Greener Journal of Oceanography and Marine Science
Vol. 2(1), pp. 06-11, 2018
ISSN: 2354-2349

DOI Link: http://doi.org/10.15580/GJOMS.2018.1.072518105
http://gjournals.org/GJOMS

Growth Response of Substituting Soya-Bean Meal with Yeast on African Catfish (*Clarias gariepinus*) Fingerlings (Burchell 1822)

EZEAFULUKWE C.F[1]* and ADAKA, G.S[1]

*[1]Department of Fisheries and Aquaculture Technology, Federal University of Technology Owerri, Imo State, Nigeria.

ARTICLE INFO

Article No.: *072518105*
***Type*:** *Research*
DOI: *10.15580/GJOMS.2018.1.072518105*

Submitted: *25/07/2018*
Accepted: *29/07/2018*
Published: *22/09/2018*

Corresponding Author
Ezeafulukwe C.F
E-mail: *emmaocy@ yahoo. com*

Keywords:
Growth response, Soya bean meal, Yeast (Saccharomyces cerevisae) Meal, Clarias gariepinus

ABSTRACT

Growth response of substituting soya bean meal with yeast (*Saccharomyces cerevisae*) meal in diets fed *Clarias gariepinus* was studied for 56 days. One hundred and fifty (150) fingerlings of two weeks old *Clarias gariepinus* in five treatment groups replicated thrice were used for the research. Each replicate had ten fishes. T_1, 0% SBM and YM served as control diet while T_2, 25%; T_3, 50%; T_4, 75% and T_5 100% YM are the other diets respectively. Parameters used were weight gain, feed conversion ratio and specific growth rate. The results showed slightly increase in growth response of *Clarias gariepinus* fed soya bean meal with yeast meal. *Clarias gariepinus* fed with 100% yeast meal (T_5, diet 4) had good performance. Increasing proportion of substitutions of yeast meal in diets fed *Clarias gariepinus* fingerlings, led to weight increase in all dietary types with exception of diet 0 (T_1) and higher growth induction in cat fishes fed diets with exception of diet 0 (control). Diet 4 induced better mean growth than the control diet.

INTRODUCTION

African catfish (*Clarias gariepinus*), family (*Clarridae*) is a North African catfish that is cultured in many tropical and sub-tropical regions of the world (Ezeafulukwe *et al.,* 2015a; Anderson and Fong, 1977). The fish constitutes the largest group of cultured species after *Cyprinus carpio* (common carp), salmonid and tilapia because it adapts and grows well under cultured system. Fish is a major constituent source of human protein source in many tropical and sub-tropical countries (Ezeafulukwe *et al.,* 2013). In order to maintain such a high rate of growth and effective production, there is need to develop cost effective and good quality feeds.

Aquaculture industry in Nigeria is currently faced with the problems of inadequate supply and prohibitive cost of quality fish feeds (Ezeafulukwe and Njoku, 2017). Fagbenro and Adeparusi (2003) reported increasing attempt to develop practical diets for farmed fish in Nigeria. Aquaculture of African catfish is a viable means of augmenting the diminishing returns from the wild (Ezeafulukwe *et al.,* 2015 b, c). The rising cost of operations in culture of this fish is due mainly to astronomical increase in fish feed price which contributes the single reason for low profit (Ezeafulukwe *et al.,* 2017; Ebochuo and Oparaejiaku, 2017a). Competition by man and industry for certain feed ingredients has put price of fish feed out of reach of the fish farmer. This has forced researcher to search for eco-friendly, unconventional ingredients which are available at cheap or no cost in other to substitute and even replace completely, most of the expensive feed ingredients.

Yeast has been unexploited in the development of aqua feed for the fisheries sector. Yeast has been considered to have some nutritional value and can be used as alternative source of protein. Yeast contains vitamins such as niacin, folic acid, riboflavin and biotin, as well as other minerals which are co-factors required for growth. Yeast also contains different quantities of essential amino acids such as threonine (93), valine (116), methionine (63), cysteine (85), Leucine (112), phenyl alanine (91), tyrosine (198), lysine (86), arginine (106) and tryptophan (141) (Spataru *et al.,* 1987). The numbers represents chemical score and limiting essential amino acids of selected protein sources. The need for these essential amino acids, vitamins and minerals was due to the fact that they induce growth, elevate blood parameters and help the immune system to fight against diseases (Ebochuo and Oparaejiaku, 2017b).

