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EFFECT OF FEEDING REGIME AND SEX ON GROWTH PERFORMANCE AND FEED UTILIZATION OF POST LARVAL FRESH WATER PRAWN *Macrobrachium rosenbergii (de Man 1879)*

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ABSTRACT

The aim of this study was to investigate the effect of feeding regime protein level and feeding time and sex on growth performance, feed utilization, survival rate and body composition of post larvae of freshwater prawn *Macrobrachium rosenbergii*. Post-larvae (PL) of *M. rosenbergii,* 30 day-old with an average weight of 20.8 ± 0.17 mg were fed at two different dietary protein 35% and 40% CP and isocaloric diets 360 kcal DE 100 g $^{-1}$. The ration was fed twice a day at three different feeding times (9:00; 12:00 h); (9:00; 15:00 h) and (9:00; 18:00 h). The experiment was conducted in concrete tanks (6 m^{-3}) for 84 days at a stocking density of 30 PL m^{-3}. The daily feed ration was fed of their collective body weight at feeding rate of 10% from 0.2 to 1.0 g prawn, 7% for 1-5 g prawn and 5% for greater than 5 g prawn. The higher significant values ($P \leq 0.05$) of survival rate, weight gain and specific growth rate ($P \leq 0.05$) were observed for prawn fed diet at 35% CP. The same trend was observed for prawn PL fed with feeding time (9:00: 15:00 h). The prawn PL either fed at 35% protein diet or feeding time (9:00: 18:00 h) showed the better-feed conversion ratio ($P \leq 0.05$). The highest protein efficiency ratio, fat retention and energy retention ($P \leq 0.05$) were showed for prawn PL fed diet at 35% CP with feeding time (9:00; 18:00 h). No significant difference was observed for the effect of dietary protein on whole body dry matter and protein contents. However, prawn carcass gained more fat ($P \leq 0.05$) when fed diet at 35% CP. Meanwhile, prawn fed at (9:00: 15:00 h) showed the highest carcass crude protein and lowest fat and ash contents ($P \leq 0.05$). Generally, males of *M. rosenbergii* recorded the better growth performance and feed utilization than the females either at different dietary protein levels or different feeding time. The results of the present study revealed that prawn *M. rosenbergii* PL fed diet at either 35% CP or feeding time (9:00; 15:00 h) obtain an optimum growth performance and feed utilization.

Keywords: Protein level, feeding time, freshwater prawn, post larvae, growth.

INTRODUCTION

World production of freshwater prawn increased from < 50,000 MT (metric tons) in 1995 to > 280,000 MT in 2003 (New 2005; FAO 2005) and has become an important part of the rice-fish or small scale carp polyculture

ecosystem in developing countries, such as Vietnam (Giap *et al*., 2005) and Bangladesh (Hossain and Islam 2006). Algal culture and nutritional enrichment of algae as larval food for prawn and other fish species has shown tremendous potential in successful rearing of aquaculture species (Chowdhury *et al*., unpublished data). The effect of dietary protein levels on post-larval *M. rosenbergii* has also been investigated in the past few decades (Balazs and Ross 1976; Ashmore *et al*., 1985; D'Abramo and Sheen 1994; Sharma and Reddy 1996; El-Sayed 1997). However, recent findings of lower protein requirement of the freshwater prawn *M. rosenbergii* showed that nitrogen (N) needed for their maintenance was lower than that needed for the marine prawn *M. japonicus* (Teshima *et al*., 2001; Teshima *et al*., 2006) and fish such as carp, *Cyprinus carpio*, and rainbow trout, *Salmo gairdneri* (Ogino *et al*., 1976; Ogino 1980).

