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The impact of salinity concentrations on the growth performance and survival of *Artemia franciscana*

Abstract

This study examines the effects of various salinity concentrations on the growth performance and survival of *Artemia franciscana* Kellogg over a 40-day cultivation period under controlled laboratory conditions at the Saline Water Aquaculture Research Centre (SWARC) in Muzaffargarh. The experiment included five treatments: T0, T1, T2, T3, and T4, with salinity levels of 20, 25, 30, 35, and 40 ppt, respectively. Each treatment was conducted in duplicate, and the nauplii were stocked at a density of 100 nauplii per aquarium. A total of 1,000 nauplii were randomly distributed across ten aquariums to assess morphological traits and survival rates. Results revealed that salinity had a significant effect ($p < 0.005$) on the growth and survival of *A. franciscana*. Growth parameters – such as weight gain, final length, and feed conversion ratio (FCR) – were highest at 40 ppt, while the poorest performance was observed at 20 ppt. Moreover, survival rates also improved significantly ($p < 0.005$) with increasing salinity, reaching a maximum of 94.8% at 40 ppt. The study suggests that higher salinity levels within a specific range can improve the growth and reproductive success of brine shrimp, paving the way for optimised aquaculture systems.

Keywords: brine shrimp, growth performance, salinity, survival, SWARC

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Introduction

Artemia is excellent live feed for newly hatched aquatic organisms that has gained a unique position in the aquaculture system (Le et al., 2019; Azra et al., 2022). Live feed is a highly consumable diet (Aragão et al., 2004) that attains central importance

as a starter feed, comprised of essential micro and macro nutrients which promote rapid growth in crustaceans and various larviculture fishes (Ogello et al., 2019). The primary production of live feed is a basic need for the better growth of all aquatic organisms. Aquaculture larvae showed high growth rates on live feed as compared to the formulated feed (Rasdi et al., 2020; Lipscomb et al., 2020). The successful rearing of aquaculture chiefly depends on the usage of suitable and properly managed live feed (Kandathil et al., 2020; Piotrowska et al., 2021). The rapidly growing fish markets have created an immersive pressure to produce healthy and low-cost feed ingredients (Goda et al., 2020; Flefil et al., 2021). *Artemia* can live by browsing on submerged stones, clumps with blue-green algae, and debris (Soundarapandian, Saravanakumar, 2009; Al Sulivany et al., 2024). It is an aquatic crustacean that belongs to the family Artemiidae. The adult *Artemia* is an obligatory filter-feeder shrimp (omnivorous) and primarily feeds on zooplanktons and microscopic planktonic microalgae (Vilchis, 2010; Riisgard et al., 2015; Kasan et al., 2020).

The growth and survival of *Artemia franciscana* Kellogg are significantly influenced by environmental parameters, particularly salinity, which affects physiological processes such as osmoregulation, growth rates, and reproductive success (Vanhaecke et al., 1984). The ability of *A. franciscana* to thrive in high salinity conditions is due to its specialised adaptations, including the production of cysts that can withstand extreme osmotic pressures (Sorgeloos et al., 2001). However, the optimal salinity range for growth and reproduction can vary depending on the strain and environmental conditions. Research has shown that growth performance, including weight and length gain, is positively correlated with salinity levels up to a certain threshold (Pérez et al., 2008). Salinity not only governs the habitat preference of *A. franciscana* but also influences its reproductive efficiency, survival rate, and nutritional quality. Prior studies have demonstrated that extreme salinity levels could hinder growth and reproductive performance, whereas moderate salinities optimise physiological responses (Le et al., 2019a). For instance, research has demonstrated that brine shrimp exhibit significant weight gain and increased length when cultured at higher salinity levels, which supports their osmoregulatory functions (Browne et al., 2002). Moreover, the relationship between salinity and the physiological response of *A. franciscana* is complex. Salinity affects not only the osmotic balance but also the availability of dissolved oxygen and nutrients in the water, both of which are critical for optimal growth (Hassan et al., 2021).

