RJOAS: Russian Journal of Agricultural and Socio-Economic Sciences
ISSN 2226-1184 (Online) | Issue 7(151), July 2024

UDC 639

ENDOGENOUS NUTRIENT ABSORPTION AND LENGTH GROWTH OF LARVAE (D0-D3) UNDER DIFFERENT REARING TECHNIQUES IN SNAKEHEAD FISH (CHANNA STRIATA)

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ABSTRACT
A detailed study on the effects of hormones on process and larval growth from various breeding techniques will provide a better understanding of optimizing snakehead fish (Channa striata) seed production. The research aims to analyze endogenous nutrient absorption and length growth in larvae (D0-D3) from several different breeding techniques of snakehead fish (Channa striata). The study was conducted at the Freshwater Aquaculture Research Center Mandiangin, South Kalimantan. Three breeding techniques were employed: firstly, observation of naturally spawned larvae (breeding technique I) from 3 pairs of broodstock. Secondly, semi-artificial spawning using Ovaprim (breeding technique II) from 3 pairs of broodstock. Thirdly, continuation of the second treatment (rematuration) involving semi-artificial spawning using Oodev and Ovaprim (breeding technique III) from 3 pairs of broodstock.

KEY WORDS
Snakehead fish, endogenous, spawning.

The development of snakehead fish (Channa striata) aquaculture in Indonesia has shown significant improvement, aligned with national programs initiated by the Ministry of Marine Affairs and Fisheries (KKP) in 2021. The successful domestication of snakehead fish by KKP in 2015 has highlighted its potential for further development (Gustiano et al., 2015). Among the Banjar community, snakehead fish (ikan gabus haruan) is a preferred choice for consumption (Bijaksana, 2009).

Despite successful domestication technologies, challenges remain in ensuring optimal seed supply. According to I'tishom et al. (2008), a critical factor in hatchery development is the sustainable supply of mature, healthy, and high-quality broodstock. Efforts to enhance seed availability in both quantity and quality are being pursued through hormone applications (Cahyanti et al., 2021).

The use of hormones in snakehead fish hatcheries involves hormonal manipulation techniques such as injection and implantation. Hormones like Oodev and Ovaprim are utilized to induce gonadal maturation and ovulation. For example, Oodev contains a complex compound from pregnant mare serum that mimics the effects of gonadotropin hormone (PMSG), accelerating gonadal maturation. Additionally, Ovaprim contains LHRH analog and anti-dopamine components, which elevate blood LH levels to trigger ovulation (Kusmini et al., 2015).

The differences in hormone-induced breeding techniques, as observed by Rawat et al. (2020), indicate that hormone applications can influence the embryo development process. However, the combined use of Oodev and Ovaprim hormones in the context of breeding has not been extensively researched. Therefore, further research is needed to analyze the embryogenesis process across various breeding techniques and to understand the reproductive status and larval growth stages post-hatching.

A detailed study larval growth from various breeding techniques will provide a better understanding of optimizing snakehead fish seed production. This will also support efforts to enhance seed productivity and quality, potentially expanding the success of snakehead fish aquaculture in Indonesia. The research aims to analyze the endogenous nutrient absorption

and length growth in larvae (D0-D3) from several different breeding techniques of snakehead fish (Channa striata).

MATERIALS AND METHODS OF RESEARCH

The research was carried out at the Mandiangin Freshwater Aquaculture Center, South Kalimantan. The broodstock used weighs 150-250 g/head and is 25-35 cm long. The spawning technique used is firstly observing the larvae resulting from natural spawning (spawning technique I) of 3 pairs of broodstock. Observations of the two larvae were spawned semi-artificially using Ovaprim (spawning technique II) with 3 pairs of broodstock. Observation of the third larva is a continuation of the activities of the second treatment (rematuration) which will be spawned semi-artificially using Oodev and Ovaprim (spawning technique III) of 3 pairs of broodstock.

Egg yolk volume was calculated using the Hemming & Buddlington formula (1988) and Determination of L and H using Fotedar (2017). Egg yolk absorption rate (LPKT) was calculated using the formula by Kendall et al (1984). Absolute length growth is the change in length from the beginning of hatching to the end of rearing. The formula for growth in length of cork larvae according to Effendi (1997).

