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The effects of feeding frequency on FCR and SGR factors of the fry of rainbow trout, *Oncorhynchus mykiss*

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Economically efficient production of carnivorous fish requires the use of suitable feeds in quantities and frequencies that produce efficient growth, considering both biological performance and return on feed costs invested by the farmer. Standard measures for determing ration performance are specific growth rate (SGR), food conversion ratio (FCR) and also condition factor (CF = weight x 100 / length^3).

Production cost efficiency can be improved by monitoring these performance indicators and assessing the impact of alterations in feed, feeding and other management practices. I conducted a study to investigate the effect of feeding frequency on growth and feed utilization efficiency in rainbow trout. The experiment involved several different treatments with feeding frequencies of 4, 6 and 8 feeds per day. The research was conduced at Ghezelrood Aquaculture center, in Broujerd, Iran.

The aims of my research into the effects of feeding frequency were to:

- Estimate and compare condition factor (CF) between experimental treatments.
- Determine optimum feeding frequencies for growth of fish with consideration of feed expense points.
- Estimate and compare SGR and FCR between experimental treatments.

Differences in feeding rate can result from different temperatures, environmental conditions and life stage of fish. In this experiment, fry of rainbow trout of around 6±1 g in body mass were placed into compartments, with 400 fry stocked in each net and with three replicates of each treatment. The fish were fed with regard to feeding tables based on body mass and temperature. They were grown for a period of 71 days with biometric assessment conducted every two weeks, while anaesthatised with carnation (clove flower) oil at a concen-

Table 1. Average FCR of rainbow trout fry in different feeding frequencies.

Daily feeding frequency	Week 2	Week 4	Week 6	Week 8	Week 10	Total period
4 times	0.61	1.35	4.59	4.71	3.02	1.51
6 times	0.51	0.85	1.90	3.61	3.61	1.52
8 times	0.52	1.34	1.71	3.87	4.42	1.63
The results are mean ± SD(n=20). There was no statistically significant difference between treatments.						

Table 2. Average weight of rainbow trout fry in different feeding frequencies (g).

Daily feeding frequency	Week 2	Week 4	Week 6	Week 8	Week 10
4 times	10.2±1.03	15±2.32	21.5±3.53	27±3.12^{b}	34.45±2.99^{a}
6 times	10.8±1.10	16.2±1.55	22.3±2.05	28.8±2.23^{a}	35.91±2.76^{a}
8 times	10.7±1.24	15.6±1.72	21.1±2.39	26.2±2.77^{b}	32.2±2.68^{b}
The results are mean ± SD(n=20). Statistically significant differences between treatments (p<0.05) are designated by superscript within each column.					

Table 3. Average SGR of rainbow trout fry at different daily feeding frequencies.

Daily feeding frequency	Week 2	Week 4	Week 6	Week 8	Week 10	Total period
4 times	3.78	2.61	2.64	1.67	1.65	2.46^{ab}
6 times	4.19	2.89	2.28	1.83	1.47	2.52^{a}
8 times	4.12	2.70	2.15	1.55	1.38	2.36^{b}
The results are mean ± SD(n=20). Statistically significant results between treatments (p<0.05) are designated by superscript within each column.						

Table 4. Average CF of rainbow trout fry at different daily feeding frequencies.

Daily feeding frequency	Week 2	Week 4	Week 6	Week 8	Week 10
4 times	1.05	1.01	1.31	1.20	1.21
6 times	1.16	1.24	1.39	1.34	1.18
8 times	1.24	1.08	1.33	1.23	1.06

tration of 6 g per 20 litres of water. The data was analysed using an analysis of variance statistical technique.

The results of my study showed that feeding six times per day led to the best results.

The minimum FCR occurred at feeding frequencies of 4 and 6 times per day, with fairly similar (statistically non-significant) overall results across treatments (table 1).

Statistically significant differences in average fish weight between treatments ($p<0.05$) were only detectable in weeks 8 and 10, towards the end of the experiment (table 2). The best results in terms of growth were obtained at a feeding frequency of 6 times per day. Feeding at 8 times per day lead to poor results, possibly because high feeding frequency led to greater energy expenditure in terms of movement, as the accessible food amount at any single feeding time was low, and some fish may have been unable to access food due to high competition.

Statistically significant differences ($p<0.05$) in SGR between treatments were observed over the full experimental period (table 3), but variation in bi-weekly samples during the course of the experiment were not significant. The highest SGR was at a feeding frequency of 6 times per day. No significant difference in CF was detected between any of the treatments (table 4), however, the best growth rates and most efficient FCR were achieved at a feeding frequency of 6 times per day.

A similar study on Channel catfish (Lovel 1989) found that feeding frequency did not have a significant difference on FCR, consistent with the outcomes of this experiment. However, Lovel (1989) also reported that feeding frequency did not significantly affect SGR, which is not consistent with this experiment. This may be due to the different species, different feeding behaviour and experiment conditions.

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