

The Various Combinations of Artificial and Natural Feeds in Fingerlings Fed

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Abstract

The study on the growth performance of *Clarias gariepinus* fingerlings fed separately on plankton, multi-feeds and a combination of multi feed and plankton lasted for 8 weeks. *Clarias gariepinus* used for the study were acclimated for one week in plastic bowl, before commencement of the experiment on the fingerlings, (10) each were stocked into these plastic bowls which were further grouped into three to give three treatments and five replicates labeled A1, B2, and C3. Treatment 1 (C1-C5) were fed with multi-feed, Treatment 2 (C2-C5) were fed plankton and Treatment 3 (C3-C5) were fed with multi fed and plankton 5% body weight mainly copepods and cyclopods. Total length and the weight of fish were measured weekly and used as growth indices. Data collected were analyzed using one way analysis of variance. Results from the study review that Treatment 1 and 3 were not significantly different from each other ($p>0.005$) for both length and weight, but were different from Treatment 2 ($p<0.005$). Based on supplement helps to reduce cost of production and still ensure optimal production.

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I. Introduction

Fish feed is the single most expensive item in fish production (Ekelemu and Ogba, 2005). The farmer will want to use any feed source that is cheap but still assures optimal production. Thus, the use of natural feed items in aquaculture can be adopted. The African catfish, *Clarias gariepinus* is recognized as the ideal culture species for aquaculture due to its continue reproductive performance under intensive rearing culture conditions, ability to efficiently utilize commercial feedstuff and the capacity to utilize atmosphere oxygen (Jeje, 1992). The African catfish generally are valued as one of the highest quality of fresh water fish in Nigeria (Mohammed and Omoregie, 2004). Despite the cultivable characteristics of catfish species, availability is limited due to an inadequate hatchery system and insufficient live food and hatchery operators. Culturing of African catfish fry to fingerlings in tanks would allow monitoring of survival, growth and enable the culture list to maintain ultimate temperature and other growing conditions (Arimoro, 2005). Also, for commercial fingerlings producers it would eliminate the need and the stress involved in harvesting fingerlings from ponds and transporting them to holding tanks before shipping to growers (Ludwig and Lochmann, 2000). In Nigeria and the world over, aquaculture is seen as a means of meeting future demands for fish at a time when stocks from the wild are showing signs of depletion. According to Ayinla (2012) aquaculture covers a range of activities from food cycle aquaculture to grow-out of wild caught juvenile and sub adult for markets. The average Nigerians is said to be under nourished, taking than 13.5gg/caput/day of animal protein recommended by the World Health Organization (Ekelemu and Olele, 2010). To be able to meet with this recommendation, fish which is one of the cheapest sources of animal protein has become a major item in the diet of Nigerians. Nigerian's fish production which was once adequate to meet the demand of the populace is now inadequate. The supply due is inadequate come from these four sources in order of their contributions which are; importation, inland estuaries and coastal or artisanal, aquaculture and industrial trawl fishery (Ayinla, 2012). In the last five years, aquaculture production in Nigeria has tripled, standing at a value of about 200,535 tons in 2010 (FDF, 2010). This figure is abysmally low, when compared to be estimated annual aquaculture production of 2.5 -4.0 million tons (Ayinla, 2012). Zooplankton is a categorization spanning a range of organisms' sizes which includes small protozoans and large metazoans. It include holo-planktonic organisms whose complete life cycle within the planktons, as well as mero-planktonic organisms that spend part of their life in the plankton before graduating to either the nekton or a sessile, benthic existence. Although zoo-plankton is primarily transported by ambient water currents, many have locomotion, used to avoid predators to increase prey encounter rate. There are different types of zooplankton which includes; rotifers, chaetognatha, ciguatera, gelatinous zooplankton, hunting copepods, ichthyo-plankton, jelly fish, marine larvae, crustacean larvae, salmon louse and sea louse. Ecologically important protazoans zooplankton groups include the foraminiferans, radiolarians and dino-flagellates. Important metazoan zooplankton include

