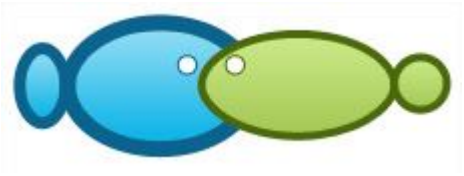

Growth performance of tinfoil barb (*Barbonymus schwanenfeldii*) fry feeding with different protein content diets

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Abstract. Tinfoil barb, *Barbonymus schwanenfeldii* is a commercially important freshwater fish, which is found in the sub-tropical and the tropical regions like Malaysia. Despite the commercial importance, research on the growth performance of *B. schwanenfeldii* is yet to be explored. This study aimed to determine the growth performance which includes the survival rate (SR) and the feed conversion ratio (FCR) of *B. schwanenfeldii* fed with different types of portentous diets in a controlled laboratory condition. The experiment was carried out for 60 days, and three types of different treatments consisted of TP0 (32% protein content), TP1 (28% protein) and TP2 (23% protein). All experiments were performed in triplicates, with every treatment being carried out in nine plastic boxes with 1 metre depth and 2 metre diameter. Every container held 330 fish, which were fed two times a day depending on their body weights, at a 10% rate (for the initial 1 month) and at the rate of 5% for later stages. Findings indicated that the fish had significantly ($p < 0.05$) different growth performance when fed on different level of protein content diets. The significant higher final body weight and lower FCR value was observed when the fish were fed with TP0, which contained the highest protein content, followed by the TP1 diet and TP2. However, it was observed that the SR did not differ significantly ($p < 0.05$) amongst the three different treatments. Our study suggested that the *B. schwanenfeldii* could be cultured in the diets containing 32% protein, in a controlled environment.
Key Words: *B. schwanenfeldii,* growth, protein diet, survival, water quality parameter.

Introduction. The tinfoil barb (*Barbus schwanenfeldii*) locally known as Lampam, belongs to the family of Cyprinidae, mostly found in tropical and sub-tropical areas including Malaysia. *B. schwanenfeldii* is fundamentally a fresh water fish and inhabits in rivers and lakes with a pH ranging from 6.5 to 7.0 and the temperature ranging from 20.4 to 33.7^{o}C (Taki 1978). The average weight of *B. schwanenfeldii* is 200 to 600 g and its size range between 10 to 25 cm. It is estimated that if a specific diet is provided, *B. schwanenfeldii* may reach a size of 30 cm (Isa et al 2012) and its weight may exceed up to 1.0 kg (Christensen 1992). *B. schwanenfeldii* is the fast-breeding fish with two cycles in a period of 15 weeks. Males of all sizes possess mature testes while female fish which is heavier than 160 g have mature ovaries throughout the year (McAdam et al 1999). *B. schwanenfeldii* feed on insects, filamentous algae, and debris for its food. *B. schwanenfeldii* is very popular among localities due to its tasty meat, and it has gained economic importance. Its meat is highly valuable and marketed on a high price that makes it important for the aquaculture (Isa et al 2012).

Due to the high demand for this fish, research has been done from time to time on the population dynamics, growth factors and the weight and length determinants (Isa et al 2012; Sugama et al 2004). The high consumption of this fish has led it to the border of being endangered and its preservation has become an essential part of sustainable development and administration of the domestic fisheries (OECD 2006). It is necessary to have an understanding of the biological mandates of the *B. schwanenfeldii*'s life history,

growth rate, mortality, and effective meat enhancing practices (Pauly 1980). Thus, this study was done to examine the growth performance consisting of survival rate (SR) and the feed conversion ratio (FCR) of *B. schwanenfeldii* in different level of protein content diets in a controlled laboratory condition.

Material and Method. *B. schwanenfeldii* fry was collected from Aquaculture Development Center, Tasik Chini, Pahang, Malaysia, with average weight and length of 1.2±0.3 g and 12.46±0.03 mm, respectively. This experiment was executed for a period of 60 days, on February to March 2015, with 3 treatments which are TP0 (32% protein), TP1 (28% protein) and TP2 (23% protein) with 3 replication each in 9 plastic containers of 1 meter deep and 2 meter diameter. The stocking density was 330 fish in each container and the fish was fed twice daily based on the body weight at the rate of 10% (initially for one month) and 5% in thereafter. The SR and FCR were calculated after Ahmadi et al (2011) and De et al (2016) respectively, using body weight gain (BWG), feed intake (FI), and mortality records. The calculations were done as:

$$BWG = 100 \times \frac{\text{final body weight} - \text{initial body weight}}{\text{initial body weight}}$$

$$FI = \frac{\text{Feed consumed}}{\text{Day}}$$

$$SR\ (\%) = \frac{\text{Number of live fish (live fry} - \text{dead fry)} \times 100}{\text{Initial number of total fish}}$$

$$FCR = \frac{\text{Food intake (g, as fed basis)}}{\text{Body weight gain (g)}}$$

Water quality parameters were examined on a daily basis during this period. Temperature and DO were assayed using oximeter (WTWoxi, Weilheim, Germany), while pH was measured using pH meter (Thermo Scientific™, Benchtop). All measurements were done according to the methods established by Tripathi & Govil (2001).