Yeast is an excellent source of high quality comparably in value to soya bean. Like soya bean, yeast is rich in lysine which makes both good excellent supplements to cereals whose proteins are generally low in lysine. Yeast is also rich in trace minerals like chromium, selenium, copper, iron, zinc, potassium and magnesium.

Feeding generally increases growth, repair tissues, improves development of reproductive cells and enhances the fish resistance to diseases. Since feed forms the major components of the growth and production of fish, the availability of palatable and digestible feed that meets the nutrient requirement of *Clarias gariepinus* would however increase profitability.

Soya bean meal being the major conventional ingredient in many fish feed is highly sought by other livestock. Some alternatives which might from plants and animal sources are now being used to substitute soya bean meal. Yeast was however used in the study to improve growth of *Clarias gariepinus* and also enhance its immunity and disease resistance (Ogu, 2015).

The study assessed the growth performance and nutrient utilization of *Clarias gariepinus* fingerlings while substituting soya bean meal with yeast as the main objective of the study.

MATERIALS AND METHODS

Study area

Owerri the capital city of Imo State, Nigeria lies within latitude 06^0 29 06s and longitude 07^0 02 06s. The area experiences a longer wert season which lasts from April to November than dry season which last for the rest of the year. It has mean daily maximum temperature range of 28^0C to 35^0C, while daily minimum values ranges from 19^0C to 24^0C, with average humidity of 80%. The vegetation is dominated by semi-deciduous forest that has already been altered by agricultural and other anthropogenic activities and the dominant topsoil is moderately humus in composition.

The study was carried out in the Fisheries and Aquaculture Research Farm of the Federal University of Technology Owerri, Nigeria which provided the farm-raised specimens used for the study. It is bounded by longitudes of 65^0 8'' E- 7^0 03 E and latitudes of 5^0 20'N – 5^0 28'N. The institution has an annual rainfall between 192-194cm and temperature of 32.18^0C.

Sample Collection

The finely grounded yeast was procured from a brewery industry at Onitsha, Anambra State, Nigeria. The dietary ingredients for the diets formulated were bought from a commercial agro service vendor in Owerri, Imo State, Nigeria while the fish used (*Clarias gariepinus*) were obtained from Anyi fish farm in Owerri, Imo State, Nigeria.

Experimental Procedure

Diets with different inclusion levels of soya bean meal and yeast at 0%, 25%, 50%, 75% and 100% were formulated. A total of 150 fingerlings of *Clarias gariepinus* collected from a commercial hatchery with a mean weight 3.00±0.06g were used for the study. The fish were held inside 15 (fifteen) plastic containers each having 10 (ten) *Clarias gariepinus* fingerlings which were randomly distributed into each of the plastic container. Fish were allowed to acclimatize for a period of 7 days before the commencement of the experiment and were starved for 24 hours to empty their gastro intestinal tract.

Each diets was assigned to a group of ten (10) *Clarias gariepinus* fingerlings in triplicate, fish were fed twice daily in the morning hours (8am) and in the evening hours (4pm) respectively.

Fish inside the 15 plastic containers were weighed simultaneously in batches at the end of every two weeks using digital weighing balance and return to their respective enclosures. The feed were adjusted every two weeks when the new mean weight of fish for the experiment were determined, unconsumed feed were siphoned out each week, stale water were renewed in the containers after 3 days from a bore hole at the farm unit. The experimental containers were monitored daily to remove mortality while physic chemical parameters were monitored for temperature, dissolved oxygen, ammonia, P^H and hardness throughout the duration of the experiment for 56 days.

Analysis of Fish samples for nutrient composition

Samples were analyzed chemically in accordance (AOAC, 2005).

Crude protein determination

Crude protein was determined in accordance with AOAC (2005). The crude protein in the sample was determined by the routine semi micro Kjeldahl, procedure and technique. This consists of three techniques of analysis, namely, digestion, distillation and titration.

Statistical analysis

The two sets of data on nutrient composition emanating from fish were subjected to analysis in accordance with DNMRT (Gordon and Gordon, 2014).

RESULTS

Table 1-6 presents the gross composition of the experimental diet, proximate analysis of experimental diets, proximate analysis of yeast, proximate analysis of experimental fish (*Clarias gariepinus*) fingerlings, physio – chemical parameters assessed and growth parameters of *Clarias gariepinus* fed with five different diets as evaluated. A total of five parameters were considered including crude protein, crude fat, crude fibre, ash and moisture.