The optimum dietary protein levels for prawn can change depending on feeding level, feeding frequency, feeding time, sex and other factors such as protein quality, and diet composition (Teshima *et al*., 2001). Meyers (1987) reported that understanding feeding behavior of cultured species can assist in the development of feeds and regimes that reduce the metabolic energy costs in feeding and encourage consumption. However, in the case of crustaceans, it is generally difficult to measure appropriate feed intake in feeding experiments because of the slow feeding habit of these organisms resulting in the leaching of some nutrients. Teshima and Kanazawa (1987) reported that for the prawn *M. rosenbergii* about 36–40% of given diets was found to be lost to the water and not ingested, as pointed out in tracer experiments on the marine prawn *M. japonicus.*

There is limited research on evaluation of diets for indoor or outdoor nursery rearing of post-larvae of *M. rosenbergii* (Briggs *et al*., 1988; Heinen and Mensi 1991). Most of the studies have been carried out on nutritional requirements of sub-adults and adults (Gitte and Indulkar 2005). However, information is needed for production of juveniles by minimizing nursery costs, as the cost of producing nursed juveniles has emerged as a major factor influencing the profitability of the nursery operators and prawn farmers. Therefore, in the present study, an attempt was made to evaluate the effect of dietary protein levels and different feeding times on growth performance and feed utilization of freshwater prawns *Macrobrachium rosenbergii* post larvae.

MATERIALS AND METHODS

Experimental design and culture techniques

A grow-out experiment of freshwater prawn *M. rosenbergii* post larvae (PL) was conducted at the Fish Farm Research Station of the National Institute of Oceanography and Fisheries (NIOF), Cairo, Egypt for 84 days. The freshwater prawns were obtained from Saft-Khalid hatchery, General Authority for Fish Resources Development, El-Bhira Governorate, Egypt. The prawns were acclimated for two weeks in one concrete pond (8x4x1 m). At the end of the acclimation period, post-larvae of *M. rosenbergii* (30 day-old with an average weight of 20.8±0.17 mg) were stocked into two cement ponds of 40 m^{-3} each, where a two cm thick layer of clean, fine sand was

spread evenly on the bottom of each ponds. Each cement pond was divided into nine equal pens by nets (6 m^{-3}). Experiments were carried out in triplicates for each treatment with stocking density of 30 PL m^{-3}. Each culture pen was provided four 30 cm long 16 mm diameter black polyvinyl chloride (PVC) pipe to minimize the cannibalism during the molting as suggested by Mariappan and Balasundaram (2004). During the acclimation, prawn larvae were fed on commercial tilapia diet (30% CP). The pond was supplied with fresh water from the Darawa Irrigation Branch, Kalubiya Governorate. The turnover rate of water was 25% day^{-1} $pond^{-1}$.

At the beginning of the experiment, three healthy groups of 40 prawns were randomly sampled, weighed, immediately killed and frozen at -20 ºC for initial carcass analysis. In addition, at the end of the experiments, 10 prawns were obtained from each treatment for the carcass composition. Another five males and five females were obtained from each treatment for the final carcass analysis.

Experimental diets

Two isocaloric (~360 kcal DE 100 g^{-1}) diets of 35% and 40% crude proteins were formulated (Table 1). The diets were processed by blending the dry ingredients into a homogenous mixture, and then the mixture was passed through laboratory pellet mill in the National Institute of Oceanography and Fisheries, Cairo, Egypt (a California Pellet Mill Co., San Francisco, California). PL were fed of their collective body weight at feeding rate of 10% from 0.2 to 1.0 g prawn, 7% for 1-5 g prawn and 5% for greater than 5 g prawn according to Poadas (2004) . The daily ration was provided twice a day in equal amount at three different feeding times (9:00: 12:00 h); (9:00: 15:00 h) and (9:00: 18:00 h). The feed ingredients fish meal, poultry by-product, soybean meal, yellow corn, wheat bran, vitamins and minerals premix were purchased from the Animal Production Islamic company (APICO), 24 Gaber ben Haian St., Dokki- El- Giza, Egypt. Soybean oil was purchased from local market.

