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Growth Performance of *Labeo rohita* (Ham.) Fed on Diet Containing Different Levels of Slaughter House Waste

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Abstract: A seven week feeding experiment was conducted to evaluate the suitability of incorporation of slaughter house waste in the diet of rohu fish. Fingerlings of *Labeo rohita* (weight 1.83±0.02 g) were used as experimental animal. Five nearly isocaloric (3.6-3.7 kcal/g) diets with 23.96 (control), 25, 30, 35 and 40% protein level were formulated. Slaughter house waste in the diets was incorporated at levels of 14.62, 24.32, 34.04 and 43.75% to replace eqnal proportion of the other ingredients. Fish were fed twice daily with the respective test diets at the rate of 4% body weight during entire culture period. Results regarding growth performance and feed conversion of *Labeo rohita* fingerlings fed different experimental diets showed that the best growth performance of fish in terms of percentage live weight gain (153.27%) was found with Diet 2 having 30% protein level and lowest (96.26%) found with control diet. Specific Growth Rate (SGR) of fish fed different levels of protein showed that highest (2.48) SGR was found with 30% protein feed and lowest (1.55) SGR was found in control diet. Significantly ($p<0.01$) higher SGR was found in diets having slaughter house waste, compared to control diet. The feed conversion efficiency (52.72) was highest in fish fed on Diet 2 compared to all other diet. Feed conversion efficiency was significantly ($p<0.01$) higher in fish fed on slaughter house waste based diet compared to control diet. Survival rates were recorded highest in fish reared with D_2 and D_3 diet (100%). Analysis of carcass composition of fish fed with various diets also showed that the fish fed with D_2 was rich in their body carcass protein and fat content (58.34 and 13.21, respectively), whereas they were low in their moisture content compared to other experimental diets. This study brings home to fact that slaughter house waste is one of the best animal proteins in terms of growth, feed conversion and body carcass composition and 30% protein level is optimum for growth of *Labeo rohita*.

Key words: Slaughter house waste, Growth, *Labeo rohita* fingerlings

Introduction

Aquafeed generally constitutes 60-70% of the operational cost in intensive and semi- intensive aquaculture system. The need to minimize feed cost through the use of newer and cheaper sources of feed ingredients, has already been felt. Selection of feed ingredients for use within an aquafeed will play a major role in dictating its ultimate nutritional and economic success. Next to fishery by-products, terrestrial vertebrate by-products usnally constitute the second major source of animal protein within aquafeeds for warm water fish species (Tacon, 1993a). Another advantage of using these animal

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by-products is their easy availability in the locality and low cost. The utilization of most vertebrate by-product meal is usually limited by specific nutritional imbalances including imbalances of essential amino acids and ash mineral (Tacon, 1993b). The dietary utilization of most vertebrate by-product meals therefore, requires careful formulation so as to obtain the desired overall nutrient profile within the finished aquafeed. With the increasing research thrust on this aspect during recent years there has been much interest on the possibility of using various non - conventional feed sources. Several workers have attempted to replace fishmeal and other animal protein sources in diet with slaughter house waste (Nandeesha *et al*., 1991; Jadhav and Rao, 1991; Khan and Jafri, 1992; Paul *et al*., 1997; Hassan *et al*., 1999) for Indian major carps.

In this communication, the results of investigation to study the efficacy of slaughter house waste for its possible inclusion in the diet of *Labeo rohita* is reported.

Materials and Methods

Experimental Site

The present experiment was conducted at Aquaculture Lab, Department of Fisheries, Raipur and feed analysis part was done at Department of Animal Nutrition, Anjora, Durg of Indira Gandhi Agricultural University, Raipur, Chhattisgarh, India during period of December to February, 2003-04

Preparation of Experimental Diets

Five different nearly iso-caloric (3.6-3.7 kcal g^{-1}) diets with 23.96, 25, 30, 35 and 40% crude protein were formulated. D_1 to D_4 were prepared using finely powdered, mustard oil cake, rice bran, slaughter house waste, vitamin-mineral mixture and soybean oil with carboxy methyl cellulose as a binder, while control diet was prepared by mixing all the above ingredients except slaughter house waste. Slaughter house waste in the diets was incorporated at levels of 14.62, 24.32, 34.04 and 43.75% to replace equal proportion of the other ingredients in D_1 to D_4. Physiological fuel values of 3.5, 4.5 and 8.5 kcal g^{-1} for carbohydrate, protein and lipid, respectively were used for dietary energy calculations (Jauncey, 1982). The composition of ingredients used for experimental diets given in Table 1. The proximate composition of the ingredients used for formulation of diets is given in Table 2. Dietary ingredients were cleaned, milled and mixed in definite proportions. Therefore, thick dough was made using luke warm water. Using a hand pelletizer, 0.5 mm thick pellets were obtained, while using in feeding experiments. The proximate compositions of the experimental diets are displayed in Table 3.

