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GROWTH PERFORMANCE OF *MACROBRACHIUM MALCOLMSONII* POST LARVAE WITH FORMULATED FEEDS USING COTTON SEED OILCAKE

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ABSTRACT

Prawns constitute an important and nutritious delicacy for human consumption and hence, there is a universal stress on the need for culture fishery of prawns. Formulated feeds play an important role as major input in aquaculture. The demand of feed is also increasing moreover, the costs of commercial feeds are non affordable to many farmers. The locally available some plant based ingredients have rich source of protein and carbohydrate e.g. cereals, pulses and nuts. In this present investigation we have formulated nine feeds contained protein concentrations of 35%, 40%, and 45% with basal diet contains cotton seed oil cake, Green gram, sunflower oil and cod liver oil. Furthermore, the over performance in morphometric data, feed utilization parameters and biochemical constituents, antioxidant, enzymatic studies, minerals and vitamins showed better performance in Feed-7 (45% protein ration + 1% Sunflower oil) fed prawns when compared with other groups. Therefore, cotton seed oilcake, green gram and sunflower oil can be utilized in combination to prepare farm made feeds for promoting the sustainable development of aquaculture of *M. malcolmsonii*.

INTRODUCTION

Aquaculture is the farming of aquatic organisms such as prawns, molluscs, sea weeds, algae in addition to various fishes. Unlike fishing, aquaculture, also known as aquafarming, implies the cultivation of aquatic populations under controlled conditions. Mariculture refers to aquaculture practiced in marine environments. The aquaculture in India has become an integral part of the rural development. In India, the fresh, brackish and marine water resources are vast. At present India is also one among the fish and prawn producing countries in the world scenario. Aquaculture is an important economic activity in all over the world. It plays a vital role in world by offering better nutrition source of income; tool to rural development is also earning foreign exchange and better employment opportunities (Rao and Ayyappan, 2000). Aquaculture is mainly concerned with crustaceans, fish, molluscs and algae. Some production methods are based on old if not ancient practices, especially in Asia. Others are the result of modern scientific research and experiments exploiting industrial techniques and new raw material resources.

Crustacean larvae are aggressive feeders and feed primarily on live foods, i.e., small zooplankton and larval stages of other aquatic invertebrates (Barros and Valenti, 2003). After transforming to postlarvae, they resemble miniature adults and gradually change from suspending in the water to dwelling at the bottom. Successful culture of crustaceans depends on the surrounding environment, quality and types of feeds. Variation of the nutritional values in live foods is recognized and thus formulated diets have been introduced (Jones *et. al.*,1993) Recent improvement of the formulated diets has been shown to be as efficient as live *Artemia* in supporting growth and survival of the larvae of giant freshwater prawn, *M. rosenbergii* (Kovalenko *et. al.*,2002).

The natural food preference of prawns depends on their age. Larvae are carnivorous**,** feeding primarily on zooplankton (especially small crustaceans), while the post larvae and adults are omnivorous, feeding on algae, aquatic plants, molluscs, aquatic insects, worms, and other crustaceans (Ismael and New, 2000). During the larval stages, prawns seize their food by its thoracic appendages and since at this stage they are non-active hunters, they food items as they encounter them, thus the importance of live prey that remains suspended in the water 26 column (Lavens *et. al.*, 2000). Moreover, the size of the food is also important, such that the brine shrimp *Artemia* nauplii have been found to be more suitable than *Cladoceranmoina* at the early prawn larval stages. In hatcheries, larvae still rely on live feed because they have low digestive capacity and cannot digest artificial diets (New, 1976).

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It is a well-established fact that live feed organisms are more favored than the artificial feed in larval and early post larval stages of various fishes and shellfishes. Growth and survival of freshwater prawn is highly dependent on the type of feed provided at early post larval stages (Alam, 1995). Generally the feed digestibility is less in the early post larval stages. Different zoo technical measures such as the enrichment of live feeds including *Artemia* spp., and *Brachionus plicatilis*, live feed supplement and substitutes, etc., contribute much towards the improvement in survival and quality (Bengston *et. al.*,1991). A variety of ingredients of vegetable and animal origin such as wheat flour, soy flour, corn flour, fish flesh, mussel, squid, hen's eggs, skimmed milk powder, and vitamin and mineral premixes can be utilized to prepare larval diet. All the ingredients are mixed together with water in an electrical blender or mixer until the mixture is dough-like which is then steamed for 30 minutes. After cooling it is stored in a refrigerator and it is advisable to use this for only four days and feeding the larvae (Rao, 2000). The prepared diet is then sieved to obtain suitable particle size and is fed during daytime at intervals of 2 to 3 hours.

