Optimal Ratio between n-3/n-6 Essential Fatty Acids in Shrimp Feed for Growth of Black Tiger Shrimp (Penaeus monodon Fabricius, 1798) Cultured in Cages in Earthen Pond

Supis Thongrod¹ Montakan Tamtin² and Siriporn Luchai Chaiyakul³

¹Thai Union Feedmill Co., Ltd.
²Coastal Aquatic Feed Research Institute
³Chumpon Coastal Fisheries Research and Development Center

Abstract

Effect of dietary n-3 to n-6 fatty acids ratio on growth and survival rate of black tiger shrimp (Penaeus monodon) were studied in net cages (1 m X 2 m X 1.5 m) hanging in an 800 m² earthen pond. There were 2 feeding trials as followed. The first trial composed of 6 treatments each with 3 replications and was conducted in shrimps with initial mean body weight of 0.077 g stocking at 70 individuals per cage. Four groups of shrimps were subjected to 4 formulated diets containing dietary n-3/n-6 fatty acids ratio of 0.17, 0.28, 0.48 and 0.75 namely treatments 1, 2, 3 and 4, respectively. Those were compared with shrimps fed commercial diet (treatment 5) and non-fed shrimps (treatment 6) which was a positive and negative control, respectively. The second trial composed of 6 treatments each with 3 replications. Shrimps with initial mean body weight of 0.420-0.427 gram were stocked at 60 individuals per cage. Diets of treatments 1-4 were the same formula as those of the first trial except an addition of cholesterol and beta-carotene (Blakeslea trispora). These diets contained n-3/n-6 fatty acid ratio equal to 0.17, 0.26, 0.42, 0.48, respectively. Control treatments namely treatment 5 and 6 were shrimps fed with non-defatted fishmeal diet contained 0.25 of n-3/n-6 ratio and shrimps fed with commercial diets, respectively.

Results after 16 weeks rearing period of the first trial showed that growth in term of weight gain (%) and feed conversion rate (FCR) of shrimps in all groups were significantly affected by the diets (p<0.05) whilst survival rate of shrimp were not significant difference (p>0.05). Weight gain (%) of shrimps in treatments 1-4 were significantly lower than that of treatment 5 (control) (p<0.05) and relative growth of those treatments compared to control were 65.5, 64.0, 66.6 and 68.2%, respectively. FCR of shrimps from the control group was the lowest (2.5) but it was not significantly difference from that of treatment 3 which was 3.3. The accumulation of n-3/n-6 fatty acids ratio in tissue of shrimps fed diets 1, 2, 3, 4 and control (5) were 0.38, 0.46, 0.65, 0.74 and 0.56, respectively. Non-fed group revealed as high
accumulation of n-3 HUFA as 12.76% in tissue. The accumulation of essential fatty acids which were C20:4n-6 (6.83%) and n-3/n-6 (0.85) were higher than those of all treatments. Additionally, C20:4n-6 and C20:5n-3 was accumulated at the highest level in shrimps fed diet 3 at amount of 4.65% and 5.27%, respectively. C22:6n-3 was 8.49% in shrimp fed diet 3 and was increased up to 8.68% in shrimp fed diet 4.

Result of second trial after 12 weeks of rearing period showed significantly difference of shrimps weight gain (%) among 6 treatments (p<0.05). Shrimp fed diet 6 had higher weight gain than those of shrimps fed diets 1-5. When growth rate of shrimps fed diets 1-5 were compared to that of control, the relative growths of those groups were 73, 78, 81, 76 and 79%, respectively. Growths of shrimps fed diets 1-4 were not significant different from that of shrimp fed diet 5 (p>0.05). FCR of shrimps fed diets 1-5 were not significant different (p>0.05) and were in the range of 3-3.3, whilst those of shrimps fed diets 1 and 2 were significant higher than that of shrimps fed diet 6 (p<0.05). Shrimps fed diet 1-6 contained n-3/n-6 fatty acids ratio of 0.37, 0.38, 0.56, 0.65, 0.48 and 0.47, respectively.

The results showed that diet 3 from both feeding trials contained suitable n-3/n-6 ratio because shrimps fed those diets accumulated the highest of essential fatty acids. It can be concluded that *P. monodon* required dietary sources of both n-3 and n-6 fatty acids and diets contained both fish and soybean oil level at 2.2 and 1.64%, respectively or with 1.3:1 ratio.

**Key words:** n-3/n-6 ratio, *Penaeus monodon*, Essential fatty acids

*Corresponding author: Phetchaburi Coastal Aquatic Feed Research Unit, Laem Pakbia Sub-district, Ban Laem District, Phetchaburi Province 76100 Tel. 032 478 210 e-mail: mtamtin@hotmail.com*