



## Effect of Different Feeds on Growth Rate and Survival of Common Carp (*Cyprinus carpio* L.) Larvae

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**Abstract:** The present study was conducted to evaluate the growth and survival rates of common carp (*Cyprinus carpio*) larvae fed different diets levels in laboratory. Two-day-old larvae were transferred from the University of Basrah Marine Science Center hatchery to the Abi Al-Khaseeb district's experiment laboratory. The larvae were distributed into four treatments 450 larvae each treatment (150 larvae per replicate and three replicates per treatment) at a stock density of 3.33 larvae /L. The treatments were as follows: T1 was given boiling egg yolks; T2 was given a processed diet with 45% protein; T3 was given Redi-Lac milk powder; and T4 was given ground *Artemia* eggs. The experiment ran for 20 days, beginning on April 17, 2022. The results showed that larvae fed on diet containing ground *Artemia* eggs (T4) produced the highest final weight (39.667mg), followed by a diet containing 45% protein processed diet (T2), Redi-Lac milk powder food (T3), and boiled egg yolks food (T1) produced the lowest final weight ( 27.333 and 24.667 mg, respectively) Statistical analysis revealed a significant difference ( $P \leq 0.05$ ) in the final weight, weight gain, daily growth rate, relative growth rate and specific growth rate between T4 and T1, but not between T4 and T2 and between T4 and T3. The survival rate showed a significant difference ( $P \leq 0.05$ ) between T4 (0.71%) and other treatments. Our results suggest that ground *Artemia* eggs is the most suitable and optimal meal for common carp fish larvae.

**Keywords:** *Artemia*, *Cyprinus carpio*, Egg yolks, Larvae, Milk powder.

### Introduction

The success of hatchery is highly dependent on the availability of live food for nourishing fish larvae, fry and fingerlings. Alternatively, live feeds were the one of most expensive components in larval fish rearing (Lim *et al.*, 2003, McKay & Jeffs, 2023). A fish cultivate success is dependent on larval rearing (Mahfuj *et al.*, 2012). As fish fry and fingerlings undergo morphological and physiological changes, including metamorphosis, during developmental process, fry may differ qualitatively and

quantitatively from juveniles and adults, in addition the larvae extremely grow rapidly, and they feed continuously, and require a high level of nutrient, The optimization of feeding and the nutritional quality of larval diets must be optimized, which directly affect the success of these early stage's growth and survival. (Mejri, *et al.*, 2021). However in designing and formulating diets, the nutritional requirements must be translated into the nutrient content. (Hamre *et al.*, 2013). Micronutrient requirements, as well as

requirements for protein, amino acids, fatty acids, and so forth, are frequently given as dietary concentrations or fractions, nutritional requirements may not usually rise in response to demanding circumstances, such as rapid development and metamorphosis (Kolkovski *et al.*, 2009).

Sándor *et al.* (2017) stated that the information about nutrient requirements for cyprinids larvae is incomplete, particularly for early life stages. As the larvae are kept commonly in natural ponds to sure their feeding naturally, while in commercial farms, a traditional practice is used in the first few days for carp larvae represented feeding them with boiled egg yolks as supplemental feeds in fish rearing for a long time (Jhingran & Pullin, 1985).

The main cause of the partial success in the exclusive use of artificial diets in larvae culture is related to the limited digestive capacity of fish larvae at the beginning of exogenous feeding (Carvalho *et al.*, 1997). Dabrowska *et al.* (1979) indicated that the growth and survival of fish larvae fed on an artificial diet was poorer compared with larvae fed natural food.

There were very few local studies, limited to a small number of experiments conducted by undergraduate students. Saleh (2006) study on the impact of various diets on the development and survival of common, grass, and silver carp larvae in a rotating water system. Al-Lamy & Taher (2016) examined the feeding and eating habits of common carp larvae and juveniles in earthen ponds. Mojer *et al.* (2021) Comparison of Growth for Cultivated Common carp, *Cyprinus carpio* Larvae between earthen ponds and recirculation aquaculture system.

The present study aims to find food for the larvae that is available and easy to obtain by

the farmer and that has a high nutritional value and can be used for a longer period of time than it is with egg yolk, which does not exceed only a few days by evaluating the effect of different feeds on growth and survival rate of common carp in the laboratory conditions.

## Materials & Methods

Larvae of artificial breeding of common carp (*Cyprinus carpio* L.) were collected from the fish hatchery of the Marine Science Center-University of Basrah. The larvae at age two days old (after the completion of the absorption of the yolk sac) were selected and their average weight was taken through choosing several random samples and calculating their number and weight and then extracting the rate per larva, which came to 3 mg .

The larvae were transferred from the hatchery to the experiment laboratory in Abi Al-Khaseeb district using plastic bags and placed inside containers containing ice to keep temperature low and lower the mortality rate of larvae during transporting. As soon as larvae arrived at the laboratory, they were put in 100-liter plastic tanks equipped with electric ventilation pumps for adequate aeration. The larvae are left for 48 hours to reduce the stress. Then they were distributed into four treatments at 450 larvae per treatment (150 larvae per replicate, three replicates per treatment) with a culture density of 3.33 larvae. L-1. The treatments were T1 was fed on boiled egg yolks, T2 was given on a 45% protein processed diet, T3 was fed on Redi-Lac milk powder, and T4 was fed on ground *Artemia* eggs.

