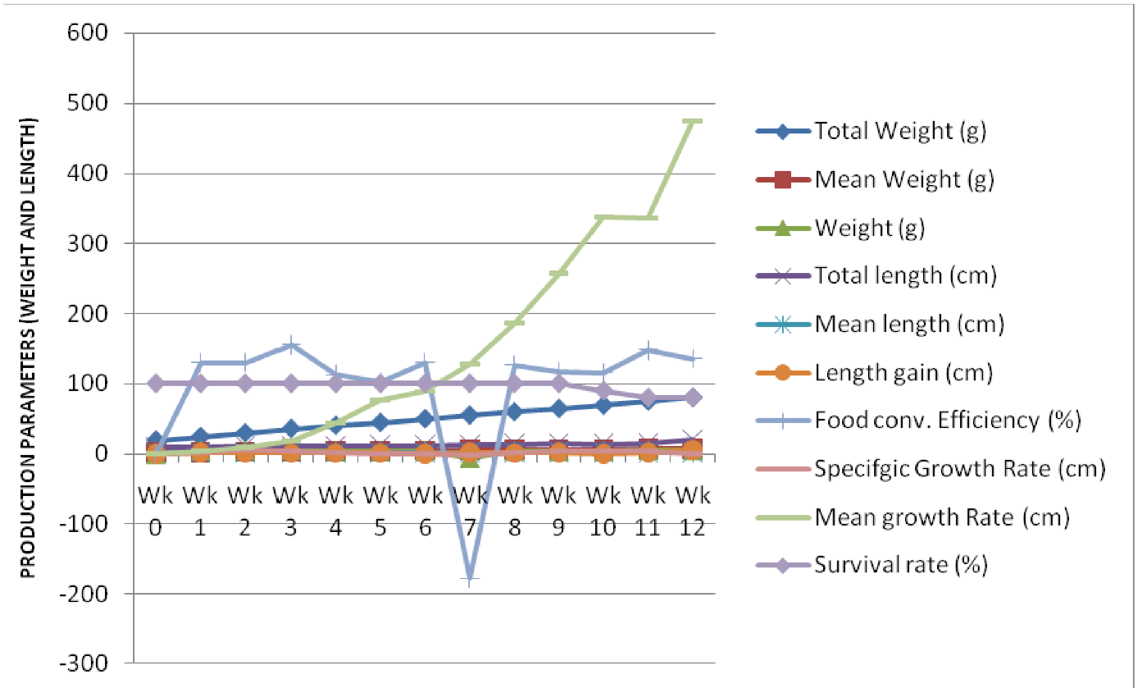

Figure 1. Chart for production parameters for Tank A.

Table 8. Production parameters for tank B.

Parameters	Wk 0	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10	Wk 11	Wk 12	Total	Mean
Total Weight (g)	18.2	20.5	19.2	18.5	20.6	25.4	21.3	17.14	19.1	22.34	26.1	24.2	19.4	271.98	20.92
Mean Weight (g)	1.82	2.05	1.92	1.85	2.06	2.54	2.13	1.714	1.91	2.234	2.61	2.42	1.94	27.20	2.09
Weight (g)	0	2.3	-1.3	-0.7	2.1	4.8	-4.1	-4.16	1.96	3.24	3.74	1.9	4.8	14.58	1.12
Total length (cm)	8	10.2	7.4	9.8	10.15	11.4	10.7	11.1	12.6	14.5	16.9	13.8	12.1	148.65	11.43
Mean length (cm)	0.8	1.02	0.74	0.94	1.15	1.14	1.07	1.11	1.26	1.45	1.69	1.38	1.21	14.96	1.15
Length gain (cm)	0	2.2	-2.8	2.4	0.35	1.25	0.7	0.4	1.5	1.9	2.4	-3.1	1.7	8.90	0.68
Food conv. Efficiency (%)	0	57.6	-32.5	-17.5	52.5	120	-102.5	-104	49	81	93.5	47.5	120	364.60	28.05
Specific Growth Rate (cm)	0	7.38	-1.37	-7.68	1.67	2.59	1.82	-1.69	7.46	1.08	9.65	-4.26	1.14	17.79	1.37
Mean growth Rate (cm)	0	5.677	21.199	53.28	25.4	19.07	27.71	21.5	46.76	48.84	54.75	127.9	41.07	493.16	37.94
Survival rate (%)	100	100	100	100	100	100	100	100	100	90	90	80	80	1240.00	95.38
Total														2600.66	200.14

