

Effect of feeding frequency on growth performances and survival of *Rutilus rutilus caspicus*

Authors:

Majid Mohammad Nejad
Shamoushaki.

Institution:

Department of Fishery,
Bandar Gaz Branch, Islamic
Azad University, Bandar
Gaz, Iran.

Corresponding author:

Majid Mohammad Nejad
Shamoushaki.

Email:

Majid_m_sh@bandargaziau.ac.ir.

Web Address:

[http://jresearchbiology.com/
Documents/RA0212.pdf](http://jresearchbiology.com/Documents/RA0212.pdf).

ABSTRACT:

Feed management plays a major role in the economical and environmental status of fish farms. Optimum feeding frequency seems to be dependent on fish size and higher frequency of feeding was found to be advantageous for higher growth and survival in younger age groups. The fishes should have the access to feed up to satiation for their optimum growth. This experiment was conducted for six weeks at four treatments and three replications as follows: Treatment A: One time a day at 8:00 h, treatment B: Two times a day at 08:00, 12:00 h, treatment C: Three times a day at 08:00, 12:00, 16:00 h and treatment D: Four times a day for feeding at 08:00, 12:00, 16:00, 20:00 h. Given the importance of the physical and chemical factors and their impact on water supply and ultimately the fish growth, these factors were so controlled through the experiment that the amount of dissolved oxygen was fixed on 5.5 - 6 ppm, the temperature 26 ± 2 °C and pH 7.5 to 8. *Rutilus rutilus caspicus* were fed during the experimental period with SFK feed staff containing: 8.7 % moisture, 11.2 % ash, 32 % protein and 10.5 % fat. Feeding rate was 10% of total body weight of fingerlings. According to the results of this study, it was shown that feeding frequency no affect body weight and length gain of fish and there is no significant difference in the rate of FCR, BWI%, SGR, GR and CF ($p < 0.05$). Result of this study showed that increasing of feeding frequency there isn't effect on growth and survival in *Rutilus rutilus caspicus*.

Keywords:

Feeding frequency, growth performances, survival, *Rutilus rutilus caspicus*.

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INTRODUCTION

Rutilus rutilus caspicus belongs to *Cyprinidae* is one of the most economically important and valuable teleostei in the Caspian Sea. This kind of fish exist in the southern part of the Caspian Sea especially Iran's shores. Approximately two third of the semi artificial propagation in Golestan province was done. Fish is the major source of protein for over one billion people around the world (Rameshguru *et al.*, 2011). Understanding of natural foods and dietary habits of fish culture could be an important factor in providing effective method of nutrition. Although intensive fish culture adaptability of the species with different feeding methods have been proven, but the choice of methods to provide food and nutrition in aquaculture should be considered dietary at patterns of normal behavior (Afshar Mazandaran, 2002). In result, understanding the nutritional qualities of fishes are very important. Fish feeding is one of the most important factors in commercial fish farming because feeding regime may have consequences on both growth efficiency and feed wastage (Tsevis *et al.*, 1992; Azzaydi *et al.*, 2000). The growth of fish at all stages is largely governed by the kind of food, ration, feeding frequency, food intake and its ability to absorb the nutrients. Among these, feeding frequency is an important aspect for the survival and growth of fish at the early stage (Mollah and Tan, 1982). Optimum feeding frequency seems to be dependent on fish size and higher frequency of feeding was found to be advantageous for higher growth and survival in younger age groups. The fishes should have the access to feed up to satiation for their optimum growth. However, over-feeding leads not only to reduction in feed conversion efficiency and increase in input cost, but also accumulation of wastes that adversely affects the water quality (Biswas *et al.*, 2006). Moreover, knowledge of the optimum feeding rate is important not only for promoting best growth and feed efficiency, but also for preventing water quality deterioration as a result of

