Eco. Env. & Cons. 28 (November Suppl. Issue) : 2022; pp. (S268-S272)
Copyright@ EM International
ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2022.v28i07s.044

Growth surveillance of *Catla catla* fingerlings fed on potato peel diet

Mansha Ansari and Nandita Singh*

Department of Zoology, G.M.Momin Women's College, University of Mumbai, Thane, M.S., India

(Received 18 March, 2022; Accepted 13 May, 2022)

ABSTRACT

Large amounts of potatoes are presently used to prepare value-added food items to fulfil the requirement, particularly from the fast food and packaged foods industries. As a result, large amounts of peels are produced, posing a serious disposal dilemma for the business, especially given the growing awareness of the importance of limiting environmental effect and ensuring long-term sustainability. The present study was done by incorporating 5%, 10% and 20% potato peel in the diet of *Catla catla.* Long term dietary study showed the highest percentage weight gain in 20% potato peel diet, followed by 10 % potato peel, 5% potato peel and control. Similarly results was seen in the gain of length of the fish. Highest percentage length gain was observed in 20% potato peel diet followed by 10 % potato peel, 5% potato peel and control. Throughout study, the fish remained healthy and survival rate was 100 %.

Key words*: Fish feed, Potato peel, Aquaculture, Alternative Feed, Catla catla*

Introduction

The growing population is expanding at an accelerating rate. This scenario necessitates immediate actions and a confrontational strategy to food cultivation in order to sustain the existing massive human population and alleviate food insecurity and hunger. Aquaculture development is one of the viable answers to developing nations lack of animal protein consumption (The World Fish Center The Millennium Development Goals: Fishing for the future 2007). People in underdeveloped countries rely heavily on fish for both sustenance and revenue. Fish is high in protein, lipids, vitamins, and minerals. When contrasted to other sources of protein, fish are well considered to be great sources of protein, as evidenced by protein content and protein efficiency ratio (Astawan *et al.,* 2004).

Aquaculture is among the world 's rapidly growing industries, with Asia currently accounting for over 90% of worldwide production (Jauncey *et al.,* 1982). The enormous growth of India's aquaculture businesses has also resulted in an increase in the manufacturing of commercial feed (Samaddar, 2018). As a result, production costs have risen because fish feed contributes for more than 60% of overall operational expenses in aquaculture farms. The increased cost of feed is mostly due to the substantial dependence on protein sources such as fishmeal as well as shrimp meal (Lim *et al.,* 1997; Omoregie, 2009). Because of the scarcity and elevated cost of pelleted diets, the progression of low-cost fish farming systems appropriate for small farmers in developing nations has been severely hampered; thus, there is a necessity to investigate the potential of non-traditional raw materials that would be more inexpensive to use in fish diet than high-cost animal protein substances (Omoregie *et al.,* 1993).

The quantity of fruit and vegetable waste (FVW)

produced by metropolitan populations is increasing on a daily basis, putting a significant strain on the ecosystem. In India, over 35 million tones of fruits and vegetables are processed annually and this resulted in about 10 million tones of wastes (Patel *et al.,* 1972). FVW may be used as a viable option for livestock and fish diets. Nowadays, the incorporation of FVW in fish diet may be a viable option because it is both ecologically friendly and reduces manufacturing costs. FVW are an excellent source of energy and a rich source of many phytochemicals (Peschel *et al.,* 2006; Amado *et al.,* 2014). Among ruminant as well as monogastric feeds, a variety of vegetable residues and wastes like baby corn, cabbage, carrot, cauliflower, cucumber, pineapple, peas, potato, sweet potato, tomato, and radish leaves are employed (Bakshi *et al.,* 2016). In contrast the use of vegetable waste in fish diet, remains an under utilised source. The utilization of such waste substances in the processing of fish feeds directly not only solves the dilemma of fish dietary requirements, but also helps to reduce ecological pollution.

