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Effect of water salinity on growth performance, survival %, feed utilization and body chemical composition of the Pacific white shrimp, *Litopenaeus vannamei* juveniles

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ABSTRACT

The current study was carried out to investigate the effect of water salinity (5, 15, 25 and 35‰) on growth performance, survival, feed utilization and body chemical composition of the Pacific white shrimp, *Litopenaeus vannamei*, juvenile in the water environment of Qaroun Lake. Juveniles of *L. vannamei* with an initial body weight (2.77 ±0.12g) were acclimated to laboratory conditions for 14days before being randomly distributed into in eight circular fiberglass tanks with a volume of 1.5m^3 for 80-days at stocking density of 40 juveniles/tank. All tanks were provided with continuous aeration. Results revealed that survival (%) was within the range of 90–98.75%, recording insignificant differences. Results of growth performance parameters were the highest with shrimp reared in water salinity (5‰) compared to the other salinity percentages. The best FCR (lowest values) was recorded with shrimp reared in water salinity of 5‰. While, shrimp reared in water salinity (35‰) showed the worst FCR. The lowest body protein content was recorded with shrimp reared in water salinity of both 5 and 15 ‰. The opposite trend was recorded for body ether extract. Based on the obtained results, the optimum growth rate of *L. vannamei* was obtained when reared in water salinity of 5‰ under experimental conditions which makes it suitable for cultivation in water environment of Lake Qarun.

INTRODUCTION

Despite the increase in the production of fish in Egypt from approximately 1.45 million tons in 2013 to approximately 1.94 million tons in 2018, the quantity of fish produced does not meet the growing customer needs (**El-Nagar *et al.*, 2020**). By production quantity, Egypt is the world's sixth largest producer of aquaculture and the largest in Africa (**FAO, 2020**).

The total production of shrimps from natural fisheries in Egypt is about 14262 tons, but the production of *Litopenaeus vannamei*, the Pacific white shrimp grown in

Egypt, has increased annually in the period extending from 2015-2018 compared to the previous years (**CAPMAS, 2020**). The introduction of a new pathogen-free *Penaeus vannamei* was linked to the leap in development. Before 2013, Egypt had two marine private hatcheries that operated with a low and irregular production capacity. Notably, to operate on farmers' demand for shrimp post larvae in some years or no demand in some others, but the case could not surpass some thousands of shrimps **(Megahed *et al.*, 2013)**. Currently, marine hatcheries has exceeded six, such as Harraz, Alwafa, El-Sharif, El-Aasir, El-Sayed Abou Omar and Berket Ghalioun. They work well with pacific white shrimp hatching and help to increase its cultivation.

Positive features of this species make it a preferred choice for shrimp culture, and one of them is that, when shrimp are exposed to water with different salinity, they undergo homeostatic adjustments and attempt to control their internal osmotic concentration with respect to their living environment (**Jannathulla *et al.*, 2020**).To restore shrimp stocks and maintain their growth in nature, their survival and food consumption under growing conditions, physiological adaptation to salinity changes are highly required (**Jaffer *et al.*, 2020**).

L. vannamei can tolerate a large range of salinities (0.5-45 ppt.). At 7-34 ppt, this species is comfortable, but grows especially well at a low salinity of about 10-15 ppt. This potential makes it a strong candidate for the newest inland farms, although a wide range of temperatures is tolerated by Pacific white shrimp, it grows best between 23-30°C, like most other tropical and subtropical species **(FAO, 2004)**.

In contrast to blue shrimp and giant tiger shrimp, *L. vannamei* requires a lower protein diet (20-35 %), nevertheless, *L. vannamei* juvenile can be successfully reared at salinities of 5 to 35‰ **(Ponce-Palafox *et al.*, 1997)**. The range of salinity considered suitable for the species' cultivation is from 15 to 25‰ **(Boyd, 1989)**. The outstanding animal-performance properties of *L. Vannamei*, together with its tolerance to a wide range of salinities, has made this species attractive to low salinity cultivation in many American countries **(McGraw *et al.*, 2002)**, China **(Cheng *et al.*, 2006) and** Thailand **(Saoud *et al.*, 2003)**, However, the physiology of marine shrimp may be impaired by decreased salinity, resulting in decreased survival **(Jiang *et al.*, 2000)**.