Table 1: Gross Composition of Experimental Diet

Ingredients	100%/0%	75%/25%	50%/50%	25%/75%	0%/100%
Fish meal	33.94	33.94	33.94	33.94	33.94
Soya bean	33.96	25.47	16.98	8.49	0.00
Yeast	0.00	8.49	16.98	25.47	33.96
Yellow maize	19.85	19.85	19.85	19.85	19.85
Wheat bran	5.00	5.00	5.00	5.00	5.00
Bone meal	1.50	1.50	1.50	1.50	1.50
Fish premix	1.50	1.50	1.50	1.50	1.50
Vitamin C	0.50	0.50	0.50	0.50	0.50
Cod liver oil	1.00	1.00	1.00	1.00	1.00
Palm oil	1.00	1.00	1.00	1.00	1.00
Lysine	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Common salt	0.25	0.25	0.25	0.25	0.25
Starch	1.00	1.00	1.00	1.00	1.00
Total	100.00	100.00	100.00	100.00	100.00

Table 2: Proximate Analysis of Experimental Diets

Parameters	Diet 0	Diet 1	Diet 2	Diet 3	Diet 4
Moisture	15.19%	13.45%	12.07%	10.64%	14.47%
Ash	9.52%	11.70%	9.99%	10.56%	11.07%
Fat	6.85%	8.40%	8.10%	6.76%	7.72%
Crude Protein	50.53%	54.93%	54.47%	60.56%	68.14%
Fiber	3.50%	2.25%	2.30%	1.20%	1.00%

Table 3: Proximate Analysis of Yeast

Parameters	Percentage (%)
Moisture	10.84
Ash	5.05
Fat	8.27
Fibre	4.50
Protein	38.21

Table 4: Proximate Analysis of Experimental Fish (*Clarias gariepinus*) Fingerlings

Parameters	Initial	Diet0	Diet1	Diet2	Diet3	Diet4
Crude Protein	14.80%	16.65%	16.05%	16.62%	16.56%	17.18%
Moisture	81.10%	81.74%	80.19%	79.22%	79.53%	70.50%
Ash	1.75%	0.19%	2.37%	1.80%	2.06%	1.23%
Fiber	0.45%	0.40%	0.25%	0.30%	0.35%	0.35%
Fat	1.60%	1.02%	1.14%	2.06%	1.50%	0.74%

Table 5: Physio – Chemical Parameters Assessed

Parameters	$T_1(D_0)$	$T_2(D_1)$	$T_3(D_2)$	$T_4(D_3)$	$T_5(D_4)$
Temperature (0^oC)	27.17±0.31 [a]	27.13±0.31 [a]	26.71±0.19 [a]	27.00±0.33 [a]	27.17±0.29 [a]
Water pH	6.29±0.04 [a]	6.29±0.04 [a]	6.29±0.04 [a]	6.38±0.11 [a]	6.35±0.13 [a]
Ammonia (mgl)	2.58±0.14 [a]	2.58±0.14 [a]	2.83±0.29 [a]	2.92±0.14 [a]	2.83±0.28 [a]
Dissolve Oxygen (mgl)	7.72±0.14 [ab]	7.90±0.13 [b]	7.69±0.17 [ab]	7.65±0.15 [a]	7.62±0.06 [a]
Hardness	147.5±6.96 [a]	143.8±6.50 [a]	147.9±1.44 [a]	145.42±3.61 [a]	143.0±6.17 [a]

No significant differences ($p>0.05$) were observed in all parameters in physio – chemical assessments except in dissolved oxygen where T_2 (diet 1) varied significantly ($p<0.05$) from the other treatments as shown in Table 5 above.

Table 6: Growth Parameters of *Clarias gariepinus* Fed with Five Different Diets

Parameters	$T_1(D_0)$ $T_2(D_1)$	$T_3(D_2)$	$T_4(D_3)$	$T_5(D_4)$	
Initial Weight (g)	43.86±0.97 [b]	43.60±0.92 [b]	43.42±0.19 [b]	43.62±0.96 [b]	43.98±0.74 [b]
Final Weight (g)	74.21±2.41 [a]	118.14±40.87 [b]	119.92±12.96 [b]	171.36±13.95 [c]	2015.30±9.27 [c]
Mean Weight Gain (g)	30.36±3.33 [a]	74.29±39.95 [b]	76.36±12.94 [b]	127.72±14.70 [c]	161.72±9.26 [c]
Mean Daily Weight Gain (g)	0.54±0.06 [a]	1.07±1.03 [a]	1.37±0.23 [a]	2.26±0.26 [b]	2.87±0.17 [b]
Specific Growth Rate (%/day)	0.94±0.09 [a]	1.67±0.54 [b]	1.81±0.19 [b]	2.40±0.17 [c]	2.71±0.09 [c]
Feed Conversion Ratio	3.05±0.36 [a]	2.97±1.30 [a]	2.33±0.41 [a]	1.97±0.24 [a]	1.92±0.11 [a]
Protein Efficiency Ratio	0.83±0.91 [a]	1.00±0.54 [a]	1.09±0.19 [a]	1.37±0.29 [a]	1.30±0.07 [a]
Feed Intake (g)	91.84±0.01 [a]	184.37±0.01 [b]	174.88±0.01 [b]	245.70±0.01 [bc]	307.65±0.01 [c]
Daily Feed Intake (g)	1.64±0.01 [a]	3.29±0.01 [b]	3.12±0.01 [b]	4.39±0.01 [c]	5.49±0.01 [c]
Protein Intake	36.74±0.01 [a]	73.75±0.01 [b]	69.95±0.01 [b]	98.28±0.01 [bc]	123.06±0.01 [c]
Survival Rate	60.00±0.01[a]	96.67±5.77[c]	86.67±5.77[b]	90.00±0.01[bc]	93.33±5.77[c]