excess feeding (Ng *et al.*, 2000; Mihelakakis *et al.*, 2002; Webster *et al.*, 2002). In this context, it is useful to know the optimum feeding rate of the cultured species and how feed efficiency, feed consumption and composition of flesh are affected by it (Eroldog˘an *et al.*, 2004). Among the different feed management practices proven to maximise the benefit of feeding, feeding frequency and ration size play an important role in regulating the feed intake, growth and waste outputs of fish (Silva *et al.*, 2007). Optimizing feeding frequency may minimise feed wastage, leading to improvement in culture environment and or reduction in size heterogeneity (Dwyer *et al.*, 2002; Tucker *et al.*, 2006), whereas poorly timed or sporadic feeding frequency may lead to increased hunger, intra-specific aggression and increased rate of cannibalism (Folkvord and Ottera, 1993). Studies on feeding behavior in several fish species have shown that if feeding frequency be in accordance with natural feeding, it will increase growth and decrease FCR (Bolliet *et al.*, 2001). So, with aspect to two or three times feeding per day in farms and existing food for *Rutilus rutilus caspicus* feeding in Iran it seems essential to specify the best feeding frequency for reaching the highest rate of growth on *Rutilus rutilus caspicus*. Considering the ideas mentioned above in this research, the effects of feeding frequency on the growth performances and survival of *Rutilus rutilus caspicus* were studied.

MATERIALS AND METHODS

In this study has been carried out in Sijual bony fishes reproduce and cultivate center (Gorgan, Golestan, Iran) on 2010 summer. This experiment was conducted for six weeks at four treatments and three replications as follows: Treatment A: One time a day at 08:00 h, treatment B: Two times a day at 08:00, 12:00 h, treatment C: Three times a day at 08:00, 12:00, 16:00 h and treatment D: Four times a day for feeding at 08:00, 12:00, 16:00, 20:00 h. Initial body weight and length



average were 0.9 gr. Given the importance of the physical and chemical factors and their impact on water supply and ultimately the fish growth, these factors were so controlled through the experiment that the amount of dissolved oxygen was fixed on 5.5 - 6 ppm, the temperature 26 ± 2 °C and pH 7.5 to 8. *Rutilus rutilus caspicus* were fed during the experimental period with SFK feed staff containing: 8.7 % moisture, 11.2 % ash, 32 % protein and 10.5 % fat. Feeding rate which paid attention to live weight and in different times and after each two weeks biometry, equal 10 % of body weight is calculated and was entered to each aquarium. Fish performances were evaluated in terms of Feed Conversion Ratio (FCR), Specific Growth Rate (SGR, % d⁻¹), Body Weight Index (BWI %), Growth Rate (GR, gr d⁻¹), Condition Factor (CF, gr/Cm) and Survival (%). These performance indices were calculated as follows (Hung et al., 1989; Ronyai et al., 1990; Biswas et al., 2010):

- $FCR = \text{total feed intake} / \text{total biomass gain}$
- $SGR = [(\ln \text{ final weight} - \ln \text{ initial weight}) / \text{rearing duration in days}] \times 100$
- $BWI = [(\text{body weight final} - \text{body weight initial}) / \text{body weight initial}] \times 100$
- $GR = (\text{body weight final} - \text{body weight initial}) / \text{rearing duration in days}$
- $BWI = [(\text{body weight} / \text{total length}^3)] \times 100$
- $\text{Survival} = (\text{number of fish harvested} / \text{number of fish stocked}) \times 100$

For analysis of all data were used SPSS version 13 and a software program for drawing graphs of Excel

2003. All data were analyzed with one-way analyses of variance (ANOVA) and significant means were subjected to a multiple comparison test (Duncan) at $P < 0.05$. When the normality of data did not present, the nonparametric test Kruskal-Wallis to compare treatments and test Mann - Whitney for paired comparison between treatments were used.

RESULTS AND DISCUSSION

Final weight and length of *Rutilus rutilus caspicus* in different treatments with 1, 2, 3 and 4 feeding frequency per day are shown in table 1. Obtained results in this study showed that increasing feeding frequency has no effect on increasing weight and length of *Rutilus rutilus caspicus* and there is no need full difference in this respect among considered treatments ($p > 0.05$). Comparison average of different feeding frequency effects on *Rutilus rutilus caspicus* growth factors during culture period are shown in table 2. The results showed that there isn't any meaningful difference in FCR, % BWI, SGR, GR, CF and survival in different treatments ($p > 0.05$).

