

INTISARI

Pengaruh Suplementasi Probiotik, Prebiotik, dan Sinbiotik dalam Pakan Terhadap Ekspresi Gen, Imunitas Non-Spesifik dan Ketahanan Ikan Nila Merah (*Oreochromis sp.*) terhadap Infeksi *Streptococcus agalactiae*

Intervensi pakan berupa probiotik, prebiotik, dan sinbiotik telah menunjukkan potensi dalam memodulasi sistem imun inang, namun pengaruhnya terhadap ekspresi gen imun bawaan serta ketahanan terhadap penyakit pada ikan nila merah (*Oreochromis sp.*) selama infeksi *Streptococcus agalactiae* masih belum jelas. Penelitian ini mengkaji pengaruh suplementasi probiotik, prebiotik, dan sinbiotik terhadap ekspresi gen imun, respons imun nonspesifik, serta ketahanan terhadap *S. agalactiae* pada ikan nila merah (*Oreochromis sp.*). Ikan ditebar dengan kepadatan 125 ekor/m³, diaklimatisasi selama 7 hari, dan diberi pakan perlakuan sebanyak 3% biomassa per hari selama 60 hari. Perlakuan pakan meliputi probiotik *Bacillus tropicus* PCP 1 dan *Lactococcus garvieae* JAL 37 (10⁸ sel/g pakan), prebiotik inulin (5 g/kg pakan), serta kombinasinya (sinbiotik). Hasil penelitian menunjukkan bahwa meskipun hanya pakan sinbiotik yang meningkatkan ekspresi gen musin-2 di usus, seluruh kelompok perlakuan menunjukkan peningkatan yang cukup besar pada aktivitas ledakan respirasi dan fagositosis sel darah putih. Tidak ada peningkatan ekspresi gen IL-1 β dan TNF- α di limpa. Uji tantangan menunjukkan bahwa perlakuan probiotik mengurangi kematian ikan menjadi 7%, sinbiotik dan prebiotik 3%, sedangkan pakan basal mengalami kematian 100% pada hari ketujuh setelah infeksi. Penelitian ini menyimpulkan bahwa suplementasi probiotik *B. tropicus* PCP 1 dan *L. garvieae* JAL 37 menunjukkan respons paling efektif dalam meningkatkan ketahanan awal ikan nila merah terhadap infeksi *S. agalactiae*, sementara pemberian prebiotik dan sinbiotik memberikan efek protektif yang lebih terbatas, sehingga berpotensi digunakan sebagai strategi pendukung pengelolaan kesehatan ikan sebelum imunisasi.

Kata Kunci: Probiotik; prebiotik, sinbiotik, ledakan respirasi, fagositosis

ABSTRACT

The Effects Of Probiotic, Prebiotic, and Synbiotic Supplementation in Feed on Gene Expression, Non-Specific Immunity, and Resistance of Red Hybrid Tilapia (*Oreochromis sp.*) to *Streptococcus agalactiae*

Feed interventions comprising probiotics, prebiotics, and synbiotics have demonstrated potential to modulate the host immune system; however, their impact on the expression of innate immune genes and disease resistance in red hybrid tilapia (*Oreochromis sp.*) during *Streptococcus agalactiae* infection remains unclear. This research investigated the effects of probiotic, prebiotic, and synbiotic supplementation on the expression of immune-related genes, nonspecific immunological responses, and resistance to *S. agalactiae* in red hybrid tilapia (*Oreochromis sp.*). Fish were introduced at a density of 125 fish/m³, acclimatized for 7 days, and then provided with a daily treatment meal comprising 3% of biomass for 60 days. The intervention comprised the probiotic *Bacillus tropicus* PCP 1 dan *Lactococcus garvieae* JAL 37 (10⁸ cell/g feed), the prebiotic inulin (5 g/kg feed), and the combination (synbiotic). The findings indicated that whereas only the synbiotic diet elevated mucin-2 gene expression in the gut, all treatment groups showed a notable enhancement in leukocyte respiratory burst activity and phagocytosis. No elevation in IL-1 β and TNF- α gene expression was observed in the spleen. Challenge tests indicated that the probiotic treatment reduced fish mortality to 7%, while synbiotic and prebiotic treatments resulted in 3% mortality. In contrast, fish fed the basal diet experienced 100% mortality by the seventh day post-infection. The study concluded that supplementation with the probiotics *B. tropicus* PCP 1 and *L. garvieae* JAL 37 showed the most effective response in enhancing the early resistance of red tilapia against *S. agalactiae* infection, whereas prebiotic and synbiotic supplementation provided more limited protective effects and may therefore be used as supportive strategies for fish health management prior to immunization.

Keywords: Probiotic; prebiotic; synbiotic; respiratory burst, phagocytosis