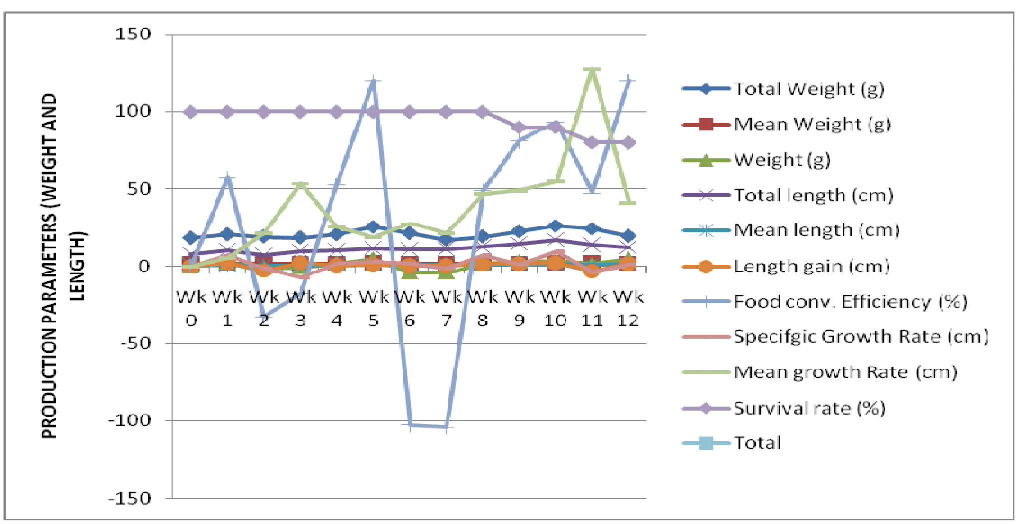

Figure 2: Chart for production parameters for Tank B.

Table 9. Production parameters for Tank C

Parameters	Wk 0	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10	Wk 11	Wk 12	Total	Mean
Total Weight (g)	20	27.5	36.4	41.6	49.8	55.1	60.12	66.15	72.17	86.19	92.8	99.1	105.5	812.43	62.49
Mean Weight (g)	2	2.75	3.64	4.16	4.98	5.51	6.012	6.615	7.217	8.619	9.28	9.91	10.55	81.24	6.25
Weight (g)	0	7.5	8.9	5.2	8.2	5.3	5.02	6.03	6.02	14.02	6.61	6.3	6.4	85.50	6.58
Total length (cm)	9.5	13.6	16.3	19.2	25.6	30.4	36.8	40.1	46.9	51.8	57.7	61.3	67.2	476.40	36.65
Mean length (cm)	0.95	1.36	1.63	1.92	2.56	3.04	3.68	4.01	4.69	5.18	5.72	6.13	6.72	47.59	3.66
Length gain (cm)	0	4.1	2.7	2.9	6.4	4.8	6.4	3.3	6.8	4.9	5.9	3.6	5.9	57.70	4.44
Food conv. Efficiency (%)	0	181.5	222.5	130	205	132.5	125.5	150.5	150.5	350.5	165.3	157.5	160	2131.30	163.95
Specific Growth Rate (cm)	0	1.97	8.69	5.03	2.79	1.25	9.01	-1.11	-1.14	1.22	-2.12	3.7	3.24	32.53	2.50
Mean growth Rate (cm)	0	2.56	7.87	30.57	35.37	108.7	161.6	222	137.8	423.5	562.1	744.3	6.32	2442.69	187.90
Survival rate (%)	100	100	100	100	100	100	100	100	100	100	100	100	100	1300.00	100.00
Total														7467.38	574.41