Table 1: Composition of experimental diets

	Diets				
Ingredients	Control	D1	D2	D3	D4
Rice bran	46.5	58.38	48.68	38.96	29.25
Mustard oil cake	46.5	20	20	20	20
Slaughter house waste	-	14.62	24.32	34.04	43.75
Soybean oil	2	2	2	2	2
Carboxy methyl cellulose	3	3	3	3	3
Vitamin-mineral mixture*	2	2	2	2	2

Composition of vitamin-mineral mixture: Vitamin A (as acetate) 5000 IU.; Cholecalciferol 1000 IU.;Thiamin monocitrate 10.00 mg; Riboflavin 10.00 mg; Pyridoxine hydrochloride 5.00 mg; Cyanacobalamin 15.00 g; Nicotinamide 75.00 mg; Calcium pentathenate 10.00 mg; Ascorbic acid 150.00 mg; a tocopheryl acetate 25.00 mg; Biotin 5.00 mg; Folic acid 5.00 mg; Menadione 100.00 mg; Choline chloride 50.00 mg; PABA 5.00 mg; Myoinocitol 10.00 mg; Calcium lactate 0.125 mg; Magnesium oxide 60.00 mg; Dried ferrous sulphate 30.00 mg; Copper sulphate 2.00 mg; Manganese sulphate 2.00 mg; Zinc sulphate 2.00 mg; Sodium molybdate dihydrate 0.25 mg; Sodium borate 0.80 mg; Potassium iodate 20.00 mg; Bicalcium phosphate 0.10 g; Cobalt chloride 20.00 mg

Table 2: Proximate composition of feed ingredients used in the formulation of diets

Ingredients	Moisture	Crude protein	Crude fat	Crude fibre	Total ash	NFE
Rice bran	9.0±0.16	13.56±0.36	10.22±0.11	19.33±0.19	10.53±0.07	37.36
Mustard oil cake	8.5±0.10	38.00±0.50	8.44±0.12	7.5±0.10	14.06±0.04	23.50
Slaughter house waste	7.8±0.20	65.00±1.88	6.11±0.25	2.33±0.17	7.93±0.02	10.83

±SEM

Table 3: Proximate composition of the experimental diets (% on dry matter basis)

Parameters	Control diet	D1	D2	D3	D4
Moisture	7.5	8.3	8.2	8.15	8.35
Crude protein	23.97	25	30	35	40
Crude fat	10.67	10.55	10.15	9.74	9.16
Crude fibre	12.46	13.12	11.47	9.82	8.17
Total ash	11.42	10.1	9.95	9.61	9.36
Nitrogen free extract	33.98	32.93	30.23	27.68	24.96
Gross Energy (k cal g^{-1})	3.61	3.63	3.67	3.69	3.69

Experimental Design

Fingerlings of *Labeo rohita,* procured from the Fish farm, Department of Fisheries, Indira Gandhi Agricultural University were given a prophylactic dip in dilute $KMnO_4$ solution before stocking in glass aquaria. After 15 days of acclimation to the formulated control diet consisting of rice bran and mustard oil cake, the fingerlings were sorted out to almost identical size (Ave. wt. 1.83±0.02 g) group were stocked at a density of 10 fingerlings in each of the specially designed glass aquaria (60×30×30 cm) containing 60 L of dechlorinated bore water. Each dietary treatment consisted of four replications and the experiment continued to 49 days. The initial weight of the fish and proximate composition of the muscle were determined prior to commencement of the experiment. Each group of fish were fed with the respective diet at the rate of 4% of the total body weight twice daily at 8.00-8.30 h and 16.00-16.30 h The water from each aquarium was partly changed daily and replenished with fresh water. The fish were weighed on weekly interval and the amount of ration adjusted accordingly. Any left over food was collected after 3 h of feeding fish, separately from each aquarium and weighed after drying in an oven to determine the feed consumption. At the termination of the experiment, the fish from all the treatments were weighed individually and processed for subsequent analysis. At the end of the experiment, 4 to 5 fish from each treatment were sacrificed and analyzed for proximate composition of whole skeletal muscle.

