Effect of Different Dietary Protein Levels on Body Composition, Digestive Enzymes, Hemolymph Indexes and Water Quality in White Shrimp Larvae *Litopenaeus vannamei* Cultured in Tanks

Nourhan E. G. Elsayed[1], Eid. A.E[1], Mervat A. M. Ali[1], Amal Elfeky[1], Zaki Z. Sharawy[2]
[1]Faculty of Agriculture, Suez Canal University, Egypt
[2]Invertebrate Laboratory, Aquaculture Division, National Institute of Oceanography and Fisheries, Suez, Egypt

Received: *23/11/2022*

Abstract: The present experiment was conducted to investigate the effects of five different protein levels (25%, 30%, 35%, 40% and 45%) on white shrimp larvae *Litopenaeus vannamei* on body composition, digestive enzymes, haemolymph indexes and water quality cultured in tanks. The experiment was performed indoor at Invertebrate laboratory of National Institute Oceanography and Fisheries (NIOF), Suez governorate, Egypt for 90 days. The experiment was carried out in 15 rectangular tanks (66×47×44cm, 50 L) each of reinforced with water salinity 20 ppt. Triplicate groups of shrimp with an initial weight of ,(0.002g) were fed twice a day at a ratio of 14% from body weight and re-adjusted gradually to 5% at the end of the experiment. The results observed that, by increasing dietary level of protein, the activity of trypsin increased up to 35% and then decreased. The highest activity values of trypsin were recorded for larvae fed 35% protein level compared to the other diets. No significant differences were recorded for lipase or amylase activity values among different experimental treatments. The percentages of total protein and cholesterol in plasma were increased in all treatments. The different protein levels also affected the production of nitrogenous compounds such as ammonia (TAN), nitrite (NO2) and nitrate (NO3). The obtain results indicate that 35% protein level may achieve the highest proximate body composition induces of white shrimp *L. vannamei* larvae cultured in tanks.

Keywords: *Litopenaeus vannamei*, body composition, enzymes, haemolymph indexes and water quality

INTRODUCTION

The Pacific white shrimp is the most widely farmed shrimp species throughout the world. Typical performance characteristics of this species, together with its tolerance against a wide range of salinities and disease, rapid growth, suitable survival and high-density culture make it be considered as a good candidate for intensive culture (Khanjani *et al.,* 2016). The white leg shrimp, *L. vannamei* is native to the Eastern Pacific coast of Mexico and Northern Peru. Due to their superior breeding characteristics, and tolerance to a wide range of salinity (0.5-40 g/L), *L. vannamei* together with *Penaeus monodon* and *Fenneropenaeus chinensis* are considered the world's three major shrimp candidates for aquaculture (Gao *et al*., 2016), This species likes areas where water temperatures are usually over 25°C the whole year. The female shrimp grow faster than males. They shrimp like muddy bottom areas (FAO, 2016).

Proteins which have numerous structural and metabolic functions play an important role in growth. Protein is the main nutrient affecting the growth performance of aquatic animals, however the cost of protein in feed is high, and its inclusion in aquaculture feed had a significant impact on overall feed costs (NRC, 2011). For these reasons, attempts to optimize the amount of dietary protein in aquaculture feeds are necessary. Protein requirements for maximal growth of white shrimp have been reported to be between 30-36% in brackish or seawater (Kureshy and Davis, 2002). There are few reports on dietary protein requirements of *L. vannamei* at salinity <5 g/L.

In this study, the effects of five dietary different protein levels (25%, 30%, 35%, 40% and 45%) of *L. vannamei* larvae on body composition, digestive enzymes, haemolymph indexes, and water quality cultured in tanks were investigated.

MATERIALS AND METHODS

Experimental diets

Five isocaloric experimental diets with different crude protein (CP) levels at 25%, 30%, 35%, 40%, 45%, were formulated shown in Table (1). Potein sources for the experimental diets ere fish meal and soybean meal. The Amino acid composition of experimental diets is shown in Table (2). The experimental diets were prepared individually weighting of each component and thoroughly mixing the mineral, vitamins and additives with corn. This mixture was added to the components together with oil. Water was added until the mixture became suitable for making granules. The wet mixture was passed through CBM granule machine with 2mm diameter. The produced pellets were dried at room temperature and kept frozen until experiment start.