Most modern crustacean diets are based on the work of the Japanese and have not been changed other than to replace unavailable Japanese products by similar foodstuffs, available in the locality. A further restriction is brought about by the fact that the Japanese incorporate 'fresh' ingredients such as squid and clams into diets; these would prove to be too expensive elsewhere. A typical modern diet contains the following ingredients: squid meal, fish meal, whale meal, Mysid shrimp meal, yeasts, soya-bean protein, active sludge, casein, gluten, starch, vitamin mixture, mineral salt mixture (Deshimaru and Kuroki, 1974). Recent research has focused on the use of plant proteins to replace marine protein sources in formulated diets. Artificial diets have been increasingly used in semi-intensive and intensive late nursery and on-growing phases to achieve fast growth and high survival (Bautista, 1986). In the present study, different proportions of basal ingredients were used to select various concentration of protein to optimize the growth of *M. malcolmsonii* post larvae.

MATERIALS AND METHODS

Collection and acclimatization of experimental animal

The freshwater prawn, *M. malcolmsonii* post larvae were collected from Anakarai in kumbakonam District. They were safely brought to the laboratory in well-oxygenated plastic bags. They were stocked in large fibre tank and acclimatized to the laboratory condition for 2 weeks before the commencement of experiments.

Maintenance of prawns

During acclimatization, prawns were fed with commercially available scampi feed. Water was routinely changed every day in order to maintain a healthy environment for the prawn apart from providing artificial aeration. This ensures sufficient oxygen supply for the prawn and an environment devoid of accumulated metabolic wastes.

Purchasing of feed ingredients

The branded feed ingredients, such as, Cotton seed oil cake, Green gram (*Vigna radiata*), tapioca flour (*Manihot esculenta)* and eggs were purchased from merchants. Vitamin B-complex capsules, sun flower oil and cod liver oil were purchased from medical shops at Coimbatore. These ingredients were air dried and stored at room temperature in laboratory.

Experimental feed

Sun flower oil (S), Cod liver oil (C), Basal ingredients (BI), such as, cotton seed oil cake and green gram and were powdered in a grinder and this combination was taken in different proportion .With this different oil like sunflower oil, and cod liver oil incorporated as supplement: Diet-1 (35%BI+S) Diet-2 (35%BI +C), Diet-3 (35%BI +S+C), Diet-4 (40%BI +S), Diet-5 (405BI+C), Diet-6 (40%BI+S+C), Diet-7 (45%BI+S), Diet-8 (45%BI+C), Diet-9 (45%BI+S+C).

Experimental procedure

M. malcolmsonii post larvae ranging from 1.1 to 1.7 cm in length and 0.13 to 0.18 g in weight were used in this experiment. The prawns were divided into nine groups. Each group contained 15 animals and the experimental period was up to 45 days. Each experimental trough contains 30L water. The water medium was renewed daily by siphoning method without severe disturbance to the prawn. The water medium was aerated adequately. A separate control group was also maintained along with the experimental set up and fed with formulated control feed, where as the experimental groups were fed with experimental feeds diet-1, diet-2, diet-3 ,diet-4,diet-5, diet-6, diet-7, diet-8, diet9. Before initializing the experiment, the initial length and weight of the animals were measured, similarly at the end of this experiment (on 45^{th} day) the final length and weight were also measured. Similar experimental setup was maintained for several times to study various parameters.

