

Use of biofloc technology during the pre-maturation period of *Litopenaeus vannamei* males: effect of feeds with different protein levels on the spermatophore and sperm quality

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Abstract

The objectives of this study were: (1) Compare two systems for pre-maturation of *Litopenaeus vannamei* in terms of spermatophore and sperm quality, (2) Compare the effect of feeds with different protein levels on reproductive quality of males reared in a biofloc-dominated system. Animals (36.40 ± 3.13 g) reared under biofloc technology (BFT) were used in the 30-day experiment, which involved four treatments: one in a clear water system (CW) and other three in a BFT system. The BFT treatments were differentiated by feed: mix of fish, squid and crab (BFT+FF) composed of 68.48% dietary protein (DP); broodstock feed (BFT+BF) composed of 52.51% DP; and juvenile feed (BFT+JF) composed of 39.91% DP. Feed in the CW was also the mix of fresh food. Spermatophore and sperm quality were analyzed at the beginning and end of the experiment. Higher normal sperm rate was recorded in the CW compared with the BFT+FF. Among the BFT treatments, the BFT+FF had the lowest normal sperm rate. Thus, the use of BFT for pre-maturation of *L. vannamei* allowed the reduction in dietary protein levels from 68.48% (BFT+FF) to 39.91% (BFT+JF) and the maintenance of spermatophore and sperm quality compared to the system based on high daily exchange rate.

Keywords: *Litopenaeus vannamei* (Boone, 1931), pre-maturation systems, biofloc technology, food, dietary protein, spermatophore, sperm quality

Introduction

Among dietary organic compounds, it has been suggested that protein is more associated with the quality of spermatophores and sperm than are lipids or carbohydrates because protein is related to the formation of spermatozoal spike (Sánchez, Pascual, Sánchez, Vargas-Albores, Moullac & Rosas 2001; Goimier, Pascual, Sánchez, Gaxiola, Sánchez & Rosas 2006). The spermatozoal spike is normally a straight structure that is involved in the initial contact between the spermatozoa and the egg coat at the beginning of the dendrobranchiate fertilization process (Braga, Nakayama, Poersch & Wasielesky 2013). Thus, when the spike is absent, spermatozoa are classified as being abnormal (Alfaro 1993) because they are generally unable to attach to the egg (Wang, Misamore, Jiang & Browdy 1995). Concerning protein levels in male diets, Goimier *et al.* (2006) evaluated the effect of three dietary protein levels (35%, 45% and 55% DPL) on the reproductive capacity of *Litopenaeus setiferus* (Linnaeus, 1767) males in a clear water system that had a 200% daily exchange rate. They reported that a lower normal sperm rate was observed in males fed 35% and 55% DPL feeds. Thus, males should be fed at 45% DPL to maintain their reproductive quality.

Feed management for shrimp maturation is not generally based on dietary protein levels, instead it is based on diversifying foods to increase the chance of reaching the broodstock nutritional requirements (Wouters, Zambrano, Espin, Calderon, Lavens &