Growth parameters

Initial and final weight of individual prawns was recorded by an electronic balance (±0.001 g). In addition, during each sampling, ten males and ten females from each treatment were randomly selected and weighed thereafter. The first sampling was conducted on the 30^{th} day after stocking and at 15 days interval thereafter. The quantity of daily diet was adjusted after each sampling. Weight gain (WG), specific growth rate (SGR), feed conversion ratio (FCR), protein efficiency ratio (PER), protein productive value (PPV), fat retention (FR) and energy retention (ER) were calculated using the following equations:

WG = Final body weight (g) - Initial body weight (g)

SGR = [(ln FBW - ln IBW) ×100]/day, where: FBW is final body weight (g); IBW is initial body weight (g); and ln = natural logarithmic

FCR = Feed intake (g)/weight gain (g)

PER= Weight gain (g)/protein intake (g).

PPV = (Retained protein (g) /protein intake (g))× 100

FR = (Retained fat (g) / fat intake (g))× 100

ER = (Retained energy (kcal) /energy intake (kcal)) ×100

Table 1: Chemical composition and proximate analysis of the experimental diets (% dry matter).

Ingredients	Experimental treatment	
	35 %	40 %
Fish meal	10	10
Poultry by-product meal	28	33
Soybean meal	23	28
Wheat bran	16	14
Yellow corn	13	9
Corn oil	8	4
Vitamin and Mineral premix [1]	2	2
Proximate composition		
Dry matter, %	91.12	90.94
Crude protein, %	35.39	39.26
Lipid, %	11.60	10.41
Total carbohydrate, %	39.41	35.11
Ash, %	13.60	15.22
Gross energy[2], kcal $100g^{-1}$	471.15	464.14
Digestible energy[3] , kcal $100g^{-1}$	360.17	360.21
Protein: energy ratio, mg $kcal^{-1}$	98.26	109.00

[1] Vitamin and mineral mixture each 1-kg of mixture contains: 4800 I.U. Vit A, 2400 IU cholecalciferol (vit. D) , 40 g Vit E, 8 g Vit K, 4.0 g Vit B_{12}, 4.0 g Vit B2, 6 g Vit B6, 4.0 g Pantothenic acid, 8.0 g Nicotinic acid, 400 mg Folic acid, 20 mg Biotin, 200 gm Choline, 4 g Copper, 0.4 g Iodine, 12 g Iron, 22 g Manganese, 22 g Zinc, 0.04 g Selenium. folic acid, 1.2 mg; niacin, 12 mg; d-calcium pantothenate, 26 mg; pyridoxine HCl 6 mg; riboflavin 7.2 mg; thiamin HCl, 1.2 mg; sodium chloride (NaCl, 39% Na, 61% Cl) 3077 mg; ferrous sulfate ($FeSO_4.7H_2O$, 20% Fe), 65mg; manganese sulfate ($MnSO_4$, 36% Mn), 89 mg; zinc sulfate ($ZnSO_4.7H_2O$, 40% Zn) 150 mg; copper sulfate ($CuSO_4.5H_2O$, 25% Cu) 28 mg; potassium iodide (KI, 24% K, 76% I) 11 mg; Celite AW521 (acid-washed diatomaceous earth silica) 1000 mg.

[2] Calculated using gross calorific values of 5.65, 4.1 and 9.45 Kcal/g for protein, carbohydrate and fat according to Brett (1973).

[3] DE was estimated by applying the coefficient of 70% of gross energy according to Hepher *et al.* (1983).

Proximate analysis

The proximate analysis of diet, ingredients and whole body composition were determined following AOAC (1995). Gross energy content of diet and whole body samples was calculated according to the gross caloric values by applying the factor 5.65 kcal g^{-1}, 9.45 kcal g^{-1}, and 4.1 kcal g^{-1} of crude protein, crude fat and total carbohydrate respectively. Dietary digestible energy (DE) was estimated using values of 5.0, 9.0 and 4.0 kcal g^{-1} for crude protein, ether extract and carbohydrate, respectively according to Das *et al*. (1996).

Statistical analysis

The data were analyzed using the MSTATE program software ANOVA procedure (MSTATE 1987) in a factorial design manner (2×3). Duncan's multiple range test (Duncan 1955) was used when ANOVA F values were significant to compare differences among individual means. Treatment effects were considered significant at ($P \leq 0.05$).

