# EFFECT OF DIFFERENT DIETARY PROTEIN ON WEEKLY WEIGHT GAIN AND BODY COMPOSITION OF *Megalops atlanticus* FINGERLINGS CULTURED IN TANKS

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**ABSTRACT**
*Five hundred (500) fingerlings of average weight varying from 5.11±1.39 to 5.26±1.63g in tanks were obtained from Lagos lagoon, Nigeria in February 2010 using gill net were fed with four diets, of which three diets [35% (T1), 40% (T2) and 45% (T3)] were formulated and Coppens as control (Ct). The protein sources of the formulated diets were soybean meal and fish meal combined at the ratio of 2:1. The best crude protein in flesh and carcass was recorded in Ct and T2. The high protein level (45% protein) did not significantly enhance the fish growth. Ash for flesh also falls within the reported range but not the same with that of carcass of the fish examined. The ash for carcass ranged from 8.24±0.12 to 10.47±0.33. The work also revealed that the Ct had the best overall bi-weekly weight gain followed by T2. The result of the study indicated that M. atlanticus can accept formulated feed.*
**Keywords**: dietary protein, body composition, *Megalops atlanticus*, pond

## INTRODUCTION

Aquaculture is growing at a fast rate in sub-Saharan Africa even with the growth, the abundant potential and resources is still underutilized and there are still more fish to discover . Farmed fish require high protein diets with an optimum amount of non-nitrogenous energy sources (mainly lipid and digestible carbohydrates) in order to grow rapidly to market size in an intensive fish culture (Lovell, 1989). Protein is the most effectively used nutrient among other nutrients in fish. Protein is the fundamental unit of fish growth and tissue elaboration (Hanley 1991). Excess protein in fish diet may be wasteful and cause diets to be unnecessarily expensive (Ahmad, 2000). This has necessitated research into the protein requirements of cultured fishes ( De Silva and Perera 1985; Siddiqui, *et al*.,1988; Fagbenro and Nwanna 1999). Realization of the optimum protein level for cultured fish would help reduce the costs and maximize the feed conversion efficiency (Charles *et al.*, 1984; Sampath, 1984; Chiu *et al.*, 1987).

The main body constituents of the fish include water, lipid, ash and protein. Carbohydrates and non-protein compounds are also important constituents but are present in small amounts and are usually ignored during analysis (Lovell 1989, Wootton 1990). The live weight of majority of fish usually consists of about 70-80% of water, 20-30% of protein and 2-12% of lipid (Love 1980). However, these values may vary considerably within and between species, and also with size, sexual condition, feeding, time of the year and physical activity.

*Megalops atlanticus*, a soft rayed fish of the order Elopiforme, sharks larval stages known as leptocephalus with eel-like fishes or herring group according to Bond, (1979). The family Megalopidae is made up of two species; *M. atlanticus* found in the Atlantic Ocean and *M. cyprinoid*, the ox-eye tarpon found in Pacific Ocean (Zerbi, 1999). The species can be found in tropical, subtropical and warm temperate of the Atlantic Ocean. The species is widely distributed along the Mauritania to Angola axis concentrating around the Gulf of Guinea zone of the eastern Atlantic area of Africa and also along the Nova Scotia to Brazil axis, concentrating in the warmer coastal waters of Florida, Gulf of Mexico and West Indies in the western Atlantic (Irevine, 1947; Fischer, *et al*., 1981 and Whitehead, *et al*., 1984).

In Nigeria, they are abundant in the coastal waters of Ondo State (Anyanwu, 2004). They are capable of migrating freely among marine, brackish and fresh water, showing a wide range of tolerance for salinities (Wade, 1962). *M. atlanticus* larvae and juveniles are found in mangrove habitats, lagoon, creeks, sea drainages and inlets. They are valued for sport in the United States America and as a good source of protein in Nigeria (Anyanwu ,2004). In order to develop the culture of this all important fish species, it is important to investigate the effect of different protein levels on the growth and body composition of the fish. This will also contribute to the determination of the optimum protein requirement of fish.

## MATERIALS AND METHODS

### Study Area

The Experiment was conducted in 12 circular 3 $m^3$ tanks installed as a partial flow through system at Badore Research Centre, Nigerian Institute of Oceanography and Marine Research. The Center lies between 06° 30' 47.8" N and 03° 36' 00.13"E to 06° 30' 24.01" N and 03° 36' 19.31" E fronting the Lagos Lagoon with total land area of 29.455 hectares.

