

Homeopathy shows potential to reduce antibiotic use in intensive shrimp aquaculture

Mazón-Suástegui J, García-Bernal M, Medina-Marrero R et al. Growth, survival, and modulation of the intestinal microbiota of shrimp *Penaeus vannamei* fed with probiotic actinomycetes and highly diluted bioactive compounds. *Lat. Am. J. Aquat. Res.* 2025; **53(2)**: 242–254.

Synopsis

Intensive aquaculture of Pacific white shrimp (*Penaeus vannamei*) faces escalating disease challenges. In particular, certain species of pathogenic *Vibrio* bacteria (e.g. *V. parahaemolyticus* and *V. alginolyticus*) commonly found in marine and coastal environments, can cause mass mortalities in farmed shrimp populations. The consequential increase in antibiotic use raises serious environmental concerns and risks accelerating antimicrobial resistance.

Beneficial probiotic bacteria e.g. *Streptomyces*,¹ and homeopathic ‘highly diluted bioactive compounds’ (HDBC),² are promising sustainable alternatives. However, their individual and combined effects on shrimp growth and gut microbiota remain incompletely understood. This knowledge gap limits evidence-based implementation of integrated probiotic-HDBC strategies in commercial shrimp production.

This study evaluates the individual and synergistic effects of *Streptomyces* probiotics and HDBC on growth, survival, and gut microbiota composition in juvenile Pacific white shrimp. The HDBC contained four substances prepared to 7C potency:³ two *Vibrio* lysates (inactivated fragments from *V. parahaemolyticus* and *V. alginolyticus* bacteria) and two homeopathic medicines – *Phosphoricum acidum* and *Silicea terra*.

The experimental design consisted of four treatment groups and two control groups, each replicated three times:

Treatment 1 (T1)	<i>Streptomyces</i> probiotics only (species N7 and species RL8)
Treatment 2 (T2)	HDBC only
Treatment 3 (T3)	HDBC plus <i>Streptomyces</i> sp. N7
Treatment 4 (T4)	HDBC plus <i>Streptomyces</i> sp. RL8
Control 1 (C1)	Untreated sterile distilled water
Control 2 (C2)	Ethanol diluted in sterile distilled water

Juvenile shrimp were obtained from commercial sources and maintained under controlled aquaculture conditions. Growth parameters including size increase and weight gain were monitored throughout the experimental period. Survival rates were calculated at study termination. Microbiological analyses quantified beneficial heterotrophic bacteria and pathogenic *Vibrio* spp. populations in both culture water and shrimp hepatopancreas⁴ tissue. Gut microbiota composition was characterised via 16S rRNA gene

1. *Streptomyces* spp. are soil bacteria known for producing antimicrobials, enzymes, and immunomodulatory compounds, making them promising probiotic candidates in aquaculture.
2. Substances prepared through serial dilution and succussion (vigorous shaking with impact) i.e. the same manufacturing process used to produce homeopathic medicine.
3. A homeopathic preparation created by diluting the original substance 1:100 seven successive times, with succussion between each stage of dilution.
4. Digestive gland in crustaceans performing similar functions to the liver and pancreas in vertebrates.

sequencing – a technique which can identify bacteria through analysis of a specific section of their genetic code.

Growth and survival outcomes were as follows:

- **Size increase was significantly greater in shrimp treated with Streptomyces probiotics only (T1) and HDBC only (T2)** compared with both control groups (C1 and C2).
- **Weight gain was significantly higher in the HDBC only group (T2)** compared with combined HDBC plus Streptomyces sp. RL8 (T4) and Streptomyces only (T1).
- Survival rates ranged from 95.33 to 99.33% across all groups. T1 and T3 recorded the highest survival, although no statistically significant differences were observed between treated and control groups.

Microbial outcomes were as follows:

- **Vibrio spp. counts in culture water decreased substantially in T1 and T2** compared with controls ($P < 0.05$).
- *Vibrio* spp. colonisation of the hepatopancreas was suppressed in T1, T2 and T4 compared with control 1 ($P < 0.05$).
- **Heterotrophic bacterial populations in the hepatopancreas increased across all treatment groups relative to C1**, indicating beneficial microbiota enhancement.
- Gut microbiota analysis revealed a diverse community dominated by Proteobacteria, Bacteroidetes, Verrucomicrobia, and Actinobacteria. **Each treatment selectively stimulated a distinct genus:** Streptomyces alone (T1) stimulated Prevotella, HDBC alone (T2) stimulated Acinetobacter, and the combination of HDBC with Streptomyces N7 (T3) stimulated Bacteroides and Enhydrobacter, while the HDBC plus Streptomyces RL8 combination (T4) stimulated no specific genus.

It is noteworthy that these findings align with previous research demonstrating similar benefits of HDBC in other aquaculture species, including juvenile Catarina scallop and longfin yellowtail fish [1-3]. Some limitations should be noted. Controlled laboratory conditions in this study may not reflect the stressors of commercial shrimp farming. The 30-day trial captures juvenile responses only, leaving long-term effects on growth, reproduction and economic outcomes unaddressed. Nevertheless, the well-structured design, multiple treatment groups, adequate replication and two distinct controls strengthen the reliability of the findings.

This research contributes valuable evidence supporting the potential application of probiotic bacteria and homeopathic preparations in Pacific white shrimp aquaculture. **The findings demonstrate that Streptomyces probiotics and HDBC, when administered individually, enhanced growth and reduced pathogenic Vibrio populations whilst modulating beneficial gut microbiota in *P. vannamei* juveniles.** These treatments show promise as components of integrated health management strategies for intensive shrimp farming, offering a natural alternative that could reduce antibiotic dependency.

References

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