The present study aimed to evaluate the effects of different water salinity levels (5, 15, 25, 35‰) on growth performance, survival%, feed utilization and body composition of *L. vannamei* shrimp under the water environment of Qaroun Lake.

MATERIALS AND METHODS

The present study was carried out from September the 21st till the 11th of December 2019 (80-days) in Shakshouk Fish Research Station, National Institute of Oceanography and Fisheries (NIOF), Fayoum Governorate, Egypt.

Shrimp-rearing conditions.

Pacific white shrimp, *Litopenaeus vannamei* (Boone, 1931) juveniles were obtained from commercial farm in Port Said Governorate in Egypt. Shrimp were acclimated to laboratory conditions for 14-days before randomly distributed into circular fiberglass tanks of 1.5 m^3 water capacities. All tanks were provided with continuous aeration. The bottom of every tank was covered with approximately 5 cm sand layer for shelter. Shrimp were held under natural photoperiod condition throughout the experimental period. About 30% of water tanks were changed twice a week.

Experimental design

Shrimp juveniles with an initial body weight of 2.77 ±0.12g were randomly distributed in 8 circular fiberglass tanks (1.5 m^3, each) at stocked density of 40 juveniles/ tank (in duplicated). The amount of feed was adjusted biweekly according to the changes in body weight throughout the experimental period (80 days). The mortality percentage was recorded at the end of the experimental period.

Feed was offered handily twice/day (9:00 and 14:00 h) at 5% of body weight, 6 days/week (Table 1). At the end of the experiment, 15 shrimp from each tank were randomly taken for the determination of body chemical analysis.

Growth performance and feed utilization value calculation

Growth performance, survival% and feed utilization were calculated according to the following equations: Weight gain (WG, g) = final weight (g) - initial weight (g); Average daily gain (ADG, g) = average weight gain (g)/ experimental period (days); Specific growth rate (SGR, %/days) = [(ln final weight -ln initial weight)/ period in days]×100, where ln is the natural log; Feed conversion ratio (FCR) = feed intake (g)/ weight gain (g); Protein efficiency ratio (PER) = weight gain (g)/ protein intake (g); Protein productive value (PPV, %) = (retained protein (g)/ protein intake (g)×100. Energy efficiency ratio (EER) = weight gain (g)/ energy intake (kcal); Energy productive value (EPV, %) = (retained energy (kcal)/ energy intake (kcal)×100 and Survival% (S, %) = (number of shrimp at the end/ number of shrimp at the start)×100.

Water quality analysis

Water temperature °C and the pH values were measured daily using Combined meter (pH/ EC/ TDS/ temperature, Mi 805). Salinity was measured daily by Refractometer (VITAL Sine SR-6, China). Dissolved oxygen (DO) concentration was determined titrimetrically according to the modified Winkler, full-bottle technique (Method 360.2; EPA, 1983). Water total ammonia, nitrite and nitrate were determined by using Spectrophotometer model (LKB Bichrom UV visible spectrophotometer) according to the method described by **APHA (1992)**. To determine the un-ionized ammonia concentration, the total ammonia concentration is multiplied by the percentage closest to the observed temperature and the pH value of the water sample (**Swann, 1997**).

Table 1. Ingredients and proximate composition of the experimental diet (g/kg on dry matter basis)

Item	Composition
Fish meal	334
Soybean meal	408
Wheat flour	188
Linseed oil	50
Fish oil	10
Vit & Min[1]	5
Calcium phosphate	5
Chemical analysis %	
Dry matter	90.41
Crude protein	40.31
Ether extract	9.62
Crude fiber	3.74
Ash	9.88
NFE[2]	26.86
GE, kcal/g[3]	4.439

1: Vitamins and minerals mixture each 3 kg of mixture contains: 12000 000 IU Vit. A, 2000 000 IU Vit. D_3, 10000 mg Vit. E, 2000 mg Vit. K_3, 1000 mg Vit. B_1, 5000 mg Vit. B_2, 1500 mg Vit. B_6, 10 mg Vit. B_{12}, 50 mg Biotin, 10000 mg Pantothenic acid, 30000 mg Nicotinic acid, 1000 mg Folic acid, 60000 mg Manganese, 50000 mg Zinc, 30000 mg Iron, 10000 mg Copper, 1000 mg Iodine, 100 mg Selenium, 100 mg Cobalt, add to 3 kg carrier ($CaCo_3$).
2: Nitrogen free extract (NFE %) = 100 – Crude protein – Crude lipid – Crude fiber – Crude ash.
3: Gross energy was calculated according to **NRC (1993)** as 5.65, 9.45, and 4.11 kcal/g for crude protein, crude fat, and carbohydrates, respectively.

