

Original Research Article

<https://doi.org/10.20546/ijcmas.2026.sp13.042>

Post-Pelleting Application of Fish Gut-Derived *Lactiplantibacillus plantarum* in Fish Feed: Growth Performance and Water Quality in a Controlled Feeding Trial

H. Preethi, K. Preethi, M. Priya Dharshini, R. Priyadarshini,
R. Parkavi and Gomathi Natrajan 

Department of Microbiology, Valliammal College for Women, E-9, Anna Nagar East, Chennai – 600102,
Tamil Nadu, India

*Corresponding author

ABSTRACT

Keywords

Probiotic feed;
pelleted feed;
Lactiplantibacillus plantarum
(*Lactobacillus plantarum*); post-
pellet coating; fish
growth; feed
conversion ratio; water
quality; aquaculture

Article Info

Received:
20 August 2026
Accepted:
29 September 2026
Available Online:
10 October 2026

Probiotic delivery through feed is a practical route for introducing beneficial microorganisms into aquaculture systems, but processing and storage conditions can influence bacterial survival. The present study evaluated the preparation of a post-pellet probiotic feed using the fish gut-derived *Lactiplantibacillus plantarum*, and examined growth-related responses during a controlled feeding trial. An actively growing culture was harvested, washed and concentrated before being mixed with a binder and applied to cooled feed pellets. Control and probiotic-coated diets were prepared under aseptic conditions and stored under refrigeration before use. Fish were acclimatized and allocated to control and probiotic-feed groups maintained under comparable tank conditions for the experimental period. Water quality remained within the ranges recorded in the thesis: temperature 27.1–27.3 °C, pH 7.2–7.3, dissolved oxygen 5.8–6.0 mg/L, salinity approximately 12 ppt and ammonia 0.014–0.015 mg/L. Initial body weight was 10 g in both groups, while the recorded final weights were 22 g in the control and 28 g in the probiotic group. The higher specific growth rate was reported for probiotic-fed fish than for controls and lower feed conversion ratio (17.86 versus 25.00). The study nevertheless demonstrates the feasibility of post-pelleting incorporation of the selected *Lactiplantibacillus plantarum* and provides preliminary evidence of a favourable growth response under the recorded experimental conditions.

Introduction

Aquaculture has developed rapidly as a major source of aquatic food and has become increasingly dependent on efficient feeds, stable rearing conditions and preventive health management. As production intensifies, the nutritional and microbial environment of cultured fish becomes progressively more important. Fish are continuously exposed to microorganisms through water, feed and the surrounding culture system, while the intestinal microbiota interacts with host digestion, epithelial function and immunity. Dietary strategies that influence these interactions are therefore being investigated not only to increase growth but also to improve the resilience of fish under intensive culture conditions (Ringo *et al.*, 2016; El-Saadony *et al.*, 2021).

Disease remains one of the major biological constraints in intensive aquaculture. Stress associated with crowding, handling, fluctuations in water quality and nutritional imbalance can weaken host resistance and favour opportunistic infections. Historically, antimicrobial compounds have been used to manage bacterial disease, but the extensive use of antibiotics has generated concerns regarding antimicrobial resistance, environmental contamination and disruption of beneficial microbial communities (Cabello, 2006; Martínez, 2009). These concerns have stimulated the development of functional feed additives that can support fish health without relying solely on antimicrobial chemotherapy. Probiotics are among the most extensively studied biological feed additives in aquaculture. Their reported functions include competitive exclusion of pathogens, production of inhibitory metabolites, modulation of gut microbial communities, enhancement of digestive processes and stimulation of host immune responses. The magnitude of these effects varies according to the microbial strain, host species, dose, duration of administration, diet composition and culture environment (Hai, 2015; Dawood *et al.*, 2016). Consequently, the development of a probiotic feed should be based on a clearly characterized strain and an experimentally appropriate delivery system.

Fish gut-derived strains are of particular interest because autochthonous microorganisms have already adapted to the intestinal environment of their host. Host-adapted strains are not automatically superior to commercial strains, but their physiological compatibility with the original host can be a useful starting point for selection (Gatesoupe, 2008; Hai, 2015).