Experimental Design

Larvae of *L. vannamei* were obtained from a commercial shrimp hatchery in Damietta, Egypt. Shrimps were transported in oxygenated double–layered polythene bags. When the shrimp arrived at the laboratory, they were moved into the acclimation tanks filled with seawaterafter filtered by plankton net (50µm) to prevent the entry of un wanted materials and suspended particles into the tanks and was diluted with fresh water to achieve a salinity of (20ppt).. Prior to start of experiment, shrimps were acclimated to laboratory condition for two weeks and fed twice daily with commercial diet (38%) crude protein. Initial samples were taken immediately after reaching larvae from hatchery, and final sample is taken from each tank at the end of study for the determination of chemical body composition.

Table (1): Formulation and proximate composition of the experimental diets (dry matter base)

Ingredients	Experimental treatments				
	T_1 (25% CP)	T_2 (30% CP)	T_3 (35% CP)	T_4 (40% CP)	T_5 (45% CP)
Fish meal(70%) protein	21.00	29.00	29.00	36.00	43.00
Soybean meal (44%) protein	23.00	23.00	34.00	34.00	34.00
Yellow corn	44.00	36.00	25.00	18.00	11.00
Sunflower oil	7.00	7.00	7.00	7.00	7.00
Mineral mixture[1]	2.00	2.00	2.00	2.00	2.00
Vitamin mixture[2]	1.00	1.00	1.00	1.00	1.00
Molasses	2.00	2.00	2.00	2.00	2.00
Proximate analysis					
Moisture	11.98	11.77	`11.49	11.30	11.12
Crude protein	25.26	30.42	35.24	40.76	45.29
Lipids	13.34	14.08	13.96	13.61	14.26
Ash	6.72	7.61	7.16	6.95	7.73
Fibers	3.71	3.70	3.96	2.95	2.93
NFE[3]	50.97	44.19	39.68	35.73	29.79
Gross energy (Kcal /100g) [4]	478.27	486.55	494.11	505.76	513.08
P/E (%)[5]	5.28	6.25	7.13	8.06	8.83

1- Each Kg mineral mixture premix contained Mn, 22 g; Zn, 22 g; Fe, 12 g; Cu, 4 g; I, 0.4 g, Selenium, 0.4 g and Co, 4.8 mg.
2- Each Kg vitamin contained Vitamin A, 4.8 million IU, D3, 0.8 million IU; E, 4 g; K, 0.8 g; B1, 0.4 g; Riboflavin, 1.6 g; B6, 0.6 g, B12, 4 mg; Pantothenic acid, 4 g; Nicotinic acid, 8 g; Folic acid, 0.4 g Biotin,20 mg
3- Nitrogen Free Extract = 100 – (%Protein + %Fat + %Fiber + %Ash).
4- Gross Energy based on protein (5.65 Kcal/g), fat (9.45 Kcal/g) and carbohydrate (4.11Kcal/g).
According to (NRC, 2011)
5- Protein energy ratio = Crude protein / Gross energy (Kcal /100g) [4]*100

After two weeks of acclimatization, all tanks were stocked with shrimp larvae in triplicate. Before distributing on tanks, we weighed the shrimp, and the initial body weight (0.002g). Shrimp were fed with experimental diets twice a day at 14% from body weight (initial weight) and re-adjusted gradually to 5% at the end of the experiment. The daily feeding rate (%) for each treatment was calculated and adjusted by estimating the biweekly sampled mean biomass.

To maintain water quality at optimum range for shrimps the following parameters were monitored during the experiment.

Daily parameters: Water temperature (°C) was measured daily at 13:00h, salinity and pH was measured daily at 10:00h using multiparameter analyzer. **Biweekly parameters:** Water sample (100ml) were collected from each tank and filtered by filter papers to analyze total ammonium nitrogen (TAN), nitrite-N (NO2-N), nitrate-N (NO3-N) using spectrophotometer model (JENWAY 6100).

