Evaluation of Survival and Growth Performance of Wild *Synodontis Melanopterus* (Boulenger 1903) Fed with Three Different Diets

[1]Ibrahim Shehu Jega*, [1]Idris Ganiyat Aderibigbe, [1]Dalhatu Yahaya Bawa, [1]Muhammad Namaga Wade, [1]Aminu Baba Gana and [2]Mohammad Yahaya Abubakar
[1]Department of Forestry and Fisheries, Kebbi State University of Science and Technology, Aliero, Nigeria
[2]Department of Fisheries and Aquaculture, Usmanu Danfodiyo University, Sokoto

DOI: https://doi.org/10.51244/IJRSI.2023.10808

Received: 22 July 2023; Revised: 01 August 2023; Accepted: 08 August 2023; Published: 05 September 2023

ABSTRACT

This study evaluated survival and growth performance of wild *Synodontis melanopterus* juveniles fed chicken viscera, commercial feed and compounded feed in plastic bowls. Juveniles of initial mean weight which were recorded were stocked in each treatment replicated 3 times. Fish were cultured for 8 weeks. The stocking rate was 10 fish per bowl. Results showed that *S. melanopterus* juveniles fed chicken viscera had no significant difference (P>0.05) in final mean weight (10.26g) to commercial feed (11.05g) and compounded feed (12.88g). Chicken viscera had significantly higher (p<0.05) specific growth rate (0.26) than commercial (0.19) and compounded diet (0.12). Fish fed chicken viscera (0.15), commercial diet (0.18) has no significant difference (p>0.05) in feed conversion ratio to compounded diet (0.20). There was no significant difference (p>0.05) in survival rate for fish fed chicken viscera (66.7%) commercial feed (50%) and compounded feed (46.67%). Water quality parameters including temperature (°C), dissolved oxygen (mg/l) and pH were not significantly different (p>0.05) during the study. Based on these findings, chicken viscera is recommended for feeding *S. melanopterus* juveniles since it does not give negative effects on growth and whole body composition and also, showed greater survival and higher growth performance.

Keywords: Growth performance, Survival, Fish feeds, *Synodontis melanopterus*, Yamama lake.

INTRODUCTION

Fishes are sources of rich Supply of protein and vitamins characterized with low cholesterol level in the diets of Nigerians. The healthiness and income generation of many Nigerians is extremely reliant on fishes. *Synodontis melanopterus* (Boulenger, 1903), locally called Kurungu in Hausa, is found in Nigeria, dwells in the wetland in Togo and many parts of Benin and it is relished as food due to its tasty muscles and high market value [1] . However, the recent habitat degradation due to water pollution, erosion, salinity and climate change has led to dwindling catches of this species in Nigerian waters, thus categorized as Near Threatened [2].

Fish and other fishery resources are extremely harnessed by man and is basically linked to the trophic chain in the entire environment where they are commonly found [3]. Nigeria's inland waterbodies is home to variety of aquatic organisms such as phytolankton, zooplanktons, crustaceans, and vertebrates including fish, crocodile, and aquatic mammals [4]. Just like other living beings, growth is a characteristic feature of fish which is simply defined as change in length and weight with time and can also be change in numbers with time in the case of population [5]. According to Welcomme [6], factors that influence growth of fish,

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume X Issue VIII August 2023

can either be endogenous or exogenous. Endogenous factors include genetic components of fish, which limits the maximum size of a given species, while exogenous factors include food availability, feeding rate and the nature of food ingested.

One of the major problems confronting the development of aquaculture industry in Nigeria is species conservation. Fish growth and survival rate depends on the kind of feed, feeding frequency, feed intake and the fish's ability to absorb the nutrients. Once fishes are removed from natural environment to artificial, enough feed must be supplied in order for them to grow. This could be in form of complete rations, where the artificial diet furnishes all the nutrients required by the fish. Both intensive and semi-intensive fish culture systems involve input of complete commercial feed which account for up to 60% of production costs and can sometimes negate the economic viability of a farm if suitable feed are not used.

