

Effects of Probiotics on Growth Parameters of Giant Freshwater Prawn (*Macrobrachium rosenbergii* de Man)

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Received: 2.07.2020 | Revised: 8.08.2020 | Accepted: 13.08.2020

ABSTRACT

Macrobrachium rosenbergii de Man “Giant Freshwater Prawn” is a commercially important species of aquaculture due to its utilization as good source of food with high protein and low cholesterol contents. Diseases caused by pathogenic bacteria have adversely affected its production and growth. In present study, 3-4 months old healthy giant freshwater prawns brought from three fish farms of Haryana (India) were cultured in the laboratory at CCS HAU Hisar, Haryana (India) aimed to find out the effects of probiotics on its growth parameters. Different treatments were administered on cultured prawns over a period of 8 weeks including control, inoculation with bacterium 1 (*Aeromonas hydrophilla*), bacterium 2 (*Pseudomonas flourcense*) and bacterium 1 + 2 together. Likewise, probiotics 1 and probiotics 2 were applied separately on healthy and diseased prawns as well as in different combinations with pathogenic bacteria. Length and weight percent in prawns were increased comparatively less after inoculation with bacterium 1 and bacterium 2 (alone and together) but significant increase in growth percent was reported when probiotics were added along with pathogenic bacteria. Probiotics 1 and 2 administered to healthy prawns had remarkably increased the percent length (92.83 & 79.07) and weight (346.79 & 320) respectively and similar trend was observed in diseased prawns. It was reported that probiotics 1 had performed better than probiotics 2 in percent increase of growth in prawns. Considering the great importance of giant freshwater prawns in aquaculture food production, there is an emergent need to optimize the best composition of probiotics for further boost in growth.

Keywords: *Macrobrachium rosenbergii*, Probiotics, Growth Parameters, Aquaculture, Inoculation.

INTRODUCTION

Giant freshwater prawn (*Macrobrachium rosenbergii* de Man) is one of the largest species of family Palaemonidae found in tropical and subtropical parts of Indo-pacific

region including China, India and Thailand. It is very valuable species of aquaculture because of its great food value with high proteins and low cholesterol amount (Shailender et al., 2012).

Cite this article: Jakhar, V. (2020). Effects of Probiotics on Growth Parameters of Giant Freshwater Prawn (*Macrobrachium rosenbergii* de Man), *Ind. J. Pure App. Biosci.* 8(4), 386-391. doi: <http://dx.doi.org/10.18782/2582-2845.8263>

This species is preferred in freshwater culture due to its larger size, fast growth, attaining maturity during captivity and omnivorous habit (Seenivasan et al., 2012). In India, *M. rosenbergii* is cultured extensively in raverine regions but this species is susceptible to pathogenic bacteria (Jakhar et al., 2016). Loss in aquaculture production due to diseases can be reduced by applying appropriate quantity of specific probiotics (Olsson et al., 1992). Probiotics have been reported improving the immunity in aquatic organisms by enhancing their resistance against pathogenic bacteria (Havenaar & Huis in't veld, 1992).

The World Health Organization (WHO) in 2001 defined probiotics as “live micro-organisms which when administered in adequate amounts confer a health benefit on the host”. Probiotics are mainly gram positive lactic acid bacteria like *Lactobacillus*, *Bifidobacterium* and *Streptococcus sp.* which are capable to increase the immunity of prawns (Fuller et al., 1992). Probiotics are non-toxic and non-pathogenic micro-organisms which have no side effects when administered to aquatic organisms (Balcazar et al., 2006). Probiotics have been observed to increase the growth rate in fishes primarily due to enhancing nutrient intake (Ringo & Gatesoupe, 1998). Probiotics supplemented with “Lactosac” elevated the growth of shrimp (Uma et al., 1999). Rate of growth was reported significantly higher in most of the aquatic organisms when fed with adequate amount of probiotics (Prabhu et al., 1999 & Selvraj et al., 2005). Higher growth rate was also seen in Turbot (*Scophthalmus maximus*) when it was given LAB regularly for 20 days (Gatesoupe, 1994). Giant freshwater prawns improved their growth rate, feed intake and immunity when fed with *Lactobacillus sporogenes* in bio-encapsulated form via Artemia (Venkat et al., 2004). Few reports have already been published to show the effects of probiotics on percent increase in growth of giant freshwater prawn (Rahiman et al., 2010, Seenivasan et al., 2014 & Karthik et al., 2018). Present study also reports the effects of probiotics on percent gain in length

and weight of *Macrobrachium rosenbergii* in India.