Potato (*Solanum tuberosum*) is amongst the most widely grown and consumed vegetables on the planet. India produced approximately 46 million metric tons of potato in 2014 (FAOSTAT, 2014). Potato is often used as a raw resources in the canning, cornstarch, and flour companies, as well as in packaged foods like chips, French fries, mashed potatoes, and frozen cuisine. The potato industry produces a lot of potato waste. One-quarter of what enters into a potato processing factory is wasted (Cardoen *et al.,* 2015). Potato peel waste, which accounts for the majority of processing waste, is a significant disposal challenge for the potato business, particularly because wet peels are susceptible to quick microbial deterioration. Potato peel, on the other hand, has a variety of nutritionally intriguing components (Charmley *et al.,* 2006). The current study was developed to evaluate the feasibility of integrating potato peel powder as a feed addition in *Catla catla*.

Materials and Methods

Experimental setup

Fish fingerlings of *Catla catla* were collected from the Aarey Colony fish farm, Mumbai. The fishes were kept in the experimental tank for a week for acclimatization to the laboratory conditions. The experiment consisted of four treatments (T_1, T_2, T_3 and T_4) with three replicates each for a period of 90 days. Before starting the experiment total length and weight of each fishes were recorded. Each diet was fed to fish at 5% of total fish wet weight per tank per day. The parameters such as Weight gain (WG), Specific Growth rate (SGR), Average Daily Gain (ADG), and Length gain (LG) were estimated by following the methodology of Brown (1957).

Experimental diet

Potato peels were procured from local vegetable market. Potato peels was processed as given by Singh and Rajini (2004). Experimental feeds were prepared by inclusion of potato peel powder @5%, 10% and 20% in the basal diet by partial replacement of all the ingredients. All the ingredients were properly weighed as per their inclusion rate in all the experimental feed. One control group was fed with basal feed without any potato peel powder supplementation (Table 1).

Water quality in all the treatments was analyzed at weekly intervals with respect to temperature, pH, dissolved oxygen, and total alkalinity, as per standard methods of APHA (2005). Fish growth in terms of total body length and body weight was recorded at monthly intervals. At the end of the study, survival of fish and fish growth were calculated with the help of following formulae :

Net Weight Gain (NWG)= Average final Body Weight (BW) (g) – Average initial Body Weight (BW) (g)

Net Length Gain (NLG) = Average final Body Length (BL) (g) – Average initial Body Length (BL) (g)

Specific Growth Rate (SGR) = ln final BW (g) – ln initial BW (g) / culture days × 100 (where, ln = Natural Logarithm)

Average Daily Gain (ADG) = Weight gain (g) / Culture days

The results obtained were statistically analyzed.

Results and Discussion

The water quality parameters is shown in Table 2. The water quality parameters were found to be in normal range. During experimental period, fishes showed active swimming, and fed regularly. Fishes in all the experimental groups showed healthy features. No mortality was recorded.

Result of growth performance in various treatment groups is shown in Table 3. The initial weight

in treatment T1, T2, T3 and T4 was 9.21±0.17, 9.51±0.28, 9.50±0.26 and 9.58±0.22 respectively. The final weight gain was recorded high in T4 (27.81±0.52) followed by T3 (24.77±0.52), T2 (21.73±0.24) and T1 (13.78±0.49) (Figure 1). In present study, the fishes of treatment T4 showed 140.67% higher growth in comparison to T1 (control), 61.80% higher than T2, and 29.55% higher than T3. Similar results were reported by Sachan *et al.* (2016), the net weight gain were highest in Catla catla fed with combination of fruit waste (5%) and vegetable waste (5%) in comparison to control diet. Similar observations of growth parameters were reported in case of Labeo rohita fed with potato peel diet reported by Maske and Satyanarayan (2012) and Verma and Satyanarayan (2016). Furthermore highest growth and survival rate of tropical gar fish larvae were found feeding potato treated feed (Frías Quintana *et al.,* 2017). Like fish, higher weight gain and survival rate and good FCR was recorded from monogastric animal such as poultry ration containing potato meal (Sultana *et al.,* 2016).