### Collection of the Experimental Fish

Five hundred (500) mixed sex *M. atlanticus* fingerlings of average weight varying from 5.11 ± 1.39 to 5.26 ± 1.63 g in tanks were obtained from Lagos lagoon Nigeria in February 2010 using gill net. The transportation was done in small batches of 250 fingerlings in a 100 L capacity vat between 0500 and 0600 hrs daily for two days from the lagoon to the experimental station. The fish were acclimatized for two weeks.

Three diets [35% (T1), 40% (T2) and 45% (T3)] crude protein (CP) were formulated from fish meal, soybean, maize as the major source of protein and energy. Premix, vitamin, binder and vegetable oil were also included in the formulation. These protein levels were chosen based on the recommendation of 35% and 40% CP for raising table size and brood stock of *Clarias gariepinus* respectively made by Ayinla and Akande (1988).

From the stock, fifty (50) fingerlings were selected randomly; the initial weight, the head length (HL), the standard length (SL) and the total length (TL) were taken using meter rule and electronic balance, type: DT-302A. The fish were distributed at 40 fingerlings per tank. Cleaning of the tanks was done once a week to reduce mortality that may occur due to poor handling

Feeding was done two times daily between 0700 and 0800 hours in the morning and 1600 and 1700 hours. The fish were fed 5% of their body weight. Sampling of fish was done twice a week. At the end of the experiment, some samples were selected from each treatment for proximate analysis

All data collected were statistically analyzed using the one-way analysis of variance, to determine significant differences among treatments using excel and SAS 9.1.

## RESULTS

The results of work on the effect of different dietary protein on weekly weight gain and body composition of *M. atlanticus* fingerlings cultured in tanks shows that there was variation in the weekly weight gain of the fish The mean protein values of the different experimental diets for the flesh ranged between 17.08 (T3) to 20.14 (initial) (Table 1). There were no significant differences between the protein values of Ct, T1, T2 and T3 respectively ($P > 0.05$). The lipid varied from 2.29% ± 0.19 in T1, 2.67% ± 0.29 in T3, 2.93%±0.08 in T2, 3.25%±0.05 in Ct to 8.224% ± 0.06 in the initial. There was a significant difference between T1, T2, T3, Ct and Initial. There was no significant difference among the four treatments ($P > 0.05$) (Table 1). There was no significant difference in the moisture between Ct and T2 ($P > 0.05$) but there was between other treatments. The ash also showed significant difference among all treatments except T1, T2 and initial. (Table 1)

The proximate analysis of the carcass shows that protein was significantly difference ($P > 0.05$) among the treatments. There was no significant difference between Ct and initial and also between T2 and T3, but all were significantly different ($P > 0.05$) from T1. The range was between 16.11± 0.18 and 19.91 ± 0.37. For lipid, the result showed significant difference among all treatments ($P > 0.05$) with Ct having the highest lipid value. The values for moisture varied from 65.00 ± 0.10 in the initial to 79.78 ± 0.25 in the T3. The highest ash value of 10.47 ± 0.33 was recorded in T3 while the lowest value of 8.12 ± 0.06 was recorded in initial (Table 2).

**Table 1: Proximate composition of the flesh *Megaloops atlanticus* fingerlins (wet weight)**

| Parameters | Ct (%) | T1 (%) | T2 (%) | T3 (%) | Initial (%) |
|---|---|---|---|---|---|
| Protein | $18.70 \pm 0.25^a$ | $17.14 \pm 0.24^a$ | $18.07 \pm 0.18^a$ | $17.08 \pm 0.15^a$ | $20.14 \pm 0.24^a$ |
| Lipid | $3.25 \pm 0.05^a$ | $2.29 \pm 0.19^a$ | $2.93 \pm 0.08^a$ | $2.67 \pm 0.29^a$ | $8.24 \pm 0.06^b$ |
| Moisture | $74.93 \pm 0.13^a$ | $76.99 \pm 0.14^b$ | $74.88 \pm 0.21^a$ | $73.98 \pm 0.27^c$ | $69.13 \pm 0.39^d$ |
| Ash | $1.13 \pm 0.07^a$ | $1.25 \pm 0.13^b$ | $1.33 \pm 0.20^b$ | $1.45 \pm 0.19^c$ | $1.28 \pm 0.24^b$ |

Figures in the same row having the same superscripts are not significantly different (P>0.05).