RESULTS AND DISCUSSION

Egg yolk volume was calculated using the Hemming & Buddlington formula (1988) and Determination of L and H using Fotedar (2017) obtained the following data in Table 1.

Table 1 – Percentage of Egg Yolk Volume to Length

Spawning	Time	Length (mm)	VKT (mm^3)	%
Spawning I	hatch	3,28±0,10	0,32±0,04	9,76
	24 hour	4,45±0,27	0,18±0,02	4,04
	48 hour	5,58±0,12	0,04±0,02	0,72
	72 hour	6,22±0,11	0,01±0,00	0,16
Spawning II	hatch	3,43±0,20	0,30±0,06	8,75
	24 hour	4,09±0,13	0,15±0,04	3,67
	48 hour	5,11±0,31	0,11±0,05	2,15
	72 hour	5,73±0,28	0,01±0,00	0,17
Spawning III	hatch	3,43±0,16	0,32±0,04	9,33
	24 hour	4,84±0,15	0,24±0,04	4,96
	48 hour	5,61±0,33	0,10±0,02	1,78
	72 hour	6,41±0,10	0,01±0,01	0,16

Size of hatched larvae and initial yolk volume in spawning technique I (3.28 ± 0.10 mm; 0.32 ± 0.04 mm3); in spawning technique II (3.43 ± 0.20 mm; 0.30 ± 0.06 mm3); in spawning technique III (3.43 ± 0.16 mm; 0.32 ± 0.04 mm3). Larval size and final egg yolk volume in spawning technique I (6.62 ± 0.11 mm; 0.01 ± 0.00 mm3); in spawning technique II (5.73 ± 0.28 mm; 0.01 ± 0.00 mm3); in spawning technique III (6.41 ± 0.10 mm; 0.01 ± 0.01 mm3). Percentage of initial yolk volume (mm3) to length and percentage of final yolk volume (mm3) to length.

Table 2 – Initial Egg Yolk Volume (mm^3) and Final Egg Yolk Volume (mm^3)

Parameter	I (Naturally)	II (Ovaprim Hormone)	III (Oodev Hormones and Ovaprim)
Initial egg yolk volume (mm3)	0,32±0,04	0,30±0,06	0,32±0,04
Final egg yolk volume (mm3)	0,01 ± 0,00	0,01 ± 0,00	0,01 ± 0,00

Table 3 – Egg Yolk Expiration Time (hours) and Egg Yolk Absorption Rate (mm^3/hour)

Parameter	I (Naturally)	II (Ovaprim Hormone)	III (Oodev Hormones and Ovaprim)
Egg yolk expiration time (hours)	72 hours 52 minutes ± 0.51 (4,351) minutes	72 hours 27 minutes ± 0.17 (4,336) minutes	72 hours 09 minutes ± 0.61 (4,325) minutes
Egg yolk absorption rate	0,0043	0,0040	0,0043

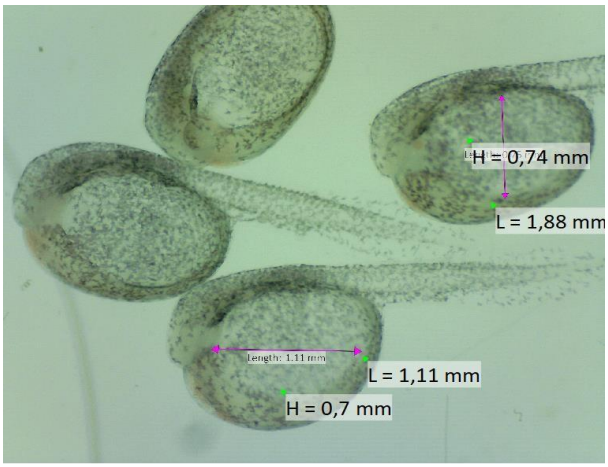

Figure 1 – Measurement of the Longest Axis (L) and Shortest Axis (H) of Egg Yolk Volume

