Research Paper

Volume : 2 | Issue : 4 | Apr 2013 • ISSN No 2277 - 8179

Animal By-Products for Freshwater Aquaculture in India

Fisheries

KEYWORDS : animal by-product, fish offal, fishmeal, protein

Kausik Mondal Assistant Professor, Department of Zoology, Sidho-Kanho-Birsha University, Purulia-723101, India

ABSTRACT

The quest for protein sources alternative to fish meal has been a priority in aquaculture research because of growing concerns on the future availability of fish meal for incorporation in fish diets. Animal by-product contains high amount of protein and lipid. This study was to evaluate the potentials of different animal by-product for inclusion into formulated diet of fish and partially substitute the fishmeal fraction The outcome of the study is that the wastes after processing can be effectively used as a feed ingredient to replace fish meal partially or fully in the diet for fish.

Introduction

Aquaculture is a growing industry in India. More than seven million fishers and fish farmers in the country depend on fisheries and aquaculture for their livelihood and another six million people are engaged directly and indirectly in related industrial activities (Ayyappan & Ahamad Ali, 2007). While production from capture fisheries has almost stagnated at about 3.5 million tonnes, aquaculture production has grown from 1.66 to 2.47 million tonnes during the last two decades. Freshwater aquaculture with a growth rate of average 6.6 % per year is the largest contributor (2.34 million tonnes) of this production and the carps alone shared about 90.5 % of it, the three Indian major carps (*Labeo rohita, Catla catla* and *Cirrhinus mrigala*) together contributing about 59.7 % of the total freshwater aquaculture production (Suresh 2007).

Fish nutrition and feeding have been identified as the most important limiting factors for the economical and environmental sustainable development of freshwater aquaculture in India. The feed mixture used for most freshwater carp culture in India generally consists of rice polish / rice bran, groundnut oil cake, roasted soybean meal and some fishmeal with occasional use of a mixture of fish/vegetable oil and a premix of vitamins and minerals (Mukhopadhyay & Mitra 2007). Since use of manufactured feed could substantially reduce the food conversion ratio and increase overall production, improvement of feed formulation and development of cost effective, eco-friendly manufactured feed have become a priority issue in freshwater aquaculture in recent years. The present annual requirement of manufactured feed for aquaculture is about 2.59 million tonnes, but only 200,000 – 250,000 tonnes of feed are manufactured per annum in the country (Suresh 2007). While there is an adequate domestic feed ingredient resource base in the country, the huge gap between requirement and production of manufactured aquafeed is mainly due to poor production of quality fishmeal. Fishmeal production in India is split into production of high quality sterile fish meal (crude protein 55-60 %) and lower quality fish meal made from sun-dried trash fish. At present, only 5,000-6,000 tonnes of high quality fish meal and 100,000 to 130,000 tonnes of low quality fish meal is produced annually in the country necessitating import of fish meal from abroad (Ayyappan & Ahmad Ali 1997) or relying on non-conventional sources of animal and plant protein. Global cyprinids production in 2007 accounted for over 10 million tonnes, utilizing an estimated 430,000 tonnes of fish meal (Tacon & Metian, 2008).

The main objective of this study was to evaluate the potentials of different animal by-product for inclusion into formulated diet of fish and partially substitute the fishmeal fraction.

Materials and methods

Shrimp head meal, crab meal, poultry waste meal, meat and bone meal and blood meal, leather meal and fish meal collect from market. The fish offal, comprising viscera of cultured carps (*Labeo rohita* and *Catla catla*), was obtained from the local retail fish markets. The portion of guts contained in the offal was carefully uncoiled, cut open and the gut contents were removed using clean water.

Proximate analyses of the Shrimp head meal, crab meal, Poultry waste meal, meat and bone meal and blood meal of slaughter house waste, leather meal, fish meal and fish offal meal were performed following the AOAC procedures (Helrich 1990) as follows: crude protein (nitrogen × 6.25) was determined by Kjeldahl method, after acid hydrolysis; lipid was extracted by petroleum ether (boiling point 40–60ºC) for 7–8 h in a Soxhlet apparatus followed by determination of lipid gravimetrically and ash was determined by combustion at 550ºC, in a muffle furnace, till a constant weight.