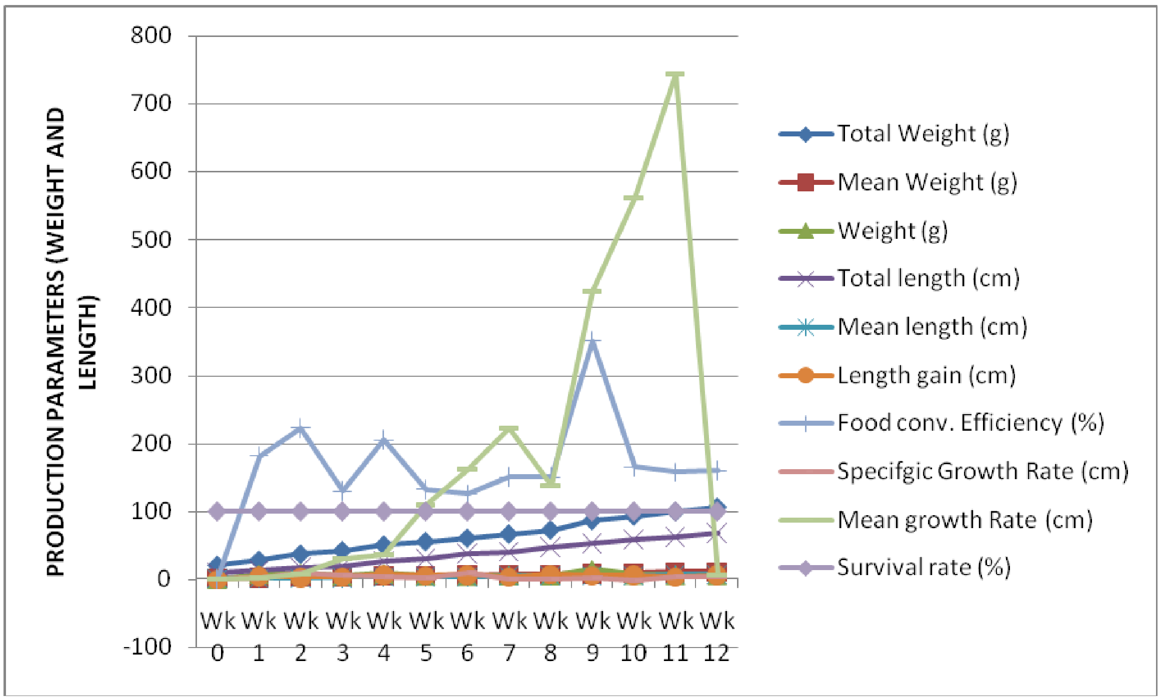

Figure 3. Chart for production parameter for Tank C.

Table 10. Analysis for production parameters A
ANOVA

	Sum of Square	Df	Mean Square	F	sig
Between Groups	5281.225	12	4401.519	0.758	0.692
Within Groups	679039.830	117	5803.759		
Total	731858.055	129			

Table 11. Analysis for production parameters B
ANOVA

	Sum of Square	Df	Mean Square	F	Sig
Between Groups	9870.041	12	822.503	0.553	0.875
Within Groups	173868.790	117	1486.058		
Total	183738.831	129			

Table 12. Analysis for production parameters C
ANOVA

	Sum of Square	Df	Mean Square	F	Sig
Between Groups	116940.916	12	9745.076	.915	.535
Within Groups	1246406.132	117	10653.044		
Total	1363347.048	129			

Table13. Physiochemical parameter measurement (Tank A inorganic diet (coppens).

Weeks	°C	Dissolved oxygen (mg/ml)	pH	Conductivity	Ammonia
0	26	6.5	8.1	29.6	0.01
1	26	6.1	7.7	30.6	0.43
2	27	5.5	8.1	31.3	0.55
3	26	5.4	7.9	29.7	0.68
4	27	6.1	7.8	29.4	1.03
5	27	6.2	8.2	30.5	1.42
6	27	6	8	31.4	1.83
7	26	6.4	8.1	32.5	2.11
8	27	6.5	8.2	30.4	2.15
9	26	6	7.8	30.5	1.42
10	27	6.2	8.2	31.4	1.82
11	26	6.4	8.1	32.5	2.11
12	27	6.5	8.2	30.4	2.12

Table 14. Physiochemical parameters measurement Tank B (Organic diet (chicken dropping).

Weeks	°C	Dissolved oxygen (mg/ml)	pH	Conductivity	Ammonia
0	26	6.5	8.1	29.6	0.01
1	27	6.1	7.5	30.6	0.21
2	27	5.4	7.7	31.2	0.25
3	26	5.5	7.2	29.8	0.31
4	26	6	7.9	29.5	0.36
5	26	6.2	8.2	30.4	0.4
6	26	6.1	8	31.1	0.49
7	27	6.4	8.1	32	0.55
8	27	6.6	8.3	30.7	1.58
9	26	6	8.2	30.4	0.36
10	26	6.1	8	31.1	0.4
11	27	6.4	8.1	32	0.55
12	27	6.6	8.3	30.7	1.58

