

**Hot water extract of *Pleurotus pulmonarius* stalk waste enhances innate immune response and immune-related gene expression in red hybrid tilapia *Oreochromis* sp. following challenge with pathogen-associated molecular patterns**

ABSTRACT

In aquaculture, commercial fish such as red hybrid tilapia are usually raised at high density to boost the production within a short period of time. This overcrowded environment, however, may cause stress to the cultured fish and increase susceptibility to infectious diseases. Antibiotics and chemotherapeutics are used by fish farmers to overcome these challenges, but this may increase the production cost. Studies have reported on the potential of mushroom polysaccharides that can act as immunostimulants to enhance the immune response and disease resistance in fish. In the current study, hot water extract (HWE) from mushroom stalk waste (MSW) was used to formulate fish feed and hence administered to red hybrid tilapia to observe the activation of immune system. Upon 30 days of feeding, the fish were challenged with pathogen-associated molecular patterns (PAMPs) such as lipopolysaccharides (LPS) and polyinosinic:polycytidylic acid (poly (I:C)) to mimic bacterial and viral infection, respectively. HWE supplementation promoted better feed utilisation in red hybrid tilapia although it did not increase the body weight gain and specific growth rate compared to the control diet. The innate immunological parameters such as phagocytic activity and respiratory burst activity were significantly higher in HWE-supplemented group than that of the control group following PAMPs challenges. HWE-supplemented diet also resulted in higher mRNA transcription of *il1b* and *tnfa* in midgut, spleen and head kidney at 1-day post PAMPs injection. *Tlr3* exhibited the highest upregulation in the HWE fed fish injected with poly (I:C). At 3-days post PAMPs injection, both *ighm* and *tcrb* expression were upregulated significantly in the spleen and head kidney. Results showed that HWE supplementation enhances the immune responses of red hybrid tilapia and induced a higher serum bactericidal activity against *S. agalactiae*.

**Keyword:** Immune response; Mushroom waste; Tilapia; PAMPs; Polysaccharides