The present study aims to evaluate the effect of varying salinity concentrations on the growth performance, morphological traits, and feed utilisation of *A. franciscana* over a 40-day cultivation period. This investigation is pivotal for enhancing aquaculture practices and ensuring the sustainable production of this vital organism. By systematically studying the impacts of salinity on *A. franciscana*, this research seeks to contribute valuable insights into the management of brine shrimp cultures under controlled conditions.

Materials and methods

Study area

The experiment was designed to evaluate the effect of varying salinity concentrations on the growth performance, morphological traits, and feed utilisation of *Artemia franciscana* over a 40-day cultivation period. The study was conducted in laboratory conditions at the Saline Water Aquaculture Research Center (32°04'19.20"N 71°04'39.6"E) at SWARC, Muzaffargarh, South Punjab, Pakistan.

Artemia franciscana cyst preparation and hatching

The materials for the experiment included: *A. franciscana* cysts (purchased from Forex Crypto Stock, USA), 1.5-liter glass bottles, glass aquariums, common salt (NaCl), aerators with air tubes and stones, electric bulbs, stirring rods, spatulas, thermostats, a salinity meter, a dissolved oxygen (DO) meter, and a pH meter. Glass aquarium tanks with a capacity of 5 litres were prepared with saline water at a salinity of 40 ppt for hatching the cysts. Decapsulated *Artemia* cysts were introduced into the tanks at a concentration of 1 g/L. Continuous vigorous aeration was provided using aerators to ensure proper mixing and oxygenation. A heater maintained a constant temperature of 28°C, and fluorescent lamps provided continuous illumination to optimise hatching conditions. After 48 hours of incubation, hatching was completed. Aeration was turned off to harvest the nauplii, and the nauplii were attracted to the light source at the bottom of the tank. Once concentrated under the light, the nauplii were collected from the bottom of the tank into a beaker containing 100 mL of distilled water. The collected sample was thoroughly mixed, and a 1 mL aliquot was extracted using a pipette. The aliquot was transferred onto a Rafter Counter cell for nauplii counting. Subsequently, the counted nauplii were transferred into the culture tanks using a pipette and adjusted to 1 individual/mL density.

Production of nauplii and fecundity

To determine fecundity, the total number of eggs produced by each broodstock was calculated using a slightly modified version of the procedure described by Le et al. (2019b). Individual mature *Artemia*, identified by the dark brown of the uterus, was removed and examined under a binocular microscope. A manual counter was then used to count each egg after being dissected. According to Sleet and Brendel (1983), nauplii produced by each *Artemia* broodstock were counted every day after day 15 in order to track nauplii production. A light source was placed on the rearing tank side to attract *Artemia* nauplii, and the aeration in the tank was turned off. A hand counter was then used to count the nauplius number.

Experimental design

The experiment was designed into five treatments: T0, T1, T2, T3, and T4, with salinity levels of 20, 25, 30, 35, and 40 ppt, respectively. Each treatment had one duplicate, and the nauplii were shifted to 100 nauplii/aquarium densities. Thousand (1000) nauplii were randomly distributed in ten aquariums; the dimensions of each tank were 914 cm, 183 cm, 122 cm and volume 200 L. The nauplii were cultured at respective salinity levels. The experiment was monitored carefully daily.

Morphological traits and feed utilisation

Artemia weight was measured by taking samples from each treatment (T0–T4) at specific time intervals. Samples were briefly blotted on absorbent paper to remove excess water, then the initial length, final length, initial weight, final weight, weight gain, feed intake, feed conversion ratio (FCR), and specific growth rate (SGR) were calculated using a precision analytical balance (Mettler Toledo XS205) according to the formulas described in studies by Al Sulivany et al. (2024) and Owais et al. (2024):

$$\text{Weight gain (mg)} = \text{Final weight} - \text{Initial weight.}$$
$$\text{Food Intake} = \text{FCR} \times \text{Weight gain (mg)}$$
$$\text{FCR} = \text{Food Intake (g)} / \text{Weight gain (mg)}$$

$$\text{SGR (\%/day)} = \{\text{Ln final body weight} - \text{Ln initial body weight}\} \times 100/\text{experimental period (d).}$$

Where (Ln) refers to the natural logarithm of the fish weight.

