

*Research Article***Potentials of Plant Polyphenols for Better Performance of Farmed Giant Freshwater prawn (*Macrobrachium rosenbergii*)****Rubel, M¹, Shimul, S.A. and Nahid, S.A.A.***^{1,2,3} Department of Fisheries Resource Management, Chattogram Veterinary and Animal Sciences University, Chattogram-4225, Bangladesh**ARTICLE INFO***Article history :*

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*Keywords :*Polyphenol, Freshwater prawn,
Growth performance, Sampling**Corresponding Author :*

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E-mail: nahid83bau@gmail.com**ABSTRACT**

This experiment was conducted by using natural bioactive additive from sugarcane plants (*Saccharum officinarum*) named as 'polyphenol' have the potential to replace some of the functions of feed additives as it contains antioxidants, minerals, nutrients, essential amino acids and also exerts anti-inflammatory and anti-bacterial properties. The experiment was conducted in tanks where freshwater prawn (*Macrobrachium rosenbergii*) were stocked in 12 tanks at 50 prawn per tank and subjected to four treatments with each treatment replicated in three times. Polyphenol was included at 0% (T₀) (regarded as control or without Polyphenol), 0.2% (T₁), 0.4% (T₂), and 0.6% (T₃) in the four diets. After stocking of prawn, sampling was done at regular interval of 15 days to check the growth performance of fish and also adjust the feeding rate. During stocking of prawn, initial length was 2cm. Final sampling showed that the average length of prawn was increased which fed with T₃ [(6.27±0.51)cm] treated fish than the T₀ [(4.85±0.13)cm], T₁ [(4.99±0.26)cm] and T₂ [(5.22 ±0.48)cm] treated prawn. Stocked prawns were too small so that initial weights were not calculated. Weight were calculated at 8th sampling where final sampling showed that the average weight of each treatment such as T₀, T₁, T₂ and T₃ were 0.89±0.10g, 1.12±0.19g, 1.16±0.24g and 2.13±0.19g respectively. Among the four treatment, T₃ showed better growth [6.27±0.51) cm] than the control [(4.85±0.13) cm] (p<0.05). T₃ has lower FCR value (1.15) than the control (2). During the research period no mortality was recorded. No disease outbreak was found during that time. Thus also support that polyphenol enhanced immunity in prawns. Polyphenol may also have nutritive properties which influenced growth performance at freshwater prawn.

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1. INTRODUCTION

Bangladesh is blessed with vast inland water bodies. Being a country of rivers and floodplains, fish plays a very important role in the daily life of many people in

Bangladesh. Historically people depended mainly on natural waters for supply of fish but as a result of declining catches of wild fish due to an increased fishing pressure by the growing population as well as

environmental degradation, people began to culture fish in enclosed waters. At present, aquaculture has been expanding both vertically and horizontally as pond fish culture and crustacean (shrimp and freshwater prawn) farming offer tremendous potential. A number of species is now cultured including crustaceans such as freshwater prawn. In Bangladesh, 24 of freshwater prawn species are found. However, only *Macrobrachium rosenbergii* has aquaculture potentials and is commercially cultured (Akand and Hasan, 1992). Total shrimp and prawn production including capture has been increased from 1.60 lakh MT in 2002-03 to 2.46 lakh MT in 2016-17 and its growth rate is 4.67 (DoF, 2017). Disease is the main constrain to improve the aquaculture production. To get rid of the diseases many aqua drugs has been used so far in Bangladesh. The resistance in harmful agents is increasing with the intense use of different drugs. To reduce the use of antibiotics and other harmful chemicals, medicinal plants and their extract can be used. Plants are rich in a wide variety of secondary metabolites of phytochemical constituents such as tannins, alkaloids and flavonoids which act against different disease. Polyphenol is kind of secondary plants metabolites which gives straw color liquid on dilution, sweet and non-astringent flavour. This natural extract has anti-inflammatory and anti-bacterial properties. These bioactive compounds have the potential to replace antibiotics and hormones from animal feeds. The objective of this research work is:

1. To observe the effects of bioactive compound (Polyphenol) in growth performance (length, weight and FCR) of prawn.

2. MATERIALS AND METHODS

The experiment was carried out from July 2017 to November 2017 at the roof top of professor quarters in Chattogram Veterinary and Animal Sciences University (Latitude: 22°36.341' N; Longitude: 91°08.475' E), Chattogram, Bangladesh. At first the materials such as plastic drum, nylon net, pipe etc. were collected in local market for preparing tank for conducting 'Prawn' culture. The water holding capacity of the tank was about 250 liters. All tanks were tagged individually for proper application of treatment feed. The PL of 'prawn' was collected in 'Halda Fisheries Ltd', Chattogram, Bangladesh.

Preparation of experimental diets

The experimental diets were prepared in a feed mill of "Halda Fisheries Ltd." by adding appropriate amount of polyphenol. Polyphenol were supplied by the "The Products Makers (Australia Pty Ltd.)" where they mainly provide their product named as "Polygain". Polygain contains natural polyphenol. The polyphenol content of Polygain supplied in the trial is 30,400 mg/Kg (dosage at 0.2%-60mg Polyphenol/kg feed, at 0.4%-120mg Polyphenol/kg feed, 0.6%-180 mg Polyphenol/kg feed). Four experimental diets were formulated by supplementing 0 (without Polyphenol, Control, T₀), 0.2% Polyphenol (T₁), 0.4% Polyphenol (T₂) and 0.6% Polyphenol (T₃). The feed formulation and proximate composition of experimental diets are shown in Table 1 and Table 2.

Table 1: Feed ingredients with their inclusion level

Ingredient	Inclusion (%)
Fish Meal 40%	18.75
Fish Meal 60%	18.75
Soya bean Meal	10
Meat & Bone Meal	15.63
Rice Bran	10.63
Wheat Bran	11.25
Mustard Oil Cake	6.25
Maize	5
Wheat Flour	3.75
Total	100
Ingredient	
DCP	0.5
Pellet binder	0.5
Soybean oil	0.5

Table 2: Proximate composition of experimental feed

Nmae	Percentage (%)
Moisture	14.91
Crude protein	35.41
Crude lipid	8.82
Ash	22.4

Experimental design

The statistical design used for the experiment was completely randomized design (CRD). For the continuation of experiment, 12 tanks were set in the study area where each tank contains 50 prawns (Table 3). The experiment was conducted with four treatments and each treatment had three replications. The

treatments were:

- 1st treatment- T₀ was without 'Polyphenol' or control group
- 2nd treatment- T₁ was 0.2% 'Polyphenol'
- 3rd treatment- T₂ was 0.4% 'Polyphenol'
- 4th treatment- T₃ was 0.6% 'Polyphenol'

Table 3: Layout of the experiment showing the distribution of 'prawn' in tanks and the applied treatments

Dietary treatment groups	Treatment×Replication (Tn×Rn)	Treatment×Replication (Tn×Rn)	Treatment×Replication (Tn×Rn)
T ₀ (Control group)	T ₀ R ₁	50	150
	T ₀ R ₂	50	
	T ₀ R ₃	50	
T ₁ (0.2% 'Polyphenol')	T ₁ R ₁	50	150
	T ₁ R ₂	50	
	T ₁ R ₃	50	
T ₂ (0.4% 'Polyphenol')	T ₂ R ₁	50	150
	T ₂ R ₂	50	
	T ₂ R ₃	50	
T ₃ (0.6% 'Polyphenol')	T ₃ R ₁	50	150
	T ₃ R ₂	50	
	T ₃ R ₃	50	
Grand Total			600

Sampling

Sampling of the experimental fish was done at regular interval of 15 days. Growth of fish in each sampling was taken by weight of fish where weight of sampling fish was taken by using a weight machine and length of fish was taken by using a measuring scale.