Liao and Huang [7] outlined the strategies for domestication in aquaculture to include species choice, stage choice, feeding control, culture from choice, facility aid choice and induced breeding in captivity and stressed that certain species must be cultured from the fry or juvenile stage. After rearing wild fry or juveniles in captivity, they become acclimated and can then be induced to spawn once they reach sexual maturity. The aim of this research was therefore to determine the suitable feed for culture of wild *Synodontis melanopterus* under captive condition with a view to subsequent artificial breeding of the fish.

MATERIALS AND METHODS

Study Area.

Lake Yamama is a natural lake situated between latitude 11°20?- 12? north and longitude 04°20?- 06? East. Yamama Lake is an oxbow lake formed by the Sheila River, which sometimes floods into the lake. The lake stretches some 900 m in length and is 195 m wide giving a surface area of about 18 hectares. Aquatic vegetation in the lake consisted of large areas of *Lilypads*, emergent *Typha*. *Cerratophylum*, and other weeds. About 60-70% of the lake is open waters; with the southern portion virtually covered with aquatic vegetation. The lake bottom is very rich in decaying vegetable matters. A few crocodiles were reported to be in the lake.

1. ***Species Identification*:** The species (*melanopterus*) was identified by counting of fin rays such as pectoral fins, dorsal fins, anal fins, adipose fins and barbells, according to fish identification manual. The fish has three pairs of barbels, D, V; A, X; P, XII; V, XII; C, 26. The dorsal fin (D) has 5 fin rays, anal fin (A) has 10, pectoral fin (P) has 12, ventral or pelvic fin (V) has 12, caudal fin (C) has 26 fin rays.

2. ***Experimental Design:*** Nine 35 liters plastic bowls were used for rearing of fish. The experiment consists of three treatments T1 (chicken viscera), T2 (commercial feed) and T3 (compounded feed) with three replicates using Complete Randomized Design (CRD). The water for the experiment was sourced from the Departmental borehole.

3. ***Experimental Fish:*** Ninety (90) *Synodontis melanopterus* juveniles were obtained from Yamama Lake, Kebbi State. Juveniles' initial mean weight was determined using electronic sensitive weighing balance. The juveniles were acclimatized for one week in order for them to get adapted to their new environment. After which they were fed with the diets. The weight (g) and length (cm) of each juveniles in each bowl was measured at the commencement of experiment. Sampling was carried out bi-weekly to determine the new body weight using electronic sensitive weighing balance and plastic ruler. The sampling exercise was carried out in the morning before feeding the fish. The experiment lasted for 56 days.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume X Issue VIII August 2023

Determination *of Water Quality Parameters*

The water quality parameters that were monitored during the experiment include; Temperature (?) which was determined using mercury in glass thermometer, the hydrogen ion concentration (pH) was measured using indicator paper and the Dissolved Oxygen (DO) was determined by titration method.

Determination *of proximate composition of the feeds*

From the proximate analysis of the feed ingredients (Table I), the crude protein content was 35% for chicken viscera, 45% for commercial feed and 22.75% for compounded feed. The compounded feed was subjected to proximate analysis at the Agricultural physical laboratory in Faculty of Agriculture, Usmanu Danfodio University, Sokoto. The analysis includes Crude protein, Crude fiber, Crude lipid and Ash content.

Table I: Percentage Composition of Feed Ingredients for Compounded Sinking Feed

Feed ingredients	Percentage composition (%)
Wheat offal	4.84
Maize	14.52
Fish meal	24.05
Groundnut cake	36.07
Soybean meal	12.02
Bone meal	2.5
Methionine	1.0
Lysine	1.0
Premix	1.0
Salt	0.5
Palm oil	2.5
TOTAL	100
Proximate composition of compounded feed	
Moisture content	9.80
Crude protein	22.75
Crude fiber	9.66
Ether extract	8.06
Ash content	11.50

Determination of survival rate: Survival rate (SR %) was determined using;

$$SR\ \% = \frac{Nt}{N0} X\ 100$$

Where, Nt = Number of fish that survived
N0 = Total number of fish stocked

***Mortality rate (MR %)*: w**as determined using;

$$MR = \frac{NT1 - NT2}{NT1} X\ 100$$

Where; Nt_1 = Number of juveniles stocked

Nt_2 = Number of juveniles remaining.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume X Issue VIII August 2023