RESULTS

The growth performance of fresh water prawn *Macrobrachium rosenbergii* in terms of final body weight (FBW), weight gain (WG), specific growth rate (SGR) and feed utilization in terms of FCR, PER, PPV, FR, and ER are shown in Table 2. The highest FBW (7.25g), WG (7.23g) and SGR (6.97% day^{-1}) were observed for prawn fed diet at 35% CP ($P \leq 0.05$). The same trend was observed for PL fed diet at feeding time (9.00:15.00 h), while; the lowest value was recorded at feeding time (9.00: 18.00 h). The prawn fed 35% CP diet or at feeding time (9.00: 18.00 h) showed significantly better FCR (2.21 and 2.37, respectively), while the worst value (2.63) was recorded for PL fed diet containing 40% CP. The highest protein efficiency ratio (1.40), protein productive value (19.09%), fat retention (25.03%) and energy retention (18.56%) were recorded for the PL fed 35% CP diet. The same trend was observed for protein efficiency ratio (1.24%), fat retention (23.57%) and energy retention (13.01%) for PL fed with (9:00: 18:00 h) feeding time. Irrespective of dietary protein levels or feeding times, males of *M. rosenbergii* recorded the better growth performance and feed utilization than the females in all scenarios Table 3. The same trend was observed for FCR and PER. The highest survival rate was observed for *M.rosenbergii* PL fed diet at 35% CP (76%) and at 9.00, 15.00h feeding time (71.5%).

Table 2: Effect of different dietary protein levels and feeding time irrespective of each other on growth performance and feed utilization of freshwater prawn *Macrobrachium rosenbergii* post larvae.

Parameters	35% CP	40% CP	MSE ±	9: 12 h	9: 15 h	9: 18h	MSE ±
Initial body weight, g prawn^{-1}	0.0208	0.0208	0.17	0.0208	0.0208	0.0208	0.017
Final body weight, g prawn $^{-1}$	7.25^{a}	6.70^{b}	0.45	7.08^{ab}	7.19^{a}	6.67^{c}	0.56
Survival rate (%)	76.00^{a}	72.50^{b}	0.50	68.50^{b}	71.50^{a}	70.00^{ab}	0.75
Weight gain g 84 days $^{-1}$ prawn $^{-1}$	7.23^{a}	6.68^{b}	0.65	7.06^{ab}	7.17^{a}	6.65^{c}	0.12
Specific growth rate(% day)	6.97^{a}	6.88^{b}	0.55	6.94^{ab}	6.96^{a}	6.87^{b}	0.18
Feed conversion ratio	2.21^{b}	2.63^{a}	0.54	2.43^{a}	2.44^{a}	2.37^{b}	0.2
Protein efficiency ratio	1.40^{a}	1.18^{b}	0.30	1.22^{ab}	1.20^{b}	1.24^{a}	0.01
Protein productive value	19.09^{a}	15.81^{b}	2.66	14.46^{c}	18.12^{a}	17.07^{ab}	1.12
Fat retention	25.03^{a}	18.56^{b}	2.66	22.26^{ab}	19.28^{c}	23.57^{a}	2.32
Energy retention	18.56^{a}	10.78^{b}	1.25	11.73^{b}	12.23^{ab}	13.01^{a}	1.36

Means in the same row sharing the same superscript are not significantly different ($P \geq 0.05$).

Proximate body compositions of M. rosenbergii PL are presented in Table 4. No significant difference ($P \geq 0.05$) was observed in the whole body dry matter (DM) and protein contents between the dietary protein treatments. However, higher body fat content (23.85%) and gross energy (5.39 kcal g^{-1}) were observed when fed 35% CP diet. Meanwhile, prawn fed at (9:00:15:00 h) showed the highest whole body protein (62.29%) and the lowest fat contents (18.46 %) and ash content (19.25%).