Statistical analysis. The growth parameters were tested for the normality and equality of variances prior to analyses. The computer software MINITAB 17 (StatSoft Inc., Tulsa, OK, USA) was used for statistical analyses. A statistical significance of 5% was adopted for all cases (De et al 2016).

Results and Discussion. The fish growth performance was significantly ($p < 0.05$) different amongst the three different types of proteinaceous diets, indicating that the protein content in each diet implies significant influence on *B. schwanenfeldii*. Significantly ($p < 0.05$) higher final fish weight was observed in the TP0, which contained the highest protein content, 32% while no significant difference ($p > 0.05$) was observed between TP1 and TP2 (Figure 1).

The SR did not differ significantly ($p > 0.05$) amongst the three treatments throughout the experimental period (Figure 2). Also, the lowest mean FCR was observed at week six and eight in treatment TP0 (Figure 3), while there were no significant differences ($p > 0.05$) among the other treated groups in FCR throughout the experiment (Figure 3).

Decreased in FCR at week six and eight for TP0 might be attributed to maintenance energy requirements that could have been utilized for growth. These findings have been parallel with study by Sealey et al (2009) which showed that the SR in neon tetra, *Paracheirodon innesi* was not affected by the protein level in the diet. The SR might be ascribed to the effects of pH and temperature on the survival and growth of fry and juvenile *B. schwanenfeldii* (Rashid 2014). A study by Suharmili et al (2015) indicated that 34.6% was the optimal dietary protein requirement of lemon fin barb *Hypsibarbus wetmorei* hybrid fingerlings for better growth and feed efficiency. This value

was higher than the optimal requirements of silver barb *Barbonymus gonionotus* (30%) (Mohanta et al 2008). The optimal dietary protein requirement may be different with fish size, species, diet formulation, culture conditions, dietary energy level and protein quality used (Webster & Lim 2002). It is studied that different protein sources can affect the protein requirement of a fish (Ogunji et al 2008). Protein composition, amino acid profile, phosphorus content and palatability of feeds are some of the factors that may contribute to the variation in the results obtained. Sufficient dietary energy level need to be studied because a portion of protein is utilized as an energy source when the fish feed is deficient in energy (Ali et al 2008). However, when fish is fed with a high protein diet, protein is delaminated and partially catabolized to provide energy for maintenance, thus reducing the protein conversion efficiency for growth of fish (Mohanta et al 2008). Utilization of dietary protein by an organism also depends on the types of diet, digestibility of dietary protein, amino acid profile, the ratio of energy to protein in diet and the amount of protein supplied (Mohanta et al 2008). In this study, the TP0 treatment was efficiently utilized and contributed to the maximum growth, resulting in higher final body weight and lowest FCR compared to other treatments.

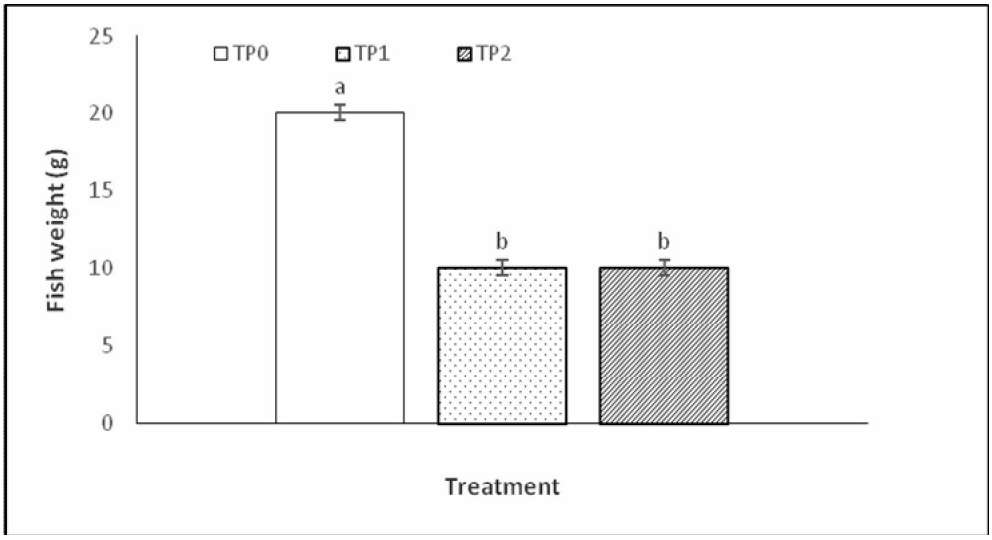

Figure 1. Final body weight (g) observed in the different treatments during the experimental period for *B. schwanenfeldii.* Different small letters on the graph show the significant difference ($p < 0.05$) between treatments.