MATERIALS AND METHODS

To conduct the experiment, around four months old giant freshwater prawns were taken from three fish farms (two in Karnal & one in Hansi, Haryana, India) and were put in the flat bottomed 30 L circular tubs at 25 °C in the laboratory of Zoology Department, CCS Haryana Agricultural University, Hisar, Haryana (India). Tubs were daily filled with dechlorinated water and it was regularly changed with fresh water after 24 hours. Prawns kept in well aerated tubs were fed with recommended balanced diet. After one week, healthy and active prawns were selected for experimental use.

To control the infections of pathogenic bacteria and to determine the effects of probiotics on growth parameters of freshwater prawns, two different composition of probiotics were used. **Probiotics 1** had *Lactobacillus casei*, *L. lactis*, *L. acidophilus*, *Streptococcus faecium*, *Bacillus licheniformis*, *B. coagulans* & *Saccharomyces cerevisiae*. **Probiotics 2** had *Bacillus subtilis*, *B. polymyxa*, *B. megaterium*, *B. licheniformis*, *Aspergillus oryzae*, *Lactobacillus sp.*, *Saccharomyces cerevisiae*, *Nitrosomonas sp.*, *Nitrobacter sp.* and *Pseudomonas putida*.

Both types of probiotics were administered separately on healthy as well as diseased prawns to find out the percent gain in length and weight. Growth parameters were recorded under normal conditions as control and after inoculation with bacterium 1 (*Aeromonas hydrophila*), bacterium 2 (*Pseudomonas fluorescence*) alone as well as bacterium 1+ 2 together. Likewise, both types of probiotics were applied separately in different possible combinations with bacteria (Table 1).

Following formulae were used to estimate the growth parameters in giant freshwater prawns-

(i) Percent gain in length –

$$L_g = L_2 - L_1$$

$$\% L_g = (L_2 - L_1) / L_1 \times 100$$

L_1 = Initial length (cm)

L_2 = Final length (cm)

L_g = Length gain (cm)

(ii) Percent gain in weight –

$$W_g = W_2 - W_1$$

$$\% W_g = (W_2 - W_1) / W_1 \times 100$$

W_1 = Initial Weight (gm)

W_2 = Final Weight (gm)

W_g = Weight gain (gm)

The results obtained were stastically analysed by applying ‘Completely Randomized Design (CRD)’ to find out the differences among means of different treatments at 0.05 level of significance (Snedecor & Cochran, 1989).

RESULTS AND DISCUSSION

Different treatments were applied to the cultured giant freshwater prawns and results for percent gain in length (Table 1) and weight (Table 2) were observed after 8 weeks. Percent increase in length was recorded 51.6% under normal conditions while 22.23 and 23.23 percent after inoculation with bacterium 1 and bacterium 2 respectively. Percent gain in length was reported very less (11.45 percent) after application of bacterium 1 + 2 together because of severe bacterial infections in prawns. Administration of probiotics on

healthy prawns had great positive effect of percent increase in length for Probiotic 1 (92.83 percent) and Probiotic 2 (79.07 percent), Probiotics also proved beneficial in increasing the length of prawns when given alongwith bacterium 1 and bacterium 2 in different combinations.

Similar trend of per cent increase in weight was observed after 8 weeks of treatments in *M. rosenbergii*. Gain in weight under normal condition (216.90 per cent), with probiotics 1 (346.79 percent) and probiotics 2 (320.63 percent). Comparatively less gain in weight was reported after inoculation with bacterium 1 (74.49 per cent), bacterium 2 (77.27 percent) and bacterium 1 + 2 together (44.53 percent). When probiotics were applied with pathogenic bacteria, it effectively increased the growth rate and a significant level of difference was observed in prawns treated with probiotics & control. Results of the experiment revealed that Probiotics 1 is more efficient in increasing the length & weight of giant freshwater prawns. It was also concluded that probiotics effectively decrease the pathogenicity of bacterium hence promote growth of *Macrobrachium rosenbergii* by suppressing the disease factors.