cnidarians such as jelly fish and the Portugese man o' war; Crustaceans such as copepods and krill chaetognaths (arrow worms); molluscs such as pteropods; and chordates such as salps and juvenile fish. This wild phylogenetic range includes similarly wide and symbiosis with autotrophic phytoplankton as seen in corals. Zooplankton feed on bacterio-plankton, phytoplankton, other zooplankton (sometimes cannibalistic), detritus (or marine snow) and even nektonic organisms. As a result, zoo-plankton is primarily found in surface waters where food resources (phytoplankton or other zooplankton) are abundant. Just as any species can be limited within a geographical region, so is zooplankton. However, species of zooplankton are not dispersed uniformly or randomly within a region of the ocean. Instead 'patches' of zooplankton species (this also applies to phytoplankton) exist throughout the oceans. Though few physical barriers exist above the mesopelagic, specific species of zooplankton are strictly restricted by salinity and temperature gradients; while other species can withstand wide range of temperature and salinity gradients (Lalil et al, 1993). Zooplankton patchiness can be also be influence by biological factors, as well as other physical factors. Biological factors include breeding, predation, concentration of phytoplankton, and vertical migration (Lalil et al, 1993). The physical factors that influence zooplankton distribution the most, is mixing of the water column (upwelling and down welling along the coastal and in the open ocean) that affect nutrient availability and, in turn phytoplankton production (Lalil et al, 1993). Successful culture of most fish fry requires the presence of zooplankton, mainly rotifers, as first food (Arimoro and Ofojekwou, 2003). It has been shown that it is still better for the first feeding larvae of most fish species since it leads to healthier larvae growth (Wang et al, 2005). These organisms must be able to meet their nutritional requirements for optimization of growth and survival (Shiri et al, 2003). According to Ajah (1998), the choice of rotifers for early fish larvae has the advantage of providing a low cost, highly predictable and reliable in the production of food organism, which is acceptable and easily caught by the fish larvae. Several techniques have been adopted for the culture of the freshwater rotifer, *Branchionus calyciflorus* (Lubzens et al 1989., Hoff and Snell, 1997). Rotifers have the additional advantage of been maintainable in a stable culture by feeding them recycled diets in a feed-back culture system (Hirata and Yamasaki, 1983, Hirata et al., 1983). Maintaining monoculture of the freshwater rotifers is complicated (Ludwig and Lochmann, 2000). It requires setting up a rotifer culture and a micro algae culture to feed the rotifers. Both cultures require constant care, precise growing condition, specialized requirement isolation to avoid contamination (Arimoro, 2006). Jeje (1992) reflected on the difficulty for establishing pure cultures of mono specific zooplankton and thus suggested that for hatchery operations especially in the developing nations like Africa, the development of a mixed culture of zooplankton population would be more realistic as the techniques involves can be more easily mastered by hatchery managers. Several chemicals like trichlorfon, (dylox^R, Fanthion (Baytex) and difubenzuron (Dimilin) have been found effective for initiating a monoculture of rotifer in ponds (Burtle and Morrison, 1987; Ludwig, 1993). Most of these chemicals are organ-phosphates which known to be toxic Cladocerans, slightly toxic to free swimming Copepods and their nauplii, but not fatal to rotifers levels below 1.5mgL, hence they can be used in initiating monoculture of rotifers. There are considerable reports of feeding successes using the marine rotifers, *Brachionus plicatilis* as live food for several marine few freshwater species (Ottera, 1993; Craig et al., 2009; Castell et al; 2003). Only a few documented studies are available on the use of the freshwater rotifer, *Brachionus Calyciflorous* for raising of freshwater fish species. For example, Lim and Wong (1993) demonstrated that consistently high survival rate for the sunshine bass fry are possible when the fry are stocked just before predatory copepods are present. Similarly, Shiri et al (2003), Arimoro and Ofojekwun (2003) reported over 60% survival rate with the fresh water fish larvae, burbot (*LotaLota*) and the African toothed carp (*Aphyosemjon Gardnari*) raised on this rotifer. The difficulty in raising most of fish species from fry stage to fingerlings still remains global problems.