PL female fed 35% CP diet recorded the highest values for whole body fat (27.07%), while the PL male fed 40% CP diet showed the lowest significant ($P < 0.05$) values of whole body fat content (18.55%) ($P < 0.05$; Table 5). The same trend was observed for the whole body gross energy (5.72 and 4.86 kcal g^{-1} respectively). However, the highest significant protein content (63.17%) of the whole body male was observed at feeding time (9:00: 15:00 h) that associated with the lower whole body fat content (15.53%).

DISCUSSION

The present study showed that 35% protein diet was optimal to achieve the maximum growth performance in *M. rosenbergii* PL. Balazs and Ross (1976) estimated dietary protein requirement at three levels of protein (15%, 25% and 35% protein diet) and reported that a dietary protein concentration of 35% was required to attain the maximum growth rate for juvenile *M. rosenbergii.* Andrews *et al*. (1972) studied the effect of protein levels (28%, 32%, 40% and 52%) in *P. setiferus*, and observed lower growth rate at 40% protein than at 28% and interestingly that a 52% protein diet resulted in further growth depression. Results of the present study are in agreement with the findings of Teshima *et al.* (2006) who reported that protein sparing effect of high protein diet (>35%CP) shows an increase in fat content in *M. rosenbergii* compare to the prawns fed diets of 35% CP. This is indicative that the increase in dietary protein levels exceeding the minimum requirement results in the loss of expensive protein in *M. rosenbergii* diets and accumulation of fats. Nevertheless, the protein requirement of the freshwater prawn *M. rosenbergii* PL is considered to be lower than other prawn species and this may be due to less protein requirement for maintenance compared to carnivorous marine prawn species (Balazs and Ross 1976; Koshio *et al*., 1992; D'Abramo and Sheen 1994).

Higher growth performance of male prawn was observed in all treatments irrespective of crude protein content and feeding time. This is similar to those of Nair *et al*. (2006). Higher FCRs registered at 40% CP treatments indicate that protein was used as energy when the supply exceeded the requirement for growth. Moreover, the feed conversion ratio (2.21 – 2.63) and protein efficiency ratio (1.18 – 1.40) obtained in the present study were lower than those observed by Ashmore *et al* (1985) and Hari and Kurup (2002). Higher FCR was observed by Cortes-Jacinto *et al*. (2003) for juvenile freshwater crayfish fed high protein diets. The mean values of feed conversion ratio of the present study were better than those obtained in the previous feeding trials and in agreement with the values obtained by Balazs and Ross (1976) when *M. rosenbergii* was reared in outdoor tanks fed with various combinations of protein sources (FCR ranged from 1.62 to 2.20). This difference can be attributed to the substantial contribution of certain type of algae present in outdoor pond to the experimental animal's nutrition (Balazs and Ross, 1976). In the pond culture study, natural food items in the pond may have satisfied a part of the protein requirement of omnivorous *M. rosenbergii* PL. Consequently, this may explain why pond-cultured *M. rosenbergii* can be fed a plant based low protein diet compared to the *M. rosenbergii* grown indoors. However, it is difficult to quantify the contribution of natural foods to the diet of prawn, as this is beyond the scope of the study.

In the present study, *M. rosenbergii* PL fed diet at feeding time (9.00:15.00 h) showed the best ($P \leq 0.05$) growth performance compare to the PL fed at (9.00: 12.00 h) or (9.00: 18.00 h). The result agreed with the finding of Wilkinson (2003) who reported that the time of the day that feed is

delivered associate with feeding organisms behavior that could be affect growth performance. Protein and energy retention seemed low compared to the findings in fishes e.g. rainbow trout (40–60%; Cuzon *et al*., 2004). However, prawn like any crustacean release cast at each molt, which can represent an energetic expenditure of 26% of the overall inter-molt energy gain (Read and Caulton 1980). Cuzon *et al*. (2004) reported that protein requirement is probably not as highly correlated with protein accretion compared to vertebrates due to chitin synthesis; chitin is a polysaccharide containing nitrogen equivalent to 43% crude protein. The highest survival rates shown in the present study may be attributed to the fulfillment of dietary requirement (Das *et al.* 1996) and the PVC pipe that may have helped the prawn to overcome molting stress and to avoid cannibalism (Mariappan and Balasundaram 2004).