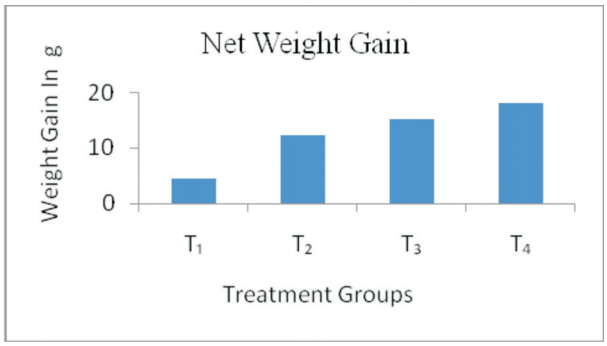

Fig. 1. Net Weight Gain in Different Treatment Groups

With respect to growth parameters, the significantly high average daily gain (ADG) was recorded in treatment T4 (0.20±0.011) followed by T3 (0.16±0.011) T2 (0.13±0.09)and T1 (0.051±0.003) (Figure 2). Highest specific growth rate (SGR) was observed in T4 (1.18±0.012) followed by T3 (1.06±0.015) T2 (0.91±0.010) and T1 (0.44±0.012) (Figure 3). This is comparable with the findings of Ali *et al.* (2017) where they evaluated the growth effectiveness of *Cyprinus carpio* supplied with various graded concentrations of processed potato peels (PP) and the best specific growth rate was obtained in the fish fed 30% potato peel diet which was followed by 45% potato peel diet while the least increase in specific growth rate (SGR%) was observed with control diets. Another study by Deka *et al.* (2016) revealed that

Table 1. Details Showing of feeding treatment groups in fishes

T_1(Control)	T_2	T_3	T_4
Basal feed	Basal feed + @5% of potato peel powder	Basal feed + @10% of potato peel powder	Basal feed + @20% of potato peel powder

Table 2. Water quality parameters during the experimental period.

Water parameters	T_1	T_2	T_3	T_4
Temperature (°C)	29.45 ± 1.13	29.13 ± 1.06	29.03 ± 1.32	29.48 ± 1.32
pH	7.42 ± 0.46	8.13 ± 0.82	8.35 ± 0.44	8.40 ± 0.37
Dissolve oxygen (mg/l)	8.15 ± 0.16	8.22 ± 0.76	8.34 ± 0.10	8.42 ± 0.12
Alkalinity (mg/l)	185.45 ± 12.13	197.45 ± 17.13	192.45 ± 15.13	193.45 ± 14.11

Table 3. Growth parameters of *Catla catla* fed with different diets

Growth Parameters	T1	T2	T3	T4
Initial Weigth (g)	9.21 ± 0.17	9.51 ± 0.28	9.50 ± 0.26	9.58 ± 0.22
Final Weight (g)	13.78 ± 0.49	21.73 ± 0.24	24.77 ± 0.52	27.81 ± 0.52
Net Weight Gain	4.56 ± 0.61	12.25 ± 0.12	15.27 ± 0.54	18.23 ± 0.41
Initial Length (cm)	6.62 ± 0.53	6.27 ± 0.27	6.4 ± 0.26	6.34 ± 0.91
Final Length (cm)	8.82 ± 0.20	11.62 ± 0.87	16.07 ± 0.27	18.21± 0.11
Net Length Gain	2.22 ± 0.40	5.35 ± 0.60	9.65 ± 0.50	11.91 ± 0.82
Average Daily Gain	0.051 ± 0.003	0.13 ± 0.09	0.16 ± 0.011	0.20 ± 0.011
Specific Growth Rate	0.44 ± 0.012	0.91 ± 0.010	1.06 ± 0.015	1.18 ± 0.012
Survival	100%	100%	100%	100%