The route by which probiotics are delivered is a critical component of efficacy. In aquaculture, feed is a practical vehicle because it permits repeated administration and allows the probiotic to reach the gastrointestinal tract directly. Hai (2015) noted that feed supplementation is among the common methods of probiotic administration in aquatic animals. Dietary delivery also permits the use of controlled doses and integration with routine feeding practices. However, probiotic cells can be damaged by feed processing, drying, oxygen exposure and prolonged storage. The method used to introduce the cells into pellets must therefore preserve both the physical properties of the feed and the viability of the microorganism.

Pelleting is particularly relevant because conventional pellet production may expose microorganisms to heat and mechanical stress. If the probiotic is mixed into the feed before high-temperature processing, substantial loss of viability may occur. Post-pelleting coating offers an alternative in which a concentrated probiotic suspension is applied to cooled pellets, thereby avoiding the highest processing temperatures. Tripathi and Giri (2014) emphasized that processing and storage are important determinants of probiotic survival in functional foods and feeds. More recent work on probiotic fish-feed coatings has also demonstrated the feasibility of applying *Lactobacillus plantarum* to finished pellets and maintaining viable cells under suitable storage conditions (Chomova *et al.*, 2023).

A post-pelleting coating generally involves four linked steps: preparation of a high-density probiotic suspension, preparation of a suitable binder or carrier, application of the suspension to the cooled pellet surface, and controlled drying. The binder should facilitate adhesion without producing unacceptable changes in pellet integrity or palatability.

Excessive moisture or high drying temperatures can reduce bacterial survival, while insufficient drying may affect storage stability. Chomova *et al.*, (2023) demonstrated that coating technologies can preserve probiotic viability when moisture exposure and storage temperature are appropriately controlled. These findings provide a conceptual basis for the post-pellet coating approach used in the present work, although the current study used a simpler binder-based method.

Storage is another important determinant of probiotic-feed quality. Temperature, humidity, oxygen exposure,

feed composition and the physical condition of the pellet can influence viable-cell counts. The source thesis stored coated pellets at 4 °C before use. Refrigeration is consistent with the general principle that lower storage temperatures can reduce the rate of viability loss. Chomová *et al.*, (2023) reported sustained viability of coated *L. plantarum* pellets during refrigerated storage and showed that viability decreased more markedly at higher temperature. The present study did not perform a quantitative storage-survival experiment, so the refrigerated storage condition should be described as a preservation measure rather than as evidence of long-term stability.

The biological response to probiotic feed is commonly evaluated using weight gain, specific growth rate, feed conversion ratio and survival. Weight gain provides a direct measure of biomass accumulation, whereas SGR expresses growth relative to body size and time. FCR is an index of feed utilization, although its interpretation depends strongly on the accuracy of feed intake and biomass measurements. Probiotic supplementation has been associated with improved growth and feed utilization in several fish species, but responses are not universal. For example, dietary *L. plantarum* has improved growth and health parameters in some carp studies, while effects on SGR or FCR can vary with dose, strain and host species (Nayak, 2010; Dawood *et al.*, 2016; Jang *et al.*, 2022).

The objective of the present study was to develop a probiotic-coated fish feed using *Lactiplantibacillus plantarum* (previously called as *Lactobacillus plantarum*), prepare the pellets by a post-pelleting coating procedure, and evaluate the associated growth and water-quality observations during the feeding experiment. Particular attention was given to feed preparation, coating, experimental husbandry and growth indices.

Materials and Methods

Probiotic strain

The probiotic candidate used in the feeding experiment was *Lactiplantibacillus plantarum* isolated and identified from the gut of Salmon fish (*Oncorhynchus* species). The strain had shown acid tolerance, bile tolerance, non-haemolytic phenotype and antibacterial activity and was therefore selected for feed application.

Preparation of probiotic inoculum

The selected *Lactiplantibacillus plantarum* isolate was inoculated into de Man, Rogosa and Sharpe (MRS) broth and incubated at 37 °C for 24–48 h to obtain an actively growing culture. Following incubation, the culture was centrifuged at approximately 4,000–5,000 rpm for 10 min to harvest the bacterial cells.