Survival rate

The number of dead *Artemia* in each treatment during the trial was counted to calculate the survival rate. Balachander and Rajaram (2019) had previously described a formula for determining this rate. To prevent deterioration of the water quality, any dead *Artemia* was removed straight from the rearing system. Survival rates were observed for up to 40 days.

$$\textit{Survival rate} = \frac{\textit{Final number of Artemia}}{\textit{Initial number of Artemia}} \times 100$$

Water parameters

Physiochemical parameters like water temperature [°C], salinity [‰], dissolved oxygen [ppm] and pH were recorded every day; they were measured by using the glass thermometer, handheld refractometer, mobile digital DO-meter (Model P-512) and digital pH meter were determined according to Hassan et al. (2021).

Statistical analysis

The data obtained were statistically analysed using the One-way Analysis of Variance (ANOVA) technique. Survival average means were compared using multiple

comparisons, comparing the mean of each group with the mean of all other groups using the Multiple comparisons Test and Tukey's Multiple Range Test (Graphpad Prism 9).

Results

The results of a study of an aquarium tank with *Artemia franciscana*, with treatments designed for five salinity levels (T0: 20 ppt, T1: 25 ppt, T2: 30 ppt, T3: 35 ppt, T4: 40 ppt), showed variations in temperature, pH, and dissolved oxygen levels (Fig. 1). The mean temperature ranged from 26.70 ± 1.60°C (T2) to 27.80 ± 2.10°C (T1), with no significant differences across treatments ($p > 0.05$). The pH values were stable across treatments, ranging from 7.62 ± 0.40 (T2) to 7.76 ± 0.7 (T1), also showing no significant variation ($p > 0.05$). Dissolved oxygen levels were consistent, ranging from 6.24 ± 0.09 mg/L (T2) to 6.58 ± 0.30 mg/L (T1), with no statistically significant differences ($p > 0.05$). These results suggest that the salinity variations across treatments did not significantly influence the recorded water parameters.

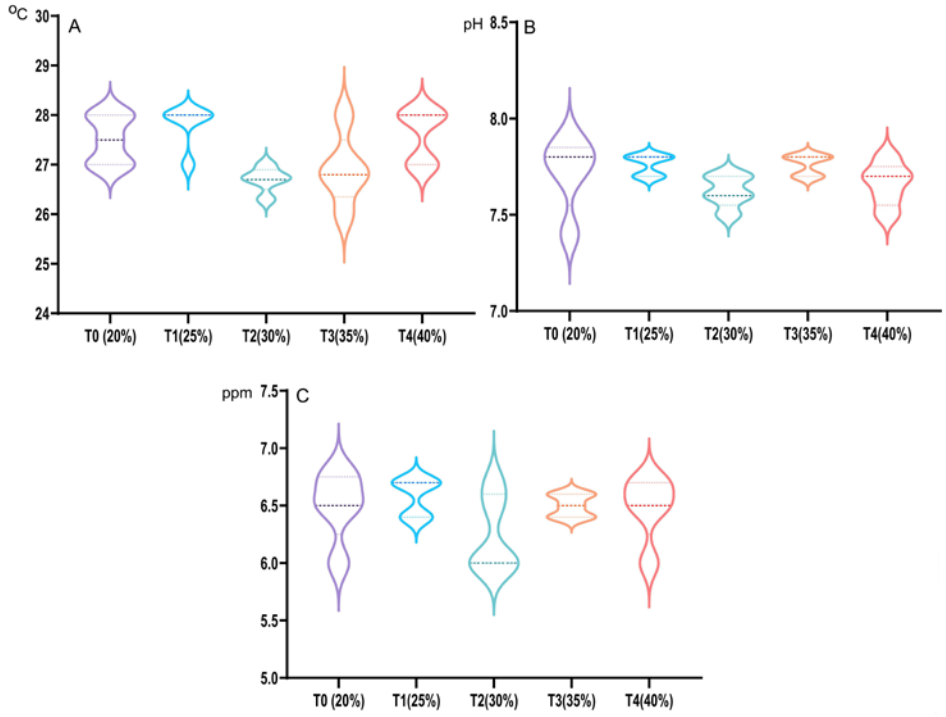

Fig. 1. Comparative analysis of water quality parameters A) temperature [°C], B) pH, and C) dissolved oxygen [ppm] levels across salinity treatments (T0–T4) in *Artemia franciscana* Kellogg tanks

