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EFFECT OF DIFFERENT LEVELS OF FISH AND VEGETABLE OIL ON GROWTH PERFORMANCE AND BODY COMPOSITION OF JUVENILES OF *LABEO ROHITA*.

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ABSTRACT

During the present investigation, juveniles of *Labeo rohita* (0.438±0.002g) were fed in triplicate with four iso-nitrogenous (40% protein) and iso-lipidic (6%) diets, @ 5% of body weight, for a period of 60 days. Diets B1-B4, supplemented with fish oil (FO) and vegetable oil (VO) at different proportions. Diet B1 (30%VO+ 70% FO), Diet B2 (50% FO+50% VO), Diet B3 (70% FO+30% VO), Diet B4 (100% FO). After 60 days of feeding a significant difference ($p<0.001$) was observed in weight gain (WG), specific growth rate (SGR), feed conversion ratio (FCR) and body lipid composition. The diet B2 shows the best result with 0.616±0.004 g WG, (0.304±0.033) SGR and (9.44±1.020) FCR and (10.22±1.102) FCE. However, there was insignificant difference ($p> 0.001$) in all the growth performance parameters between diet B4 and B2. Whereas, Diet B1 registered poorest performance i.e. (0.424±0.002) WG, (0.206± 0.023) SGR, (12.28±0.002) FCR and (8.19±0.083) FCE. The following trend emerges in term of weight gain, SGR, FCR and PER B2> B4> B3> B1. Body proximate composition revealed that the quality of dietary lipid significantly affected the body lipid level. The juvenile fed with diet B2 obtained a significant ($p<0.001$) higher body lipid content i.e 1.18, as compared with other diets i.e.B4, B3, B2 and B1, where it was 1.03, 1.04, 1.07 respectively. The present result thus revealed that vegetable oil could partially replace the fish oil up to 50% in supplemented diet, to enhance the growth of juveniles of *Labeo rohita.*

KEYWORDS: Fish oil, Vegetable oil, Growth rate parameters, Body lipid composition, *Labeo rohita.*

INTRODUCTION

Fish oil derived from wild harvested whole fish currently constitutes the major aquatic protein and lipid source available within the animal feed marketplace. As the wild capture fishery has reached its stagnation, aquaculture thought to be a reliable source for the fish oil. Ironically, 60% of the global fish oil production is being utilized by aqua-feeds and if the same trend continue, 85% of the global fish oil production will be utilized. (Barlow, 2000). Thus aquaculture industry should search for some alternate viable lipid sources to sustain its growth.

Potential substitute for fish oil in aquafeed could be plant oils. This is probably because of more stable price and more production of plant oil (Bimbo,1990). Successful replacement of fish oil with vegetable oil would reduce both the absolute dependence on fish oil as a raw material and its related cost.

Dietary lipids play an important role as potential supplier of energy, essential fatty acids and soluble vitamins. They also affect the quality of cultured fish because of their influence on the fatty acid composition of body tissues (Mukhopadhayay and Rout,1996). The addition of lipids in fish diets contributes to protein sparing by increasing their digestible energy value. Many reports suggest that vegetable oils have equal effects compared to fish oil on growth in Salmonds (Bell *et al* 2001, 2002, 2003).

Thus, the current study investigates the effect of replacement of fish oil with vegetable oil on growth performance parameters and body lipid composition of juveniles of *Labeo rohita*.

MATERIALS AND METHODS

2.1 Experimental fish and acclimatization.

Juveniles of *Labeo rohita* were brought from Gho-manasa fish farm in Jammu City and brought to lab in University of Jammu, where they were kept in plastic troughs of 20 L capacity. Fingerlings captured, were then acclimated in plastic troughs at a temperature of about 22–25°C for about 7 days and were fed on a mixture of rice bran and mustard oil cake.

2.2 Diet preparation.

Five diets were formulated to contain approximately equal amount of digestible 40% protein (predetermined) and digestible energy (14.86 cl/Kg). Various ingredients used were Fishmeal, soybean, rice bran, wheat bran, mustard oil cake, fish oil, vegetable oil and vitamin mineral mixture. Ingredients were thoroughly mixed and appropriate quantity of water was added and a dough was made. Dough was passed through a pelletizer and the pellets are dried at 37 °C for two days. So, the concerned dried diet was packaged into plastic bag and stored until its usage.

Diet B1 (30%VO+ 70% FO), Diet B2 (50% FO+50% VO), Diet B3 (70% FO+30% VO), Diet B4 (100% FO). The proximate composition of the experimental diets and samples of the fish muscle were determined by standard methods using hot air oven for moisture, ash, lipid, and protein content respectively (Table 1).