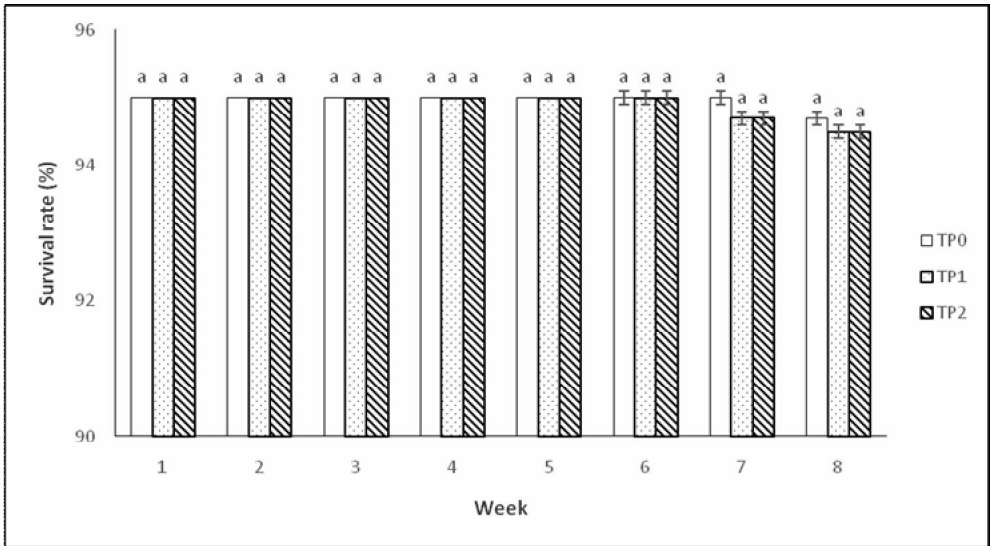

Figure 2. Fish survival rate (%) observed in the different treatments during the experimental period for *B. schwanenfeldii.* Different small letters on the graph show the significant difference ($p < 0.05$) between treatments.

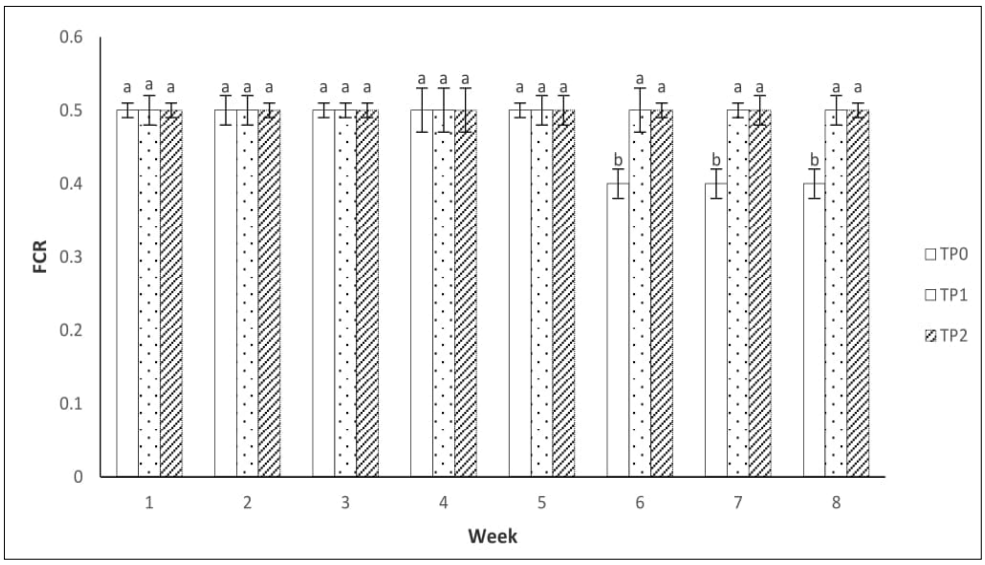

Figure 3. Food conversion ratio (FCR) in the different treatments during the experimental period for *B. schwanenfeldii.* Different small letters on the graph show the significant difference ($p < 0.05$) between treatments.

The water quality parameters were found to be within the controlled range and no significant differences ($p > 0.05$) were observed throughout the experimental period. The temperature was found to be within 25.00±0.10°C, dissolved oxygen (DO) was within 7.2±0.3 mg L^{-1} and pH was within 6.5±0.2.

Conclusions. The treatment with the highest protein content, TP0 improved the final body weight in *B. schwanenfeldii* fish and reducing the FCR value. A diet containing 32% protein should be recommended for the practical culture of *B. schwanenfeldii* fry as it gave the best growth performance.

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