Tab. 1. Mean ± SEM of temperature, pH, and dissolved oxygen across different salinity treatments in *Artemia franciscana* Kellogg aquaculture tanks

Water parameters	Treatment				
	T0 (20 ppt)	T1 (25 ppt)	T2 (30 ppt)	T3 (35 ppt)	T4 (40 ppt)
Temperature [°C]	27.50 ± 1.45	27.80 ± 2.10	26.70 ± 16.00	26.90 ± 0.90	27.60 ± 2.50
pH	7.72 ± 0.50	7.76 ± 0.70	7.62 ± 0.40	7.76 ± 0.30	7.66 ± 0.60
Dissolved oxygen [mg/L]	6.50 ± 0.60	6.58 ± 0.30	6.24 ± 0.09	6.50 ± 0.20	6.48 ± 0.05

The effects of varying salinity concentrations (20 ppt, 25 ppt, 30 ppt, 35 ppt, and 40 ppt) on the parameters of morphology and feed utilisation of *A. franciscana* over a 40-day cultivation period revealed complex patterns of growth and development which are shown in the Tab. 2 and Fig. 2 – Appendix 1.

Tab. 2. The impact of different salinity concentrations on the morphological traits and feed utilisation of *Artemia franciscana* Kellogg over a 40-day cultivation period; values marked with different letters differ significantly according to the Tukey test ($p \leq 0.05$)

Performance parameters	Treatment				
	T0 (20 ppt)	T1 (25 ppt)	T2 (30 ppt)	T3 (35 ppt)	T4 (40 ppt)
IW [mg]	2.30 ± 0.19	2.60 ± 0.31	2.10 ± 0.41	2.20 ± 0.31	2.30 ± 0.21
FW [mg]	4.60^{a} ± 0.32	5.60^{a} ± 0.31	7.40^{b} ± 0.41	8.60^{c} ± 0.52	10.40^{d} ± 0.50
WG [mg]	2.40^{a} ± 0.32	3.00^{ac} ± 0.40	5.20^{c} ± 0.37	6.40^{d} ± 0.41	8.00^{e} ± 0.32
IL [mm]	2.40 ± 0.23	2.60 ± 0.25	2.20 ± 0.19	2.20 ± 0.20	2.40 ± 0.23
FL [mm]	4.40^{a} ± 0.23	5.60^{b} ± 0.32	5.80^{cd} ± 0.20	6.60^{bd} ± 0.24	8.40^{e} ± 0.31
FI [mg]	4.28^{a} ± 0.45	4.96^{a} ± 0.50	7.84^{cd} ± 0.50	9.12^{de} ± 0.59	10.20^{e} ± 0.37
FCR	1.78^{a} ± 0.03	1.65^{b} ± 0.08	1.51^{c} ± 0.06	1.42^{d} ± 0.05	1.27^{e} ± 0.04
SGR [%]	1.82^{a} ± 0.18	1.91^{b} ± 0.24	2.99^{c} ± 0.25	3.36^{d} ± 0.24	3.62^{e} ± 0.23

The initial measurements showed no significant ($p > 0.05$) variations among treatments, with IW ranging from the lowest in T2 (2.10 ± 0.41 mg) to the highest in T1 (2.60 ± 0.31 mg) (Fig. 2A – Appendix 1) and IL varying from 2.20 ± 0.19 mm to 2.60 ± 0.25 mm (Fig. 2D – Appendix 1), indicating homogeneous starting conditions across all experimental groups. However, the FW measurements demonstrated a remarkable and statistically significant ($p < 0.05$) salinity-dependent increase, with T4 (40%) yielding the highest final weight of 10.40 ± 0.50 mg, followed by T3 (8.60 ± 0.52 mg), T2 (7.40 ± 0.41 mg), T1 (5.60 ± 0.31 mg), and T0 (4.60 ± 0.32 mg) (Fig. 2B – Appendix 1). This trend was further reflected in the WG parameter (Fig. 2C – Appendix 1), where T4 exhibited the highest gain of 8.00 ± 0.32 mg, significantly different from all other treatments ($p < 0.05$), while T1 and T0 showed the lowest gains of 3.00 ± 0.40 mg and 2.40 ± 0.32 mg, respectively. Final length (FL) measurements further corroborated