Chemical analysis

Diet and body composition were analyzed for their proximate composition in triplicates following the methods described by **AOAC (1984)**. Gross energy was calculated according to **NRC (1993)** using the factors 5.64, 9.44 and 4.11 Kcal/g for protein, fat and carbohydrates, respectively for formulated diets, while for fish 5.5 and 9.5 Kcal/g for protein and fat, respectively were used **(Viola *et al*., 1981)**.

Determination of Heavy metals

The determination was carried out at the Environmental and Food Pollutants Laboratory, Faculty of Agriculture, Fayoum University. It was as follows:

Sample preparation: Samples were ground and approximately 0.2 – 0.3 g of sample was weighed and added into the polytetrafluoro-ethylene digestion vessel with 5 mL of concentrated HNO_3 and 2 mL of hydrogen peroxide (H_2O_2). Subsequently, the samples were digested using a two-step temperature program. During the first step, the temperature was linearly increased to 190°C over 10 minutes; the maximum power of the rotating magnetron was 1000 W. During the second step, the temperature was maintained at 190°C for 30 minutes. After digestion and cooling, each solution was evaporated to ~2 mL and diluted with deionized water in a 50-mL volumetric flask for the AAS analysis. The results were reported as the average of three repeated measurements, and all digestions were conducted in triplicate.

Instruments: An Agilent atomic absorption spectrometer, equipped with Agilent single-element hollow cathode lamps and a 10-cm air–acetylene burner, was used for the determination of the metal ions. All instrumental settings were those recommended in the manufacturer's manual book that is given in Table (2).

Table 2. Instrumental conditions for flame atomic absorption spectrometer.

Element	Wavelength (nm)	Slit width (nm)	Lamp Current (mA)
Fe	248.3	0.2	30
Pb	283.3	0.7	15
Ni	232.0	0.2	30
Co	240.7	0.2	30
Cd	228.8	0.7	12
Cu	324.8	0.7	15

Statistical analysis

The data were analyzed by one-way ANOVA and significant differences were determined by Duncan Waller Multiple Range Test at P≥0.05 level using SPSS Statistical Package Program (SPSS, 2008) release 17 statistical software.

RESULTS AND DISCUSSION

Water quality

Average water quality parameters are shown in Table (3). There were no significant differences in the parameters of the water quality characteristics, except for salinity, which was the target during the trial period.

Table (3): Average water quality parameters values during the experimental period.

Parameters	Salinity			
	5‰	**15‰**	**25‰**	**35‰**
Temperature, °C	21	21	20.8	21
pH	6.80	7.20	7.80	7.90
Salinity, ‰	5.07	15.1	24.8	35.8
Dissolved oxygen (mg/l)	5.80	5.30	5.20	5.5
Fe	0.15	0.20	0.25	0.27
Cu	0.03	0.04	0.05	0.06
Ni	0.11	0.13	0.16	0.16
Zinc	0.22	0.30	0.10	0.06

Growth performance and survival rate of *Litopenaeus vannamei*.

Results of growth performance and survival (%) of shrimp reared in different salinity levels are present in Table (4). No significant difference in shrimp length or the initial weight of shrimp was recorded in the experimental treatments. The survival (%) ranged between 90-98.75%, with slight differences (P≤0.05). The results showed that significant differences (P≥0.05) were recorded in the final length, final weight, total weight gain, daily weight gain and the specific growth rate among the treatments. Results of growth performance values were recorded the highest in water salinity (5‰) compared to the other salinities (15, 25 and 35‰). These results indicated that water salinity (5‰) may be optimum to obtain the highest growth rate for *L. vannamei* compared to the other water salinity levels under experimental conditions. These results are consistent with the findings of **Esparza-Leal *et al.* (2019)**, who found that the growth efficiency coefficients of *L. vannamei* pups (3.5 g) exposed to salinity from 1 to 35 g / L were not significantly different in temperature fluctuations from 25.2 to 27.9°C, except for the low survival of shrimp in the 10 g/L treatment (83.3 %). **Jayasankar *et al.* (2009)** determined the optimal growth compared to species living in normal seawater was 5 g/l in long-term growth studies of *L. Vannamei* juveniles sustained at different salinities. In this connection, *L. Vannamei* can be successfully cultivated in land systems in low-salinity, as reported by **Esparza-Leal *et al*. (2010)**, who found that shrimp can be grown successfully in low salinity well water. The previous authors added that, when shrimp are acclimatized for longer periods, production performance and survival rates are significantly higher. **Laramore *et al.* (2001)**, found that post larval survival was not significantly different from 2 g/l to 30 g/L. Notably, post larvae had better survival at lower salinities (2 g/L) at 0.05 0.35 g.