2.3 Experimental design.

Juveniles of *Labeo rohita* at the beginning of experiment were stocked at a density of 25 in each plastic trough of 20 L capacity in triplicates. The experiment was conducted for 60 days. Initial weight and proximate composition of muscle of fish were determined prior to the commencement of the experiment. Juveniles of *Labeo rohita* were fed @ 5% of their body weight twice daily. The left over feed and excreta were removed on every second day by siphoning method separately from each tub. Before stocking, weight of the fingerlings were recorded.

2.4 Measuring indices and methods.

1. Weight gain = Final weight (g) – Initial weight (g).
2. Specific growth rate (SGR) = In final weight (g) – In initial weight (g) × 100/ time (days).
3. Feed conversion ratio = Diet fed (g)/ total weight gain (g).
4. Feed conversion efficiency = [(Gain in wet weight of fish / feed fed)] ×100.

2.5 Biochemical Analysis.

At the end of the experiment (after 60 days), juveniles were observed for weight increment followed by biochemical analysis. Proximate composition of the feed ingredients and experimental diets were determined in the laboratory using standard methods. The crude protein and lipid contents of feed ingredients were determined by Lowry method and Folch method. The ash content was determined by first igniting the sample and then heating it in the muffle furnace at 660ºC (±10ºC) for 6h (AOAC, 1995).

2.6 Statistical Analysis.

Differences between treatments were analyzed using independent-measures one-way ANOVA. The values were expressed as mean ± SE. values $p<0.05$ were considered as significant and p values <0.001were considered as highly significant *p.*

RESULTS AND DISCUSSION

The present results clearly reveal that there was insignificant difference ($p>0.01$) in growth parameters among various oil supplemented diets. However, highest growth performance i.e. 0.616 ± 0.004 in juveniles fed diet B2, followed by 0.581 ± 0.002 was observed in the juveniles fed on diet B4, followed by 0.535±0.008 with diet B3and least with diet B1i.e 0.424 ± 0.002. The following trend emerges in term of weight gain, SGR, FCR and PER Diet B2> B4> B3> B1. (Table 2, fig 1).

Specific growth rate (SGR)

During the present work, the highest value of specific growth rate was found to be with diet B2 having value 0.304±0.033 followed by diet B4 with 0.275±0.038, then with diet B3 having value 0.216±0.025 and least with diet B1. The present results thus clearly revealed that there was insignificant difference ($P>0.05$) in SGR among oil supplemented diets B1-B4. However diet B2 shows the best performance as compared to other diets in these experiments.

Present study clearly reveals that the proportion of vegetable oil and fish oil is excellent for the growth performance of the fishes; it may be due to appropriate proportion of fatty acids. Vegetable oils are considered as an alternative lipid source of fish feeds because of their sustainable production, relatively low cost and abundant polyunsaturated fatty acids (PUFA) such as linolenic acid and linolenic acid (Regost *et al.*, 2003). In the similar manner, Regost *et al* (2003) also reported the feasibility of total replacement of FO by vegetable oils in turbot fish meal based diets. Similar results have been found by Ferreira *et al.* (2011), Matsushita *et al*. (2006); Yones and Hakim (2010). Kamaurudin *et al.* (2012) in *Tor tambroides* reported that partial replacement of fish oil with vegetable oil in fish feed shows better growth performance without any adverse effect. Similarly, Ochang *et al.* (2007) provide evidence that palm oil can effectively replace cod liver oil for Nile Tilapia, *Oreochromis niloticus.*

Keremah and Terimokumo (2014) suggested soybean oil and palm oil to be of choice and cheaper to use as potential substitute for cod liver oil in *Heterobranchus longifilis* fingerlings. Misaka *et al.* (2014) reported that growth, feed efficiency and some health parameters show more positive effects when fish oil is supplemented with cottonseed oil.

Protein efficiency ratio

During the present investigation, PER was found to be highest with diet B2 i.e 0.400±0.044, followed by diet B4 with value 0.326± 0.050, B3 with value 0.283±0.033 and least with diet B1 having PER 0.271±0.030 (table 37) The present results clearly revealed that there was insignificant difference ($P>0.05$) in PER among animal and vegetable oil supplemented diets (B1-B4). Watanabe (2002) reported that replacement of 60% fish oil with palm oil in herring diets had no significant negative effect on fish growth. Present observations are in line with Kaushik *et al*. (2004) who also reported that superior feed utilization efficiency (PER and FCR) was exhibited by fishes when fed on diet containing both animal and vegetable oil.

Table 1: Composition of experimental diets for the juveniles of *Labeo rohita*.

Ingredients	Diet B1	Diet B2	Diet B3	Diet B4
FISHMEAL	39.00	39.00	39.00	39.00
SOYBEAN	26.00	26.00	26.00	26.00
MUSTARDOIL CAKE	22.00	22.00	22.00	22.00
RICE BRAN	4.00	4.00	4.00	4.00
WHEAT BRAN	5.00	5.00	5.00	5.00
VEGETABLE OIL	02.10	1.50	0.90	-------
FISH OIL	00.90	1.50	2.10	3.00
VITAMIN+ MINERAL	1.00	1.00	1.00	1.00

Table 2: Initial Weight, Final Weight, PER, SGR, FCR, FCE and PWG.