the positive effect of higher salinity, with T4 achieving the maximum length of 8.40 ± 0.31 mm, significantly different from all other treatments ($p < 0.05$), while T2 (5.80 ± 0.20 mm) and T3 (6.60 ± 0.24 mm) showed some statistical similarities ($p > 0.05$) (Fig. 2E – Appendix 1).

The feed intake (FI) demonstrated a strong positive correlation with increasing salinity, ranging from 4.28 ± 0.45 mg in T0 to 10.20 ± 0.37 mg in T4, with treatments T2 (7.84 ± 0.50 mg), T3 (9.12 ± 0.59 mg), and T4 showing statistical similarities ($p > 0.05$) in their upper ranges (Fig. 2F – Appendix 1). On the other hands, the FCR (feed conversion ratio) exhibited a significant improving trend ($p < 0.05$) with increasing salinity, demonstrating optimal feed utilisation efficiency in T4 (1.27 ± 0.04) compared to the less efficient conversion rates in T0 (1.78 ± 0.03), T1 (1.65 ± 0.08), T2 (1.51 ± 0.06), and T3 (1.42 ± 0.05) (Fig. 2G – Appendix 1). The SGR (specific growth rate) displayed a consistent and significant enhancement with increasing salinity levels (Fig. 2H – Appendix 1), progressing from 1.82 ± 0.18% in T0 to 3.62 ± 0.23% in T4, with all treatments showing statistically significant differences from each other ($p < 0.05$). The survival rates (SRs) of *A. franciscana* demonstrated significant variations across different salinity levels throughout the 40-day experimental period, with pronounced temporal patterns and treatment-specific responses (Tab. 3; Fig. 3).

Tab. 3. Survival rates (SR) of *Artemia franciscana* Kellogg under different salinity levels, monitored at three-day intervals from day 1 to day 40; values marked with different letters differ significantly according to the Tukey test ($p \leq 0.05$)

Duration	Treatment				
	T0 (20%)	T1 (25%)	T2 (30%)	T3 (35%)	T4 (40%)
Day (1–4)	$49.20^{b} \pm 0.38$	$68.11^{c} \pm 2.56$	$74.70^{b} \pm 0.50$	$80.60^{a} \pm 1.49$	$86.40^{b} \pm 80.45$
Day (5–8)	$51.60^{d} \pm 0.50$	$68.60^{c} \pm 2.70$	$75.10^{b} \pm 1.10$	$80.86^{b} \pm 2.10$	$89.32^{b} \pm 80.32$
Day (9–12)	$54.50^{c} \pm 0.60$	$69.30^{c} \pm 2,85$	$76.90^{b} \pm 2.10$	$81.60^{a} \pm 1.40$	$89.04^{b} \pm 80.00$
Day (13–16)	$60.20^{d} \pm 0.12$	$70.80^{c} \pm 3.10$	$76.90^{b} \pm 2.10$	$82.70^{a} \pm 1.46$	$89.60^{b} \pm 78.60$
Day (17–20)	$61.50^{b} \pm 0.50$	$71.90^{b} \pm 3.80$	$76.60^{a} \pm 1.54$	$82.41^{a} \pm 0.30$	$90.93^{a} \pm 77.90$
Day (21–24)	$62.20^{c} \pm 0.40$	$71.70^{c} \pm 3.60$	$77.10^{b} \pm 1.10$	$83.40^{a} \pm 0.50$	$90.20^{ab} \pm 77.10$
Day (25–28)	$63.09^{b} \pm 0.03$	$72.60^{b} \pm 3.50$	$77.82^{a} \pm 1.70$	$84.22^{a} \pm 0.70$	$90.02^{a} \pm 75.10$
Day (29–32)	$64.40^{d} \pm 0.48$	$72.10^{c} \pm 3.10$	$78.50^{b} \pm 1.50$	84.20a ± 0.90	$91.50^{ab} \pm 71.50$
Day (33–36)	$65.70^{d} \pm 0.53$	$73.30^{c} \pm 1.60$	$78.50^{b} \pm 1.62$	$85.18^{a} \pm 0.75$	$93.87^{a} \pm 68.80$
Day (37–40)	$66.50^{d} \pm 1.38$	$73.63^{c} \pm 1.50$	$79.80^{b} \pm 2.50$	$85.70^{b} \pm 1.40$	$94.80^{a} \pm 65.77$
Minimum	49.20	68.11	74.70	80.60	86.40
Maximum	66.50	73.63	79.80	85.70	94.80
Mean ± SEM	$59.89^{a} \pm 1.90$	$71.20^{b} \pm 0.60$	$77.19^{c} \pm 0.49$	$83.10^{c} \pm 0.55$	$90.57^{d} \pm 0.76$