Determination of Growth Parameters

$$PWG = \frac{W2 - W1}{W1} X\ 100$$

Where, W_1 = initial weight

W_2 = final weight

Specific Growth Rate (SGR)

SGR is used to estimate the production of fish after a certain period.

$$SGR\% = \frac{InW2(g) - InW1(g)}{T} X\ 100$$

Where, W_1 = initial weight
W_2 = final weight
T = number of days in feeding period
In = natural logarithm

Feed Conversion Ratio (FCR)

The more suitable the diet for growth, the less food is required to produce a unit weight gain, i.e. a lower FCR. FCR is calculated as the weight of the feed fed to the fish divided by the weight of fish growth.

$$FCR = \frac{\text{Total Food intake (g)}}{\text{Weight gain (g)}}$$

Condition factor (K)

Condition factor (K) of the juvenile was calculated at the beginning and end of the experiment as follows:

$$K = \frac{100 \text{ x } W}{L3}$$

Where, W= weight of fish (g)

L= total length of fish (cm)

Data analysis

Survival, growth performances and feed utilization obtained from different treatments was subjected to one-way Analysis of Variance (ANOVA) to test for significant difference at 0.05 alpha level. Results with $p \leq 0.05$ were considered significantly different. The statistical analysis was done using IBM SPSS Inc. (Windows version 22.0).

RESULTS

Water Quality Parameters

Water quality parameters such as temperature, pH and dissolved oxygen (DO) are given in Table II. There

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume X Issue VIII August 2023

were no significant differences (p>0.05) in the water quality parameters of the bowls during the study. The temperature has higher (27.0 ± 0.00) value in T3

(compounded feed) while the least value is in T1 (chicken viscera) and T2 (commercial feed) (26.8 ± 0.00). The pH was highest (6.8 ± 0.00) in T1 (chicken viscera) and T2 (commercial feed) and the lowest in T3 (compounded feed) (6.7 ± 0.00). Similarly, DO was highest in T1 (chicken viscera) (7.4 ± 3.78) and lowest (5.9 ± 2.86) in T2 (commercial feed).

Table II: Mean (+SD) of Water Quality Parameters

Treatments	Parameters		
	Temperature (ºC)	pH	DO (mg/l)
T1 (chicken viscera)	26.8 ± 0.00[a]	6.8 ± 0.00 a	7.4 ± 3.78[a]
T2 (commercial feed)	26.8 ± 0.00[a]	6.8 ± 0.00 a	5.9 ± 2.86[a]
T3 (compounded feed)	27.0 ± 0.00[a]	6.7 ± 0.00 a	7.2 ± 3.5[a]

Means in the same column with the same superscripts are not significantly different (p>0.05).

Growth Performance and Survival of S. melanopterus

The growth performance of *S. melanopterus* juveniles fed chicken viscera, commercial and compounded diets are presented in Table III. At the start of the experiment, the mean weight of the fish were 8.85g, 10.01g and 12.12g for *S. melanopterus* fed chicken viscera, commercial and compounded diets, respectively. Final weights were 10.26g, 11.05g and 12.88g for chicken viscera, commercial and compounded diets, respectively.

Table III: Growth Performance and Survival of Wild *Synodontis melanopterus* Juveniles Fed with Three Diets

Treatments				**Parameters**					
	MIW (g)	**MFW (g)**	**MWG (g)**	**SR (%)**	**MR (%)**	**PWG (%)**	**SGR (%/day)**	**FCR**	**CF**
T1 (chicken viscera)	8.85±1.150[a]	10.26±1.29[a]	9.56±1.22[a]	66.67±21.52[a]	33.33±21.52[a]	15.31±1.95[a]	0.26±0.03[a]	0.15±0.00[a]	1.00±0.10[a]
T2 (commercial feed)	10.01±1.15[a]	11.05±1.29[a]	10.53±1.22[a]	50.00±21.52[a]	50.00±21.52[a]	10.71±1.95[ab]	0.19±0.03[ab]	0.18±0.00[a]	0.86±0.10[a]
T3 (compounded feed)	12.12±1.15[a]	12.88±1.29[a]	12.49±1.22[a]	46.67±21.52[a]	53.33±21.52[a]	6.31±1.95[b]	0.12±0.03[b]	0.20±0.00[a]	0.87±0.10[a]

Means in the same column with different superscripts are significantly different (p<0.05). Means in the same column with same superscripts are not significantly different (p>0.05).

