

CHAPTER VI

CONCLUSION

In conclusion, based on the overall results, dietary supplementation with recombinant probiotic *B. subtilis* expressing *GULO* could be considered for prophylactic and therapeutic applications, owing to the combined effects of vitamin C and probiotic *B. subtilis*. In prophylactic roles, supplementation with recombinant *B. subtilis* expressing *GULO* in normal fish resulted in improvements in growth performance, antioxidant activity, and immune responses. In addition, it may demonstrate therapeutic potential in the early stages of *S. agalactiae* infections due to its ability to enhance immune responses and pro-inflammatory cytokine production and to exhibit antagonistic properties against *S. agalactiae*. These could help to reduce the prevalence of the disease in Nile tilapia, particularly in the intensive aquaculture industry, which often relies on the application of drugs and chemicals. However, this study was primarily conducted under strictly controlled laboratory conditions. Further research is needed to assess long-term effects, optimize the dosage under field conditions, and improve signal peptides for enhanced recombinant *B. subtilis* protein expression.