Result and Discussion

Different types of animal by-product that are frequently used for the formulation of diet for fish. The proximate composition of animal by-products are: Shrimp head (waste) meal (Crude protein (CP): 59.1%, Crude lipid (CL): 22 % and ash 3.1%); crab meal (CP: 32 %, Crude lipid CL: 1.5 % and ash: 14 %); silkworm pupae (CP: 71 %, CL: 19 % and ash 6.8 %); poultry feather meal (CP:78.8 %, CL: 10.6 % and ash 4.6%); slaughter house wastes such as meat and bone meal (CP: 56.8 %, CL: 9.4 % and ash: 28.9 %) and blood meal CP:82 %, CL:2.8 % and ash:4.6 %). Another most important and easily available by-product is fish offal. Huge amount of fish offal are generated daily basis in our retail and wholesale market. Very commonly available fish of our market is Rohu (*Labeo rohita*) and Catla (*Catla catla*). The average net weight of the consumable parts available from Rohu and Catla, excluding the head portion, are around 657 and 626 g/kg of fish respectively, while the amount that is unusable and is generally disposed of as waste is around 180 and 150 g/kg of Rohu and Catla respectively. Gut length of rohu and catla, are around 7.6 meter and 5.4 meter respectively. Therefore, unusable wastes potentially generated from the supply of carps to the three wholesale markets of Kolkata ranges from 3,175 to 11,907 kg / day. Viscera typically contain 31.5 to 38.9 % protein and 40.6 to 43.8 % lipid (Mondal et al. 2006). Carps have a long intestine (Plate 1 and 2) which allows for digestion of a variety of feedstuff and they also have a high amylase activity. Viscera of Catla have a slightly higher content of lipid than that of Rohu while the later contain a higher amount of protein due to its greater gut length.

Large quantities of wastes and by-products are produced every day in India. Disposal of these wastes and by-products greatly affects the local environment. Recycling nutrients, of these wastes and by-products through formulation of diet for fish is a viable option of eco-friendly disposal of these wastes. Shrimp head (waste) meal, which contains high levels of protein with excellent amino acid profile comparable to that of fishmeal (Meyers 1986). The utilization of shrimp wastes in shrimp diets has been studied by various workers (Lim and Dominy 1990; Nwanna 2003) and found as potential diet ingredient with high biological value. Crab meal contains carotenoid pigments, and is very effective in improving growth and/or colour of fillet of fish or shrimp (Williams et al. 2005). Crab meal has been used for substitution of casein in the diet for the shellfish *Haliotis discus hannai* for a higher growth performance (Cho et al. 2008). Silkworm pupae has been found as good and less expensive alternative source of protein in fish diet formulation. Rangacharyulu et al. (2003) used fermented

silk worm pupae (SWP) silage while Hossain et al. (1997) used boiled silkworm pupae to replace fishmeal in the formulation of fish diet. By-products of the poultry processing industry such as blood meal, feather meal and poultry by-product meal (PBM) are high in protein and contain favorable profiles of indispensable amino acids (IAA) for fish production (Tacon 1993). The leather meal mainly collagen hydrolysates recovered from enzymatic treatment of chrome shavings and vegetable tanned shavings find several commercial including animal diet preparation (Chakraborty 2003). Certain slaughter house wastes such as blood, condemned offal and condemned carcasses can be used for blood meal and bone meal which find uses for fish diet formulation (Biswas 2003). Animal is slaughtered for meat which is the 'main product'. All other parts including the hides and skins are termed as the 'by-product'. The inedible by-products are ruminal contents, horns and hooves and some organs and glands. This meat and bone meal has a high nutritive source for livestock, poultry and aquaculture (Biswas 2003). Fermented fish offal is also viable alternative of fish meal in the formulation of diet for fishes (Mondal et al. 2012). Fish offal meal are easily available and the processing is very simple than the other by-products.

The outcome of the study is that the wastes after processing can be effectively used as a feed ingredient to replace fish meal partially or fully in the diet for fish.