In conclusion, the present study revealed that prawn *M. rosenbergii* PL fed diet at either 35% CP or feeding time (9:00: 15:00 h) shows optimum growth performance and feed utilization. Generally, the growth and feed utilization of male *M. rosenbergii* were the better than the female at different dietary protein levels or feeding times.

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تـأثير نظـام التغذيـة والجـنس علـى معـدلات النمـو والاسـتفادة مـن الغـذاء ليرقـات جمبري المياة العذبة

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أجريت هذه الدراسة بهدف دراسة تأثير نظام التغذية وبشمل (مستوى البروتين ووقت التغذية) والجنس على معدلات النمو والاستفادة من الغذاء ومعدل البقاء على الحياة والتركيب الكيماوي للجسم ليرقات جمبري المياة العذبة. تم تغذية يرقات الجمبري بمتوسط وزن ابتدائي ٠,١٧± ٢٠,٨ ملليجم على مستويين من البروتين (٣٥% &٤٠%) وكانت العلائق متساوية فى محتواها من الطاقة (٣٦٠ ك كالورى/١٠٠جم) وتم تغذية كل عليقه مرتين يوميا على ثلاث فترات زمنية مختلفة (٩,٠٠&١٢,٠٠)& (٩,٠٠&١٥,٠٠)& (٩,٠٠&١٨,٠٠). تم أجراء التجربة في أحواض خرسانية لمدة ٨٤ يوما بكثافة تخزين ٣٠ يرقة لكل متر. معدل التغذية اليومية أعتمد على الوزن الكلى لليرقات بالحوض بمعدل ١٠% من الوزن الكلى للحوض عندما كان متوسط وزن اليرقات من ٠,٢-١جم, ٧% عند متوسط وزن من ١-٥جم , ٥% لمتوسط وزن أكبر من ٥جم. الأسماك التى غذيت على ٣٥% بروتين وعند توقيت (٩,٠٠&١٥,٠٠) سجلت أعلى معدل للنمو وبقاء على الحياة. فى حين أن الأسماك التى غذيت على ٣٥% بروتين وعند توقيت (٩,٠٠&١٨,٠٠) سجلت أفضل قيم لمعاملات التحويل الغذائى & كفاء الأستفادة من البروتين والدهن والطاقة المحتجزة. لم يلاحظ آي تأثير معنوي لمستوى البروتين بالعليقة على محتوى الجسم من المادة الجافة والبروتين. فى حين أن الأسماك التى غذيت ٣٥% بروتين سجلت أعلى محتوى للجسم من الدهن. سجلت الأسماك التى غذيت عند توقيت (٩,٠٠&١٥,٠٠) أعلى محتوى للجسم من البروتين وأقل محتوى للجسم من الدهن والرماد. سجلت ذكور الجمبري أعلى معدلات للنمو والتحويل الغذائى مقارنة بالأناث بغض النظر عن مستوى البروتين أو ميعاد التغذية. نتائج هذه الدراسة أوضحت أن يرقات الجمبري حققت أفضل معدل للنمو وكفاه استفادة من الغذاء عند مستوى بروتين ٣٥% وعند توقيت تغذية (٩,٠٠&١٥,٠٠).

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Table 3: Effect of different dietary protein levels and feeding time irrespective of each other on growth performance and feed utilization of male and female freshwater prawn *Macrobrachium rosenbergii* post larvae.