All data were analyzed by two-way ANOVA. The ANOVA were performed by using the SAS v9.0.0 (2004) program. The ANOVA was followed by Duncan (1955) at P<0.05 level of significant.

RESULTS AND DISCUSSION

As shown in Table (2), with the increase of dietary protein level, the moisture content decreased. The opposite trend was observed for body protein content. Lowest moisture content was recorded for larvae fed the diet content 40% protein level. Both 40% and 45% protein levels were significantly lower compared to the 25%, 30%, 35% CP levels ($P<0.05$).No significant difference was observed among the rest of the groups ($p>0.05$).

The results showed that body protein content of the 45% CP level diet recorded the highest 72.90% values. Protein content of the 40% and 45% CP levels diet observed significantly higher ($P<0.05$) values than the 30% and 25% CP levels ($P<0.05$). No significant differences were found among the other protein levels. The body fat content of shrimp and ash did not observe any significant differences between the protein levels. Body compositions of aquatic animals have been found to correlate with dietary nutrients. Some studies showed the protein level of aquatic animals initially increased then decreased with increasing dietary protein levels (Mohanta *et al.,* 2007). The results of this study showed that dietary protein levels significantly affected proximate compositions of whole shrimp. Crude protein content generally increased with increasing dietary protein levels. This is consistent with some studies on the *Pampus argenteus* (Hu *et al.,* 2008), *L. vannamei* (Hu *et al.,* 2008) and *Scylla serrata* (Unnikrishnan and Paulraj, 2010). However, some studies showed that crude protein content was not affected by dietary protein levels in *Scylla serrata* (Catacutan, 2002). Changes in moisture content of shrimp were opposite to protein content; moisture content decreased with increasing dietary protein levels. This is consistent with a study of *Scylla serrata* (Sheen and Wu, 1999). Some reports indicate that moisture content of the *Scylla serrata*was not affected by dietary protein levels (Unnikrishnan and Paulraj, 2010). Dietary protein level did not affect whole body lipid and ash content of *L. vannamei* with increasing dietary protein levels, which is similar to *Barbodes altus* (Adrian, 1997).

Table (2): Effect of dietary protein levels on chemical composition (Mean±SD) of *L. vannamei* larvae

Items	Dietary protein levels %				
	T_5 (45% CP)	T_4 (40% CP)	T_3 (35% CP)	T_2 (30% CP)	T_1 (25% CP)
Moisture	77.82±0.06^a	76.93±0.90^a	77.25±0.37^a	75.52±0.62^b	75.74±0.68^b
Protein	70.16±0.82^a	70.37±0.44^a	71.49±1.46^{ab}	72.76±1.36^b	72.90±1.63^b
Lipid	4.62±0.25^a	4.47±0.35^a	4.67±0.64^a	4.58±0.48^a	4.68±0.71^a
Ash	12.54±0.33^a	11.70±0.77^a	11.69±0.90^a	11.40±0.79^a	12.16±0.32^a

Data are presented as means ±SD. Values in the same row with different superscript letters are significantly different ($P < 0.05$)

In this study dietary protein levels had a significant effect on *L. vannamei* trypsin activity ($p<0.05$). With the increase of the dietary protein level, trypsin activity first increased up to 35% CP and then decreased. Maximum activity was observed in the 35% CP level and it was significantly higher than the 25%, 30% and 45% CP levels ($P<0.05$). In the 25% protein level, activity was significantly lower than 35%, 40% and 45% CP levels ($P<0.05$). No significant differences were found among the other protein levels. Dietary protein levels had no significant effect on lipase and amylase activities.

In this study, trypsin activity in liver and pancreas first increased then decreased with increasing dietary protein levels as shown in Table (3). These results differ from a study on *Penaeus japonicus*, probably due to the different size of shrimps and different protein diets (Rodriguez, 1994). Similar results obtained by (Gao *et al.,* 2016). A study on the relationship between the amount of the trypsin mRNA in *Dicentrarchus labrax* and the ingredients in the diet, showed that at the molecular level the responses of trypsin and amylase to the diet were regulated independently (Peres *et al*., 1998). Future studies are needed on the expression of the genes encoding digestive enzymes and endocrine regulation pathways to further explore the mechanisms for the regulation of *L. vannamei* digestive enzymes.