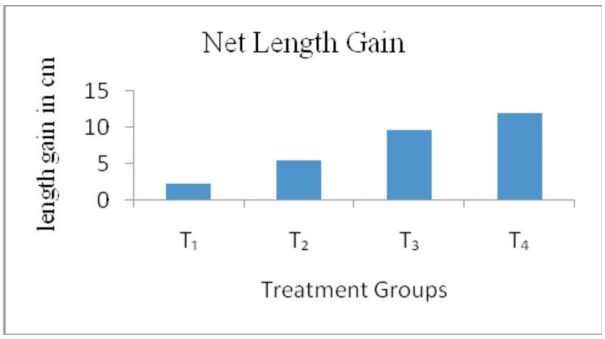

Fig. 2. Net Length Gain in Different Treatment Groups

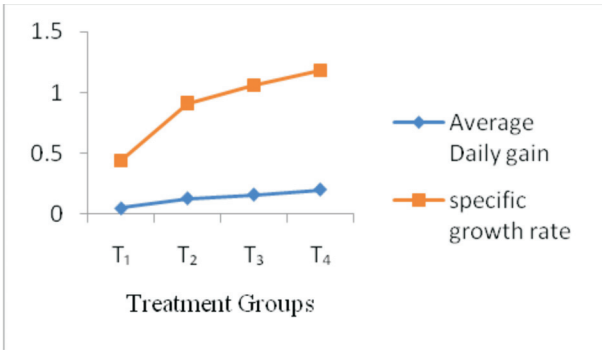

Fig. 3. Average Daily Gain and Specific Growth Rate in Different Treatment Groups

the diet including pineapple waste resulted in significantly better % SGR, as compared to that on the fish meal based control diet.

Conclusion

With respect to results obtained in this study, the best results were obtained in T4 with 20% incorporation of potato peel powder in comparison to its lower inclusion level. Carps being herbivorous fish can utilize potato peel powder mixed diet, efficiently. There is hardly any study reported till now regarding the use of potato peel powder in carps feed. Hence, from the present study, it can be concluded that potato peel powder have a considerable potential as supplementary feed ingredients for partial replacement of different ingredients in conventional feed of *Catla catla*.

References

Amado, I. R., Franco, D., Sánchez, M., Zapata, C. and Vázquez, J. A. 2014. Optimisation of antioxidant extraction from *Solanum tuberosum* potato peel waste by surface response methodology. *Food Chem.* 165: 290-299.

APHA, 2012. *Standard Methods for the Examination of Water and Waste Water.* 22nd ed. American Public Health Association, Washington, D.C.

Astawan, M. 2004. "Ikan yang Sedap dan Bergizi". Tiga Serangkai. Solo : 1–7.

Bakshi, M. P. S., Wadhwa, M. and Makkar, H. P. S. 2016. Waste to worth: vegetable wastes as animal feed. *CAB Reviews.* 11(12),

Brown, M.E. 1957. Experimental Studies on Growth. pp. 361-400. In: W.S. Hoar and D.J. Randall (eds.). *Physiology of Fishes.* Vol. 1. Academic Press, New York

Cardoen, D., Joshi, P., Diels, L., Sarma, P. M. and Pant, D. 2015. Agriculture biomass in India: Part 1. Estimation and characterization. *Resources, Conservation and Recycling.* 102: 39–48.

Charmley, E., Nelson, D. and Zvomuya, F. 2006. Nutrient cycling in vegetable processing industry: Utilization of potato peel by-products. *Canadian Journal of Soil Science.* 86 : 612-629.

Deka, A., Sahu, N.P. and Jain, K.K. 2016. Utilization of Fruit Processing Wastes in the Diet of *Labeo rohita* Fingerling. Fish Nutrition Division, CIFE, 7-Bungalows, Versova, Andheri (W), Mumbai-61-1661 (2003)

El-Nadi, Ali and Ahmed, Hesham and Zeinhom, Mohamed, 2018. Graded Levels of Potato Peels Effects as Partial Replacement for Corn in Dite of Common Carp (*Cyprinus carpio*). *International Journal of ChemTech Research.* 10(2): 566-572

FAOSTAT. FAO, 2014. FAOSTAT [WWW Document]. URL http://faostat.fao.org/ (accessed at 21/2/2017).