Parameters	35% CP		40% CP		MSE ±	9: 12 h		9: 15 h		9: 18 h		MSE ±
	♂	♀	♂	♀		♂	♀	♂	♀	♂	♀	
Initial body weight, mg prawn^{-1}	0.0208	0.0208	0.0208	0.0208	0.017	0.0208	0.0208	0.0208	0.0208	0.0208	0.0208	0.017
Final body weight, g prawn $^{-1}$	8.62^{a}	5.89^{c}	7.85^{b}	5.54^{c}	1.65	8.48^{a}	5.67^{b}	8.56^{a}	5.80^{b}	8.67^{a}	5.68^{b}	1.88
Weight gain g 84 days $^{-1}$ prawn $^{-1}$	8.60^{a}	5.87^{b}	7.83^{a}	5.52^{b}	1.65	8.46^{a}	5.65^{b}	8.54^{a}	5.78^{b}	8.65^{a}	5.66^{b}	1.85
Specific growth rate(% day)	7.18^{a}	6.72^{b}	7.06^{a}	6.65^{b}	0.001	7.16^{a}	6.68^{b}	7.17^{a}	6.70^{b}	7.18^{a}	6.68^{b}	0.001
Feed conversion ratio	2.10^{b}	2.22^{b}	2.43^{a}	2.73^{a}	0.001	2.27^{b}	2.70^{ab}	2.23^{ab}	2.75^{a}	2.03^{c}	2.35^{ab}	0.69
Protein efficiency ratio	1.37^{a}	1.36^{a}	1.13^{bc}	0.94^{c}	0.21	1.27^{b}	1.05^{c}	1.30^{ab}	1.04^{c}	1.42^{a}	1.21^{b}	0.11

Means in the same row sharing the same superscript are not significantly different (*P*≥0.05).

Table 4: Effect of different dietary protein level and feeding time irrespective of each other on chemical body composition of freshwater prawn *Macrobrachium rosenbergii* post larvae.

Parameters	35% CP	40% CP	MSE ±	9: 12 h	9: 15 h	9: 18 h	MSE ±
Dry matter (%)	24.53	23.74	0.88	23.60	24.17	24.94	0.001
Crude protein (%)	55.53	56.43	0.65	50.51^{c}	62.29^{a}	55.14^{b}	1.06
Crude fat (%)	23.85^{a}	19.44^{b}	1.45	24.03^{a}	18.46^{c}	22.44^{b}	2.1
Ash (%)	20.62^{b}	24.13^{a}	1.20	25.46^{a}	19.25^{c}	22.42^{b}	1.65
Gross energy, Kcal g $^{-1}$	5.39^{a}	5.03^{b}	0.45	5.13	5.26	5.24	0.12

Means in the same row sharing the same superscript are not significantly different (*P*≥0.05).

Table 5: Effect of different dietary protein level and feeding time irrespective of each other on chemical body composition of male and female freshwater prawn *Macrobrachium rosenbergii* post larvae

Parameters	35% CP		40% CP		MSE±	9: 12 h		9: 15 h		9: 18 h		MSE±
	♂	♀	♂	♀		♂	♀	♂	♀	♂	♀	
Dry matter (%)	25.00^{a}	24.40^{b}	24.09^{b}	23.38^{c}	0.99	23.23^{b}	23.98^{b}	23.95^{b}	24.39^{ab}	26.57^{ab}	23.31^{b}	1.22
Crude protein (%)	55.13^{b}	55.93^{b}	55.06^{b}	57.80^{a}	1.65	50.64^{d}	50.39^{e}	63.17^{a}	61.41^{ab}	51.48^{cd}	58.79^{b}	1.88
Crude fat (%)	20.62^{b}	27.07^{a}	18.55^{b}	20.33^{b}	1.33	21.04^{b}	27.03^{a}	15.53^{c}	21.40^{b}	22.20^{b}	22.69^{b}	1.85
Ash (%)	24.25^{ab}	17.00^{c}	26.39^{a}	21.87^{b}	1.23	28.32^{a}	22.58^{b}	21.30^{bc}	17.19^{d}	26.32^{ab}	18.52^{cd}	2.14
Gross energy , Kcal g $^{-1}$	5.06^{b}	5.72^{a}	4.86^{c}	5.19^{b}	0.51	4.85^{c}	5.40^{ab}	5.04^{b}	5.49^{a}	5.01^{b}	5.47^{a}	0.45

Means in the same row sharing the same superscript are not significantly different (*P*≥0.05).