In the present work, a high survival (98.75%) was recorded in the 5‰ treatment, which is consistent with other studies reporting survival of 93.9% at salinity of 1 g/l **(Esparza-Leal *et al.*, 2019)** and survival of 94–98% at salinities of 2–5 g/l **(Boyd & Tucker, 1998; Samocha *et al.*, 2004)**. On the other hand, no major variations in the survival of *L. vannamei* was reported when cultivated at salinities of 2-25 g/l (**Perez-Velasquez *et al.*, 2007)**. The results of the growth parameters in the present of study coincide with those reported by **Robertson *et al.* (1993)**, **Bray *et al.* (1994)**, **Samocha *et al.* (2004)** and **Sowers *et al.* (2006)**. In addition, **Maica *et al.* (2014)** found that, salinity had a major effect on shrimp survival, with increasing mortality as salinity fell from 32 to 16 and 4‰. **Laramore *et al.* (2001)** reported similar results with *L. vannamei* post larvae at salinity levels of 4 and 30‰ (survival of 86 and 100%, respectively); **Jayasankar *et al.* (2009)**, with salinity post larvae of 0.0, 0.5, 0.75 and 1.5‰ (survival of 2, 29, 47 and 85 % respectively) and salinity juveniles of 0.0, 0.5 and 0.75 ‰ (survival of 65, 77 and 93 %, respectively). Moreover, results concur with those of both **Decamp *et al.* (2003)**, with juveniles at salinities of 9, 18 and 36 ‰, in a system without water exchange (survival of 68, 93 and 94 %, respectively) and **Maica *et al.* (2012)**, with juveniles at salinities of 2, 4 and 25‰, in the same system (survival of 22.50, 72.73 and 97.50 % , respectively).

Pursuant to **Cheng *et al.* (2005)**, *L. vannamei* juveniles raised at low salinity gain less weight than those held in seawater, the decreased salinity was reflected in a decrease in shrimp growth in the study of **Maica *et al.* (2014)** confirming a decreasing trend in specific growth rate and weight gain. Although the variations were not statistically important, the findings were insightful since the weight gain was 4‰; almost half of the salinity obtained at 32‰ **(Laramore *et al.*, 2001; Walker *et al.*, 2009; Maica *et al.*, 2012)**. Furthermore, **Saoud *et al.* (2003**) clarified that, the ionic composition of well waters could be a more significant limiting factor compared to salinity for the growth and survival of shrimp. Some ion shortages, such as magnesium ($Mg2^+$) and potassium (K^+), showed a detrimental effect on shrimp growth and survival. Additionally, sodium (Na^+) and K^+ ratio of low salinity waters could be a crucial factor for the good growth and survival of shrimp (**Roy *et al.*, 2007)**.

Effect of salinity on feed utilization of *Litopenaeus vannamei*

As shown in Table (5) significant differences (P≤0.05) were obtained in all feed utilization parameters between treatments, except the PPV. The highest feed intake value was observed with *L. vannamei* shrimp reared in water salinity (15‰). The best FCR (lowest value) was recorded with shrimp reared in water salinity (5‰), while the worst was recorded with shrimp reared in water salinity (35‰), with insignificant differences between 15, 25 and 35‰. PER and EER values obtained for shrimp reared in water salinity (5‰) were relatively highest compared to the other salinities (15, 25 and 35‰). The same trend was observed with respect to EPV values. Results of the present work demonstrated that not all the treatments of salinity water were equal with regard to measures of feed utilization. According to **Bray *et al*. (1994)** and **Samocha *et al.* (1998),** *L. vanname*i at low salinities (2-10‰) maintained in seawater grow better than at elevated salinities (>15‰). **Jayasankar *et al*. (2009)** found that the optimal growth of *L. vannamei* was observed, comparable to that found in natural seawater. *L. vannamei* can be cultured effectively in a salinity of 5 ppt. as inland systems of low salinity. **Jaffer *et al*. (2020)** found that *L. vannamei* prefer lower salinities.