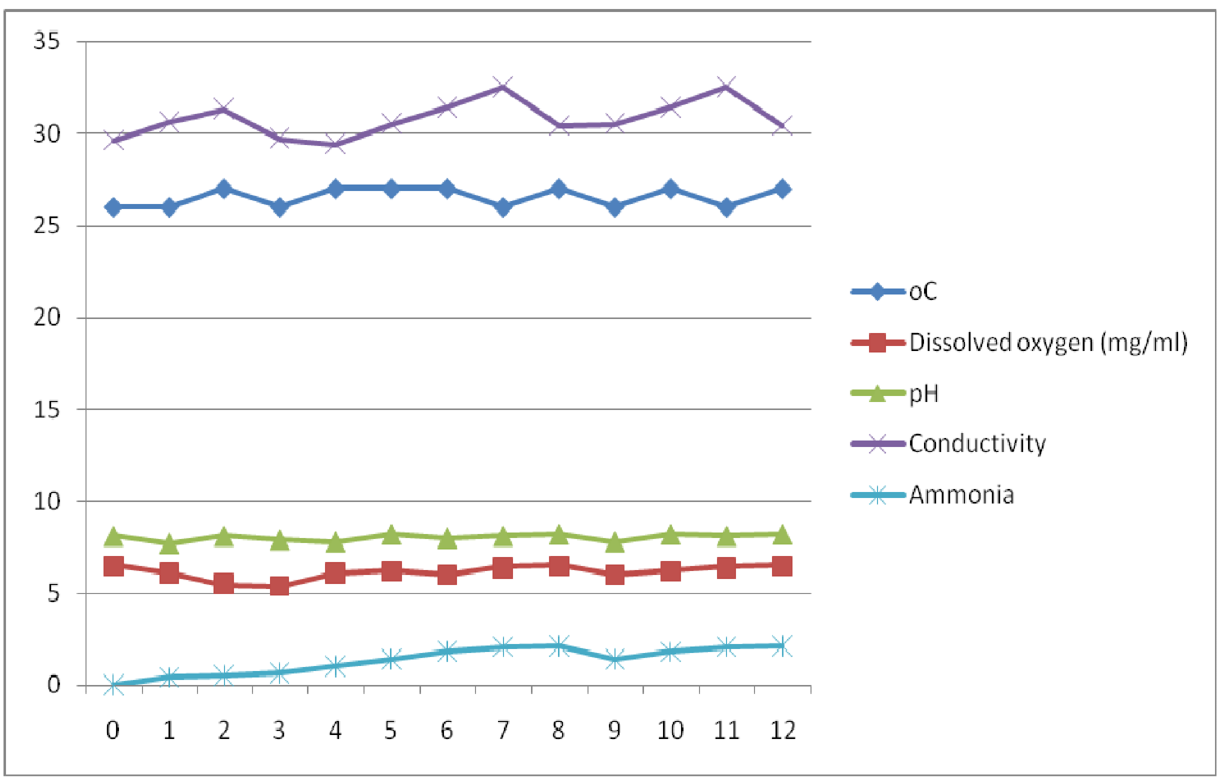

Figure 4. Physiochemical parameter chart 1

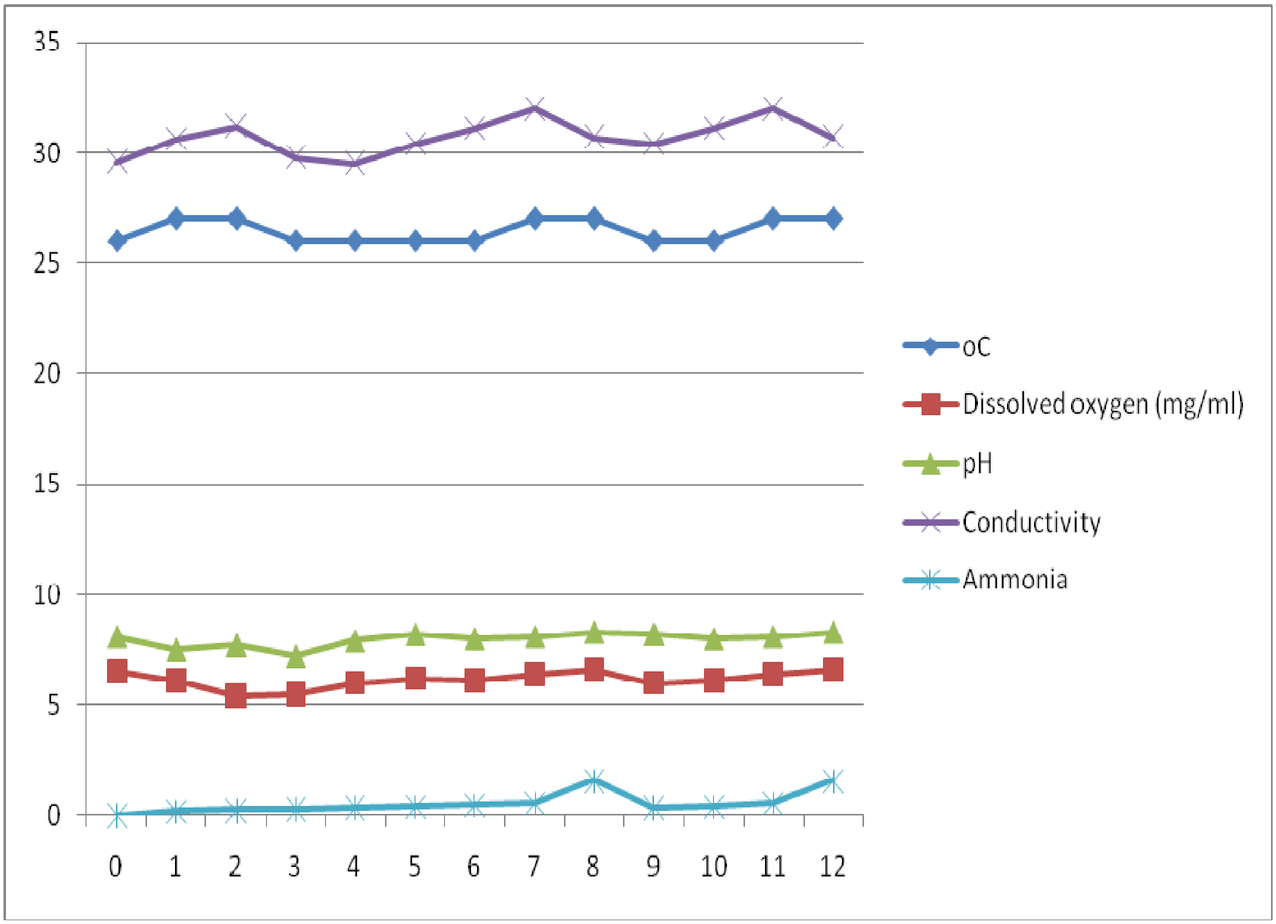

Figure 5. Physiochemical parameter chart 2

Table 15. Physiochemical parameters in Tank C (organic and inorganic diets)

Weeks	°C	Dissolved oxygen (mg/ml)	pH	Conductivity	Ammonia
0	26	6.5	8.1	29.6	0.01
1	26	6.2	7.6	30.6	0.43
2	27	5.3	7.5	31.3	0.55
3	27	5.5	7.7	29.7	0.68
4	26	6.1	8.3	29.4	1.03
5	27	6.2	8.1	30.5	1.42
6	26	5.9	8	31.4	1.83
7	27	6.4	8.2	32.5	2.11
8	27	6.5	8.1	30.4	2.15
9	26	6.2	8	31.5	1.03
10	27	5.9	8.1	31.4	1.42
11	27	5.5	8.1	32.5	1.83
12	27	6.4	8.2	30.4	2.15

Table 16. Statistical analysis A correlation

	GTW	GTL
GTW Pearson correlation Sig. (2-tailed) N	1 13	0.901** 0.000 13
GTL Pearson Correlation Sig. (2-tailed) N	0.901** 0.000 13	1 13

**Correlation is significant at the 0.01 level (2-tailed).

Table 17. Statistical analysis B correlations

	VAR00001	VAR00002
VAR000 Pearson 01 Correlation Significant N	1 13	0.671* 0.012 13
VAR000 Pearson 02Correlation Sig. (2-tailed) N	0.671* 0.012 13	1 13

*Correlation is significant at the 0.05 level (2-taied).

Table 18. Statistical analysis C correlations

	VAR00001	VAR00002
VAR000 Pearson 01Correlation Sig. (2-tailed) N	1 13	0.995** 0.000 13
VAR000 Pearson 02correlation Sig. (2-tailed) N	0.995** 0.000 13	1 13