The lowest salinity group, T0 (20 ppt), exhibited consistently inferior SRs, beginning at 49.20 ± 0.38% during days 1–4 and gradually increasing to 66.50 ± 1.38% by days 37–40, with an overall mean SR of 59.89 ± 1.90%, significantly lower ($p < 0.05$) than all other treatments. At T1 (25 ppt), improved survival was observed compared to T0, with initial rates of 68.11 ± 2.56% increasing to 73.63 ± 1.50% by the end of the experiment, resulting in a mean hazard ratio (SR) of 71.20 ± 0.60%. The intermediate salinity treatment T2 (30 ppt) demonstrated notably better performance, with SRs progressing from 74.70 ± 0.50% to 79.80 ± 2.50% over the study period, resulting in a mean SR of 77.19 ± 0.49%, significantly different from both lower and higher salinity groups ($p < 0.05$).

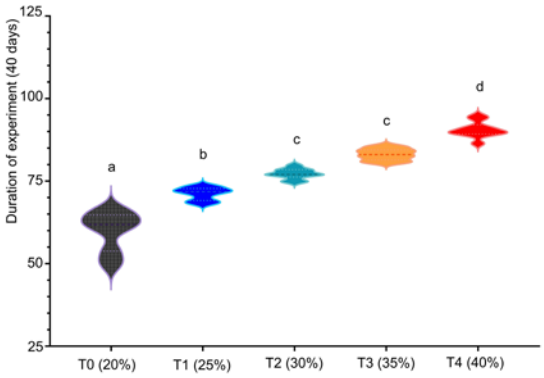

Fig. 3. Survival rates of *Artemia franciscana* Kellogg at different salinity levels, assessed every three days from day 1 to day 40; letters (a, b, c, d, and e) denote significant differences at $p \leq 0.05$

T3 (35 ppt) exhibited robust survival performance, initiating at 80.60 ± 1.49% and reaching 85.70 ± 1.40% by the end of this study, with a mean SR of 83.10 ± 0.55%. The highest salinity treatment, T4 (40 ppt), demonstrated superior SRs throughout the experiment, beginning at 86.40 ± 80.45% and achieving the highest final SR of 94.80 ± 65.77%, with an outstanding mean SR of 90.57 ± 0.76%, significantly higher ($p < 0.05$) than all other treatments. Statistical analysis revealed significant differences between treatments at most time points, with T4 and T3 occasionally showing statistical similarities ($p > 0.05$) during the middle phase of the experiment (days 21–28). The temporal progression of SRs showed a general upward trend across all treatments, with the most dramatic improvements observed in T0 (17.30% increase) and the most stable performance in T4 (8.40% increase). The data revealed clear stratification of SRs corresponding to salinity levels, with higher salinities consistently supporting better survival outcomes. Notably, the standard error of the mean (SEM) values was generally smaller in higher salinity treatments (T2, T3, and T4) compared to lower salinity treatments (T0 and T1), indicating more stable and consistent SRs at higher salinities.