Table 4. Effect of salinity on growth performance and survival (%) of *Litopenaeus vannamei*.

Items	Salinity				SED*
	5 ‰	15 ‰	25 ‰	35 ‰	
Initial length (cm)	6.35	6.45	6.55	6.45	0.122
Final length (cm)	12.75[a]	12.35[ab]	12.05[b]	11.95[b]	0.187
Initial weight (g)	2.73	2.78	2.80	2.78	0.161
Final weight (g)	12.20[a]	11.14[ab]	10.62[b]	10.51[b]	0.479
Total weight gain (g)	9.47[a]	8.36[b]	7.82[b]	7.73[b]	0.330
Daily weight gain (mg/ day)	118.38[a]	104.44[b]	97.76[b]	96.57[b]	4.121
SGR (%/day)	1.87[a]	1.74[b]	1.67[b]	1.66[b]	0.032
Survival rate, %	98.75	91.25	90.00	93.75	3.853

- (a, b) Averages in the same row having different superscripts differ significantly (P≤0.05). * SED is the standard error of difference.

Similar to the present results, **Roy *et al.* (2007)** detected that the growth of *L. vannamei* at high salinity was slow. Differences in feed utilization parameters can be attributed to the fact that, high water salinity reduces the solubility and availability of dissolved oxygen in water which may result in stress, even a little that may affect the performance of the fish **(Weiss, 1970; Khanjani *et al.*, 2020).** Another important factor observed in crustaceans submitted to low salinities and indicators of increased metabolic rate, is the increase in the ammonia excretion rate and higher utilization of proteins as substrate **(Setlarto *et al.*, 2004).** Those differences may also be due the activity of Na^+/K^+- ATPase and enzymes (**Palacios *et al.*, 2004).**

On the other hand, the current results may differ from those of **Maica *et al.* (2014)** who found that, with increasing salinity, feed conversion was not greatly affected, but on the contrary, continued to increase. **Decamp *et al.* (2003)** did not notice major variations between the values of feed conversion for *L. vannamei* juveniles reared at 9, 18 and 36‰ but recorded better feed conversion values (lower) with increased salinity (1.9, 1.8 and 1.6, respectively). In this study, the improvement in feed utilization with decreasing salinity was also demonstrated by a significant increase in the protein retention rate of shrimp reared at 5‰ compared to the shrimp maintained at 15, 25 and 35‰.

Table 5. Effect of salinity on feed utilization of *Litopenaeus vannamei*.

Items	**Salinity**				**SED***
	5 ‰	**15 ‰**	**25 ‰**	**35 ‰**	
Feed intake (g/shrimp)	15.07^b	16.59^a	15.81^{ab}	15.89^{ab}	0.448
FCR	1.59^b	1.99^a	2.03^a	2.06^a	0.126
Protein utilization					
PER	1.56^a	1.25^b	1.23^b	1.21^b	0.077
PPV, %	25.47	22.58	19.32	18.2	4.629
Energy utilization					
EER	0.141^a	0.114^b	0.111^b	0.109^b	0.007
EPV, %	17.58^a	16.02^b	11.72^b	11.24^b	2.471

- (a, b) Averages in the same row having different superscripts differ significantly ($P \leq 0.05$).

* SED is the standard error of difference

Effect of salinity on proximate body composition of *Litopenaeus vannamei*

Body chemical composition and energy content of *L. vannamei* at the beginning and at the end of the experiment are shown in Table (6). The results showed that insignificant differences were obtained in body moisture, crude protein (CP) and ash contents at the end of the experimental period. While, ether extract (EE) and gross energy (GE) had significant differences ($P \leq 0.05$). The lowest protein content was recorded in shrimp reared in water salinity of 5 and 15‰. The opposite trend was recorded for body ether extract. These findings are similar to those of **Li *et al.* (2007)**, who found a clear correlation between *L. vannamei* juveniles body moisture content (735, 750 and 767 g/kg) as salinity increased (3, 17, and 32 ‰). On the other hand, **Maica *et al.* (2014)** found that the content of moisture did not vary substantially between salinities, appearing to decrease as salinity increased. Similarly, protein, lipids, and ash body contents increased from the lowest to the highest salinity levels, but the differences were significant for lipids only. In this context, **Huang *et al.* (2004)** stated that, the biochemical composition (moisture, lipids and protein) of penaeid shrimp varied with salinity changes. In addition, **Perez-Velazquez *et al.* (2007)** and **Liang *et al.* (2008)** found that, *L. vannamei* juveniles moisture content increased as the salinity decreased from 30 to 0.5-1.5‰ (moisture content of 747.0 and 807.0 g/kg, respectively) and from 50 to 2‰ (708.0 and 737.0 g/kg, respectively).