Table (3): Effect of dietary protein levels on digestive enzymes (Mean±SD) of *L. vannamei* larvae

Items	Dietary Protein levels %				
	T_5 (45% CP)	T_4 (40% CP)	T_3 (35% CP)	T_2 (30% CP)	T_1 (25% CP)
Trypsin U/mg	122.10±1.20^e	126.50±1.50^d	139.20±1.30^a	134.20±1.10^b	130.10±1.30^c
Lipase U/mg	9.29±1.30^a	9.19±1.12^a	9.41±1.20^a	9.41±1.40^a	9.43±1.50^a
Amylase U/mg	1.60±1.50^a	1.40±1.20^a	1.50±1.40^a	1.50±1.30^a	1.50±1.32^a

Data are presented as means ±SD. Values in the same row with different superscript letters are significantly different ($P < 0.05$)

Crustaceans have an open-vessel circulatory system such that the inter organ transport of nutrients is considered being operated through the haemolymph. Some studies had demonstrated that metabolites in haemolymph can be used as indices of nutritional status because the haemolymph, together with muscle, and the digestive gland, is a reserve tissue (Sanchez *et al.,* 2001).

Moreover, measuring the protein concentration of a crustacean's haemolymph can provide valuable information to identify its condition (Ozbay and Riley, 2002). The serum total protein are associated with dietary protein level, and elevated with increasing dietary protein level in this study. Similar to our result, (Rosas *et al.*, 2000) showed that haemolymph protein content increased with the dietary protein in *L. vannamei* juveniles. Variations in glucose concentrations in haemolymph are related to quantity and quality of carbohydrates in the diet (Rosas *et al.,* 2001). Also, glucose can derive from glyconeogenesis from amino acids (Wiglesworth and Griffith, 1994), which is in agreement with our results and we obtained a significantly increase in glucose haemolymph concentration in shrimp with the protein level in the diet increasing from 25 to 40%. This study clearly demonstrated that plasma triglyceride levels were not significantly affected by increment level of dietary protein, whereas the plasma total cholesterol levels were significantly increased as shown in Table (4). Our results agree with Yue *et al*. (2012) and Shahka *et al.* (2014) they reported that plasma cholesterol levels were enhanced in whiteleg shrimp fed higher levels of fish meal diets.

Table (4): Effect of dietary protein levels on the haemolymph parameters (Mean±SD) of *L. vannamei* larvae

Items	Dietary Protein levels %				
	T_5 (45% CP)	**T_4 (40% CP)**	**T_3 (35% CP)**	**T_2 (30% CP)**	**T_1 (25% CP)**
Total protein(g/dl)	18.20±1	23±1	23±1	24.20±1	24.40±1
Glucose (mg/dl)	1290±49.1	1344±49.1	1556±49.1	1607±49.1	1339±49.1
Cholesterol(mg/dl)	135±14.1	150±14.1	152±14.1	204±14.1	235±14.1
Triglyceride(mg/dl)	225±23.5	220±23.5	228±23.5	232±23.5	235±23.5

Data are presented as means ±SD. Values in the same row with different superscript letters are significantly different (p < 0.05)

The daily water quality parameters such as temperature, dissolved oxygen, salinity and pH monitored during the experimental period are shown in Table (5). During the experimental period (90-days), temperature, dissolved oxygen, salinity and pH did not show any significant difference and they were at the optimum range for *L. vannamei* cultured (Da silva, 2015).

The concentrations of nitrogen parameters measured during this experiment are presented in Table (5). The results showed that TAN, NO_2 and NO_3 concentrations were increased (P <0.05) by the increasing of protein level during the experiment. Nitrogen plays an important role in the aquaculture system due to its dual role, as a nutrient and toxicant (Burford and Lorenzen, 2004). Most of the nitrogen input in shrimp culture systems enters the water column as ammonia (Mishra *et al.,* 2008). Ammonia is the main end product of protein catabolism in crustaceans and is also generated in the aquatic system by the breakdown of uneaten feed and waste (Carbajal-Hernández *et al.,* 2012).