**Correlation is significant at the 0.05 level (2-tailed)

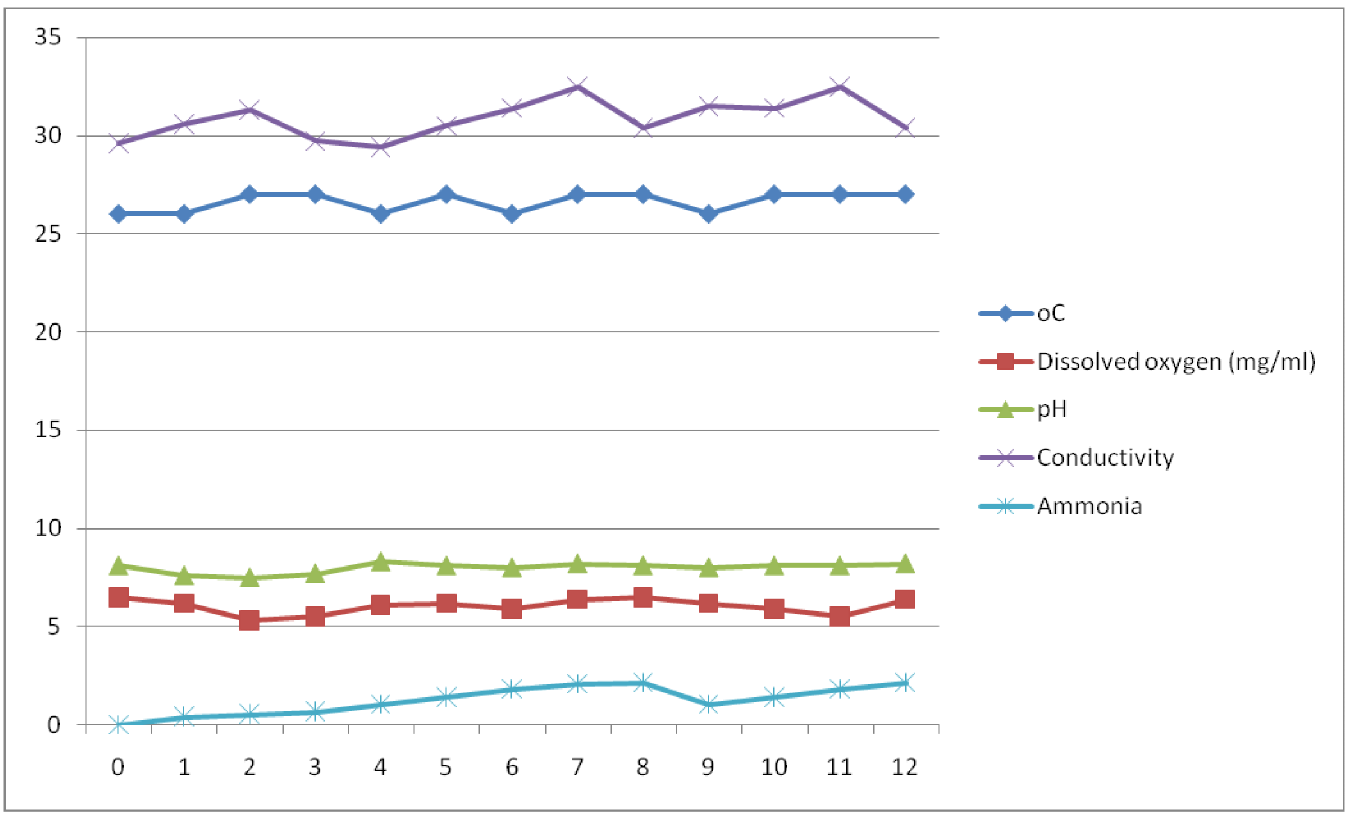

Figure 6. Physiochemical parameters chart 3.

and low rate of pollution. The advantage of organic fertilizer lies in the fact that they deplete in dissolved oxygen during decomposition (Adigun, 2005). Althogh some researcher Lan and Pan, (1993), Madu and Tsumba, (1998) reported that nutritive value of natural food promote better growth and higher yield of fish than that achieved from artificial feed, this fact should be over emphasized. It may be true that nature promote better

Table 19. Correlation between the Weight and Length.

	wk0	wk1	wk2	wk3	wk4	wk5	wk6	wk7	wk8	wk9	wk10	wk11	wk12
Gross Total weight	19.1	24.3	29.5	35.7	40.2	44.3	49.5	54.7	59.7	64.3	68.9	74.8	80.1
Log weight value	0	1.49	6.02	3.95	1.8 4	1.21	1.14	8.85	6.65	5.23	4.28	4.63	3.53
Gross total length	10	10.6	10.9	11.4	11.7	12.1	12.13	13.5	13.9	14.8	14.12	15.16	20.19
Log length value	0	3.62	8.68	9.28	4.02	4.17	2.56	9.48	2.26	4.32	2.71	4	1.48