Analytical Methods

Prior to formulation of the diets, all the feed ingredients were analyzed for their proximate composition using standard methods (AOAC, 1990). Moisture content was measured by the difference in weight after keeping the sample in oven (100°C) for 24 h Ash content was determined by incinerating the sample in a muffle furnace (600°C) for 5 h Crude protein was estimated by micro- kjeldhal method (N×6.25), while fat was quantified by continuous Soxhlet extraction technique using petroleum ether as solvent. Crude fibre was analysed using fibra plus apparatus.

Data Collection

Absolute growth (g) = Fiual weight- Initial weight

Feed conversion efficiency (FCE) = Live weight (g)/ Feed consumed (g)×100

Specific growth rate (SGR) = Log_e Fiual wt. – Log_e Initial wt. / Experimental period (days)×100

Net protein utilization (NPU) = Fish protein gain/Quantity of protein consumed×100

Statistical Analysis

Analysis of variance (Snedecor and Cochran, 1968) followed by Duncan's Multiple Range Test (Duncan, 1955) was employed to test the differences between the means.

Results

The water quality parameters (temperature, pH, dissolved oxygen, total alkalinity and free CO_2 of the water in the experimental aquaria ranged from 18.7-26°C, 7.45-7.82, 6.65-7.20 mg L^{-1}, 80-100 mg L^{-1} and 0.0-2.32 mg L^{-1}, respectively) were well within the range for fish culture.

Growth performance indicated by absolute growth, percentage live weight and Specific Growth Rate (SGR), Feed Conversion Efficiency (FCE), Net Protein Utilization (NPU) and survival rate when subjected to analysis of variance revealed significant influence of slaughter house waste (Table 4). Data indicate that the fish fed with diet D_2 having 30% protein level reflected best growth in terms of absolute growth (2.80 g), percent live weight gain (153.2%) and specific growth rate. The highest food conversion efficiency (52.72) and net protein utilization (2.48) were also obtained with the same diet. The lowest percentage live weight gain (96.26), specific growth rate (1.55%) and feed conversion efficiency (36.88) were recorded with control diet. Growth performance and feed efficiency showed significant ($p<0.01$) difference between control and experimental diets.

The protein and lipid in the muscle of the experimental fish increased over the initial in all the dietary treatments (Fig. 1). After the experimental period of 49 days, moisture content in fish body tissue was decreased. However, the decrease in the moisture content was not directly related to the protein content of the feed in fish body tissues. Lipid levels increases in all diet groups and highest found in D_2 and lowest in D_4. Highest value of body carcass protein was observed in fish fed on D_2 having 30 % protein level and lowest in the group feeding D_4 having 40% protein level. All these values were found to be significantly higher ($p<0.01$) than those with the control diet. Significantly ($p<0.01$) lower ash content was found in all experimental diets compared to initial value.

The highest survival rate was recorded in treatments D_2 and D_3 receiving 30 and 35% protein diet. Survival rate decreased with increased or decreased level of protein.

Table 4: Growth and feed utilization of *Labeo rohita* fingerlings fed the control and test diets for 49 days

Parameters	Control diet	D_1	D_2	D_3	D_4
Initial length (mm)	55.00±12.5	55.00±14.2	55.00±13.4	55.00±14.5	55.00±15.2
Initial weight (g)	1.82±0.01	1.82±0.01	1.83±0.02	1.81±0.01	1.81±0.01
Final length (mm)	69.00±18.4	71.00±19.2	74.00±25.1	72.00±22.2	71.00±21.4
Final weight (g)	3.58±0.01^e	3.79±0.01^d	4.63±0.02^a	4.51±0.01^b	4.27±0.02^c
Absolute growth (g)	1.75±0.01^e	1.96±0.01^d	2.80±0.01^a	2.69±0.01^b	2.44±0.02^c
Percentage increase in weight	96.26e	107.39d	153.27^a	148.52b	133.52^c
Specific growth rate (% day^{-1})	1.55±0.01^e	1.73±0.01^d	2.48±0.01^a	2.38±0.02^b	2.16±0.07^c
Feed intake	4.79±0.01^e	4.92±0.02^d	5.32±0.01^a	5.21±0.01^b	5.07±0.01^c
Feed conversion efficiency (FCE)	36.88±0.31^e	39.86±0.33^d	52.72±0.16^a	51.77±0.35^b	48.12±0.26^c
Net Protein Utilization (NPU)	1.38±0.01^d	2.28±0.03^b	2.48±0.06^a	1.61±0.06^c	1.29±0.11^d
Percent survival (%)	97.50±2.5^a	97.25±2.5^a	100.00±0.0^a	100.00±0.0^a	95.00±2.88^a

Values in the same rows with different superscripts differ significantly ($p<0.01$)