The supernatant was carefully discarded, and the resulting cell pellet was washed twice with sterile phosphate-buffered saline (PBS) to remove residual culture-medium components. The washed bacterial biomass was subsequently resuspended in sterile physiological saline to obtain a concentrated probiotic cell suspension for incorporation into the fish feed. (Chomova *et al.*, 2023; Jang *et al.*, 2023).

Preparation of basal feed and binder

Commercial fish-feed pellets were used as the basal feed. The pellets were maintained under hygienic conditions at room temperature before probiotic application. Gelatin was used as the binding agent. A 2% (w/v) gelatin solution was prepared by dissolving gelatin in distilled water using a water bath and allowing the solution to cool to approximately 30 °C. The cooled gelatin solution was subsequently mixed with the probiotic suspension for application onto the feed pellets. This procedure was adapted from the gelatin-based probiotic feed preparation described by Cretu *et al.*, (2022)

Post-pelleting probiotic coating

The cooled commercial fish-feed pellets were gently mixed with the probiotic–gelatin suspension to ensure uniform distribution of the probiotic cells over the surface of the pellets. Gentle mixing was performed to minimize mechanical damage to the bacterial cells and to obtain a uniform coating.

The coated pellets were spread uniformly on sterile trays and allowed to dry under aseptic conditions at room temperature for 12–24 h. After drying, the probiotic-coated pellets were packed in sterile airtight polyethylene bags and stored at 4 °C until use. The post-pelleting application of probiotic preparations using a binding material and subsequent refrigerated storage has been previously described (Tripathi and Giri, 2014).

Experimental fish and tank conditions

Healthy fish of approximately uniform size and body weight were acclimatized to the laboratory conditions for one week prior to the feeding experiment. During the acclimatization period, the fish were maintained under the same environmental conditions as those used during the experimental trial. Following acclimatization, the fish were randomly allocated into two experimental groups: a control group receiving basal commercial feed and a probiotic group receiving the *Lactiplantibacillus plantarum*-coated feed.

The fish were maintained in separate, continuously aerated tanks containing dechlorinated water under comparable environmental conditions. The experimental tanks were maintained and monitored throughout the feeding trial to minimize differences in environmental conditions between the control and probiotic groups.

The experimental design followed procedures commonly used in controlled probiotic feeding trials in fish (Nayak, 2010; Dawood *et al.*, 2016).

Feeding regime

The fish were fed twice daily throughout the 30-day feeding trial. The control group received the basal commercial feed, whereas the experimental group received the post-pelleting *Lactiplantibacillus plantarum*-coated feed. Feed was administered at approximately 3–5% of body weight per day. Feeding was carried out under similar conditions for both experimental groups, and care was taken to minimize feed wastage. The feeding regime was maintained throughout the experimental period.

Growth measurements and growth performance

Growth measurements were recorded at five-day intervals during the 30-day feeding trial (Day 0, Day 5, Day 10, Day 15, Day 20, Day 25 and Day 30). At each sampling interval, fish were carefully removed from their respective tanks, gently blotted to remove excess water and weighed individually using a digital balance. After weighing, the fish were immediately returned to their respective tanks.

Weight gain was calculated as the difference between the final and initial body weights:

Weight gain (g) = Final body weight (g) – Initial body weight (g)

Specific growth rate (SGR) was calculated using the logarithmic expression:

$$\text{SGR (\% day}^{-1}\text{)} = [(\ln W_2 - \ln W_1) / t] \times 100$$

Where W_1 represents the initial body weight (g), W_2 represents the final body weight (g), and t represents the duration of the feeding trial in days.

Feed conversion ratio (FCR) was calculated as:

$$\text{FCR} = \text{Total feed consumed (g)} / \text{Weight gain (g)}$$

These parameters were used to evaluate the growth performance and feed utilization of fish receiving the control and probiotic-supplemented diets. The use of weight gain, SGR and FCR as growth-performance indices is consistent with established approaches used in probiotic feeding studies in aquaculture (Nayak, 2010; Dawood *et al.*, 2016; Jang *et al.*, 2022).