Treatment means within the same row with different superscript letters a, b, c are significantly different ($p<0.05$).

There were no significant difference ($p>0.05$) among the following parameter initial weight, feed conversion ratio and protein efficiency ratio as shown in Table 6 above. Significant difference ($p<0.05$) interactions between diets were seen in the following parameters final weight, mean daily weight gain, specific growth, feed intake, daily feed

intake, protein intake and survival rate as indicated in Table 6 above.

DISCUSSION

The increased mean weight gain and specific growth rate observed in catfish fed 100% yeast meal based diet may be due to effect of protein. This observation tarried with the findings of Eyo (2005) who stated that hybrid catfish *Heterobrachus bidorsalis* X *Clarias gariepinus* starved energy source stirred protein molecules thus affecting growth of the fishes. However, Jarmolowicz *et al.,* (2012) reported the effect of brewer's yeast extract on growth while Yua*n et al.,* (2012) reported a significant negative relationship between growth response and the level of fish meal protein requirement with fermented soya bean meal.

The specific growth rate obtained in the study were better than that reported for *Oreochromis niloticus* in the replacement of fish meal with yeast (Ebrahim and Abou-Seif, 2008; Bob-Manuel and Alfred-Ochiya, 2011).

The fish with the highest weight increase had the highest carcass protein and lowest moisture content. The high carcass protein observed was due to good protein retention for growth and also because the energy available in the diets were adequate to spare the protein. A similar observation reported for *Oreochromis niloticus* (Ebrahim and Abou-Seif, 2008). The carcass crude lipid increased with the high levels of yeast but at low levels, there was observable difference (Ogu, 2015). This result varied from the findings of (Carter and Hauler; Lewis and Kohler, 2008; Ebrahim and Abou-Seif, 2008) who noticed no difference in crude lipid with fish replacement but was similar to Kikuchi (1991) where lipid increased with fish meal replacement.

CONCLUSION

Yeast could be substituted for soya bean as protein in fish diets at different levels of inclusion. The various levels of yeast replacement for soya bean meal in the four tested diets were suitable for *Clarias gariepinus* because of enhanced nutritional status, higher growth rate and improved health of fish.

REFERENCES

Anderson, J.L and Fong, Q.S.W (1977). Aquaculture, Economics and Management. *J. Int. Assoc. Aquacult. Econ. Manag. 1 (2): 112.*

AOAC (2005). Association of Official Analytical Chemist. Official Method of Analysis.

Washinton D.C. pp 146.

Carter, C.G and Hauler, R.C (2000). Fish meal replacement by plant meals in extruded feeds for Altantic salmon, *Salmo salar* L. *Aquaculture*, 185: 299-311.

Ebrahim, M.S.M and Abou-Seif, R.A (2008). Fish meal replacement by yeast protein (*S. cerevisiae*) supplemented with biogenic L- carintine as a source of methionine plus lysine mixture in feed for Nile Tilapia (*Oreochromis niloticus*) fingerlings. *8th International Symposium on Tilapia in Aquaculture*. Pp. 999-1009.

Ebochuo V.C. and Oparaejiaku, J. (2017a). Nutritive value and organoleptic attributes of Xylopia Aethiopica pre-treated smoke cured Clarias Gariepinus (Burchell, 1822). *Direct Res. J. Biol. Biotechnol. Sci.* 3 (3): 56 – 59.