Calculation of growth parameter

The following parameter was calculated:

$$\text{Feed conversion ratio (FCR)} = \frac{\text{Total amount of feed given (g)}}{\text{Total weigh gain (g)}}$$

Analysis of proximate composition

The proximate composition of the experimental diet was done in "Nutrition Laboratory" of Faculty of Fisheries, Chattogram Veterinary and Animal Sciences University. Protein was determined by Kjeldahl apparatus (Distillation unit: VELP-UDK 129; Digestion unit: VELP-DK 20/26), lipid by digital

soxhlet apparatus (FoodALYT RD 40), ash content by muffle furnace (Nabertherm-L9/13) and moisture content by hot air oven (BINDER-ED115) by using standard protocol.

Statistical analysis

Statistical analysis were performed by using MS excel (Microsoft office excel-2007, USA) and IBM SPSS Statistics 23 Version. Values are expressed as means ± standard deviation (SD). Data were analyzed by one-way analysis of variance (ANOVA) followed by Tukey's post hoc test to assess statistically significant differences among the control and different treated values. Statistical significance was set at P < 0.05.

3. RESULTS AND DISCUSSIONS

Growth performance

Growth performance of farmed prawn is summarized in Table 4. Among dietary treatment, significant

differences ($p < 0.05$) were observed for final weight and final length. Growth parameters were significantly higher in fish fed with T3 treated feed.

Table 4: Growth performance of farmed Prawn

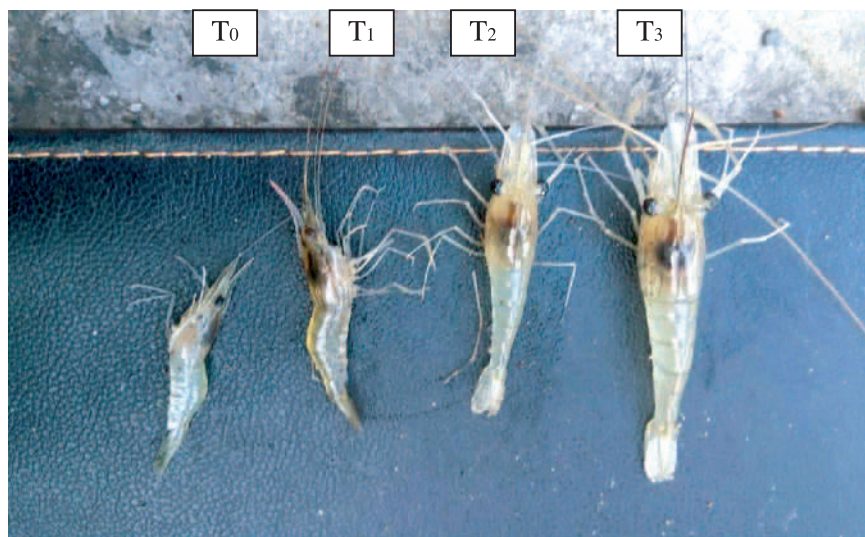
Treatment	Length	Weight
Control	4.85±.13 ^b (4.70-4.95)	0.89±0.10 ^b (0.78-0.96)
T ₁ (0.2 % Polyphenol)	4.99± .25 ^b (4.70-5.20)	1.12±0.19 ^b (0.90-1.25)
T ₂ (0.4% Polyphenol)	5.22±.48 ^b (4.70-5.65)	1.16±0.24 ^b (0.89-1.34)
T ₃ (0.6 % Polyphenol)	6.27±.51 ^a (5.95-6.86)	2.13±0.19 ^a (2.00-2.35)
Level of significance	0.007	0.00

*Values are means ±S.D. Within a row, means with the same letters are not significantly different ($P < 0.05$)