Culture of the Fresh Water Rotifer, (*Brachionus Calyciflorous*)

The freshwater rotifer, *Brachionus Calyciflorous* was first isolated from a mixed population of zooplankton comprising rotifers, Copepods cladocerans from a 300 basin duck weed tank situated in the zoological garden of the University of Jos, Jos, Nigeria. Pure cultures were obtained by a series of chemical treatment with diazinon (Basudine^R) to establish the safe concentration for rotifers. This was achieved through another published investigation in the same laboratory by Agbon et al. (2002) as 1.2mgL⁻¹ of the active ingredient. And this concentration, crustaceans (Cladocerans and Copepods), aquatic insect including mosquitoes larvae failed to survive thereby allowing the rotifers to multiply. A more detailed method of culture is contained in Arimoro and Ofojekwu (2004) and Arimoro (2005). This rotifers was mass produces in 300 plastic tanks using algae species *Scenedesmus* species and *Chorella* species in combination with baker's yeast. In addition, modified for continuous culture of the rotifers was employed (Hirata and Yamaski, 1983). In modifying the previous method and organ-phosphoric acid ester (diazinon) applied at the rate of 1.2mgL⁻¹ was used to obtain a pure culture of rotifers. Mixed algae species particularly, *Scenedesmus* species and *chlorella* species were used in continuous culture of rotifers instead of the unialgal culture used in the previous method. Another important modification was that rotifers were siphoned from the top of the aliquot without disturbing

the button, instead of filtering as was the case in the original method culture sediments such as faeces and excess food where fermented in a bucket for 1-2 weeks and to this was added 50ugL⁻¹of vitamins B₁₂. The vitamin favored the growth of bacterial for bio-decomposition of the sediments. The resulting fermented by a biomass was then used for the cultivation of the mixed algae. The algae produced from these subsistence nutrients were fed back to the rotifers in the form of recycled diets. In this way, continuous steady cultures of algae and rotifers were maintained. In nature, zooplankton is one of primarily food of larvae fish. Two of the dominant zooplankton groups were rotifer (rotifers) and a sub- class of the crustaceans, copepoda (copepods). These two groups are the preferred prey for shrimp fishes and are the live feeds used most often by culturists. The intensive larvae culture of most marine fish depends on a large supply of zooplankton. *Brachionus plicatilis*, is a small rotifer first developed as larvae fish food in Japan in the 1950s, since then, many methods of culturing it has been developed. More than 60 species of marine finfish are cultured using *Brachionus plicatilis*, as live food. There are different types of Zooplankton which includes; rotifers, chaetognatha, ciguatera, ctenophora, gelatinous zooplankton, hunting copepods, ichthyoplankton, jelly fish, marine larvae, crustacean larvae, salmon louse and sea louse.

II. Material And Methods

The experiment was carried out at the Fish Biology Laboratory of Federal College of Freshwater Fisheries Technology, New Bussa, Niger State.

Experimental System: The feeding trail on the growth of *Clarias gariepinus* fingerlings was conducted using plastic bowls filled with 2/3 tap water. The water was aerated using BOYU AIR PUMP S2000 to ensure good and sustainable aeration, the water changed regularly and replace with freshwater twice a week.

Experimental Fish: A total of One Hundred and Fifty fingerlings of *Clarias gariepinus* with an average mean weight of 30.16± 0.22g, were obtained from Mosrence Fish Farm located at the Senior Camp, New Bussa, Niger State. The fish were transferred to the Fish Biology Laboratory and acclimatized to for seven (7) days and starved for 24hours before being fed with the experimental diets in order for them to empty their gastric intestinal tract.

Experimental Diets: Three (3) Treatment diets were used in feeding of the experimental fish which were multi-feed diets, Plankton diets and the combination of Multi feed and Plankton diets.