GROWTH PARAMETERS	DEIT B1	DEIT B2	DEIT B3	DEIT B4
INITIAL WEIGHT	0.48± 0.002	0.480± 0.002	0.431± 0.001	0.460± 0.002
FINAL WEIGHT	0.424± 0.002	0.616± 0.004	0.535± 0.008	0.581± 0.002
PER	0.283± 0.025	0.400± 0.044	0.271± 0.030	0.362± 0.050
SGR	0.216± 0.025	0.304± 0.033	0.206± 0.023	0.275± 0.038
FCR	12.28± 1.543	9.44± 1.020	11.97± 1.177	9.91 ±1.375
FCE	7.14± 1.025	10.22 ±1.102	8.19± 0.831	8.46 ±1.545
PWG	23.56± 1.0273	28.26 ±0.689	24.21 ±2.209	26.14 ±0.095

Table 3:- Showing proximate composition of muscle of juveniles of *Labeo rohita*.

Diets	CRUDE PROTEIN	LIPID	MOISTURE	ASH
Diet B1	8.68	1.07	70.88	1.67
Diet B2	9.20	1.18	70.10	1.89
Diet B3	8.99	1.04	70.99	1.78
Diet B4	9.06	1.03	70.42	1.55

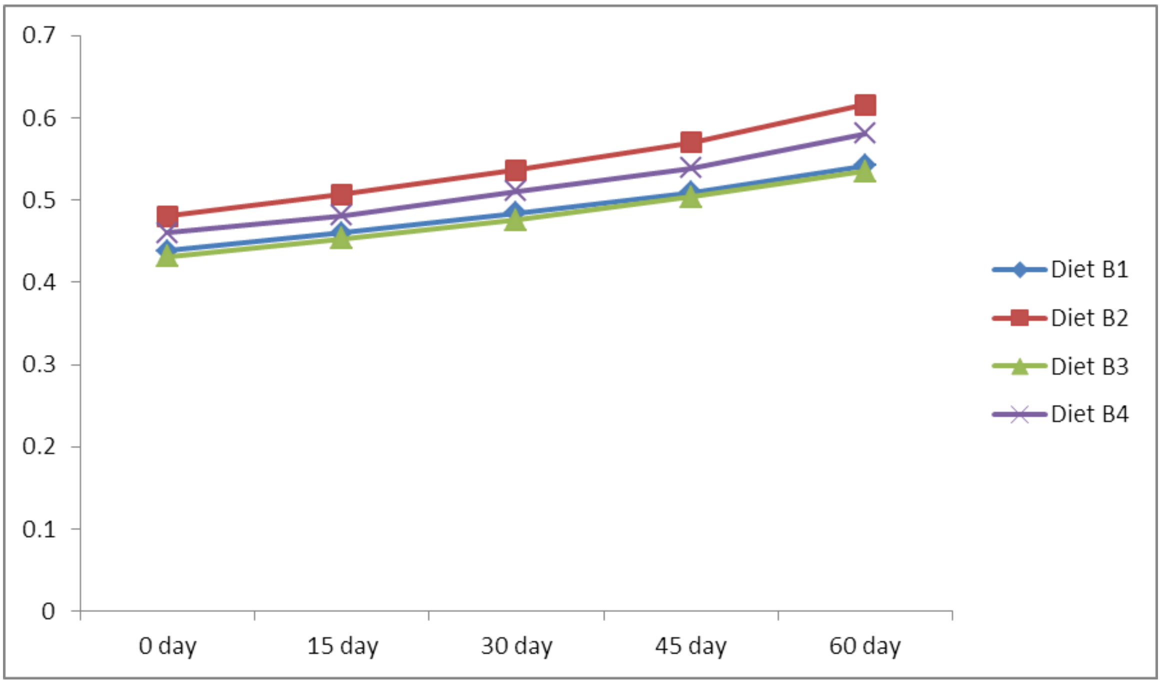

Fig 1:- Showing growth in weight (grams) of juveniles of *Labeo rohita* at 40% protein with supplemented oil (FO and VO) @ 3% varying levels.

CONCLUSION

Based on the present results and discussion, it clearly appears that vegetable oil has been shown equally responsible for enhancing growth performance and apparent protein sparing effect in diets with partial replacement of fish oil with vegetable oil. Hence it is recommended that for intensive culture of *Labeo rohita* cost effective diets with 40% crude protein and 3% crude lipids (supplemented with 1.5% fish oil and 1.5% of vegetable oil) should be fed to maximize fish growth to enhance the economic returns.

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