Effect of polyphenol on prawn length

The result of the present study showed that dietary supplementation of polyphenol improved the growth performances of prawn and highest ($p < 0.05$) final length was found in 0.6% polyphenol supplemented diet. Length of the experimental freshwater prawn was recorded at every 15 days interval throughout the experiment period. At the end of the five month long experimental result indicate that highest length was

found in T₃(6.27±0.51cm) treated prawn than the other treated prawn such as T₀(4.85±0.13cm), T₁(4.99±0.26cm) and T₂(5.22±0.48cm) (Photograph 1) treated prawn ($P < 0.05$). From this study it is observed that polyphenols have great effect on growth performance of farmed prawn. Prawn fed with polyphenol has better growth performance than the fish fed without polyphenol. Because Polyphenol acts as attractants which enhance feed intake and growth rate. It showed to enhance feed consumption and also responsible for reduce wastage of feed that deteriorate water quality. No feed residues were left in polyphenol treated prawn containing tank than the control because polyphenol contains good smell which easily attracts prawn and consume all feed and maintain good water quality. According to Viveros *et al.* 2011; Polyphenol have the capacity minimizing adhesion of pathogenic bacteria (*E. coli*, *Clostridium*), inhibit the progression of infections in the digestive tract, and improve nutrient utilization and finally animal performance. Brenes *et al.* (2010) suggested that the positive effect of polyphenol rich grape by-products such as grape pomace and grape seed extract incorporated into feed in decreasing lipid oxidation in chicken meat. Magrone *et al.*; (2016) attempted to administration of a polyphenol enriched feed to farmed sea bass which suggest that Polyphenol create lower levels of intestinal pro-inflammatory cytokines helping as an expression of a robust and protective adaptive immune response. The present study thus concludes that polyphenol has direct effects on increasing length of farmed prawn.



Photograph 1: Comparison among T₀, T₁, T₂ and T₃ treated Prawn

Effect of polyphenol on prawn weight

During stocking prawn, prawns were too small so that initial weights were not calculated. Weight were calculated at 8th sampling where final sampling showed that the average weight of each treatment such as T₀, T₁, T₂ and T₃ were 0.89±0.10g, 1.12±0.19g, 1.16±0.24g and 2.13±0.19g respectively. 0.6% polyphenol treated fish has higher weight than the control fish (P<0.05). Polyphenol had great effects on extension growth of maize (*Zea mays L.*) shoot coleoptile segments, lettuce (*Lactuca sativa L.*) roots, and on radish (*Raphanus sativus L.*) seed germination (Stoms, 1981). Majewska and Czczot, 2009 suggested polyphenols has multiple function and act as plant hormones, inhibitors of enzymatic reactions and plant growth regulators. Numerous in vitro studies have shown that the polyphenols found in grape by-products inhibit the growth of certain pathogens such as *Staphylococcus aureus*, *Escherichia coli*, *Campylobacter*, *Salmonella*, and *Helicobacter pylori* (Ganan *et al.*, 2009). As a result, 0.6% Polyphenol containing diet has better growth performances than the other diet.

Effects on Feed Conversion Ratio

Best FCR (1.15) was found in 0.6% polyphenol treated feed fed to prawn, whereas the FCR value of 0.2% and 0.4% polyphenol treated prawn were 1.85 and 1.86 respectively. All polyphenol treated prawn show better FCR performance than control prawn (2.00). Gessner *et al.* (2013a) conducted study that diets with polyphenol rich plant products from either grapes or hops exerts an anti-inflammatory effect in the small intestine and also improve food conversion ratio in piglets. Supplementation of polyphenol by feeding either GME or SH exerts anti-inflammatory effects and lower feed conversion ratio (Fiesel *et al.*, 2014).

4. CONCLUSION

Freshwater prawn is one of the most commercially important fishery products which contribute greatly to our national economy. Now-a-days, huge numbers of population are involved in freshwater prawn farming. Disease occurrence is a common issue and a matter of headache for the poor farmers in freshwater prawn because of their highly sensitivity to water quality and

other environmental stress. Use of high doses of antibiotic is a common phenomenon which is very harmful for the consumer as well as export market. The results of this experiment are supporting consumer protection by describing the way of preventing diseases in freshwater prawn with the use of polyphenols. The research is also showing the potential role of polyphenols in the growth performance, immune response of prawn, safety and disease free prawn. This type of research work will be a new dimension for improving fisheries industry in Bangladesh.

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