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Biofloc technology application in African catfish fingerling production: The effects on the reproductive performance of broodstock and the quality of eggs and larvae

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ABSTRACT

The present study evaluated the effects of biofloc technology (BFT) application on African catfish (*Clarias gariepinus*) fingerling production with more focus given to the reproductive performance of broodstock and the quality of eggs and larvae. For broodstock experiment, two broodstock culture systems were compared, i.e. biofloc and control systems. In biofloc systems, regular additions of organic carbon source (molasses, C/N ratio of 10) were conducted to stimulate the growth of heterotrophic microbial biomass as the main constituent of biofloc, whereas no molasses was added to the control systems. Young female broodstock with a mean body weight of 657 ± 0 g were maintained in three replicate outdoor tanks (2.5 × 2.0 × 0.8 m) per treatment at a density of 5 fish/m^2, whereas male fish were maintained in two replicate tanks per treatment at a density of 4 fish/m^2. The larvae produced by the broodstocks in both systems were subsequently assessed by larval starvation tolerance test and growth test. The gonadosomatic index (GSI) and fecundity of female broodstocks in both treatments were generally comparable, except on day-122 when the relative fecundity of biofloc broodstock was 26% higher than that of the control ($P < 0.05$). Interestingly, the embryonic development rate of eggs produced by biofloc broodstocks was higher than that of the control ($P < 0.05$). The survival in starvation tolerance test and growth tests was notably improved in the larvae produced by biofloc broodstocks. Furthermore maintaining the larvae in biofloc systems could also enhance the fish survival and final body length.

Statement of relevance: This study demonstrates a novel research on the application of biofloc technology in broodstock and larval rearing of African catfish. Housing African catfish broodstock in biofloc systems significantly affected the embryonic development rate and the larval quality. Improvements in survival and growth were observed in the larvae housed in biofloc systems.

1. Introduction

Biofloc systems are relatively new aquaculture systems, which has been widely applied in recent years. The basic principle of this technology is the microbial conversion of nutrient waste in aquaculture systems (mainly ammonia) into microbial biomass that can be utilized back by the cultured organisms as a food source (De Schryver et al., 2008; Avnimelech, 2009; Crab et al., 2012). Hence, the nutrient wastes that maybe toxic for the cultured organisms can be maintained at low concentrations and the feed nutrient utilization efficiency can be enhanced. Furthermore, previous studies demonstrated that the application of biofloc systems not only improved the feed efficiency and reduced the nutrient waste, but also brought about positive effects on the immunity (Ekasari et al., 2014; Cardona et al., 2016) and the reproductive performance of the cultured organisms (Emerenciano et al., 2014; Ekasari et al., 2015b; Braga et al., 2015; Cardona et al., 2016). Our study on Nile tilapia showed that housing the broodstock in biofloc systems resulted in 65% higher larvae production (Ekasari et al., 2015a) with higher quality, i.e. more resistance to *Streptococcus agalactiae* infection and more tolerance to salinity stress (Ekasari et al., 2015a). These positive effects of biofloc systems in tilapia or shrimp reproduction have been attributed to the consumption of bioflocs that contain various essential nutrients by the broodstocks. Indeed, bioflocs have been reported to compose of some essential nutrients that support the animal's optimal growth and reproductive success such as essential amino acids, essential fatty acids, antioxidants and vitamins (Ekasari et al., 2015b; Ju et al., 2008; Kuhn et al., 2009). In addition, the consumption of bioflocs by the animals might release some microbial components known as microbial associated molecular patterns (MAMPs)

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