Discussion

This study describes the pivotal role of various salinity levels in cultivating *Artemia franciscana* Kellogg, a critical live feed in aquaculture. *Artemia* has firmly established itself as an irreplaceable live feed source, demonstrating remarkable versatility by supporting approximately 85% of fish larvae development across an impressively diverse salinity range (3–300 ppt), as documented by Kulasekarapandian and Ravichandran (2003), and Mulyani et al., (2021). This exceptional adaptability, combined with its unique nutritional profile, has positioned *Artemia* as a cornerstone in modern aquaculture operation. According to Bahr et al. (2021), salinity significantly influences every aspect of valuable aquatic life, particularly Artemia, controlling physiological behaviour, growth rate, metabolic rate, ingestion, food conversion, hormone stimulation, osmoregulation, and survival rate.

The current study describes the positive correlation between increased salinity levels, growth performance, and survival of *A. franciscana*. Similarly, Hand and Menze (2015) and Jaffer et al. (2024) studied the adaptive mechanisms of *A. franciscana* in hyperosmotic environments. At 40 ppt, *A. franciscana* exhibited significant weight gain, feed utilisation, and survival rates, underscoring its optimal physiological adaptation at higher salinities. Marden et al. (2020) and Pérez et al. (2008) also found significant weight gain, feed utilisation, and survival rates of *A. franciscana* at higher salinity. They established a threshold salinity range that maximises the physiological responses of brine shrimp. Improved survival rates at higher salinities may be attributed to enhanced osmoregulatory efficiency and reduced physiological stress (Browne et al., 2002). At 20 ppt *A. franciscana* exhibited poor growth performance. Hassan et al. (2021) and Ngarari et al. (2024) also reported that poor performance at 20 ppt indicates suboptimal conditions that may likely disrupt ionic balance and nutrient uptake.

The feed conversion ratio (FCR) and specific growth rate (SGR) were significantly improved under higher salinity conditions, suggesting efficient nutrient assimilation. These findings are consistent with those of Le et al. (2019) and Zidan et al. (2024), who reported enhanced growth metrics in *A. franciscana* cultured at salinities conducive to their natural habitat. The increased feed intake observed at higher salinities reflects the organism's metabolic demands and efficient energy utilisation. This study also highlights the critical need for stable water parameters, including pH, dissolved oxygen, and temperature, which were consistently maintained across treatments. The absence of significant fluctuations in these parameters ensured that the observed effects were predominantly due to salinity variations. Such methodological rigour is crucial in aquaculture research (Pires, 2023). Future research should explore the interactions between salinity and other environmental factors, such as temperature and nutrient availability, to further optimise the rearing conditions of *A. franciscana*. Additionally,

the implications of salinity on the biochemical composition and nutritional value of brine shrimp for aquaculture species warrant investigation.

In conclusion, this study substantiates the importance of salinity as a critical factor in the growth and survival of *Artemia franciscana*. By optimising salinity levels in culture systems, aquaculturists can enhance the productivity and sustainability of live feed production, ultimately benefiting the broader aquaculture industry.

Conclusion

This study demonstrates that salinity levels profoundly influence the growth performance, feed utilisation, and survival rates of *Artemia franciscana* Kellogg, with optimal outcomes observed at 40 ppt. The findings underscore the importance of salinity in enhancing osmoregulatory efficiency, nutrient assimilation, and physiological adaptation, offering critical insights for optimising aquaculture systems and ensuring sustainable production of this vital live feed resource.

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Conflict of interest

The authors declare no conflict of interest related to this article.