Water quality monitoring

Water quality parameters were monitored throughout the 30-day feeding trial to maintain suitable and comparable environmental conditions in the experimental tanks. Temperature, pH, dissolved oxygen (DO), salinity and ammonia were measured regularly using appropriate water-quality measuring instruments. Measurements were recorded for both control and probiotic-treatment tanks throughout the experimental period. Continuous aeration was provided to maintain adequate dissolved oxygen levels, and water was periodically exchanged to maintain suitable water-quality conditions. The monitored water-quality parameters were maintained within the acceptable ranges for the experimental fish during the feeding trial (Boyd, 2015).

Results and Discussion

The selected *Lactiplantibacillus plantarum* isolate showed active growth in MRS broth, as indicated by visible turbidity following incubation. After centrifugation, a distinct bacterial cell pellet was obtained, and the recovered biomass was resuspended in sterile physiological saline for preparation of the probiotic feed. The growth of the selected *L. plantarum*

isolate in MRS broth is presented in Fig 1, while the recovery of probiotic biomass following centrifugation is shown in Fig 2.

Two dietary treatments, namely control feed and probiotic-coated feed, were prepared for the feeding experiment. The probiotic suspension was mixed with the gelatin binder and subsequently mixed gently with the cooled commercial fish-feed pellets to obtain uniform distribution of the probiotic cells over the pellet surface. The control and probiotic-coated feed pellets are presented in Fig 3. The prepared pellets were uniform in appearance and retained their physical integrity during the feed preparation process, as shown in Fig 4. The post-pelleting application of the probiotic–gelatin suspension to the feed pellets is shown in Fig 5.

The feeding trial was conducted for a period of 30 days under controlled tank conditions. Water-quality parameters were monitored throughout the experimental period. The mean temperature was 27.1 ± 0.3 °C in the control tank and 27.3 ± 0.2 °C in the probiotic tank, while the corresponding pH values were 7.2 ± 0.1 and 7.3 ± 0.1 , respectively. Dissolved oxygen concentrations were 5.8 ± 0.2 mg L⁻¹ in the control tank and 6.0 ± 0.2 mg L⁻¹ in the probiotic tank. Salinity was recorded as 12.0 ± 0.5 ppt in the control tank and 12.0 ± 0.4 ppt in the probiotic tank, whereas ammonia concentrations were 0.015 ± 0.002 mg L⁻¹ and 0.014 ± 0.002 mg L⁻¹, respectively. The water-quality parameters recorded in the control and probiotic-treatment tanks are presented in Table 1. The relatively small differences observed between the two tanks indicate that the environmental conditions remained comparable during the feeding experiment.

Fish growth was monitored throughout the experimental period, and photographic observations were recorded at different stages of the feeding trial. The photographic series documented the fish from the beginning of the experiment through Day 30 and provided visual observations of the progression of the feeding trial. Representative observations of the fish during the experimental period are presented in Fig 6.

The initial body weight recorded for both the control and probiotic-feed groups was 10 g. At the end of the recorded experimental period, the final body weight was 22 g in the control group and 28 g in the probiotic-feed group. Based on the recorded initial and final body

weights, the corresponding weight gains were 12 g and 18 g, respectively. Thus, fish receiving the probiotic-coated feed showed a higher recorded final body weight and absolute weight gain than fish receiving the control feed. The initial body weight, final body weight and calculated weight gain of the two treatment groups are presented in Table 2.

The recorded growth observations indicated a higher absolute weight gain in the probiotic-feed group compared with the control group.

The present study demonstrated the feasibility of preparing a post-pellet probiotic feed using the fish gut-derived *Lactiplantibacillus plantarum* isolate. The isolate showed active growth in MRS broth, and bacterial biomass was successfully recovered by centrifugation, washed and incorporated into the feed using gelatin as a binding material. The coated pellets retained their physical integrity after application and drying, indicating that the post-pelleting approach was suitable for application of the probiotic to commercial fish feed. Similar observations were reported by Chomová *et al.*, (2023), who developed a post-pelleting coating technology for *L. plantarum*-containing fish feed and demonstrated that the coating did not adversely affect the physical characteristics of the pellets. Their study further showed that viable *L. plantarum* cells could be maintained during refrigerated storage at 4 °C and could gradually be released from the coated pellets.