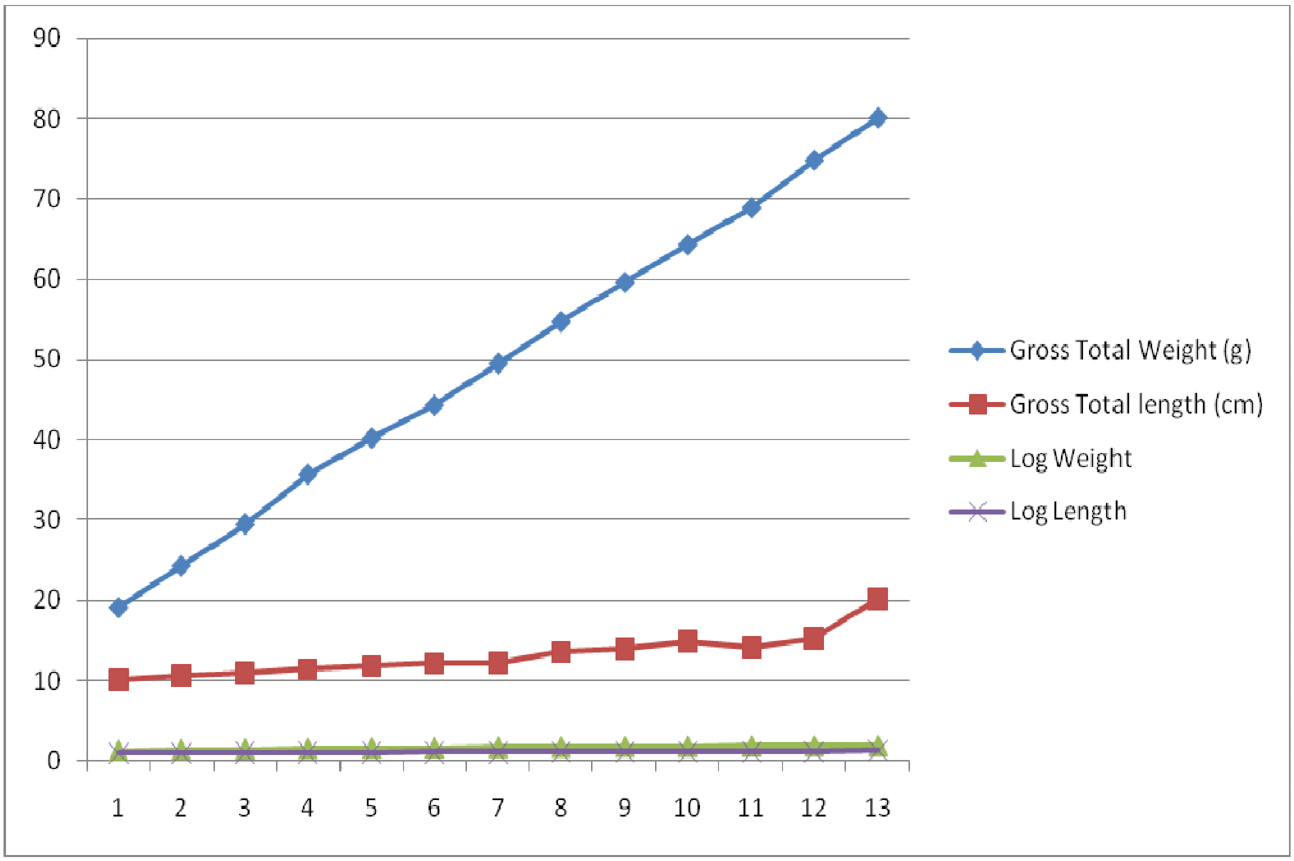

Figure 7. Chart showing production parameters for Tank A (Length - Weight relationship).

Table 20. Production parameters for Tank B (Length - Weight relationship).

	wk0	wk1	wk2	wk3	wk4	wk5	wk6	wk7	wk8	wk9	wk10	wk11	wk12
Gross Total Weight	18.2	20.5	19.2	18.5	20.6	25.4	21.3	17.14	19.1	22.34	26.1	24.2	19.4
log weight value	0	7.38	7.68	1.66	2.59	-1.82	1.92	8.39	1.08	-29.8	4.26	-1.14	2.03
Gross Total length	8	10.2	7.4	9.8	10.15	11.4	10.7	11.1	12.6	14.5	16.9	13.8	12.1
Log length value	0	1.51	5.81	5.45	1.44	6.55	3.25	9.82	9.68	9.5	-2.4	6.79	9.95

growth than artificial but when organic fertilizer is use to enhance their growth the reverse is the case due to aforementioned reasons. In present study, fish fed with artificial feeds performed better than those fed with organic feeds only, but those fed with both organic and artificial feeds performed best.