KEY: MIW = Mean Initial Weight, MFW = Mean Final Weight, MWG = Mean Weight Gain, SR = Survival Rate, MR = Mortality Rate, PWG = Percentage Weight Gain, SGR = Specific Growth Rate, FCR = Feed Conversion Ratio, CF = Condition Factor.

From the results obtained, fishes fed with T3 (compounded feed) recorded the highest MFW (12.88 ± 1.29) while fishes fed with T1 (chicken viscera) recorded the lowest MFW (10.26 ± 1.29). However, no

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume X Issue VIII August 2023

significant difference ($p>0.05$) was observed between the treatments.

The survival rate (%) of juveniles was highest (66.67 ± 21.52) in the T1 (chicken viscera) and lowest (46.67 ± 21.52) in T3 (compounded feed. Furthermore, significant difference ($p<0.05$) was observed in PWG (Table III) where fish fed with T1 (chicken viscera) recorded the highest value (15.31 ± 1.95) and T3 (compounded feed) the lowest (6.31 ± 1.95). Significant difference ($p<0.05$) was observed in SGR in which fish fed with T1 (chicken viscera) showed the highest value (0.26 ± 0.03) and T3 (compounded feed) showed the lowest value (0.12 ± 0.03).

No significant difference ($p>0.05$) was observed in FCR between the treatments. The lowest FCR was in T3 (0.20 ± 0.00) and the highest was in T1 (0.15 ± 0.00). Condition factor (CF) was observed not to be significantly different ($p>0.05$) in all treatments. The highest CF was recorded from fish fed T1 (1.00 ± 0.10) and the least was from T2 (0.86 ± 0.10).

DISCUSSION

Fish feed is a major input in fish culture business and has remained a principal constraint to fish farmers in Nigeria and other developing countries because of high cost and availability. According to Dwyer *et al.* [8] both over-feeding and under-feeding may also affect the specific growth rates and the efficiency of feed conversion. Over-and under-feeding can be detrimental to the health of the fish and may cause a marked deterioration in water quality, reduced weight, poor feed utilization, and increased susceptibility to infection. The physico-chemical parameters of water used for culture of *S. melanopterus* during the experimental period were within the range recommended for *S. melanopterus* culture. The water quality parameters in the present study were not affected by the forms of the diets. These values fell within the reported by Ndimele and Owodeinde [9] as the best for tropical fishes. Generally, survival was good in all treatments. This could be attributed to proper handling during the whole experimental period. Growth parameters, survival and mortality are great tools for evaluating the effect of feed and its value composition on fish species. In this study, *S. melanopterus* responded positively to the chicken viscera, commercial and locally formulated diets as showed in their growth performance. Growth performance indices evaluated in the present study showed that percentage weight gain (PWG) and specific growth rate (SGR) of *Synodontis melanopterus* fed chicken viscera significantly differed ($p<0.05$) from fish fed commercial and compounded feed. Vincent *et al.* [10] reported that there was significant difference in the weight gain, specific growth rate and feed conversion ratio of African Catfish *Clarias gariepinus* fed chicken viscera. They further reported that the weight gain and specific growth rate were significantly higher but significantly lower in feed conversion ratio. Ajani *et al* . [11] reported that there was no significant difference in the mean weight gain and daily feed intake of *C. gariepinus* fed floating commercial diet and compounded sinking diet. However, they reported higher weight gain in fish fed floating commercial diet than compounded sinking diet. Similarly, Limbu [12] reported that feeding *C. gariepinus* using either commercial floating diet or compounded sinking diets did not significantly affect growth and survival. Olanipekun [13] showed variations in growth performance with higher mean weight gain and mean growth rate in fish fed compounded sinking diet and also, lower feed conversion ratio and higher survival rate in fish fed compounded sinking feed. Meanwhile, Mustapha *et al.* [14] and Ekanem *et al.* [15] found higher growth performance for *C. gariepinus* fed commercial floating diets compared to those fed compounded sinking diets.