Biochemical analysis

The initial and final concentrations of biochemical constituents, such as total protein, carbohydrate, amino acid and total lipid were estimated in test prawns. Estimation of Protein (Lowry et al., 1951), Amino acid (Moore and Stein, 1948), Lipid (Folch Method, 1957)

Vitamin and Minerals analysis

The initial and final concentrations of vitamin-E and vitamin-C were estimated in test prawns. Vitamin-E (α-tocopherol): (Brown, 1952) Vitamin-C (Ascorbic Acid): **(**Mapson, 1961). The initial and final concentrations of minerals like sodium and potassium were estimated in test prawns.

Analysis of enzymatic antioxidant

The activity of CAT was determined in heamolysate and tissue homogenate by the method of (Sinha and Saxena, 1972).The levels of lipid peroxidation in plasma and

tissues were determined by the method of (Niehaus and Samuelson, 1968).

Food indices

Food indices, such as Increase in Biomass, Percentage weight gain, Specific growth rate, Food intake percentage, feed conversion ratio, condition factor, survival rate and mortality rate were all calculated as follows,

$$\text{Percentage weight gain} = \frac{\text{Final wt} - \text{Initial wt}}{\text{Initial wt of the prawn}} \times 100$$

$$\text{Specific Growth Rate (SGR)} = \frac{\text{Final wt} - \text{Initial wt}}{\text{No. of total experiments}} \times 100$$

$$\text{Feed Conversion Ratio (FCR)} = \frac{\text{Feed consumed dry weight}}{\text{Live weight gain (wet weight)}}$$

$$\text{Condition factor} = \frac{\text{Prawn weight gain (g)}}{\text{Prawn length (cm)}^3} \times 100$$

$$\text{Survival rate} = \frac{\text{Final prawn number}}{\text{Initial prawn number}} \times 100$$

$$\text{Protein efficiency ratio} = \frac{\text{Weight gain}}{\text{Protein intake}} \times 100$$

$$\text{Feed Conversion efficiency ratio} = \frac{\text{Weight gain}}{\text{Feed consumed}}$$

Statistical analysis

The data obtained from study and evaluation was statistically subjected to analysis of variance (ANOVA) and means separation was by (Snedecor and Cochran, 1980).

RESULTS

In the present study, different protein concentration formulated feeds fed with *M. malcolmsonii* post larvae for 45 days after the experimental trail the following growth parameters, proximate composition, vitamin C and E, activity of acid and alkaline Phosphatase, Catalase and lipid per oxidation studies were carried out the results are tabulated and explain following.

Proximate composition of formulated diet

The Feed I contained 35% of basal diet with sunflower oil. The Feed II contained the 35% of basal diet and cod liver oil. The Feed III contained 35% of basal diet and sunflower oil+ cod liver oil. Feed IV contained 40% of basal diet with sunflower oil. The Feed V contained the 40% of basal diet and cod liver oil. The Feed VI contained 40% of basal diet and sunflower oil+ cod liver oil. Feed VII contained 45% of basal diet with sunflower oil. The Feed VIII contained the 45% of basal diet cod liver oil. The Feed IX contained 45% of basal diet and sunflower oil+ cod liver oil. The higher survival and growth performance were observed in feed VII followed by the other experimental groups such as feed I, feed II, feed III, feed IV, feed V, feed VI, feed VIII, feed IX, feed than the control group (Table 1).

Table 1 The morphometric data of the *M. malcolmsonii* post larvae fed with different formulated diets

Protein (%)	Experiment groups	Length (cm)	Weight (gm)
	Initial	2.34±0.20	0.16±0.12
35%	Diet-1 (S)	4.70±0.26	0.77±0.16
	Diet-2 (C)	4.30±0.15	0.79±0.23
	Diet-3 (S+C)	4.16±0.20	0.77±0.16
40%	Diet-4 (S)	4.50±0.70	0.90±0.50
	Diet-5 (C)	3.50±0.25	0.82±0.26
	Diet-6 (S+C)	4.50±0.45	0.92±0.34
45%	Diet-7 (S)	4.75±0.40	0.99±0.36
	Diet-8 (C)	4.00±0.40	0.80±0.20
	Diet-9 (S+C)	3.80±0.30	0.81±0.28

Each value is mean ± standard deviation of three individual observations.