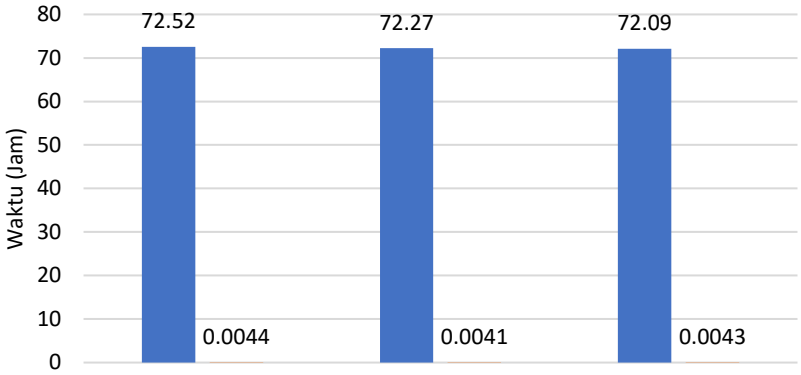

Figure 2 – Egg Yolk Volume Expiration Time (hours) and Egg Yolk Volume Absorption Rate (mm^3/hour)

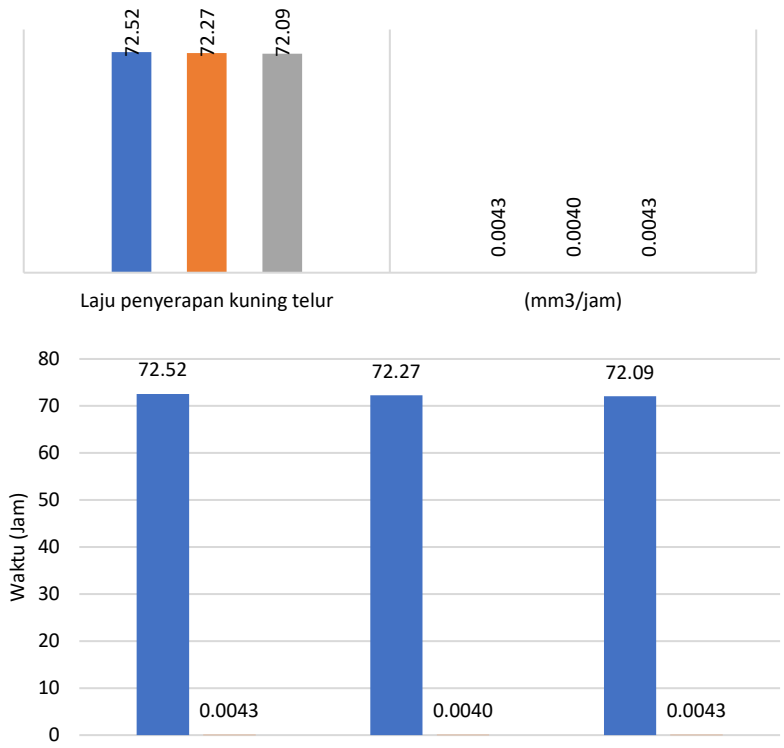

Figure 3 – Egg yolk absorption rate

Time to run out of egg yolk (hours) for spawning I with a duration of 72 hours 52 minutes ± 0.51 (4,351) minutes. Spawning II with a duration of 72 hours 27 minutes ± 0.17 (4,336) minutes. Spawning III with a duration of 72 hours 09 minutes ± 0.61 (4,325) minutes. Egg yolk absorption rate (LPKT) was calculated using the formula of Kendall et al (1984) fastest duration of spawning II and Egg Yolk Absorption Rate (mm3/hour) 0.0040. Longest spawning duration I and Egg Yolk Absorption Rate (mm3/hour) 0.0043. The fastest duration in spawning II is because the initial volume of egg yolk is lower when compared to spawning I and III, so that if combined with time, the initial volume minus the final yolk volume divided by the absorption time will result in a faster absorption rate. Although in spawning III the time duration is shorter compared to spawning II and I and the initial volume of egg yolk is higher.

According to Gunawan et al. (2019), research on yellowfin tuna indicated that newly hatched larvae up to five days old are a critical period, often experiencing mortality due to surface tension trapping them at the water surface. This highlights the sensitivity of newly hatched larvae to extreme environmental changes.