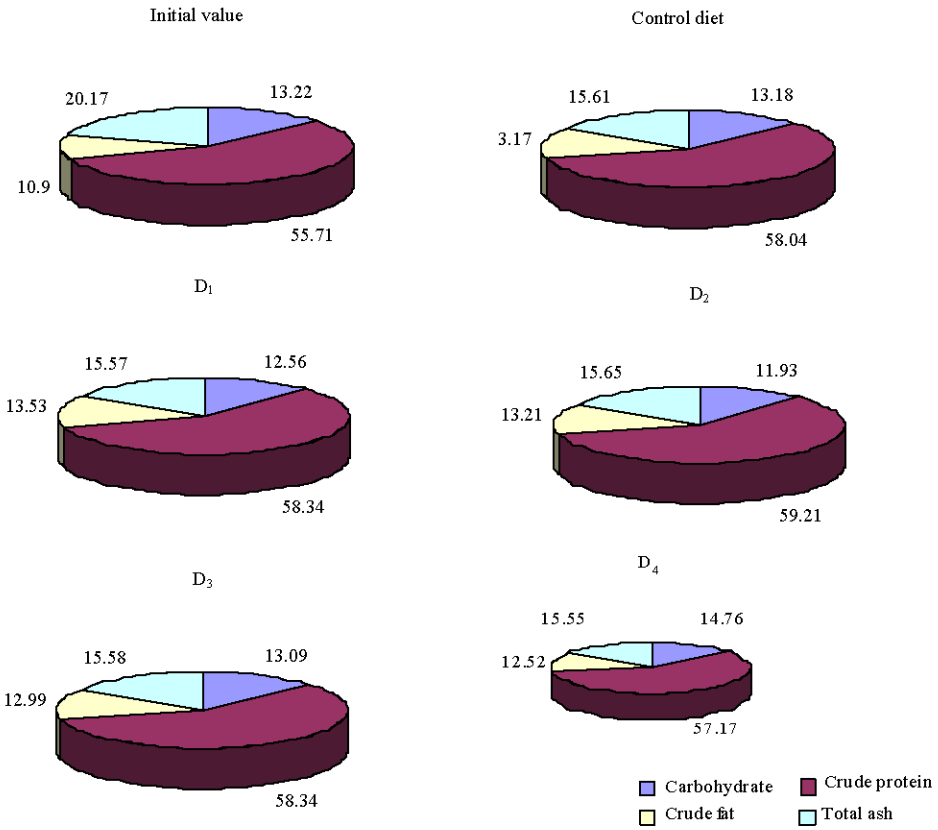

Fig.1: Initial and final carcass composition (% dry matter basis) of *Labeo rohita* under various diet treatments

Discussion

At the end of the feeding trial, significant increase in weight gain was recorded among the various treatment groups fed diets containing slaughter house waste as compared to control diet. This indicates the efficacy of slaughter house waste as a feed ingredient for *Labeo rohita*. The highest percentage of live weight gain indicating best performance was noted with fish fed 30% protein diet. This points to the fact that under a given condition better performance in terms of growth, digestion, absorption and eventually better conversion of nutrients to flesh. Greater degree of protein (Jafri and Anwar, 1995) and energy (Jafri and Hassan, 1999) digestibility of goat offal by *Labeo rohita* justifies the performance of this diet in producing maximum live weight gain. In a review, Nandeesha *et al*. (1991) stated that the growth attained by carps on slaughter house waste based diet was comparable to that fed on fish meal. Hassan *et al*. (1999) also found best growth of *Labeo rohita* fingerlings with diet containing slaughter house waste. Jadhav and Rao (1991) reported that goat offal gives the best growth in carps.

The best feed conversion was noted with the group fed slaughter house waste based diets. Similarly, among all the diets, the NPU, used to compare the efficacy of different experimental feed,

was found to be highest with D_2 having 30% protein level, indicating the superiority of this feed for *L. rohita*. Protein utilization of diets decreases with increase of protein level in diet Hassan *et al*. (1991).

Results on optimum protein levels for *Labeo rohita* are in broad agreement with those of Gangadhara *et al*. (1997), Chakraborty *et al*. (1999), Rangacharyulu *et al*. (2000). These authors obtained high growth and feed efficiency in fish when fed on a diet containing 30-35% crude protein.

Further, growth depressing effect of high protein levels in carps has been reported for several fish species like, rohu (Khan and Jafri, 1992; Chakraborthy *et al*., 1999; Nandeesha *et al*. 1991).