Morphometric data

Taken experimental *M. malcolmsonii* post larvae have 2.34 cm± 0.2 lengths and 0.16g ± 0.1 weights. At the end of the feeding trail for a period of 45th day, the final length and weight were recorded. At the final day of the experiment, the morphometric data showed maximum level of length and weight gained in feed VII (4.75±0.40cm & 0.80±0.20g) and minimum level of length and weight gained in feed V (3.50±0.25cm & 0.80±0.03g) respectively.

Proximate composition

The initial day of the *M. malcolmsonii* post larvae muscle tissue proximate composition were analyzed (such as total protein (32.06±2.01 mg/g), amino acid (10.18±0.10 mg/g), carbohydrate (25.36±2.63 mg/g), (lipid 12.4±1.6 mg/g), respectively (Table-2). At the end of the feeding trail for a period of 45th day, the experimental post larvae muscle tissue proximate composition such as total protein, amino acid, carbohydrate and lipid were analyzed. In this study maximum level of body proximate composition gained in Feed VII fed prawn post larvae tissue followed by the Feed I, Feed II, Feed III, Feed IV, Feed V, Feed VI, Feed VIII and Feed IX, fed prawn tissue.

Concentration of non-enzymatic antioxidants vitamin C and E

The concentration of vitamin-C in the initial prawn muscle tissue in (12.47±0.71µmol/mg protein) and Hepatopancreas have (19.37±0.92µmol/mg protein). At the end of the feeding trail for a period of 45th day, showed the vitamin C content were found to be higher in prawn fed with feed VII group Hepatopancreas (39.10±2.10) were presented in Table-3.

The vitamin E content in the initial prawn was found to be tissue (10.71±0.50µmol/mg protein) and Hepatopancreas (18.34±0.87µmol/mg protein). At the end of the feeding trail for a period of 45th day, showed the vitamin E content were found to be higher in prawn fed

Table 2 The Proximate composition of *M. malcolmsonii* post larvae fed with different formulated diets

Experiment groups		Protein (mg/g)	Amino acid (mg/g)	Carbohydrate (mg/g)	Lipid (mg/g)
Protein (%)	Initial	32.06±2.01	10.18±0.10	25.36±2.63	12.47±1.61
35%	Diet-1 (S)	54.73±2.42	35.89±3.01	27.44±2.32	13.99±1.70
	Diet-2 (C)	51.46±2.25	34.14±2.62	26.00±2.00	13.31±1.20
	Diet-3 (S+C)	58.26±2.58	46.26±3.15	27.49±2.41	14.67±1.70
40%	Diet-4 (S)	65.06±2.61	47.53±3.22	27.63±2.32	14.98±1.81
	Diet-5 (C)	51.93±2.25	34.70±2.50	26.14±2.25	13.35±1.30
	Diet-6 (S+C)	54.40±2.32	35.55±2.92	26.80±2.20	13.69±1.50
45%	Diet-7 (S)	71.03±3.10	55.51±3.60	28.62±2.25	16.19±2.00
	Diet-8 (C)	44.46±2.27	33.81±3.20	25.45±2.17	12.97±1.30
	Diet-9 (S+C)	47.86±2.14	33.29±3.20	26.00±2.00	13.24±1.15

Each value is mean ± standard deviation of three individual observations.

with feed VII group Hepatopancreas (17.76±2.5 µmol/mg protein) were presented in Table-3 .

Table 3 Concentrations of vitamin (C & E) in *M. malcolmsonii* post larvae fed with different formulated diets

Experiment groups	Vitamins	
	Vitamin-C (µmol/mg protein)	Vitamin-E (µmol/mg protein)
Initial	19.37±0.92	18.34±0.87
Final(45%S)	39.10±2.10	64.60±2.84

Each value is mean ± standard deviation of three individual observations

Minerals

Experimental period, the Sodium and Potassium activity were studied in the fed *M. malcolmsonii* post larvae. The results showed Sodium (0.19±0.05mg/g) and Potassium (0.17±0.04mg/g) followed by other groups were presented in Table-4.