Table 1: Effect of probiotics on length gain in giant freshwater prawn (*M. rosenbergii*)

Length gain (cm) ^a			
Treatment	Initial cm	Final cm	% increase after 8 weeks
CONTROL	5.10±0.07	7.74±0.00	51.64±3.40
C+B1	5.1075±0.13	6.24±0.00	22.23±3.22
C+B2	5.20±0.08	6.41±0.00	23.23±2.02
C+B1+B2	5.02±0.05	5.60±0.00	11.45±1.09
C+P1	5.20±0.08	10.03±0.00	92.83±3.17
C+P2	5.20±0.08	9.31±0.00	79.07±2.81
C+B1+P1	5.002±0.005	8.90±0.00	77.91±0.17
C+B1+P2	5.10±0.08	8.40±0.00	64.73±2.63
C+B2+P1	5.07±0.05	8.84±0.00	74.20±1.73
C+B2+P2	5.10±0.009	8.27±0.00	61.91±0.30
C+B1+B2+P1	5.10±0.009	8.81±0.008	72.49±0.41
C+B1+B2+P2	5.01±0.01	7.9075±0.009	57.67±0.31
C+D+P1	4.87±0.05	7.81±0.07	92.83±3.17
C+D+P2	4.85±0.05	7.75±0.10	79.07±2.81
CD Value (P<0.05)	0.029	0.126	3.03

C=Control, P1=Probiotic 1, P2=Probiotic 2, B1= *Aeromonas hydrophilla*, B2= *Pseudomonas fluorescense*, D=Diseased prawn

a= Mean±s.d., N=27 (9 prawns x 3 replication)

* = Prawn died after three weeks.

Table 2: Effect of probiotics on weight gain in giant freshwater prawn (*M. rosenbergii*)

Weight gain (g) ^a in eight weeks			
Treatment	Initial wt	Final wt	% increase after 8 weeks
CONTROL	1.83±0.01	5.81±0.01	216.90±2.58
C+B1	1.95±0.02	3.41±0.01	74.49±3.08
C+B2	1.87±0.008	3.31±0.01	77.271±0.24
C+B1+B2	1.80±0.009	2.61±0.01	44.53±1.09
C+P1	1.90±0.009	8.52±0.01	346.79±2.19
C+P2	1.84±0.009	7.75±0.00	320.63±2.19
C+B1+P1	1.81±0.01	7.12±0.02	293.11±2.59
C+B1+P2	1.94±0.01	6.56±0.01	238.15±2.46
C+B2+P1	1.90±0.009	8.52±0.01	253.40±3.59
C+B2+P2	1.84±0.009	7.75±0.00	233.31±3.81
C+B1+B2+P1	1.85±0.01	3.93±0.009	112.85±2.14
C+B1+B2+P2	1.81±0.02	3.76±0.009	107.03±2.47
C+D+P1	1.82±0.02	3.94±0.02	116.93±3.77
C+D+P2	1.82±0.008	3.92±0.02	115.39±2.00
CD Value (P≤0.05)	0.024	0.022	3.74

C=Control, P1=Probiotic 1, P2=Probiotic 2, B1= *Aeromonas hydrophilla*, B2= *Pseudomonas fluorescence*, D=Diseased prawn

a= Mean±s.d., N=27 (9 prawns x 3 replication)

* = Prawn died after three weeks

CONCLUSION

Giant freshwater prawn is being studied extensively because of its economic importance in freshwater aquaculture. In present study, two types of probiotics administered in healthy and diseased freshwater prawns have shown significant increase in length and weight. Prawns inoculated with pathogenic bacterium 1 and bacterium 2 shown less increase in growth due

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to pathogenicity of these bacteria. Application of probiotics alongwith pathogenic bacteria had remarkably increased the length & weight in prawns due to the fact that probiotics are capable to stimulate growth by reducing the pathogenic effect of bacteria. Out of the two compositions of probiotics, Probiotic 1 had been reported more effective to increase the growth. As aquaculture is need of the hour to meet the emerging demand of food for fast

growing population of the world and scientific culture of giant freshwater prawns can solve the food problem. Though, present study advocates the administration of Probiotics 1 for higher growth, yet there is need of advance research to find out the optimum concentration of probiotics for minimizing the infection of pathogenic bacteria and elevating the growth of *Macrobrachium rosenbergii*.

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