Of the various factors which govern the carcass quality, nutrient composition exerts the strongest influence. In the present experiment, although the diets were isocaloric, the influence of different protein levels on body composition was clearly seen.

The study, thus, clearly indicated that slaughter house waste is a good source of animal protein in terms of feed, protein conversion and growth efficiency and 30% protein level is optimum for growth of *Labeo rohita*.

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References

AOAC, 1990. Official Methods of Analysis 15th Edn., K. Helrich (Ed.). Association of Official Analytical Chemists, Arlington VA. pp: 648.

Chakraborty, S.C., S.A. Chowdhury and S. Chakraborty, 1999. Energy budget of Indian Major Carp, *Labeo rohita* fingerlings fed on diets with different protein levels. Asian Fish. Sci., 12: 297-308.

Duncan, G.B., 1955. Multiple range and multiple F-test. Biometrics, 11: 1-42.

Gangadhara, B., M.C. Nandeesha, J.J. Varghese and P. Keshavanath, 1997. Effect of varying protein and lipid levels on the growth of rohu, *Labeo rohita*. In: Asian Fish. Sci., 10: 139-147.

Hassan, M.A., A.K. Jafri, M.F. Anwar and Erfanullah, 1991. Effect of varing dietary energy to protein ratio on the growth, feed efficiency and carcass composition for *Labeo rohita* fingerlings-A preliminary study. In: Proc. National Sem. on New Horizons in Freshwater Aqua. Central Institute of Freshwater Aqua. Bhubaneswar, 23-25 Jan, pp: 78-80.

Hassan, M.A. and M.A. Khan, 1999. Efficacy of animal wastes as supplementary feed for Indian Major Carp, *Labeo rohita*, fingerling. J. Inland Fish. Soc. India, 31: 52-57.

Jadhav, A.G. and P.D. Rao, 1991. Effect of supplementary feed such as abattoir and fish market waste on growth of the fingerlings of *Labeo rohita* (Ham.) In: Proc. National Sem. on New Horizons in Freshwater Aqua. Central Institute of Freshwater Aqua. Bhubaneswar, 23-25 Jan, pp: 81-83.

Jafri, A.K. and M.A. Hassan, 1999. Energy digestibility coefficient of commonly used feedstuffs in different size classes of Indian Major Carps, *Labeo rohit* (Hamilton) and Cirhinus mrigala chamitton. Asian Fish. Sci., 12: 17-24.

Jafri, A.K. and M.F. Anwar, 1995. Protein digestibility of some low-cost feedstuffs in fingerling Indian major carps. Asian Fish. Sci., 8: 47-53.

Jauncey, K., 1982. The effects of varying dietary protein level on the growth, food conversion, protein utilization and body composition of juvenile tilapias (*Sarotherodon mossambicus*). Aquaculture, 27: 43-54.

Khan, M.A. and A.K. Jafri, 1992. Replacement of fish meal with offal meal in formulated diets for the carp fingerlings *Labeo rohita* (Ham.). J. Aquacult., 2: 56-62.

Nandeesha, M.C., G.K. Srikanth, P. Keshavanath and S.K. Das, 1991. Fish Nutrition Research in Asia, Fish. Soc. Special Publ. No. 5 Asian Fisheries Society. Philippines, pp: 75-81.

Paul, B.N., S. Nandi, S. Sarkar and P.K. Mukhopadhyay, 1997. Effects of feeding unconventional animal protein sources on the nitrogen metabolism in rohu *Labeo rohita* (Hamilton.) The Israeli. J. Aqua. Bamidgeh, 49: 183-192.

Rangacharyulu, P.V., B.N. Paul, S. Nandi, S. Sarkar and P.K. Mukhopadhyay, 2000. Effect of different protein and energy levels on growth, nitrogen metabolism and body composition of rohu (*Labeo rohita*). J. Aqua., 8: 17-24.

Snedecor, G.W. and W.G. Cochran, 1968. Statistical Methods. Oxford and IBH Publishing Company, New Delhi, India, pp: 593.

Tacon, A.D.J., 1993a. Feed Formulation and on Farm Feed Management, pp: 61-74. In : Proceedings of the FAO/AADCP Regional Expert Consultation on Farm-made Aquafeeds, (New, M.B., Tacon, A.D.J and I. Csavas Eds.), 14-18 December, 1992, Bangkok, Thailand. FAO- RAPA/ AADCP, Bangkok, Thailand, pp: 432.

Tacon, A.D.J., 1993b. Feed Ingredients for Warm Water Fish: Fish Meal and Other Processed Feedstuffs. FAO Fisheries Circular. No. 856, FAO, pp: 64.