Although a starch-hydrogel system was used in their study rather than the gelatin-based coating used in the present experiment, both studies demonstrate the potential of post-pelleting application as a practical method for introducing *L. plantarum* into finished fish feed. The water-quality parameters recorded during the present 30-day feeding experiment also remained relatively comparable between the control and probiotic groups. Temperature, pH, dissolved oxygen, salinity and ammonia showed only minor differences between treatments (Table 1), indicating that the experimental groups were maintained under broadly similar environmental conditions. Since water quality is an important determinant of fish growth, the comparable environmental conditions provide support for interpreting the observed growth difference primarily in relation to the dietary treatments, although the absence of replicate-level statistical analysis means that these observations should be considered descriptive.

Table.1 Water-quality parameters recorded during the feeding experiment.

Parameter	Control tank	Probiotic tank	Range/criterion recorded in thesis
Temperature (°C)	27.1 ± 0.3	27.3 ± 0.2	26–28
pH	7.2 ± 0.1	7.3 ± 0.1	6.5–8.0
Dissolved oxygen (mg L ⁻¹)	5.8 ± 0.2	6.0 ± 0.2	>5
Salinity (ppt)	12.0 ± 0.5	12.0 ± 0.4	10–15
Ammonia (mg L ⁻¹)	0.015 ± 0.002	0.014 ± 0.002	<0.02

Table.2 Initial and final body weights recorded for control and probiotic-feed groups.

Parameter	Control feed	Probiotic feed
Initial weight (g)	10	10
Final weight (g)	22	28
Recorded experimental duration	30 days*	30 days*
Weight gain calculated from table values (g)	12	18

Fig.1 Growth of the selected *Lactiplantibacillus plantarum* isolate in MRS broth.



Fig.2 Recovery of *Lactiplantibacillus plantarum* biomass following centrifugation.



Fig.3 Comparison of control feed and probiotic-coated feed pellets.

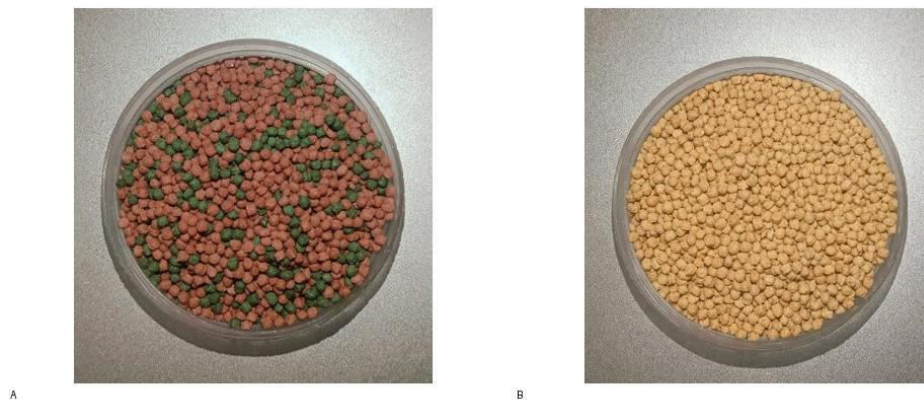


Fig.4 Preparation of fish-feed pellets used for the feeding experiment



Fig.5 Post-pelleting coating of fish-feed pellets with the probiotic-gelatin suspension

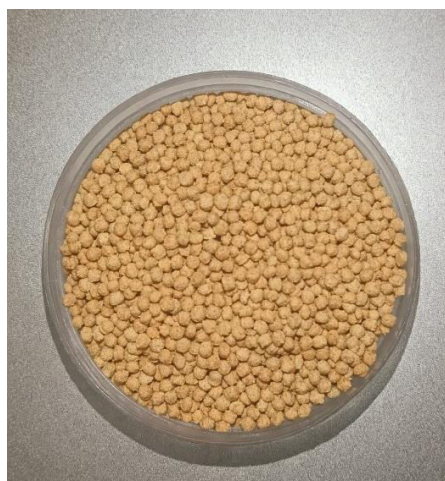


Fig.6 Representative observations of fish during the 30-day feeding experiment.