Culture condition like flock density, temperature, water quality and feeding frequency are effective on fish growth in aquaculture (Wallace et al, 1988). Change in some factors like feeding frequency, feeding technique, or fish density may cause some changes in different fish species body weight (McCarthy et al, 1996). Feeding frequency is an important aspect for the survival and growth of fish at the early stage (Mollah and Tan, 1982). Over-feeding leads not only to reduction in feed

Table 1. The average of weight and length of *Rutilus rutilus caspicus* in different treatments

Treatments		Initial weight (gr)	Initial length (cm)	Final weight (gr)	Final length (cm)
A	1 time feeding per day	0.9±0.23 ^a	4.61±0.18 ^a	3.25±0.087 ^a	5.13±0.37 ^a
B	2 times feeding per day	0.9±0.23 ^a	4.61±0.18 ^a	3.29±0.034 ^a	5.06±0.33 ^a
C	3 times feeding per day	0.9±0.23 ^a	4.61±0.18 ^a	3.27±0.077 ^a	5.15±0.3 ^a
D	4 times feeding per day	0.9±0.23 ^a	4.61±0.18 ^a	3.27±0.071 ^a	5.12±0.28 ^a

The small Latin letters show that there are significant differences among different treatments

Table 2. Effect of different feeding frequency on growth performances in *Rutilus rutilus caspicus*

Indicadores	Treatment A	Treatment B	Treatment C	Treatment D
FCR	3.73±0.1 ^a	3.70±0.04 ^a	3.71±0.04 ^a	3.78±0.08 ^a
SGR (% d-1)	2.62±0.044 ^a	2.65±0.017 ^a	2.63±0.021 ^a	2.63±0.035 ^a
BWI (%)	225±5.92 ^a	229±2.6 ^a	227.4±2.78 ^a	227.13±4.9 ^a
GR (gr d-1)	0.05±0.0017 ^a	0.0513±0.0006 ^a	0.0503±0.0006 ^a	0.0503±0.0015 ^a
CF (gr/Cm)	2.41±0.25 ^a	2.54±0.12 ^a	2.4±0.165 ^a	2.46±0.34 ^a
Survival (%)	93.33±2.89 ^a	85±5 ^a	93.33±2.89 ^a	91.67±5.77 ^a

The small Latin letters show that there are significant differences among different treatments

conversion efficiency and increase in input cost, but also accumulation of wastes that adversely affects the water quality (Biswas et al., 2006). Also, the survey results showed that increasing of feeding frequency there isn't effect on growth and survival in *Rutilus rutilus caspicus*. Booth et al (2008) noted that 1 to 4 feeding frequency per day may have the best function for increasing growth in *Salmonidae* and Australian snapper, the results of this study is not the same. Johansen and Jobling (1998) have reported that feeding frequency increase, fish swimming activity increase too and so energy consuming will be more and growth will be less. The highest growth in the low frequency of feeding occurs (Tsevis et al, 1992). Study conclusions have shown that one-time feeding will be enough for the normal growth of *Micropogonias furnieri* (Aristizabal-Abud., 1990), Korean rock fish (Lee et al., 2000), yellow tail flounder (Dwyer et al., 2002), the results of this study is the same. But for some species it should be 2 to 6 times a day like European seabass (Ruohonen et al., 1998) and Tilapia (Riche et al., 2004), the results of this study is not the same. Research on business culture species like Black Rock fish have shown that one - time feeding per day results in normal growth and full use of feed in comparison to one time feeding in every 2 days or 2 time feed per day (Guen- up et al, 2004), the results of this study is not the same. Although results of other researchers showed that increasing feeding frequency, causes feed acceptance increase and fish growth in many cases (Dwyer et al.,

2002). Study results on young cat fish by Murai and Andrews (1976) have shown that more feeding frequency is needed for growth increase. Similarly, Mollah and Tan (1982) and Charles et al (1984) have reported that increasing feeding frequency in *Clarias macrocephalus* and *Cyprinus carpio* will cause an increase in growth, the results of this study is not the same. Comparison of other study show none of the results were not consistent with the results of this study was that increased feeding frequency varies in different fish.

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Conclusion

However, research results showed that the feeding frequency and growth rate are different in different species. Listen Read phonetically Totally, we can conclude with respect to resulting conclusions that feeding frequency per day will have a meaningful effect on *Rutilus rutilus caspicus* weight and length and two-times feeding is advised under tested situation including changing water and airing.



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