Experimental Procedure: At the beginning of the feeding trial, 10 fingerlings were stocked randomly in 15 plastic bowls which was made up of 3 Treatments and 5 Replicates, each of the fishes with an initial mean weight of 30.16 ±0.02g. the weight was obtained using a sensitive electrical weighing balance (METLER TOLEDO, PB602 weigh balance, 3000 x 0.1g). The water was completely changed twice weekly as the bowls were properly washed before replacing it with a freshwater and also mortality was monitored.

Monitoring Water Quality Parameters: The water quality parameters were monitored which Temperature, Dissolved Oxygen, Conductivity, pH and Turbidity.

III. Results And Discussion

Table 1: Proximate composition analysis of Experimental Diet (multi-feed) in feeding *Clarias gariepinus* fingerlings during the experiment.

S/N	% Moisture	% Ash Content	% Crude fiber	% Crude protein	% Crude fat	% N.F.E
1.	5.75	66.6	2.50	42.45	7.69	34.95
2.	7.12	7.38	3.15	45.09	7.14	30.12
3.	6.44	7.02	2.65	43.54	7.42	32.54

The crude protein from this table is (43.54), crude fiber (2.65), crude fat (7.42), moisture content (6.44), Ash content (7.02) and N.F.E.(32.54).

Table 2: mean weekly weigh (g) gain of *Clariasgariepinus* fingerlings fed with different diets at 5% body weight for 56 days.

Tanks	WEEK INITIAL	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8
A1	30.16	31.18	32.74	35.44	41.85	51.21	58.69	81.52	86.90
B2	30.16	30.18	30.32	31.05	32.05	34.63	38.82	42.56	46.38
C3	30.16	31.04	31.97	34.26	42.48	54.10	62.30	82.33	90.17
	30.16	30.80	31.68	33.58	38.79	46.65	53.27	68.80	74.48

From the table, the highest growth rate was recorded in Treatment 111 (90.17g) fed multi feed and plankton while the less was in Treatment 11 (46.38g) fed plankton only.

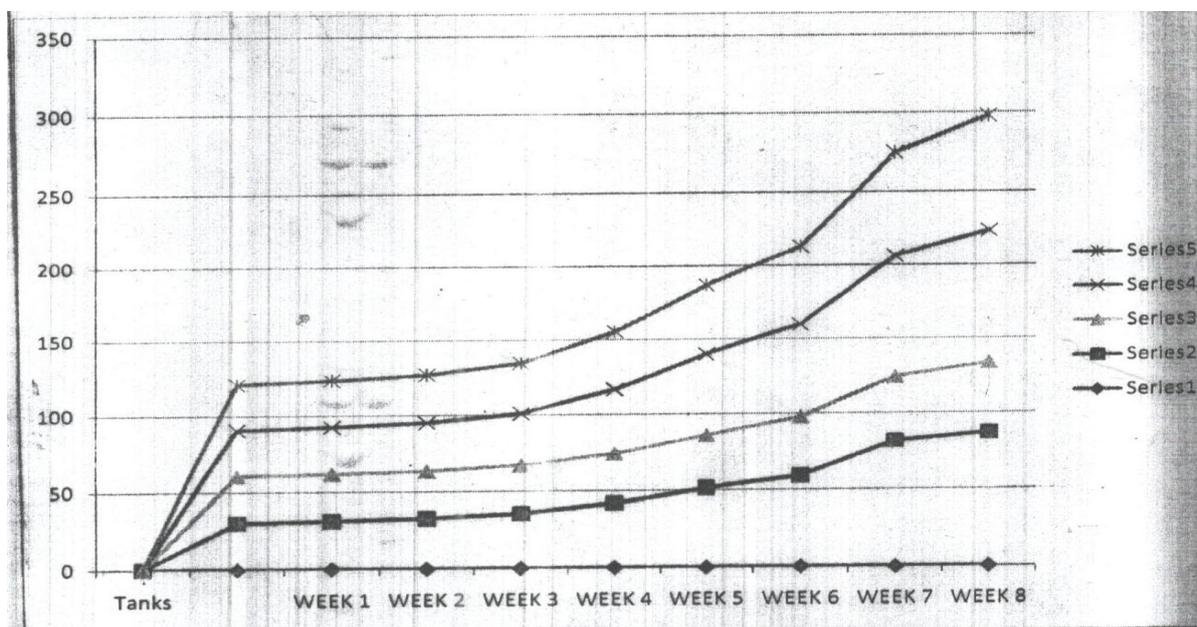


Figure 1: Graphical representation of mean weekly weight of experimental fish for 56 days

Table 3: Summary of growth parameters of the weight gain of fish for 56 days.