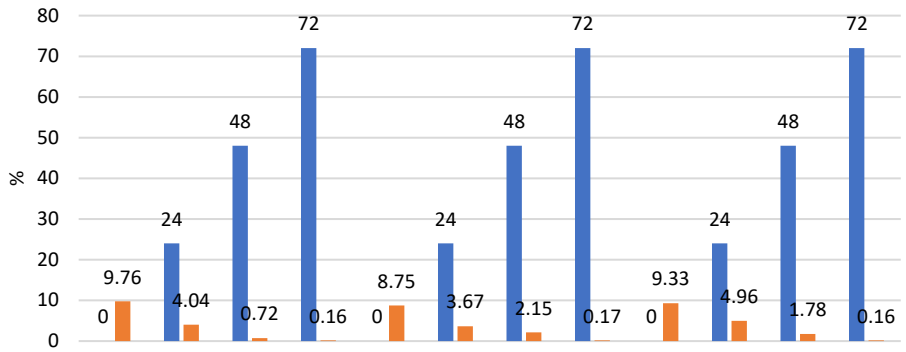

Figure 4 – Graph of egg yolk volume percentage against length and age (hours)

From the graph in Figure 4, it can be concluded that increasing age and length is followed by a decrease in egg yolk volume. At the beginning of hatching (0-23) the egg yolk volume value was highest compared to the 24th, 48th and 72nd hours. The highest percentage of absorption of egg yolk volume towards length increase in 0-23 hours was the highest in spawning technique I and the lowest in spawning technique II. At the 24th hour, the highest percentage of egg yolk volume absorption in relation to length increase was in spawning technique III and the lowest was in spawning technique II. At the 48th hour, the highest percentage of absorption of egg yolk volume to increase in length was in spawning technique II and the lowest was spawning technique I. At the 72nd hour, the highest percentage of absorption of egg yolk volume to increase in length was in spawning technique II and the smallest was spawning techniques I and III. The differences in egg yolk absorption time from each spawning system, both I, II and III, are thought to be due to internal and external factors.

Internal factors during vitalogenesis in the egg cause disturbances in balance, affecting embryo development and resulting in larvae with various morphological abnormalities in the head, body, and fins. Larvae with normal condition and high vitality tend to survive and adapt better compared to abnormal larvae. This is closely related to genetic sources influencing survival; high-quality genetic sources tend to result in higher survival rates. In this study, no abnormalities were found in breeding techniques I and III, while in breeding technique II, 25% of the hatched larvae (8 individuals) were abnormal, with 6 normal and 2 abnormal. Cahyanti et al. (2021) found no abnormal larvae in natural breeding (I), while in hormone-stimulated breeding (II), the abnormal larvae were 1.30 ± 0.423%, indicating a lower percentage of abnormal larvae compared to previous studies. These abnormalities are suspected to be due to hormonal influence during embryo development, resulting in abnormal larvae at hatching due to forced ovulation processes. According to Usman et al. (2019), assessing larval quality by fasting until all larvae die demonstrates increasing vitality with longer fasting periods.

Meanwhile, external factors include temperature, where higher temperatures accelerate the yolk absorption process due to increased energy expenditure. Conversely, lower temperatures result in slower and less efficient yolk absorption. Rapid energy depletion while morphological changes in the eyes, mouth, fins, and digestive system are not yet functional may lead to increased larval mortality. Mortality rates are higher in larvae at D3 stage because their food reserves as an energy source are depleted, and they start adapting to external food sources while their digestive system is not yet fully functional. Larvae with higher adaptive capabilities tend to survive better in extreme conditions, especially during temperature fluctuations.