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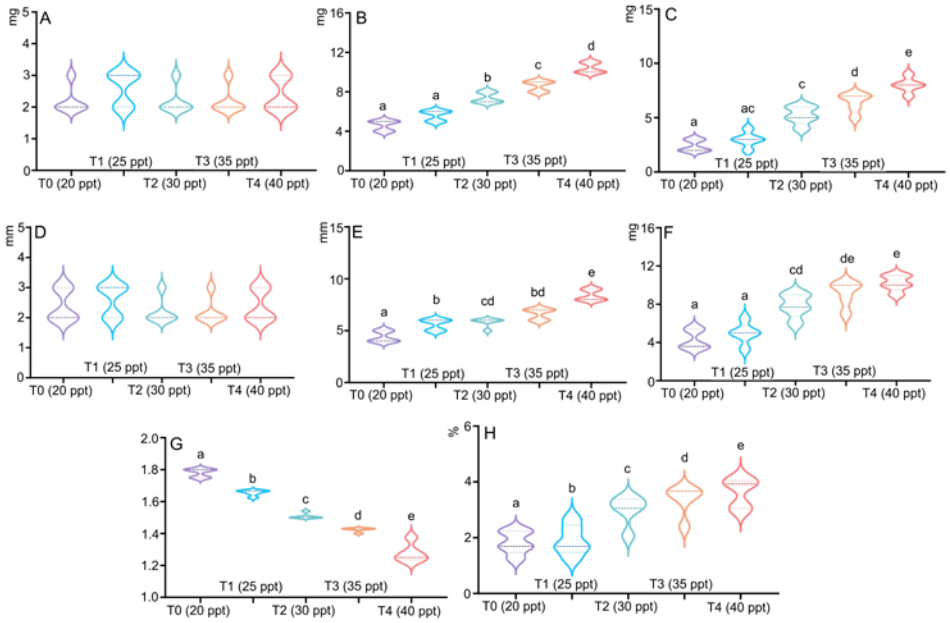

Fig. 2. Effect of varying salinity concentrations (T0: 20 ppt, T1: 25 ppt, T2: 30 ppt, T3: 35 ppt, T4: 40 ppt) on the morphological traits and feed utilisation of *Artemia franciscana* Kellogg after a 40-day cultivation period: A) initial weight, B) final weight, C) weight gain, D) initial length, E) final length, F) feed intake, G) feed conversion ratio, H) specific growth rate; superscripts with distinct letters (a, b, c, d, and e) denote significant differences at $p \leq 0.05$

Wpływ stężeń zasolenia na wydajność wzrostu i przeżywalność *Artemia franciscana*

Streszczenie

Niniejszy eksperyment bada wpływ różnych stężeń zasolenia na wydajność wzrostu i przeżywalność *Artemia franciscana* Kellogg w 40-dniowym okresie hodowli w kontrolowanych warunkach laboratoryjnych, w Saline Water Aquaculture Research Center (SWARC) w Muzaffargarh, w południowym Pendżabie (Pakistan). Eksperyment zaprojektowano w pięciu zabiegach: T0, T1, T2, T3 i T4, z poziomami zasolenia odpowiednio 20, 25, 30, 35 i 40 ppt. Każdy zabieg miał jeden duplikat, a pływiki (naupliusy) przesunięto do 100 zagęszczeń pływików/akwarium. Tysiąc (1000) pływików rozprowadzono losowo w dziesięciu akwariach, aby sprawdzić cechy morfologiczne i wskaźniki przeżywalności. Wyniki wykazały, że zasolenie znacząco ($p < 0,005$) wpłynęło na wzrost i przeżywalność *A. franciscana*. Parametry wzrostu, takie jak: przyrost masy ciała, długość końcowa i współczynnik konwersji paszy (FCR) okazały się znacząco wysokie przy 40 ppt, podczas gdy najniższa wydajność wystąpiła przy 20 ppt. Co więcej, wskaźniki przeżywalności również znacząco ($p < 0,005$) stopniowo poprawiały się wraz ze wzrostem zasolenia, osiągając maksimum 94,8% przy 40 ppt. Badanie sugeruje, że wyższe poziomy zasolenia w określonym zakresie poprawiają wzrost i sukces reprodukcyjny krewetki solankowej, torując drogę dla zoptymalizowanych systemów akwakultury. Wyniki te podkreślają krytyczną rolę zasolenia w zwiększaniu wydajności fizjologicznej i odżywczej *A. franciscana*, oferując cenne spostrzeżenia na temat zrównoważonych praktyk akwakultury.

Słowa kluczowe: krewetki solankowe, wydajność wzrostu, zasolenie, przeżywalność, SWARC

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