The mean condition factor proved that fish in all the treatments were in good condition throughout the period of this study reason being that they all showed a relatively constancy all through. Olurin and Aderibigbe [16] documented that a fish well fed will obtain a higher condition factor than one poorly fed. The average biweekly growth of fish recorded in this study was higher than that of Jegede and Fagbenro [17]. There was no significant difference ($p>0.05$) in survival rate of experimental fish fed with different diets. The Survival rate observed in this study was higher than that of Dayal *et al.* [18] in India who had 62% as the highest Survival rate. The feed conversion ratio of 0.15, 0.18 and 0.20 was obtained by fish fed

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume X Issue VIII August 2023

with chicken viscera, commercial and compounded diet respectively. FCR in T1 is lower in comparison with others, this is an indication that T1 diet is of better quality than the other diets. This finding corroborates with that of Olele *et al*. [19]. The lowest FCR of fish obtained indicated better feed utilization by the fish and this obviously accounted for better growth performance of *S. melanopterus* fed T1 among others, this result supports the observation made by Shabbir *et al.* [20]. The current results have shown dissimilar growth performance between *S. melanopterus* juveniles fed chicken viscera, commercial and compounded feeds. There has been a higher weight gain in fish fed chicken viscera (T1) than commercial (T2) and compounded feed (T3). The present study indicates increased biweekly mean weight for *S. melanopterus* fed chicken viscera, commercial and compounded feeds shows that the fish utilized the feed for growth. Biweekly mean weight gain increasing throughout the rearing period for *S. melanopterus* fed all the diets indicates the fish converted the feed to flesh.

CONCLUSION

Farmers depend more on floating (commercial) diet which limits the development of *S. melanopterus* farming due to its being more expensive and requires specialized facilities to produce than sinking (compounded) diets; moreover most farmers have no technology to produce it. The present study has showed no significant difference in growth performance between the wild *S. melanopterus* fed chicken viscera, commercial and compounded diets. From the present study, all treatments administered to the fish did not affect the water quality parameters; also, survival and growth performance was good in all treatments. This research revealed that wild *Synodontis melanopterus* can be reared in plastic bowls at their early stage of growth and can be fed with chicken viscera, commercial floating feed and compounded sinking feed.

Based on findings in this study, it is therefore recommended to adopt chicken viscera in feeding wild *S. melanopterus* under culture, since it gives better survival rate and growth performances. Chicken viscera are also readily available.

ACKNOWLEDGEMENT

This research was funded by the Nigeria Tertiary Education Trust Fund (TETFUND), Grant No: TETF/DR&D/CE/ALIERO/IBR/2020/VOL.1. We are therefore thankful for the financial support.

REFERENCES

1. Olaosebikan, B. D. and Raji, A. (2013). *Field Guide to Nigeria Freshwater Fishes*. Federal College of Freshwater Fisheries Technology, New-Bussa, Niger State, Nigeria, (2):1-79.
2. Lizama, M, Ambrosio A. (2002) Condition Factor in Nine Species of Fish of the Characidae Family in the Upper Paraná River Floodplain, Brazil. 62(1):113-
3. Craig, J.F., Halls A.S., Barr J.J.F., and Bean, C.W. (2004). The Bangladesh flood plain. *FisheriesResearch*, 66: 271-286.
4. Atobatele, O. E. and Ugwumba, O. A. (2008). Seasonal variation in the physico – chemistry of a small tropical reservoir, Aiba reservoir, Iwo, Osun, Nigeria. *African Journal of Bio-technology* ,7(12):1962-1971.
5. Abowei, J.F.N and Ezekiel, E. N. (2013). The Length-weight relationship and condition factor of *Chrysichthys nigrodigitatus* (Lacepède, 1803) from Amassoma River flood plains. *Scientia Agriculture*, 3 (2):30-37.
6. Welcomme, R. L. (2001). *Inland Fisheries*: *Ecology and Management*. Food and Agriculture Organization /Blackwell Science Publication, 358pp.
7. Liao, I.C, Huang, Y.S. (2000). Methodological approach used for the domestication of potential candidates for aquaculture. Recent advances in Mediterranean aquaculture finfish species diversification. Zaragoza: *CIHEAM*, 47: 97-107