Therefore, throughout the study the TAN, NO_2 and NO_3 showed a slight increase up to optimum protein level in white leg shrimp fed up to 35% CP diet. Excessive dietary protein will increase excretion of nitrogenous waste (Boonyaratpalin, 1996). Therefore, the TAN, NO_2 and NO_3 significantly increased with a further increase in dietary protein levels from 35 to 45%. Nitrogen in the form of ammonia and nitrite is highly toxic to shrimp; however, the toxicity depends on various factors including species tolerance, water characteristics (pH, temperature, salinity, DO) and exposure duration (Barajas *et al.,* 2006). Nitrate, unlike ammonia and nitrite is less toxic to shrimp; however, a high concentration (100 mg/l) was reported to be lethal to shrimp (Van Rijn *et al.,* 2006).

Table (5): Effects of dietary protein levels on the nitrogen parameters (Mean±SD) of L.vannamei larvae

Items	Dietary Protein levels %				
	T_5 (45% CP)	**T_4 (40% CP)**	**T_3 (35% CP)**	**T_2 (30% CP)**	**T_1 (25% CP)**
Temperature ºC	$28.5±0.53^a$	$28.4±0.47^a$	$28.2±0.58^a$	$28.3±0.57^a$	$28.4±0.43^a$
Oxygen (mg/l)	$5.20±0.50^a$	$5.30±0.53^a$	$5.20±0.50^a$	$5.20±0.52^a$	$5.20±0.52^a$
Salinity	$20.2±0.51^a$	$20.2±0.33^a$	$21.3±0.32^a$	$20.2±0.39^a$	$20.2±0.58^a$
pH	$7.8±0.33^a$	$7.9±0.21^a$	$7.9±0.30^a$	$7.9±0.23^a$	$7.9±0.31^a$
TAN (mg/l)	0.61±0.04	0.62±0.04	0.66±0.04	0.80±0.04	0.10±0.04
NO_2(mg/l)	0.13±0.01	0.12±0.01	0.14±0.01	0.16±0.01	0.20±0.01
NO_3 (mg/l)	0.32±0.02	0.30±0.02	0.32±0.02	0.38±0.02	0.40±0.02

Data are presented as means ±SD. Values in the same row with different superscript letters are significantly different (P< 0.05)

REFERENCES

Adrian, E. and K. F. Shim (1997). Growth response of juvenile *Barbodesalus* fed isocaloric diets with variable protein levels. Aquaculture, 158: 321-329.

Barajas, F. M., R. S. Villegas, G. P. Clark, J. G. Mosqueda and B. L. Moreno (2006). Daily variation in short-term static toxicity of unionized ammonia in *Litopenaeus vannamei* (Boone) post-larvae. Aquaculture Research, 37: 1406-1412.

Boonyaratpalin, M. (1996). Nutritional requirements of commercially important shrimps in the tropics, pp. 10-28.

Burford, M. A. and K. Lorenzen (2004). Modeling nitrogen dynamics in intensive shrimp ponds: the role of sediments remineralization. Aquaculture, 229: 129-145.

Carbajal-Hernández, J., L. Sánchez-Fernández, A. Carrasco-Ochoa and J. Martínez-Trinidad (2012). Immediate water quality assessment in shrimp culture using fuzzy inference systems. Expert Systems with Applications, 39: 10571-10582.

Catacutan, M. R. (2002). Growth and body composition of juvenile mud crab, *Scylla serrata*, fed different dietary protein and lipid levels and protein to energy ratios. Aquaculture, 208: 113-123.

Da Silva, E., J. Silva, F. Ferreira, M. Soares, R. Soares and S. Peixoto (2015). Influence of stocking density on the zootechnical performance of *Litopenaeus vannamei* during the nursery phase in abiofloc system. Bol. Inst. Pesca, São Paulo, 41(Esp.): 777-783.

Duncan, D. B. (1955). Multiple range and Mmultiple f test Biometrice, 11:1-42.

FAO (2016). The State of World Fisheries and Aquaculture Contributing to food security and nutrition for all. Food and Agriculture Organization of the United Nations, Roma.