**Table 2: Proximate composition of the Carcass of Tank cultured *Megalops atlanticus* (wet weight)**

| Parameters | Ct (%) | T1 (%) | T2 (%) | T3 (%) | Initial (%) |
|---|---|---|---|---|---|
| Protein | $18.35 \pm 0.49^{a}$ | $16.11 \pm 0.18^{d}$ | $17.83 \pm 0.11^{c}$ | $17.12 \pm 0.19^{c}$ | $19.91 \pm 0.37^{a}$ |
| Lipid | $6.18 \pm 0.11^{a}$ | $3.03 \pm 0.10^{c}$ | $2.16 \pm 0.08^{c}$ | $1.95 \pm 0.05^{d}$ | $5.06 \pm 0.12^{b}$ |
| Moisture | $67.02 \pm 0.19^{a}$ | $70.14 \pm 0.12^{b}$ | $70.25 \pm 0.21^{b}$ | $79.78 \pm 0.25^{c}$ | $65.00 \pm 0.10^{a}$ |
| Ash | $8.24 \pm 0.12^{a}$ | $9.09 \pm 0.22^{b}$ | $8.76 \pm 0.14^{a}$ | $10.47 \pm 0.33^{b}$ | $8.12 \pm 0.06^{a}$ |

Figures in the same row having the same superscripts are not significantly different (P > 0.05)

Fig. 1 shows the bi-weekly weight gain of *M. atlanticus* fed four dies of varying protein levels (Ct, T1, T2 and T3). The highest bi-weekly weight gain was observed in week six for Ct. Weight gain recorded bi-weekly revealed that Ct had the best weight gain at 4, 6, 10 and 12 weeks of the experiment. The second better growth was seen in T2 with the highest peak seen at week 4. The weight gain varied with varied protein levels.

Fig. 2 also showed that Ct had the best bi-weekly length increase having its highest peak at week 12 while T2 was the second best having its peaks at weeks 2 and 10.