Plate 1. Digestive tract of *Labeo rohita* Plate 2. Digestive tract of *Catla catla*

REFERENCE

Ayyappan, S. and Ahmad Ali, S. 2007. Analysis of feeds and fertilizers for sustainable aquaculture development in India. In M.R. Hasan, T. Hecht, S.S. De Silva and A.G.J. Tacon (eds). Study and analysis of feeds and fertilizers for sustainable aquaculture development. FAO Fisheries Technical Paper. No. 497. Rome, FAO. pp. 191–219. | Biswas, G. 2003. Slaughter house waste utilization. Newsletter, EMCB-ENVIS node on environmental biotechnology, Department of Environmental Science, University of Kalyani, VOL 3, pp.3-4. | Chakraborty, R. 2003. Ecofriendly solid waste management in leather industry. Newsletter, EMCB-ENVIS node on environmental biotechnology, Department of Environmental Science, University of Kalyani, VOL 3, pp.2. | Cho, S.H., Park, J., Kim, C. and Yoo, J.H. 2008. Effect of casein substitution with fishmeal, soybean meal and crustacean meal in the diet of the abalone Haliotis discus hannai Ino. Aquaculture Nutrition 14, 61–66. | Helrich W. (ed.) 1990. Official methods of analyses. Vol. I. 15th edn. Association of Official Analytical Chemists, Washington, DC, USA. | Hossain, M.A., Nahar, N. and Kamal, M. 1997. Nutrient digestibility coefficients of some plant and animal proteins for rohu (Labeo rohita). Aquaculture 151, 37–45. | Lim, C. and Dominy, W. 1990. Evaluation of soybean meal, as a replacement for marine animal protein in diets for shrimp (Penaeus vannamei). Aquaculture 87, 53–63. | Meyers, S.P. 1986. Utilization of Shrimp Processing Wastes. Infofish Marketing Dig., 4/86, 18-19. | Mondal, K., Kaviraj, A. and Mukhopadhyay, P.K. 2006. Fish waste in urban and suburan markets of Kolkata : problems and potentials. Aquaculture Asia 11, 22-25. | Mondal, K., Kaviraj, A. and Mukhopadhyay, P.K. 2012. Effects of partial replacement of fishmeal in the diet by mulberry leaf meal on growth performance and digestive enzyme activities of Indian minor carp Labeo bata. International Journal of Aquatic Science 3 (1): 72-83. | Mukhopadhyay, P.K. and Mitra, G. 2007. Plant derived feedstuff for freshwater aquaculture in India. AQUA Culture Asia Pacific Magazine 19-21. | Nwanna, L.C. 2003. Nutritional value and digestibility of fermented shrimp head waste meal by African catfish Clarias gariepinus. Pakistan Journal of Nutrition 2, 339-345. | Rangacharyulu, P.V., Giri, S.S., Paul, B.N., Yashoda, K.P., Rao, R.J., Mahendrakar, N.S., Mohanty, S.N. and Mukhopadhyay. P.K. 2003. Utilization of fermented silkworm pupae silage in feed for carps. Bioresource Technology 86, 29-32. | Suresh, A.V. 2007. Development of the aquafeed industry in India. In M.R. Hasan, T. Hecht, S.S. De Silva and A.G.J. Tacon (eds). Study and analysis of feeds and fertilizers for sustainable aquaculture development. FAO Fisheries Technical Paper.No. 497. Rome, FAO. pp. 221–243. | Tacon, A.G.J. 1993. Feed formulation and on-farm feed management. In M.B. New, A.G.J. Tacon and I. Csavas, eds. Farm-made aquafeeds, p. 61-74. Proceedings of the FAO/AADCP Regional Expert Consultation on Farm-Made Aquafeeds. Bangkok, FAO-RAPA/AADCP. | Tacon A. G. J., Metian M. 2008. Global overview on the use of fish meal and fish oil in industrially compounded aquafeeds: trends and future prospects. Aquaculture 285, 146–158. | Williams, K.C., Smith, D.M., Barclay, M.C., Tabrett, S.J. and Riding, G. 2005. Evidence of a growth factor in some crustacean-based feed ingredients in diets for the giant tiger shrimp Penaeus monodon. Aquaculture 250, 377–390. |