Treatment	Multi feed	Plankton	Multi feed and plankton
Initial	30.160±0.014 ^a	30.156±0.052 ^a	30.156±0.018 ^a
1 st Week	31.17±0.355 ^a	32.730±0.451	31.042±0.641 ^a
2 nd Week	32.730±0.451	30.320±0.071 ^c	31.974±0.442 ^b
3 rd Week	35.044±1.585 ^a	31.050±0.162 ^b	34.260±0.487 ^a
4 th Week	41.850±2.812 ^a	32.208±0.647 ^b	42.482±1.853 ^a

5th Week	51.210±4.778 ^a	34.630±1.564 ^b	54.100±3.640 ^a
6th Week	58.694±5.656 ^a	38.824±2.523 ^b	62.302±5.178 ^a
7th Week	81.522±4.557 ^b	42.558±2.173 ^a	82.328±6.567 ^a
8th Week	86.904±4.662 ^a	46.380±2.784 ^b	90.172±5.972 ^a

The highest weight gain in this table is in Treatment III (90.172± 5.972^a) and the lowest in Treatment II (46.380±2.784^b), there is no significant difference between Treatment I and III (p>0.05) but there is significant difference amongst Treatment II and III (p<0.05). Mean with different super script within the column are significantly different (p<0.05).

Table 4: Water quality parameter monitored during the experiment.

Sample	pH	DO	Conductivity (NSL/CM)	Temperature 0	Turbidity (NTU)
A	7.0	4.80	520	30	10

The water quality parameters monitored are the pH (7.0), Dissolved oxygen (4.80), Conductivity (520cm), Temperature (30⁰c) and Turbidity (10NTU).

IV. Discussion

Fish feed is the single most expensive item in fish production (Ekelemu and Ogba, 2005), the farmer will want to use any feed source that is cheap but still assures optimal production and profit is due to the fact that the natural food is rich in protein and nutrient, not available in the processed feed (Ayinda, 2003). According to (Sogbesan, 1998) fingerlings are always able to convert the protein component in naturel meals more efficiently than those found in artificial feed. Table 2; shows the mean weekly weight, which is the increase of weight gain by fish, the highest mean increase in weight was recorded in Treatment II which was feed with Multi-feed and plankton while the lowest was observed in Treatment II which was fed with plankton only. This result was supported by the finding of (Ugwumba et al 2001) and McCallum and Trauth (2002), that aquaculture animals (tadpoles of toad, frog and fish) grow better when fed mixed diet containing live food and compounded diet than when fed either live food or compounded food alone. This is not far from the fact that the synergetic effect of combined biological compounds is higher than when fed with that of individual compound. Survival rate (90.17) in this study was highest in Treatment III which was fed with plankton only (86.90). This result was supported by the finding of (Ovie, 2003), who observed that the growth and survival of fingerlings enhance when fed with live plankton. The response to feed was better in Treatment II. The result obtained in this study has shown clearly the possibility of culturing *Clarias gariepinus* using multi-feed and plankton to reduce cost and optimize production. This result was supported by (Ekelemu, 2012) who reported that fish production in aquaculture is based on reduction in cost production by using the best available natural feed with conventional feed.

V. Recommendation

The use of natural food (plankton) in combination with commercial feed in fish production could be adopted in fish culture as natural food can be accepted by *Clarias gariepinus* at any stage of growth and this combination reduces cost of production. Thus, the incorporation of natural food with commercial feed is better option recommend in order to achieve optimal growth of *Clarias gariepinus* fingerlings.

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