The experiment started on April on 17th April 2022, and larvae were fed two meals a day to satiation with (morning and evening). Measurements were taken for some

environmental factors such as temperature, dissolved oxygen, salinity and pH periodically with a partial change in the water. Electric aeration pumps were used to aerate the water. The larvae's final weight in each treatment was measured at the end of the 20-day experiment. Growth parameters including weight gain, daily growth rate, relative growth rate, specific growth rate, survival rate and feed conversion rate calculated using the following equations (Jobling, 1993):

$$\text{Weight gain (WI, g)} = \text{FW} - \text{IW}$$

$$\begin{aligned} \text{Daily growth rate (DGR, g/day)} \\ = (\text{FW} - \text{IW}) / \text{days} \end{aligned}$$

$$\begin{aligned} \text{Relative growth rate (RGR, \%)} \\ = 100 \times (\text{FW} - \text{IW}) / \text{IW} \end{aligned}$$

$$\text{Specific growth rate (SGR, \%/day)} = 100 \times (\ln \text{FW} - \ln \text{IW}) / \text{days}$$

$$\text{Survival rate (SR, \%)} = (\text{Final count} / \text{Initial count}) \times 100$$

$$\text{Feed conversion rate} = \text{Food intake} / \text{weight increment}$$

Where: FW = Final fish weight (g); IW = Initial fish weight (g)

## Results

Table (1) presented the water quality parameters of the aquaria during the experimental period, water temperature during the experimental period in the aquaria ranged between 23.81-24.02°C, dissolved oxygen between 7.92- 8.35 mg/L, salinity between 2.23-2.54 PSU and pH between 8.15-8.32..

**Table (1): Environmental parameters during the experimental period.**

Water Quality	Value
Temperature (°C)	23.91± 0.15
Dissolve Oxygen (mg.L <sup>-1</sup> )	8.13±0.30
Salinity (psu)	2.38±0.21
pH	8.23±0.12

The weight measurements of common carp larvae fed on different diets during the experiment were showed in Table (2).The results indicated that the larvae fed diet containing ground *Artemia* eggs (T4) gained the highest final weight, followed by the diet containing 45% protein processed diet (T2), then diet composed of Redi-Lac milk powder (T3), whereas larvae fed boiling egg yolks (T1) had the lowest final weight.

The growth parameters for FW, WG, DGR, RGR, and SGR had the highest values in T4 at 39.667 mg, 36.667 mg, 1.833 mg/day, 1222.222 percent, and 12.909 %/day; the

lowest values were found in T1 at 24.667 mg, 21.667 mg, 1.083 mg/day, 722.222 %, and 10.306 %/day, respectively. The statistical analysis of growth parameters results revealed a significant differences (P≤0.05) in the FW, WG, DGR, RGR and SGR between T4 and T1, while there were no significant differences (P>0.05) between T4 with T2 and T3. Also there were no significant differences (P>0.05) between T2 and T1, and between T3 and T1. The survival rate showed significant differences (P≤0.05) between T4 and other treatments, but no significant differences (P>0.05) recorded between T2 and T3.

**Table (2): Weight Measurements of common carp larvae fed different diet during the experiment.**

Treatment	Rep.	IW (mg)	FW (mg)	WG (mg)	SR (%)
T1	1	3	22	19	32
	2	3	17	14	23
	3	3	35	32	23
T2	1	3	20	17	11
	2	3	43	40	8
	3	3	35	32	6
T3	1	3	25	29	31
	2	3	30	27	20
	3	3	27	24	26
T4	1	3	40	37	73
	2	3	40	37	67
	3	3	39	36	72

**Table (3): Growth parameters of common carp larvae fed different diet during the experiment.**

Treatment	IW (mg)	FW (mg)	WG (mg)	DGR (mg.d <sup>-1</sup> )	RGR (%)	SGR (%/d)	SR (%)
T1	3	24.667 b ±7.587	21.667 b ±7.587	1.083 b ±0.465	722.222 b ±309.719	10.306 b ±1.830	26 b ±5
T2	3	32.667 ab ±9.534	29.667 ab ±9.534	1.483 ab ±0.584	988.889 ab ±389.206	11.694 ab ±1.981	8 c ±3
T3	3	27.333 ab ±2.055	26.667 ab ±2.055	1.333 ab ±0.126	888.889 ab ±83.887	11.033 ab ±0.458	26 b ±6
T4	3	39.667a ±0.471	36.667 a ±0.471	1.833 a ±0.029	1222.222 a ±19.245	12.909 a ±0.073	71 a ±3

## Discussion

The present study revealed that the environmental parameters of the water in the experimental system was in the range of tolerance of common carp larvae, where water temperature (23.91°C) is generally good for most warm water fishes (Carballo, 2008). Oyugi *et al.* (2012) found that highest feeding rates for common carp achieved at 24°C. Common carp are moreover can survive in a

wide range of conditions, besides it was a eurythermal and euryhaline species (Crivelli, 1981, Troca *et al.*, 2012).