Ebochuo V.C. and Oparaejiaku, J. (2017b). Microbial Evaluation of *Carica papaya* Leaf Extract Pre-Treated Smoke cured Grass Eater (*Distichodus rostratus* Gunther 1864). *CARD International Journal of Agricultural Research and Food Production.* 2 (3): 84 -96

Eyo, J.E (2005). Effects of substituting soya bean meal for maggot in acceptability of diets, growth performance and cost benefit of diets fed to hybrid catfish *Heterobrachus bidorsalis* X *Clarias gariepinus*. *J. Sci. Technol. Res.* 4: 38 – 43.

Ezeafulukwe, C. F. and Njoku, D.C. (2017). Comparative studies on haematology of *Clarias gariepinus* from two different aquatic environments. *Direct Res. J. Biol. Biotechnol. Sci.* 3 (2): 36-39.

Ezeafulukwe, C.F, Onuoha, L.C and Ahaotu, E.O (2017). Growth performance of *Clarias gariepinus* (Buchell 1822) fed varying inclusion levels of cassava flour. *Greener Journal of Biological Sciences,* 7(5) : 045-049.

Ezeafulukwe, C.F, Njoku, D.C, Anyanwu, C.N, Madu, H.C, Ekeledo, C.B and Adaka, G.S (2015a). Comparative studies on nutrient composition of wild and pond-reared catfish, *Clarias gariepinus* (Burchell, 1822). *Inter J Vet Sci*, 4(3): 127-130.

Ezeafulukwe, C.F, Njoku, D.C, Anyanwu, C.N, Amadi-Eke, A.S, Nwaka, D.E, Opara, A.C, Ekeledo, C.B, Adaka, G.S, Madu, H.C and Agorua, U.N (2015b). Patterns of growth and the degree of correlation between length and weights of cichlid fishes in two aquatic environments in Imo State, Nigeria. *Inter J Agri Biosci,* 4(5): 185-187.

Ezeafulukwe, C.F, Njoku, D.C, Ekeledo, C.B and Adaka, G.S, (2015c). Morphomeristic characteristics of selected cichlid fishes from two aquatic environments in Imo State, Nigeria. *Inter J Vet Sci,* 4(3): 131-135.

Ezeafulukwe, C.F, Ahaotu, E.O, Madubuike, F.N and L.E Osuagwu (2013). Effect of Fertilization of Fish Pond with Graded Levels of Pig Dung on the Performance of *Clarias gariepinus* (Cat Fish) raised under Tropical Conditions. *Inter J Appl Sci Engr, 1(1): 31-36*.

Fagbenro, A.O and Adeparusi, E (2003). Feedstuff and dietary substitution for farmed fish in Nigeria. Paper presented in Pan African Fish and Fisheries *Conference, Contonou, Benin Rep.* 276-278pp.

Gordon, S. P and Gordon, F. S (2014). Contemporary Statistics: A computer Approach. Mc.Graw – Hill Publishers, U.S.A. pp 98 -112.

Jarmolowicz, S, Zakes, S.I, Wicki,A, Kowalska, A, Hopko, M, Glabski,E, Demska, Z.K and Partyka, K (2012). Effects of brewer's yeast extract on growth performance and health of juvenile pikeperch *Sander lucioperca* (L). *Aquacult. Nutr.* 18: 457-464

Lewis, H.A and Kohler, M (2008). Corn gluten meal partially replaced dietary fish meal without compromising growth or fatty acid composition of Sunshine bass. *North Am. J. Aquacult*. 70 :50-60.

Ogu, L.N (2015). The Effect of Substituting Soya Bean Meal with Brewer's Yeast on the Growth and Nutrient Utilization of African Catfish (*Clarias Gariepinus*) Fingerlings (Burchell 1822). B. Agric Tech Thesis. Federal University of Technology Owerri, Nigeria. 60pp.

Spataru, P., Viveen, W.J.A.R and Gophen, M. (1987). Food composition of *Clarias gariepinus* in Lake Kinneret (Israel). *Hydrobiologica 144: 77 – 82.*

Yuan, Y.C, Lin,Y.C, Yang, H.S, Gong, S.Y and Yu, D,H (2012). Evaluation of fermented soya bean meal in the practical diets for juvenile sucker, *Myoyprinus asiaticus*. *Aquacult. Nutr.* 10: 1365-2095.

Cite this Article: Ezeafulukwe CF, Adaka GS (2018). Growth Response of Substituting Soya-Bean Meal with Yeast on African Catfish (*Clarias gariepinus*) Fingerlings (Burchell 1822). Greener Journal of Oceanography and Marine Science, 2(1), 06-11, http://doi.org/10.15580/GJOMS.2018.1.072518105.