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Laboratory and Field Assessments of Oral Vibrio Vaccine Indicate the Potential for Protection against Vibriosis in Cultured Marine Fishes

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Abstract
Vibriosis is one of the most common threats to farmed grouper; thus, substantial efforts are underway to control the disease. This study presents an oral vaccination against multiple Vibrio spp. in a marine fish with double booster immunisation. The Vibrio harveyi strain VH1 vaccine candidate was selected from infected groupers Epinephelus sp. in a local farm and was formalin inactivated and combined with commercial feed at a 10% ratio (v/w). A laboratory vaccination trial was conducted for seventy days. The induction of IgM antibody responses in the serum of Asian seabass Lates calcarifer immunised with the oral Vibrio harveyi strain VH1 was significantly ($p < 0.05$) increased as early as week one post-primary vaccination. Subsequent administration of the first and second booster for 5 consecutive days, starting on days 14 and 42, respectively, improved the specific antibody level and reached a highly significant ($p < 0.05$) value at days 35 and 49 before slightly decreasing from day 56 onwards. Antibody titres of the control unvaccinated group remained relatively stable and low throughout the experimental period. At the end of the 70-day vaccination trial, 23 days post final boost, an intraperitoneal challenge with a field strain of Vibrio harveyi, V. alginolyticus, and V. parahaemolyticus was carried out. Our challenge study showed that oral Vibrio harveyi strain VH1 vaccine candidate could induce significant protection, with an RPS of 70–80% against different Vibrio species. Thereafter, a field trial was conducted in a mariculture farm to study the effect of field vaccination using the oral Vibrio harveyi strain VH1 vaccine candidate. A total of 3000 hybrid grouper juveniles were divided into two groups in triplicate. Fish of Group 1 were not vaccinated, while Group 2 were vaccinated with the feed-based vaccine. Vaccinations were carried out on days 0, 14, and 42 via feeding the fish with the vaccine at 4% body weight for 5 consecutive days. At the end of the study period, the fish survival rate was 80% for the vaccinated group, significantly ($p < 0.05$) higher than the 65% seen in the control unvaccinated group. Furthermore, the vaccinated fish showed significantly ($p < 0.05$) better growth performances. Therefore, the oral Vibrio vaccine from the inactivated Vibrio harveyi strain VH1 is a potential versatile vaccine candidate that could stimulate good immune responses and confer high protection in both Asian seabass, Lates calcarifer, and farm hybrid grouper Epinephelus fuscoguttatus × Epinephelus lanceolatus. © 2022 by the authorsLicensee MDPI, Basel, Switzerland.

Author Keywords
Marine fishes; Oral vaccine; Vibrio harveyi; Vibriosis

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DNA topoisomerase (ATP hydrolysing) B, formaldehyde, genomic DNA, immunoglobulin M, RNA 16S, unclassified drug, vaccine, vibrio vaccine; antibiotic resistance, antibody production, antibody response, aquaculture, Article, bacterium identification, bacterium isolation, body weight gain, colony forming unit, controlled study, Epinephelus, Epinephelus fuscoguttatus, Epinephelus lanceolatus, fish, food intake, growth, immune response, immunization, laboratory, Lates calcarifer, muscle necrosis, nonhuman, polymerase chain reaction, protection, sequence analysis, skin necrosis, skin ulcer, survival, survival rate, vaccination, Vibrio, Vibrio alginolyticus, Vibrio harveyi, Vibrio parahaemolyticus, vibriosis, water quality

Chemicals/CAS
formaldehyde, 50-00-0; immunoglobulin M, 9007-85-6

Tradenames
T100, Biorad, United States; YSI Pro Plus

Manufacturers
Qiagen, Germany; Biorad, United States; HACH Company, United States; Thermo

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