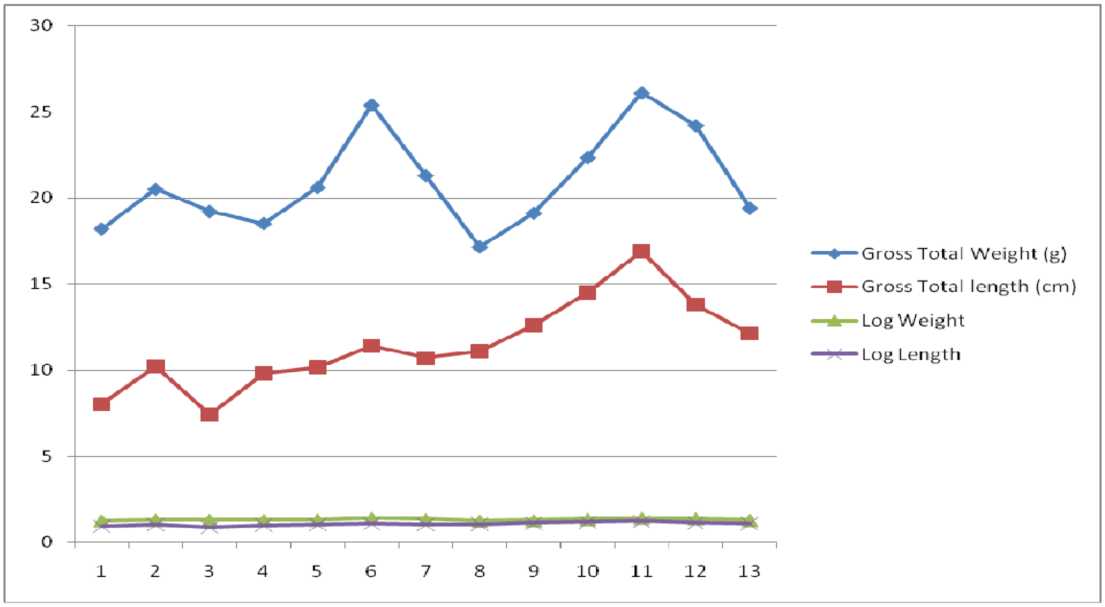

Figure 8. Chart showing production parameters for Tank B (Length - Weight Relationship).

Table 21. Production parameters for Tank C (Length - Weight Relationship).

	wk0	wk1	wk2	wk3	wk4	wk5	wk6	wk7	wk8	wk9	wk10	wk11	wk12
Gross Total weight	20	27.5	35.4	41.6	49.8	55.1	60.12	66.15	72.17	86.19	92.8	99.1	105.1
Log weight values	0	1.98	8.69	2.07	2.23	1.25	9.01	8.47	6.75	1.22	4.58	3.7	3.24
Gross total length	9.5	13.6	16.3	19.2	25.6	30.4	36.8	40.1	46.9	51.8	57.7	61.3	67.2
Log length values	0	2.23	3.38	4.46	2.13	1.98	7.61	1.71	6.85	6.69	-3.41	4.75	

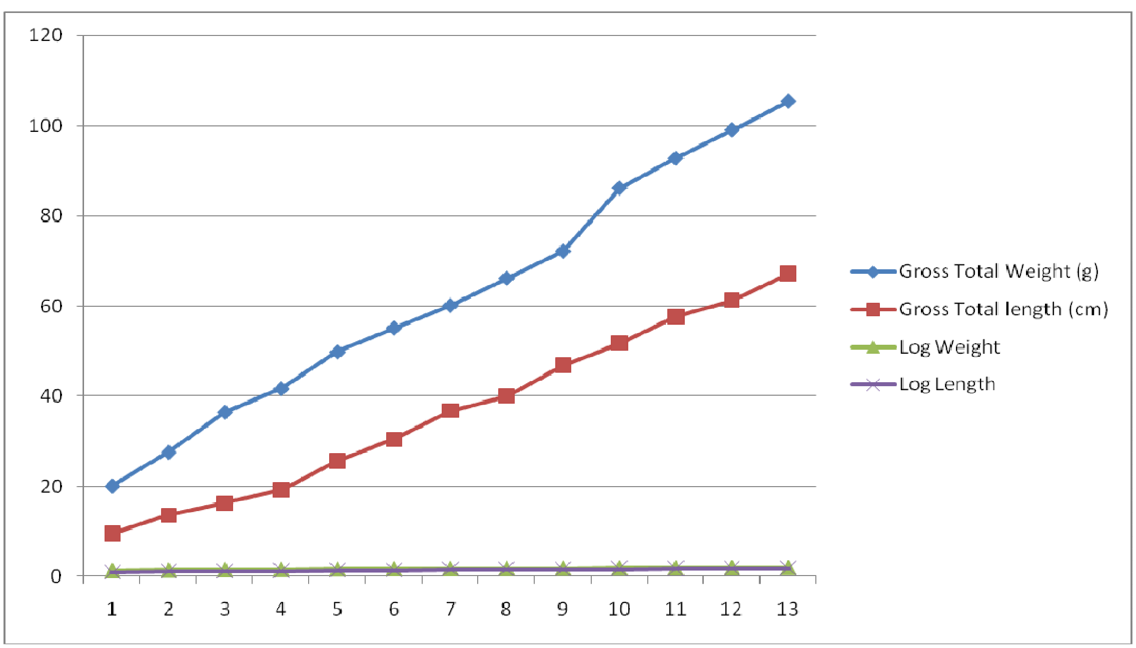

Figure 9: Showing production parameters for Tank C (length - Weight relationship).

The present study revealed that treatment C is the best and conducive for rearing Clarias gariepinus (Tables 19-21 and Figures 7-9).

CONCLUSION

In general, results of this study have shown that treatment C is the best alternative for the rearing of Clarias gariepinus fingerlings. The diet resulted to the best growth/ total length increase, as well as the best condition factor. Again on the basis of easy availability, compatibility, affordability, and less competition, treatment C proves to be superior to treatment A, while Treat B is lacking behind in terms of water quality. It can be concluded from this study that the cost of production was greatly reduced and the general growth indices of fish greatly improved. Therefore, better growth and productivity of Clarias gariepinus fingerings is a combination of organic and inorganic diet should ba applied.

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