8. Dwyer, K.S, Brown J.A, Parrish C,Lall, S.A. Feeding frequency affects food consumption, feeding pattern and growth of juvenile yellowtail flounder (Limanda ferruginea). *Aqua,* 2002; 213(1-4): 279-292.
9. Ndimele, P.E. and Owodeinde, F.G., (2012). Comparative Reproductive and Growth Performance of *Clarias gariepinus* (Burchell, 1822) and its Hybrid Induced with Synthetic Hormone and Pituitary Gland of *Clarias gariepinus. Turkish Journal of Fisheries and Aquatic Sciences*.12: 619 – 626.
10. Vincent, O., Hamed O. O., and Youssouf A. (2016). Chicken Viscera Meal as a Main Component in Diet for African Catfish *Clarias gariepinus* (Burchell 1822) Reared in Earthen Ponds. *Journal of Food and Nutrition Research.* 4, No. 12, , pp 799-805.
11. Ajani, F, Dawodu M. O, Bello-Olusoji, O.A. (2011). Effects of feed forms and feeding frequency on growth performance and nutrient utilization of *Clarias gariepinus Afr J Agric Res*, 2011; 6(2): 318-322.
12. Limbu, SM. (2015). The effect of floating and sinking diets on growth performance, feed conversion efficiency, yield and costeffectiveness of African sharp tooth catfish, Clarias gariepinus reared in earthen ponds. *Int J Fish Aquat Stud*, 2015; 2(5): 253- 259.
13. Olanipekan, OE. (2014). Growth performance of juvenile catfish (Clarias gariepinus) fed with floating (imported) and formulated (sinking) pelleted feeds in floating cages. M.Sc. Thesis, University of Agriculture, Abeokuta, Nigeria.
14. Mustapha MK, Akinware BF, Faseyi CA, Alade AA. (2014). Comparative effect of local and foreign commercial feeds on the growth and survival of *Clarias gariepinus J Fish*, ; 2(2): 106-112.
15. Ekanem, A.P, Eyo V.O, Obiekezie, A.I, Enin, U.I,Udo, P.J. (2012). A comparative study of the growth performance and food utilization of the African catfish (*Clarias gariepinus*) fed Unical Aqua feed and Coppens commercial feed.. *J Mar Biol Oceanogr*,; 1(2): 1-6.
16. Olurin, K.B. and Aderibighe, O.A. (2006). Length-weight and Condition Factor of Pond Reared Juvenile O. niloticus. *World Journal of Zoology*. 1(2): 82-85.
17. Jegede, T. and Fagbenro, O (2008). Dietary Neem. Azadirachta indica Leaf Meal as Reproduction Inhibitor in Redbelly Tilapia, Tilapia zilli. 8th International Symposium on Tilapia in Aquaculture. In Aquaculture. Proceedings. Cairo, Egypt, 12-14: 365-373.
18. Dayal, R., Srivastava, P.P., Bhatnagar, A., Chowdhary, S., Yadav, A.K. and Lakra, W. S. (2012). Comparative Utilization Impact of Various Dietary Lipids, on Growth Indices, in Striped Murrel, Channa striatus (Bloch) Fingerlings. *Online Journal of Animal and Feed Research.* 2(1): 64-69.
19. Olele, N. F., Onyema, M. I. and Odiko, A.E., (2013). Growth Performance, Survival Rate and Nutrient Profile of Clarias gariepinus Fingerlings Fed Rations of Soybean as Alternative Protein Source. Academic Journal of Interdisciplinary Studies. 2(10):58-66.
20. Shabbir, S., Salim, M. and Rashid, M. (2003). Study on the Feed Conversion Ratio (FCR) in Major Carp (Cirrhinus mrigala) Fed on Sunflower Meal, Wheat Bran and Maize Gluten (30*%). Pakistan Veterinary Journal*. 23(1):1-3.