A clear difference was observed in the growth performance of the two experimental groups. Both groups started with an initial body weight of 10 g, whereas the final body weight was 22 g in the control group and 28 g in the probiotic group, corresponding to absolute weight gains of 12 and 18 g, respectively (Table 2). Thus, the fish receiving *L. plantarum*-coated feed showed a higher recorded final body weight and greater absolute weight gain during the experimental period. This observation is consistent with several previous investigations demonstrating beneficial effects of dietary *L. plantarum* on fish growth. [Jang et al., \(2022\)](#) reported

significantly improved growth performance in common carp (*Cyprinus carpio*) receiving graded dietary levels of *L. plantarum*, with the highest probiotic supplementation producing the greatest overall improvement. The authors also detected increased lactic acid bacteria in the gastrointestinal tract of probiotic-fed fish, suggesting survival and establishment of the administered organism in the digestive tract. Similarly, dietary supplementation with *L. plantarum* at 10^8 CFU g⁻¹ feed significantly enhanced SGR and FCR in *Pangasius bocourti*, together with improvements in immune parameters and post-challenge survival. Another study on *P. bocourti* also

reported improved SGR and FCR following dietary *L. plantarum* supplementation over a 90-day feeding period. The improved growth observed in the present study may therefore be associated with the potential probiotic functions of *L. plantarum*, including modulation of the intestinal microbial community and enhancement of digestive or physiological processes.

Overall, the findings of the present study indicate that post-pelleting application of the fish gut-derived *L. plantarum* isolate is a feasible approach for producing probiotic-coated fish feed and was associated with a higher final body weight and absolute weight gain under the experimental conditions.

The growth response is broadly supported by previous studies in which dietary *L. plantarum* improved growth, feed utilization and physiological responses in different cultured fish species. However, probiotic responses can vary depending on the bacterial strain, viable-cell concentration, fish species, feeding duration, feed formulation and environmental conditions. For example, [Jang et al., \(2022\)](#) observed a dose-dependent response to *L. plantarum* in common carp, while other field studies have reported that probiotic supplementation may improve digestive and immune parameters without necessarily producing a significant growth response. Therefore, the higher growth observed in the present study should be regarded as a promising preliminary response rather than definitive evidence of a statistically significant probiotic effect. Further experiments using replicated tanks, a clearly defined probiotic concentration in CFU g⁻¹ feed, quantitative assessment of probiotic viability after coating and storage, accurate feed-consumption records, and appropriate statistical analysis are required to validate the growth-promoting potential of the selected *L. plantarum* isolate. Such investigations would also help determine whether the post-pelleting gelatin-based coating can provide a reliable and practical method for probiotic delivery in aquaculture feed.

In conclusion, the present study demonstrated the feasibility of applying the fish gut-derived *Lactiplantibacillus plantarum* to commercial fish-feed pellets using a post-pelleting coating approach. The probiotic biomass was successfully incorporated with a binder onto cooled feed pellets, and the coated pellets retained satisfactory visible structural integrity following drying and refrigerated storage. The water-quality parameters remained broadly comparable between the control and probiotic groups throughout the feeding trial.

Fish receiving the probiotic-coated feed recorded a higher final body weight (28 g) compared with the control group (22 g), with both groups having an initial body weight of 10 g, indicating a promising growth response under the experimental conditions.

Overall, the findings provide preliminary evidence for the feasibility of post-pelleting delivery of the selected fish gut-derived *L. plantarum* strain in aquaculture feed. However, validation through replicated feeding trials with a defined probiotic dose, quantitative viable-cell counts, accurate feed-consumption records, verified SGR and FCR calculations, and appropriate statistical analysis is required to establish its efficacy and reproducibility. The present study provides a basis for further evaluation of strain-specific probiotic feed formulations for sustainable aquaculture.

Author Contributions

Preethi H: Contributed in the research work and writing the content. Preethi K: Contributed in the Experimental works and documentation. Priya Dharshini M: Documentation of results. Priyadarshini R: Effectively participated in the sample collection and processing. Parkavi R: Contributed in the experimental work. Gomathi N: Conceived the original idea and designed the model and wrote the manuscript.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

References

Boyd, C.E. (2015). *Water Quality: An Introduction*. 2nd edn. Cham: Springer.