Gao, W, L. Tian, W. Hu, M. Luo, J. Liu, Q. Qiaoqing Xu and J. Juan Tian (2016). Optimal Dietary Protein Level for the White Shrimp (*Litopenaeus vannamei*) in Low Salinity Water. The Israeli Journal of Aquaculture - Bamidgeh, IJA_68: 1-8.

Hu, Y., B. P. Tan, K. S. Mai and Q. H. Ai (2008). Growth and body composition of juvenile white shrimp, *Litopenaeus vannamei,* fed dietary different ratios of dietary protein to energy J. Aquacult Nutr., 14: 499-506.

Khanjani, M. H., M. M. Sajjadi, M. Alizadeh and I. Sourinejad (2016). Study on nursery growth performance of Pacific white shrimp *Litopenaeus vannamei* (Boone, 1931) under different feeding levels in zero water exchange system. Iranian Journal of Fisheries Sciences, 15: (4).

Kureshy, N. and D. A. Davis (2002). Protein requirement for maintenance and maximum weight gain for the Pacific white shrimp, *Litopenaeus vannamei.* Aquaculture, 204: 125-129.

Mishra, J. K., T. M. Samocha, S. Patnaik, M. Speed, R. L. Gandy and A. M. Ali (2008). Performance of an intensive nursery system for the Pacific white shrimp, *Litopenaeus vannamei*, under limited discharge condition. Aquacultural Engineering, 38: 2-15.

Mohanta, K. N., S. N. Mohanty, J. K. Jena and N. P. Sahu (2007). Protein requirement of silver barb, *Puntius gonionotus* flingerlings. Aquac Nutr., 13: 1-10.

National Research Council (NRC) (2011). Nutrient Requirements of Fish and Shrimp. National Academies Press, Washington, DC, 70-71.

Ozbay, G. and J. G. Riley (2002). An analysis of refractometry as a method of determining blood total protein concentration in the American lobster *Homarus americanus* (Milne Edwards). Aquaculture Research, 33: 557- 562.

Peres, A. (1998). Dietary regulation of activities and mRNA levels of trypsin and amylase in Seabass (*Dicenlarcrhus labrax*) larvae. J. Fish Physiol Biochem., 19(2): 145-152.

Rodriguez, A., L. L. Vay, G. Mourente and D. A. Jones (1994). Biochemical composition and digestion enzyme activity in larvae an post larvae of *Penaeus japonicas* during herbivorous and carnivorous feeding. Mar Biol., 118(1): 45-51.

Rosas, C., G. Taboada, C. Pascual, G. Gaxiola and A. van Wormhoudt (2001). Effect of dietary protein and energy levels on growth, oxygen consumption, haemolymph and digestive gland carbo-hydrates, nitrogen excretion and osmotic pressure of *Litopenaeus vannamei* (Boone) and *L. setiferus* (Linne) juveniles (Crustacea, Decapoda; Penaeidae). Aquaculture Research, 32: 531-547.

Rosas, C., G. Cuzon, G. Gaxiola, L. Arena, P. Lemaire, C. Soyez and A. Van Wormhoudt (2000). Influence of dietary carbohydrate on the metabolism of juvenile *Litopenaeus stylirostris*. Journal of Experimental Marine Biology and Ecology, 24: 181-198.

Sanchez Ariadna, Cristina Pascual, Adolfo Sanchez, Francisco Vargas-Albores, Gilles Le Moullac, Carlos Rosas (2001). Hemolymph metabolic variables and immune response in *Litopenaeus setiferus* adult males: the effect of acclimation, Aquaculture, 198: 13-28.

Shahkar, E., H. Yun, G. Park, I. Jang, S. Kim, K. Katya, C. Sungchul and S. Bai (2014). Evaluation of Optimum Dietary Protein Level for Juvenile Whiteleg Shrimp (*Litopenaeus Vannamei*). Journal of Crustacean Biology, 34(5): 552-558.

Sheen, S. S. and S. W. Wu (1999). The effect of dietary lipid levels on the growth response if juvenile mud crab, *Scylla scrrate.* J. Aquaculture, 175: 143-153.

