ABSTRACT

Artificial feed with natural, non-conventional, low cost, easily available and substitute animal proteins of silkworm pupae and silkworm moths and synthetic, unconventional, less costly, less available and alternative to animal proteins of synthetic amino acids, in replacement to natural, conventional, highly costly, available and traditional animal proteins of shrimp meals were formulated for free swimming fries, fries and fingerlings of rainbow trout, *Oncorhynchus mykiss* (Walbaum) and their impact on survival and growth during exogenous feeding in farmer's raceways were evaluated. Again, impact of the diets with natural and animal proteins (silkworm pupae, shrimp meals, and silkworm moths) were compared to that of the diet with synthetic proteins (synthetic amino acids) on survival and growth of the free swimming fries, fries, and fingerlings of rainbow trout. Further, impact of physico-chemical parameters of the raceways and age of the broods and size of the broods, eggs, sac fries and free swimming fries of rainbow trout on survival and growth of the free swimming fries, fries and fingerlings were studied. Finally, what level of impact did physico-chemical parameters; age of the broods and size of the broods, eggs, sac fries and free swimming fries; and artificial feed could put on survival and growth of the free swimming fries, fries and fingerlings of rainbow trout was also mentioned.

Three feed formulations, two with substitute animal proteins of silkworm pupae (Treatment-1) as the first diet and silkworm moths (Treatment-2) as the second diet and the one with alternative to animal proteins of synthetic amino acids having lysine and methionine (Treatment-3) as the third diet were evaluated against the feed with shrimp meals (Treatment-4) acting as control as the fourth diet on survival and growth of the free swimming fries, fries and fingerlings through total feed intake and total protein

intake including feed efficiency indicators of feed efficiency, protein efficiency ratio, absolute growth rate, specific growth rate, relative growth rate, condition factor, feed conversion ratio and protein productive value along with highest growth period and cost analyses. All the four diets (three formulated and one control) were fed to the free swimming fries, fries and fingerlings for two consecutive years.

A significant difference ($P < 0.01$) on survival and growth of free swimming fries, fries and fingerlings of rainbow trout due to physico-chemical parameters in each year was noticed. The physico-chemical parameters were significant ($P < 0.01$) in each year. However, physico-chemical parameters each of the first year (December 2010 to May 2011) were not significantly different ($P > 0.05$) from that of the second year (December 2011 to May 2012).

There was significant difference ($P < 0.01$) on survival and growth of free swimming fries, fries and fingerlings of rainbow trout due to age of the broods and size of the broods, eggs, sac fries and free swimming fries in each year. The age of the broods and size of the broods, eggs, sac fries and free swimming fries were significant ($P < 0.01$) in each year. Again, age of the broods and size of the broods, eggs, sac fries and free swimming fries of rainbow trout each of the first year (December 2010 to May 2011) were significantly different ($P < 0.01$) from that of the second year (December 2011 to May 2012).

The survival and growth due to total feed intake and total protein intake including all feed efficiency indicators of all the four diets in each year were found significantly different ($P < 0.01$). Again, total feed intake and total protein intake of all the four diets each of the first year (December 2010 to May 2011) were significantly different ($P < 0.01$) from that of the second year (December 2010 to May 2011) however, all the feed

efficiency indicators each of the first year (December 2010 to May 2011) were insignificant ($P > 0.05$) from that of the second year (December 2010 to May 2011).

The survival rate with shrimp meals diet fed stages revealed superiority ($P < 0.01$) over other feed formulations, silkworm pupae diet lesser survival, silkworm moths diet less survival, and synthetic amino acids diet least survival. However, survival due to shrimp meals diet was insignificant ($P > 0.05$) with that of silkworm pupae diet.

The growth with silkworm pupae diet fed stages showed superiority ($P < 0.01$) over all the four diets and synthetic amino acids diet lowest whereas shrimp meals and silkworm moths diets exhibited low and lower growth respectively. However, growth due to silkworm pupae diet was highly significant ($P < 0.01$) with that of shrimp meals diet. So, total feed intake, total protein intake, and feed efficiency indicators of feed efficiency, protein efficiency ratio, absolute growth rate, specific growth rate, and relative growth rate were highest due to silkworm pupae diet, higher due to shrimp meals diet, low due to silkworm moths diet, and lowest due to synthetic amino acids diet. However, condition factor was highest due to silkworm pupae diet, higher due to shrimp meals diet, low due to synthetic amino acids diet and lowest due to silkworm moths diet. Unlike other feed indicators, feed conversion ratio exhibited highest due to synthetic amino acids diet, higher due to silkworm moths diet, low due to shrimp meals diet, and lowest due to silkworm pupae diet. Further, protein productive value of synthetic amino acids diet was highest, shrimp meals diet higher, silkworm moths diet low, and silkworm pupae diet lowest resembling the crude protein percent of the diets.

The cost analyses revealed silkworm moths diet cheapest with low production cost, silkworm pupae diet cheaper with lowest, synthetic amino acids diet less costly with highest, and shrimp meals diet highly costly with higher production cost. The highest growth period was observed during April to May and lowest during December to

January in all the four diets during December 2010 to May 2011 and December 2011 to May 2012.

Results showed that survival and growth of free swimming fries, fries, and fingerlings of rainbow trout might be due to suitable physico-chemical parameters of the raceways; mainly due to age of the broods, and size of the broods, eggs, sac fries, and free swimming fries of the rainbow trout; and exclusively due to formulated and control artificial feeds. Results also indicated that diets containing natural and animal proteins of silkworm pupae, shrimp meals, and silkworm moths were superior to the diet containing synthetic amino acids. The results finally confirmed that cost effective silkworm pupae diet could be used as better substitute to completely replaced shrimp meals diet without compromising survival and growth.