The recorded findings of the lipid and ash content are similar to those of **Liang *et al.* (2008)**, and **Li *et al*. (2007)** reporting a decrease in lipid and ash content according to the rise in salinity for *L. vannamei* juveniles, but the differences were not significant.

Table 6. Effect of salinity on body chemical composition of *Litopenaeus vannamei*.

Items	Start	Salinity				SED*
		5 ‰	15 ‰	25 ‰	35 ‰	
Moisture	73.29	74.79	72.44	76.54	76.80	2.717
CP	70.46	67.02	66.22	70.57	69.27	3.823
EE	9.53^{b}	13.41^{a}	14.27^{a}	9.02^{b}	9.47^{b}	1.439
Ash	17.88	18.57	19.01	17.91	18.76	2.956
GE, kcal/g	4.79^{abc}	4.96^{ab}	5.00^{a}	4.74^{bc}	4.71^{c}	0.095

- (a, b, c ..) Averages in the same row having different superscripts differ significantly (P≤0.05).

* SED is the standard error of difference

CONCLUSION

Pacific white shrimp, *Litopenaeus vannamei* is rapidly replacing other shrimp species in Egypt; the main explanation for this shift is that *L. vannamei* has a faster growth rate, higher inventory rate and yield. In shrimp aquaculture, the growth and survival of individuals are influenced by a variety of environmental factors, the most important of which is salinity. Based on the obtained results, the optimum growth rate of *L. vannamei* was obtained when reared in water salinity (5‰) under experimental conditions which makes it suitable for cultivation in water environment of Lake Qarun.

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الملخص العربي

تأثير ملوحة المياه على أداء النمو ومعدل البقاء وكفاءة الإستفادة من الغذاء والتركيب الكيميائي للجسم لزريعة الجمبري الفنمي

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أجريت هذه الدراسة بهدف دراسة تأثير أربع مستويات ملوحة للمياه (5، 15، 25 و 35 جزء في الألف) علي مظاهر النمو، معدل الإعاشة، التركيب الكيماوي للجسم وكفاءة الإستفادة من الغذاء لزريعة الجمبري الفنمي تحت البيئة المائية لبحيرة قارون. تم أقلمة زريعة جمبري بوزن إبتدائي 0.12± 2.77 جم مع ظروف المعمل لمدة 14 يوم قبل توزيعها عشوائيا في ثمانية تنكات دائرية من الفيبرجلاس بحجم 1.5 م^3 لمدة 80 يوم بكثافة تخزين 40 يرقة لكل تانك وتم تزويد جميع التنكات بتهوية مستمره. أظهرت النتائج تراوح معدل البقاء بين90,00٪ – 98,75٪ مع وجود إختلافات طفيفه. وفيما يخص معدلات الأداء كانت نتائج معدلات النمو أعلي مع الجمبري المربي في مستوي ملوحه 5 جزء في الألف مقارنة بملوحات المياه الأخرى (15 و25 و 35 جزء في الألف). تم تسجيل أفضل معامل تحويل غذائي للجمبري المربي تحت مستوي ملوحه 5 جزء في الألف بينما سجلت أسوأ معامل تحويل غذائي (FCR) مع الجمبري المربي تحت مستوي ملوحه 35 جزء في الألف وفيما يخص التحليل الكيماوي للجسم سجلت أقل نسبة بروتين في الجسم مع الجمبري المربي في 5 جزء في الألف ملوحه بينما سجلت قيم مستخلث الإيثير عكس ذلك. تشير النتائج التي تم الحصول عليها بأن بمعدل النمو الأمثل للجمبري الفانمي كان عند تربيته تحت مستوي ملوحة 5 جزء في الألف تحت ظروف التجربه. كما تشير النتائج الي ملائمة زراعة الجمبري الفانمي في البيئة المائية لبحيرة قارون.