Statistical Analysis System (1988). SAS/ STAT User's Guide Release 6.03 edition. SAS Institute Inc. Cary. NC.

Unnikrishnan, U. and R. Paulraj (2010). Dietary protein requirement of giant mud crab *Scylla serrata* juveniles fed isoenergetic formulated diets having graded protein levels. J. Aquacult Res., 41: 278-294.

Van, Rijn, J., Y. Tal and H. J. Schreier (2006). Denitrification in recirculating systems: theory and applications. Aquaculture Engineering, 34: 364-376.

Wiglesworth, J. M. and D. R. W. Griffith (1994). Carbohydrate digestion in *Penaeus monodon*. Marine Biology, 120: 571-578.

Yue, Y. R., Y. J. Liu, L. X. Tian, L. Gan, H. J. Yang and G. Y. Liang (2012). Effects of replacing fish meal with soybean meal and peanut meal on growth, feed utilization and haemolymph indexes for juvenile white shrimp, *Litopenaeus vannamei*, Boone. Aquaculture Research, 43: 1687-1696.

تأثير مستويات مختلفة من بروتين العليقة على تركيب الجسم، الإنزيمات الهاضمة، مؤشرات الهيموليمف وجودة المياه ليرقات الجمبري الفانمي المستزرع في التنكات

نورهان السيد غريب - عبد الحميد محمد صلاح عيد - مرفت على محمد على - أمال محمد إبراهيم الفقى - زكى زكى شعراوى

[1]كلية الزراعة - جامعة قناة السويس بالإسماعيلية - مصر

[2]معمل اللافقاريات - شعبة تربية الأحياء المائية - المعهد القومي لعلوم البحار والمصايد - فرع السويس – مصر

أجريت هذه التجربة لدراسة تأثير خمسة مستويات بروتينية مختلفة (٢٥٪، ٣٠٪، ٣٥٪، ٤٠٪ و٤٥٪) في أحواض استزراع الجمبرى الفانمى على تركيب الجسم، مؤشرات الهيموليمف، الإنزيمات وجوده المياه للجمبري الفانمي. أجريت التجربة في معمل اللافقاريات التابع للمعهد القومي لعلوم البحار والمصايد (NIOF)، محافظة السويس - مصر لمدة ٩٠ يوم. أجريت التجربة في ١٥ خزاناً مستطيلاً (٦٦ × ٤٧ × ٤٤ سم، ٥٠ لتر لكل منها) تم ملئة بمياه ملوحتها ٢٠ جزء في الاف. تم تغذية ٣ مكررات لكل معاملة من الجمبري (بوزن ابتدائي ٠.٠٠٢ جم) ثلاث مرات يوميًا بنسبة ١٤٪ من وزن الجسم (الوزن الداخلي) وأعيد تعديلها تدريجيًا إلى ٥٪ في نهاية التجربة. أظهرت النتائج أنه عن طريق زيادة مستوى البروتين بالعليقة، زاد نشاط التربسين في البداية حتى ٣٥٪ ثم انخفض. تم تسجيل أعلى قيم نشاط للتربسين لليرقات المغذاة على مستوى بروتين ٣٥٪ مقارنة بمختلف المستويات الأخرى. لا تسجل فروق ذات دلالة إحصائية في قيم نشاط الليباز أو الأميليز بين المعاملات التجريبية المختلفة. سجلت زيادة في نسب البروتين الكلي والكوليسترول في البلازما في جميع المعاملات. أثرت مستويات البروتين المختلفة أيضًا على إنتاج المركبات النيتروجينية مثل الأمونيا (TAN) والنتريت (NO2) والنترات (NO3) في مياه الاستزراع. أظهرت النتائج أن مستوى بروتين ٣٥٪ يمكن أن يكون المستوى الأمثل لتحقيق أفضل تركيبة جسم وتحفز أداء نمو يرقات الجمبري الفانمى المستزرعة في التنكات.

الكلمات الدالة: الجمبرى الفانمى, تركيب الجسم، مؤشرت الهيموليمف، الإنزيمات الهاضمة وجوده المياه