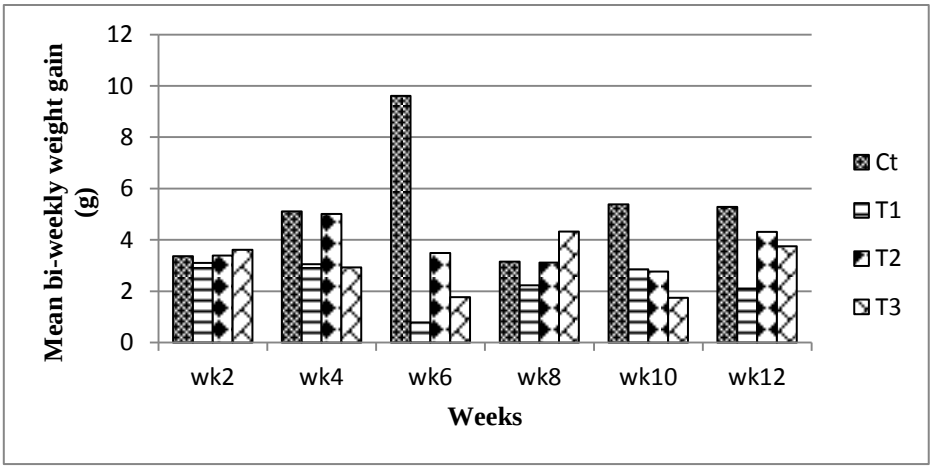


**Fig. 1: Bi-weekly weight gain of fingerlings fed four Different diets for 12 weeks in tanks**

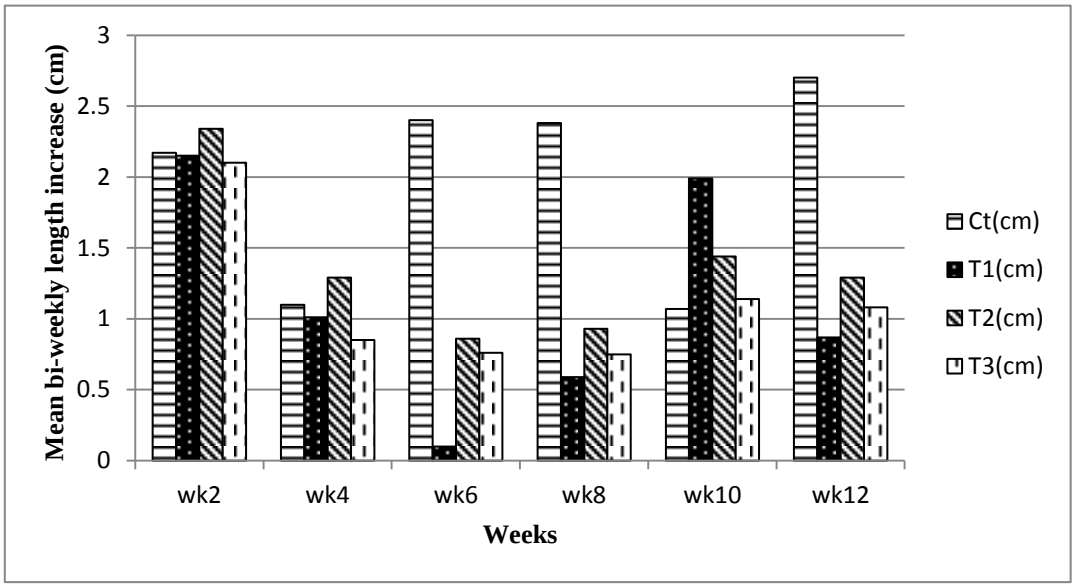


**Fig. 2: Bi- weekly length increase of fingerlings fed four different diets for 12 weeks in tanks**

## DISCUSSION

Tabachek (1986) and Heinen and Hankins (1995) reported that live weight gain was affected by increasing level of protein in diets. Because fish could use protein both for supplying energy and routine metabolism function of cold water fish. The body composition is used as indicator to assess the nutritional status and condition of fish. Ali *et al.* **(**2006) observed that body composition like ash, fat, organic and protein contents vary significantly in four fish species in relation to depth. In these studies, the different protein levels affect some of the factors measured (crude protein, fats, moisture and ash) significantly (P>0.05) for flesh and carcass. Emmanuel, *et al*. (2011) reported the proximate composition of *M. atlanticus* juvenile head and tail as follows; protein 21.39%, moisture 31.81%, fat 0.39% and ash 17.64% for the head and protein 28.12%, moisture 32.10%, fat 0.54% and ash 16.03 for the tail. The best crude protein in flesh and carcass was recorded in Ct and T2. The high protein level (45% protein) did not significantly enhance the fish growth. This result may be due to the fact that each fish size has a certain protein limit after which excess protein level could not be utilized efficiently. Muraleedharan, *et al*. (1996) reported that the proximate composition of fish varies greatly from one individual to another depending on age, sex, environment and season with protein levels ranging from 16-21%, lipid, 0.1-25%, ash, 0.4-1.5%, moisture 60-81% with extremes of 96%. The results in this study fall within the range. There were no significant difference among the treatments (P>0.05) on lipid, but are significantly different when compared to the initial. The initial had higher crude protein recorded when compared to other treatments in both flesh and carcass, El-Dakar, *et al*. (2010) reported no significant differences (P<0.0.5) in protein content of *Siganus rivulatus*, fed different dietary energy**.** However, fat content increased with increasing dietary energy and feeding levels. Ahmadzadenia, *et al*. (2011), reported that crude protein was significantly different in all treatment in a study of effect of replacing different levels of soybean meal with Spirulina on the carcass of Rainbow trout while crude fat and ash were not significant different in all treatments. Ash for flesh also falls within the reported range but not the same with that of carcass of the fish examined. The ash for carcass ranged from 8.24±0.12 to 10.47±0.33. This could be as a result of the high calcium present in the carcass.

The mean bi-weekly weight gain showed that the highest peak was recorded in the control (Ct) in the six week. The work also reviewed that the Ct had the best overall bi-weekly weight gain followed by T2. The mean bi-weekly length increase also reviewed that Ct also had the best with so many peaks, also followed by T2. This study was very important in the sense that it reviewed the growth regime of *M. atlanticus* fed feed of varying protein levels and can serve as a guide to culture of the fish.

## CONCLUSION

The result recorded in this study indicated that *M. atlanticus* can be cultured in tanks with formulated feed and it also indicated that protein levels can affect weight gain of *M. atlanticus.* The result also showed that diet of 40% crude protein level had the best weight gain among the formulated diets meaning that if the feed is improved into

floating feed, it will perform better as well as reduce cost of production.

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