The highest values of growth parameters that recorded in the present study for common carp larvae fed on ground *Artemia* eggs was consistent with many previous studies, such as Cheah *et al.* (1985) found that low survival rates were in larvae fed egg yolk which suggested that use this kind of feeding for

larvae must to be reassessed. Zainiyah *et al.* (2019) indicated that common carp larvae that fed on *Artemia* sp. had the maximum growth compared to pellets and cake artificial feed .

No encouraged results for replacing natural food with artificial diet for common carp larvae, Dabrowski *et al.* (1978) fed common carp larvae on artificial feed (freeze-dried spleen, fish protein and chicken egg yolk) and found that larval growth was negligible. Sharma & Chakrabarti (1999) recorded average common carp larvae weight fed live food three to five times higher than larvae which fed the artificial diet .

Although milk powder considered a complete feed (about 39% protein) which casein comprise most percentage (Kailasapathy, 2016), the growth and survival of common carp larvae in the present study were like to larvae fed on boiled egg yolks which considered low compared to *Artemia* eggs treatment. Saha *et al.* (1998) found similar results in using 30% powdered milk in artificial diet for feeding *Clarias batrachus* larvae. Ed-Idoko *et al.* (2021) indicated that the highest weight gained in the common carp was for fry fed on *Artemia* compared to dried egg yolk. Mojer *et al.* (2021) concluded that earthen ponds were better than recirculation aquaculture system (RAS) for cultivation common carp larvae, due to availability of live foods in the former one. Al-Faiz *et al.* (2022) recorded the highest survival rate, but lowest growth performance in RAS compared to earthen pond. High growth and survival rate with *Artemia* treatment may be due to their richness in highly un- saturated fatty acids (HUFA) and vitamins (Rasdi & Qin, 2016). Using *Artemia* nauplii to feed fish larva improved the fish growth and development and reduced the mortality percentage (Łączyńska *et al.*, 2016, Prusińska *et al.*, 2020). *Artemia* sp. is a credible supply

of essential nutrients and enzymes, where tiny fish larva can derive their growth and development needs and enzymes that cannot be synthesized effectively by the fish itself (Prusińska *et al.*, 2020).

## Conclusion

Based on current results about the growth and survival rate of common carp larvae, it could be concluded that *Artemia* is more applicable and suitable for common carp larval feeding especially for the first 20-30 days.

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## Contributions of authors

A.M.M., planning the methodology, collection the data.

A.Y.A, wrote and edit the manuscript, analyzed the data.

## Ethical approval

All applicable national and international guidelines for the care and use of animals were followed.

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## Conflicts of interest

The authors declare that they have no conflict of interests.

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## تأثير الاغذية المختلفة في معدل النمو والبقاء ليرقات الكارب الشائع (*Cyprinus carpio*)

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**المستخلص:** أجريت هذه الدراسة لتقييم معدل نمو وبقاء يرقات الكارب الشائع (*Cyprinus carpio*) باستعمال مستويات غذائية مختلفة في المختبر. تم جلب اليرقات (عمرها يومين) من مفسس الأسماك التابع لمركز علوم البحار، جامعة البصرة، ومن نقلت إلى مختبر التجارب في منطقة أبي الخصيب. تم توزيع اليرقات على أربع معاملات بواقع 450 يرقة لكل معاملة لكل معاملة (150 يرقة لكل مكرر وثلاثة مكررات لكل معاملة) بكثافة استزراع بلغت 3.33 يرقة/لتر. وكانت المعاملات كالتالي: T1 غذيت على صفار البيض المسلوق، T2 غذيت على عليقة 45% بروتين، T3 غذيت على مسحوق حليب Redi-Lac و T4 غذيت على مسحوق بيض أرتميا. بدأت التجربة في 17 نيسان 2022 واستمرت لمدة 20 يوماً. أشارت النتائج إلى أن أعلى وزن نهائي (39.667 ملغم) تم الحصول عليه عند تغذية اليرقات على عليقة تحتوي على مسحوق بيض الأرتميا (T4)، ثم يليها العليقة المصنعة التي تحتوي على 45% بروتين (T2)، ثم غذاء حليب Redi-Lac، بينما أقل وزن نهائي (24.667 ملغم) (T3) كان في غذاء صفار البيض المسلوق (T1). أثبت التحليل الإحصائي وجود فرق معنوي ( $P \leq 0.05$ ) في الوزن النهائي والزيادة الوزنية ومعدل النمو اليومي ومعدل النمو النسبي ومعدل النمو النوعي بين T1 و T4، في حين لم تكن هناك فروق معنوية ( $P > 0.05$ ) بين T4 و T2 و T1. بين T4 و T3. أظهر معدل البقاء فرقاً معنوياً ( $P \leq 0.05$ ) بين T4 (0.71 %) والمعاملات الأخرى. تشير النتائج إلى أن الأرتميا هو أكثر قابلية للتطبيق وأفضل غذاء ليرقات الأسماك.

الكلمات المفتاحية: *Cyprinus carpio*، صفار البيض، اليرقات، بودرة الحليب.