Frías-Quintana, C. A., C. A. Álvarez-González, D. Tovar-Ramírez, R. Martínez-García, S. Camarillo-Coop, E. Peña, and Galaviz, M. A. 2017. Use of Potato Starch in Diets of Tropical Gar (*Atractosteus tropicus*, Gill 1863) Larvae. Fishes, 2(1): 3

Garg, M. 2015 Nutritional Evaluation and Utilization of Pea Pod Powder for Preparation of Jaggery Biscuits. *J. Food Process Technol.* 6 : 522.doi:10.4172/2157-7110.1000522

Jauncey, K. and Ross, S. 1982. *A Guide to Labeo rohita Feed and Feeding*. University of Sterling, Scotland.

Kaur, S., Kaur, V. I., Hollyappa, S.A. and Khairnar, S. O. 2016. Effect of dietary supplementation of synthetic and natural β-carotene on survival, growth and pigmentation in freshwater ornamental fish koi (*Cyprinus carpio* L.) carp. *Indian J. Anim. Nutri.* 33(4): 448-455.

Lim, C., Eales, R.M., Prendergast, J.G., Mcleese, A.F., Shearer, J.M. and Higgs, D.A. 1997. Nutritive values of low and high fibre canola meals for shrimps (*Ipenaeus vannamei*). *Aquacult. Nutr.* 3 : 269-279.

Maske, N. S. and Satyanarayan, S. 2012. Effect of special

fish feed prepared using potato peels on fresh water fish *Labeo rohita*. *J. Indust. Poll. Cont.* 29 : 245-267.

Omoregie, E. and Ogbemudia, F.I. 1993. Effect of substituting fishmeal with palm kernel on growth and food utilization of the Nile Tilapia, (*Oreochromis niloticus*). *Israeli J. Aquacult.* 43 : 113-119.

Omoregie, E., Igoche, L., Ojobe, T. O., Absalom, K. V. and Onusiriuka, B. C. 2009. Effect of varying levels of sweet potato (*Ipomea batatas*) peels on growth, feed utilization and some biochemical responses of the cichlid (*Oreochromis niloticus*). *African J. Food AgriNutri Develop.* 9(2): 700-712.

Patel, B.M., Patel, C.A. and Talpada, P.M. 1972. Evaluation of mango seed kernels and tomato waste in the ration of bullocks. *Indian J Nutr Diet.* 9(6) : 347-350.

Peschel, W., Rabaneda, F. S., Diekmann, W., Plescher, A. and Gartzía, I. 2006. An industrial approach in the search of natural antioxidants from vegetable and fruit wastes. *Food Chem.* 97 : 137-150.

Samaddar, A. 2018. A review of fish meal replacement with fermented biodegradable organic wastes in aquaculture. *Int. J. Fish. Aquatic Stud.* 6(6): 203-208.

Singh, N. and Rajini, P.S. 2004. Free radical scavenging activity of an aqueous extract of potato peel. *Food Chemistry.* 85: 611-616.

Sultana, F., Khatun, H. and Ali, M. A. 2016. Use of potato as carbohydrate source in poultry ration. *Chem. Biol. Tech. Agric.* 3 : 30.

Tewari, Grishma, Pandey, Abhed and Holeyappa, Shanthanagouda anad Hundal, Jaspal. 2019. Effect of Pea Pod as Feed Ingredient on Growth Performance of Common CARP, CYPRINUS CARPIO. 22. 795-799.

The World Fish Center The Millennium Development Goals: Fishing for the future 2007. Brochure No. 1709. Zargar, S., Mulmule, G.V. and Ghosh, T.K. 2010. Development of low cost fish feed using by-products and nutritious food industry wastes. *Journal of IAEM.* 37(1) : 1 05-109.

Verma, S. R. and Satyanarayan, S. 2016. Effect of special fish feed prepared using food industrial waste on *Labeo rohita*, Fisheries and Aquaculture in the Modern World. Intech Open, UK.

Yogesh Sachan, Shyama, S. Rakesh Pratap Yadav, Rejoice Uchoi and Sreenath V.R. Research, 2016. *Journal of Animal, Veterinary and Fishery Science*. ISSN 2320 – 6535, 4(2): 7-12, February.