Research by Cahyanti et al. (2021) on natural breeding (breeding technique I) shows faster yolk absorption within 2 days (2,718 minutes or 45.3 hours) with a yolk volume of 0.17 mm3, while hormone-induced breeding (breeding technique II) shows slower absorption within 3,273 minutes or 54.55 hours with a yolk volume of 0.16 mm3. The quicker absorption is likely due to smaller yolk volumes (0.17 mm3 and 0.16 mm3), which deplete faster as an energy source as the larvae age. Temperature plays a crucial role in yolk absorption rate; this study recorded an average temperature of 27.6-27.7°C, which is within normal conditions for larvae. In comparison, Rawat et al. (2020) found a longer yolk absorption time of 77.15 hours post-hatching at 26.0°C, indicating a larger yolk volume and slower absorption compared to this study (with a 5-hour difference). This slower absorption is likely due to a larger yolk volume and lower temperature, leading to slower yolk absorption. Larger yolk reserves enable larvae to survive longer, providing energy to support the development of eyes and fins and sustain their activities.

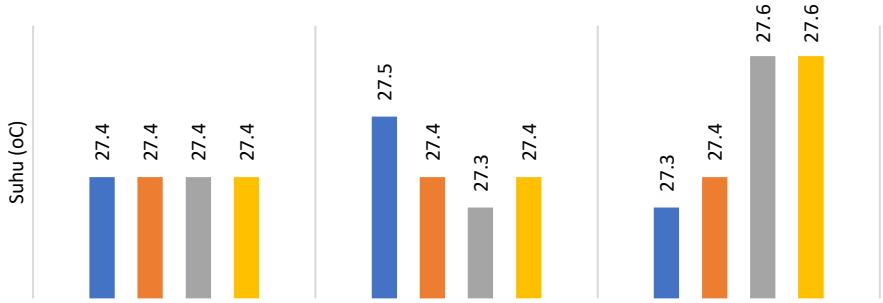

Figure 5 – Average temperature D0-D3

Table 4 – Temperature and Time (DO-D3)

Age	Spawning Technique I	Spawning Technique II	Spawning Technique III
Hatching (Hour)	27,7±0,5	27,6±0,1	27,7±0,5
24	27,7±0,5	27,7±0,5	27,5±0,2
48	27,7±0,5	27,7±0,5	27,7±0,2
72	27,7±0,5	27,7±0,5	27,7±0,0

Table 5 – Percentage Growth in Length and Time (DO-D3)

Spawning	Time	Total length (mm)	Percentage to Length %
Spawning I	hatch	3,28±0,10	
	24 hour	4,45±0,27	73,71
	48 hour	5,58±0,12	79,75
	72 hour	6,22±0,11	84,29
Spawning II	hatch	3,43±0,20	
	24 hour	4,09±0,13	83,86
	48 hour	5,11±0,31	80,04
	72 hour	5,73±0,28	89,18
Spawning III	hacth	3,43±0,16	
	24 hour	4,84±0,15	70,86
	48 hour	5,61±0,33	86,26
	72 hour	6,41±0,10	87,52

The results showed that the absolute length growth of haruan snakehead fish (Channa striata) larvae from day 0 to day 3 (D0-D3) varied between different spawning techniques. In spawning technique I, it was seen that the larvae reached an average length of 6.22 mm on the 3rd day after hatching, with a growth percentage of 84.29%. Meanwhile, spawning techniques II and III also produced significant growth, with larvae in spawning technique II reaching an average length of 5.73 mm (89.18%) on day 3, and in spawning technique III reaching 6.41 mm (87.52%) at the same time. These results indicate that the choice of spawning technique can influence the initial growth of Haruan snakehead fish larvae, which needs to be considered in efforts to optimize commercial seed production.

According to Kohno et al. (1986), rapid length growth in newly hatched larvae up to 33 hours of age is attributed to the nutrient source from the yolk used for organ maintenance, and larvae begin active swimming. Rapid length increase depends on the rate of yolk absorption. Genetic factors, nutritional feed, and rearing conditions are presumed to contribute to optimal length growth, with good genetic sources yielding superior seed. Cahyanti et al. (2021) noted that the growth rate in length and weight is slower in hormone-induced breeding compared to natural breeding. According to Effendi (1997), growth refers to changes in size, both in weight and length, over a specific period.

CONCLUSION

Spawning technique I produce the longest egg yolk absorption time. Spawning technique II showed the fastest yolk absorption rate but lower initial yolk volume, while spawning technique III produced the highest absolute length growth on day 3.

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