Table 4 Concentrations of minerals (Na & k) in *M. malcolmsonii* Post larvae fed with different formulated diets

Protein (%)	Experimental Diets	Sodium (mg/g)	Potassium (mg/g)
	Initial	0.04±0.002	0.02±0.001
35%	Diet-1 (S)	0.12±0.03	0.03±0.002
	Diet-2 (C)	0.12±0.03	0.02±0.001
	Diet-3 (S+C)	0.10±0.01	0.05±0.003
40%	Diet-4 (S)	0.14±0.04	0.10±0.01
	Diet-5 (C)	0.10±0.01	0.12±0.03
	Diet-6 (S+C)	0.17±0.03	0.15±0.03
45%	Diet-7 (S)	0.19±0.05	0.17±0.04
	Diet-8 (C)	0.18±0.04	0.14±0.02
	Diet-9 (S+C)	0.10±0.10	0.14±0.02

Each value is mean ± standard deviation of three individual observations.

Activity of enzymatic antioxidants

Acid and Alkaline Phosphatase activities in the Hepatopancreas of prawn fed with diets-1, 4, and 7 are given in table-4. The activities of ACP and ALP were to be elevated in diet-7 fed prawn, and this was followed by diet-4 and diet-1. The Acid Phosphatase activity in the diet-7 (6.00±0.25) was found to be higher when compared with diet-4 (3.30±0.15) and in diet-1 (2.75±0.10). The Alkaline Phosphatase activity in the diet-7 (33.97±2.15) was found to be higher when compared with diet-4 (25.76±2.10) and in diet-1 (22.17±2.00).

Catalase

Catalase activity at the end of feeding trail was found to be higher in prawn fed with feed VII (45% Sunflower) when compare with initial. In the muscle tissue its level was 25.92±1.65 µmol of H_2O_2 consumed/minute/mg protein against the initial value 18.69±0.56. In the Hepatopancreas 32.38±2.01 µmol of H_2O_2 consumed/minute/mg protein against the initial value 30.37±1.92 were presented in Table-5.

Lipid Peroxidase

Lipid Peroxidase activity at the end of feeding trail was found to be higher in prawn fed with feed VII (45% Sunflower oil) when compare with initial. In the muscle tissue its level was 78.29±3.20 µmol MDA/ mg protein (µmol TBARS / mg protein against the initial value 28.70±1.50.In the Hepatopancreas 130.41±3.50 µmol MDA/ mg protein (µmol TBARS / mg protein against the initial value 72.68±3.00 were presented in Table-5.

Nutritional indices

Food indices parameters, such as survival rate, weight gained, condition factor, specific growth rate, feed conversion ratio, and protein efficiency ratio are given in

Table 5 Antioxidant enzyme activity of *M. malcolmsonii* fed with different formulated diets

Experiment groups	Catalase (µmol of H_2O_2 consumed /min/mg protein)		Lipid Peroxidase (µmol MDA/mg protein(µmol TBARS/mg protein)	
	Tissue	Hepatopancreas	Tissue	Hepatopancreas
Initial	18.69±0.56	30.37±1.92	28.70±1.50	72.68±3.00
45% (S)	25.92±1.65	32.38±2.01	78.27±3.20	130.41±3.50

Each value is mean ± standard deviation of three individual observations.

table-6. Higher survival rate was observed in prawns fed with diet-V and diet-VII when compared to other diet fed prawns. The weight gain, specific growth rate and feed conversion rate were observed to higher in diet-VII when compared to other diet fed prawns. The condition factor and protein efficiency ratio were observed to higher in diet-V, diet-VIII and diet-IX respectively when compare to other diets fed prawns.

vannameii. **(**Gullian et al., 2010) reported that the survival of post-larval *P. vannameii* and *P. stylirostris* were not affected when 20 % cotton seed meal was included in a 30% protein diet.