- Cabello, F.C. (2006). Heavy use of prophylactic antibiotics in aquaculture: a growing problem for human and animal health and for the environment. *Environmental Microbiology*, 8, 1137–1144. <https://doi.org/10.1111/j.1462-2920.2006.01054.x>
- Chomová, N., Pavloková, S., Sondorová, M., Mudroňová, D., Fečkaninová, A., Popelka, P., Koščová, J., Žitňan, R. and Franc, A. (2023). Development and evaluation of a fish feed mixture containing the probiotic *Lactiplantibacillus plantarum* prepared using an innovative pellet coating method. *Frontiers in Veterinary Science*, 10, 1196884. <https://doi.org/10.3389/fvets.2023.1196884>
- Dawood, M.A.O., Koshio, S. and Esteban, M.A. (2016). Beneficial roles of probiotics in aquaculture: a review. *Reviews in Aquaculture*, 10, 950–974. <https://doi.org/10.1111/raq.12202>
- El-Saadony, M.T., Alagawany, M., Patra, A.K., Kar, I., Tiwari, R., Dawood, M.A.O., Dhama, K. and Abdel-Latif, H.M.R. (2021). The functionality of probiotics in aquaculture: an overview. *Fish & Shellfish Immunology*, 117, 36–52. <https://doi.org/10.1016/j.fsi.2021.07.007>
- Gatesoupe, F.J. (2008). Updating the importance of lactic acid bacteria in fish farming: natural occurrence and probiotic treatments. *Journal of Molecular Microbiology and Biotechnology*, 14, 107–114. <https://doi.org/10.1159/000106089>
- Hai, N.V. (2015). The use of probiotics in aquaculture. *Journal of Applied Microbiology*, 119, 917–935. <https://doi.org/10.1111/jam.12886>
- Jang, W.J., Lee, J.M., Hasan, M.T., Lee, B.J., Lim, S.G. and Kong, I.S. (2022). Oral feed-based administration of *Lactobacillus plantarum* enhances growth, haematological and immunological responses in *Cyprinus carpio*. *Emerging Animal Species*, 3, 100003. <https://doi.org/10.1016/j.eas.2022.100003>
- Kumar, P., Jain, K.K. and Sardar, P. (2022). Review of probiotics in aquafeeds: mechanism of action and current status. *Indian Journal of Animal Nutrition*, 39, 348–365.
- Martínez, J.L. (2009). Environmental pollution by antibiotics and by antibiotic resistance determinants. *Environmental Pollution*, 157, 2893–2902. <https://doi.org/10.1016/j.envpol.2009.05.051>
- Nayak, S.K. (2010). Probiotics and immunity: a fish perspective. *Fish & Shellfish Immunology*, 29, 2–14. <https://doi.org/10.1016/j.fsi.2010.02.017>
- Ringø, E., Zhou, Z., Olsen, R.E. and Song, S.K. (2016). Use of gut microbiota in aquaculture: a review. *Aquaculture Nutrition*, 22, 219–235. <https://doi.org/10.1111/anu.12345>
- Tripathi, M.K. and Giri, S.K. (2014). Probiotic functional foods: survival of probiotics during processing and storage. *Journal of Functional Foods*, 9, 225–241. <https://doi.org/10.1016/j.jff.2014.04.030>
- Zheng, J., Wittouck, S., Salvetti, E., Franz, C.M.A.P., Harris, H.M.B., Mattarelli, P., O'Toole, P.W., Pot, B., Vandamme, P., Walter, J., Watanabe, K., Wuyts, S., Felis, G.E., Gänzle, M.G. and Lebeer, S. (2020). A taxonomic note on the genus *Lactobacillus*: description of 23 novel genera, emended description of the genus *Lactobacillus* Beijerinck 1901, and union of *Lactobacillaceae* and *Leuconostocaceae*. *International Journal of Systematic and Evolutionary Microbiology*, 70, 2782–2858. <https://doi.org/10.1099/ijsem.0.003107>

How to cite this article:

Preethi H., Preethi K., Priya Dharshini M., Priyadarshini R., Parkavi R. and Gomathi N. 2026. Post-Pelleting Application of Fish Gut-Derived *Lactiplantibacillus plantarum* in Fish Feed: Growth Performance and Water Quality in a Controlled Feeding Trial. *Int.J.Curr.Microbiol.App.Sci*. Special Issue-13: 404-413.

doi: <https://doi.org/10.20546/ijcmas.2026.sp13.042>