Furthermore the growth performance of post larvae of *M. malcolmsonii* was observed, the final length and weight of the prawn were found to be maximum in the diet-7 fed prawn group followed by other groups such as

Table 6 Nutritional indices of *M. malcolmsonii* Post larvae fed with different oil incorporated diets

Protein (%)	Experiment Diet	SR (%)	WG (g)	CF (%)	SGR (%)	FCR (%)	PER (%)
35%	Diet-1 (S)	76.92±3.1	0.66±0.05	1.06±0.10	2.73±0.27	3.48±0.25	3.35±0.32
	Diet-2 (C)	61.53±2.5	0.62±0.05	0.98±0.10	2.63±0.26	3.01±0.14	2.32±0.21
	Diet-3 (S+C)	76.92±3.1	0.74±0.06	1.25±0.12	3.00±0.30	3.63±0.20	3.82±0.32
40%	Diet-4 (S)	84.61±3.5	0.76±0.06	1.45±0.14	3.06±0.30	3.65±0.27	4.17±0.42
	Diet-5 (C)	69.23±3.0	0.64±0.05	0.99±0.10	2.66±0.26	3.40±0.26	2.69±0.26
	Diet-6 (S+C)	69.23±3.0	0.65±0.05	1.00±0.12	2.70±0.27	3.41±0.25	2.86±0.27
45%	Diet-7 (S)	92.30±4.0	0.83±0.09	0.61±1.01	3.30±0.35	3.73±0.31	5.08±0.50
	Diet-8 (C)	61.53±2.5	0.61±0.05	0.74±0.06	2.56±0.25	2.79±0.13	2.12±0.20
	Diet-9 (S+C)	69.20±2.5	0.61±0.05	0.92±0.10	2.56±0.25	2.79±0.13	2.24±0.20

Each value is mean ± standard deviation of three individual observations
SR = Survival rate, WG = Weight gain, CF = Condition Factor, SGR = survival Growth Rate, FCR = Feed Conversion Rate, PER = Protein Efficiency Ratio.

Survival Rate

Feeding trail for a period of 45th day showed survivality was higher in Feed V, and VII and minimum level of survival observer in Feed VI (Table, 6) ,higher weight gain in Feed VII and in low level of weight gain in Feed I (Table, 6), higher condition factor were observed in Feed VII and in low level of condition factor in Feed I (Table, 6), specific growth in Feed VII and in low level of specific growth in Feed I (Table, 6)**,** higher feed conversion ratio were observed in Feed specific growth VII and in low level of specific growth in Feed I (Table 6), higher protein efficiency ratio in Feed II and in low level of specific growth in Feed VII (Table 6).

DISCUSSION

Aquaculture have vital role in many countries by offering better nutrition and source of income. Asian countries have witnessed the growth of aquaculture in recent years the goal is to produce the greatest possible weight per culture unit in most aqua cultural operations (Direkbusarakom, 1995). The commercial culture of various prawn and shrimp species for food is the one of the fastest growing areas of aquaculture (Rosenberry, 2005). The freshwater prawns *Macrobrachium malcolmsonii* are suitable for culture, as they grow to the marketable size reaching an average weight of 40-70g in 6 months (Kannupandi, 1995).

In the present study the higher survival performance was observed in diet-7 fed prawn group followed by the other groups such as diet-5, diet-4, diet-3, diet-1, diet- 2, diet-6, and diet-8. The diet-9 fed prawn group was showed the lower survival rate when compared with all experimental groups. This indicates that the experimental an animal had good health condition with nutrient availability. Higher rate of survival were observed in experimental animals which shows that the post larval quality was improved in cotton seed meal diet fed prawns**.** **(**Lim, 1996) has reported that the higher survival was observed in cotton seed meal diet fed juvenile *Penaeus* diet-1, diet- 4, diet- 6, diet- 3, diet-8, diet- 10 and diet-6 fed prawn groups. Lim (1996) has reported that the higher growth was observed in cotton seed meal diet fed juvenile *Penaeus vannameii*. **(**Gullian et al., 2010) reported that the significant growth performance were observed in 20 % cotton seed meal supplemented diet fed shrimp, *P. vannameii* and *P. stylirostris*.

Biochemical studies are very important from the nutritional point of view the biochemical constituents in animals are known to vary with season, size of the animal, stage of maturity and availability of food. The feed regulates influence on carbohydrate and lipid metabolism in crustacean which was found to vary with time and species. Prawn is rich in variety of organic and inorganic constituents. The organic components include proteins, amino acids, carbohydrates and lipids. The inorganic constituents are water and minerals (Bhavan et al., 2010).
The content of total protein was found to be maximum in diet-7 fed prawn group followed by diet-4, diet-3 diet- 1, diet-6, diet-5, diet-2 and diet-8 fed prawn groups. However significant variation was seen in the concentration of protein between experimental groups. There was minimum concentration of protein between experimental diet-2 and diet-5 fed prawn groups, likewise the content of total amino acid was found to be maximum in diet-7 fed prawn group followed by diet-4, diet-3 diet-1, diet-6, diet-5, diet-2 and diet-8 fed prawn groups. However significant variation was seen in the concentration of amino acid between experimental groups. There was minimum concentration of amino acid between experimental diet-2 and diet-5 fed prawn groups. The concentration of amino acid was found to be minimum in diet-2 when compared with die-5 and diet-9.
In the present study the concentration of Vitamin C and E were analyzed in the diet-7 which was incorporated with 45% protein and sunflower oil mixed formulated feed fed groups. Vitamins are complex organic compounds with distinct role in various metabolic processes. They are indispensable for normal growth, maintenance and

reproduction in mammals. Requirement of vitamins in prawn has been widely studied using deletion or dose response technique. The requirement depends on various factors such as size, age, growth rate, water temperature and composition of diets. Usually Vitamins are used at higher dosage as a safety margin in crustaceans compared to that fishes (Conklin, 1980).

In the present study the activity of Catalase was analyzed in diet-7 which was incorporated with 45% protein and sunflower oil mixed formulated feed fed groups. Catalase is a common enzyme found in nearly all living organisms that are exposed to oxygen, where it functions to catalyze the decomposition of hydrogen peroxide to water and oxygen (Chelikani, 2007).

The freshwater prawn *Macrobrachium malcolmsonii* is "Mansoon river prawn"; it is a cultivable species in India. The *M. malcolmsonii* is an omnivorous bottom dwelling prawn and naturally feeds on decomposing plants and animals, small worms, insects and their larvae. They are also cannibalistic in nature and may consume freshly moulted conspecifics in pond environments. Application of feed and fertilizers from the beginning of the *M. malcolmsonii* rearing not only increases the availability of natural food but also decreases the water transparency, therefore reducing the growth of weeds. For grow out culture of *M. malcolmsonii* high protein diets of 50% either plant origin or animal origin are required. In the present study, among three levels of protein concentration, the diet contained 45% protein has produced best performance.

CONCLUSION

In the present investigation, the over performance in morphometric data, feed utilization parameters and biochemical constituents, enzymatic studies and level of electrolytes showed better performance in Feed-7 (45% protein ration + 1% Sunflower oil) fed prawns when compared with other groups. Therefore, cotton seed oilcake, green gram and sunflower oil can be utilized in combination to prepare farm made feeds for promoting the sustainable development of aquaculture of *M. malcolmsonii*.

References

Alam, M.J., Ang, K.J., Begum, M., 1995. Use of egg custard augmented with cod liver oil and Moina micrura on production of freshwater prawn post larvae. *Aquac.* Int, 3: 249–259.

Barros, H.P., Valenti, W.C., 2003. Food intake *of Macrobrachium rosenbergii* uringlarval development. *Aquaculture,* 216: 165– 176.

Bautista, M.R., 1986. The response of penaeus monodon juveniles to varifujing protein/energy rations in test diets. *Aquaculture, 5*3 229-292.

Bengston, D.A., Leger, P., Sorgeloos, P., 1991. Use of Artemia as a food source for aquaculture. In: Brown, R.A., Sorgeoos, P., Trotman, C.N.A. (Eds.), Artemia Biology. CRC Press Inc, Fish L,

Bhavan, P.S., Radhakrishnan, S., Seenivasan, C., Shanthi, R., Poongodi, R., Kannan, S., 2010. Proximate composition and profiles of amino acids and fatty acids in the muscle of adult males and females of commercially viable prawn species *Macrobrachium rosenbergii* collected from natural culture environments. *International Journal of Biology*. Vol. 2, No. 2;

Brown, F., 1952. The estimation of vitamin E. 2. Quantitative analysis of tocopherol mixtures by paper chromatography. Biochem J.52(3): 523–526.

Conklin, D. E., 1980. Nutrition. In: Cobb, J., Phillips, B. (Eds.), The Biology and Management of Lobster. Academic Press, New York, USA, pp. 277–300.

Deshimaru, O., Kuroki, K., 1974. Studies on a purified diet for prawn III. A feeding experiment with amino acid test diets. Nippon Suisan Gakkaishi, 40 :1127-1131.

Direkbusarakom, S., Herunsalee, A., Boonyaratpalin, S., Danayadol, Y., Aekpanithanpong U., 1995. Effect of Phyllanthus spp against yellow-head baculovirus infection in black tiger shrimp, Penaeus monodon. In: Diseases in Asian Aquaculture II. M Shariff JR Arthur and R.P Subasinghe (eds). Fish Health Section. *Asian Fisheries Society*, Manila, p. 81-8.

Jones, D. A., Kamarudin, M.S., Le Vay, L.L., 1993. The potential for the replacement of live feeds in larval culture. *J. World Aquac. Soc.* 24, 199– 210.

Jordi folch, M., Lees, T., Sloane Stanley, H., 1956. A simple method for the isolation and purification of total lipides from animal tissues. Biochem. J. (1961) 80, 284

Kannupandi, T., 1995. Development of technology for hatchery production in *M. malcolmsonii and M.rosenbergii. TNSCS and T project technical report, pp: 51.*

Kovalenko, E.E., Abramo, L.R., Ohs, C.L., Buddington, R.K., 2002. A successful microbound diet for the larval culture of freshwater prawn *Macrobrachium rosenbergii*. *Aquaculture* 210, 385-395.

Lavens, P., Thongrod, S., Sorgeloos, P., 2000. Larval prawn feeds and the dietary importance of Artemia. In: New, M.B., Valenti, W.C. (Eds.), Freshwater Prawn Culture: The Farming of *Macrobrachium rosenbergii*. *Blackwell Science*, Oxford, pp. 91–110.

Lim, C., 1996. Effect of dietary pH on amino acid utilization by shrimp *P. vannamei. Aquaculture* 114:293-303

Lowry, O.H., Rosebrough, N.J., Farr, A.L., Randall, R.J., 1951. Protein measurement with the folin phenol reagent. *J Biol Chem 1951; 193:265-75.*

Mapson, W., 1961. A Note on the Estimation of Dehydro-L-Ascorbic Acid in Plant Tissues by the Roe & Kuether Procedure. Biochem. J. 80, 459

Carlos, M., Sanders, A.P., Lope, R., 2010**.** Viability of culturing pink shrimp *Farfantepenaeus duorarum* in low-salinity groundwater from the Yucatán Peninsula (SE, México). Aquaculture, 302, 3-4 202-207

New, M.B., 1976. A review of dietary studies with shrimp and prawns. *Aquaculture* 9, 101–144.

Niehaus, W.G., Samuelsson, B., 1968. Formation of Malonaldehyde from Phospholipid rachidonate

during Microsomal Lipid Peroxidation.European Journal of Biochemistry 6, 126–130.

Rao, K.J., Ayyappan, S., 2000. Hatchery technology of giant freshwater prawn, *Macrobrachium rosenbergii*. *Fishing Chimes* 19: 112-117.

Rao, K.J., 2000. Technology Project in Mission Mode on Semi-Intensive Prawn Aquaculture, at CIFA: A Retrospection. Department of Biotechnology Government of India and Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar, India.

Rosenberry, B., 2005. World shrimp farming 2005. Shrimps news international 276 pp.

Sinha, S., Saxena, R., 2006. Cadmium accumulation and its influence on lipid peroxidation and antioxidative system in an aquatic plant, Bacopa monnieri L. Chemosphere. 62, (2): 233-246

Snedecor, G.W., Cochran, W.G., 1980. "Statistical Methods", 7th Ed. Oxford and IBIT Public. Co. New York.

William, H., Moore, S.S., 1968. Chromatographic Determination of the Amino Acid Composition of Proteins. J. Amer. chem. Soc. 23: 437–44.

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