THE EFFECT OF DOSE *PREGNANT MARE SERUM GONADOTROPIN* (PMSG) HORMONE ON EGG DIAMETER AND EGG FECUNDITY OF *Channa striata*

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Abstrak

Channa striata is a fishery commodity that has high economic value. However, the availability of cork fish is very dependent on the availability of nature due to the lack of technology in the provision of seeds in a sustainable manner. In general, semi-artificial spawning with hormone induction is done for parent efficiency as well as increasing the quality and quantity of fish eggs as potential fish seeds. One of the spawning hormones that can be used is *Pregnant Mare Serum Gonadotropin* (PMSG), this hormone contains many elements *folicle stimulating hormon* (FSH) which can trigger gonad maturation in the early stages of oocyte formation and egg yolk filling in the process of vitelogenesis which will have an impact on egg diameter and fecundity. The purpose of this study is to determine the optimal dose of the PMSG hormone to increase egg quality in this case is the diameter of the egg and the quantity of eggs in this case is fecundity. The female cork fish used has a size range of 30-40 cm with a weight of 500 - 700 g, adapted in a controlled container then PMSG hormone induced by treatment A dose: 0.75 mL / kg; B: 1.0 mL / kg; C: 1.25 mL / kg; D: 1.5 mL / kg and repeated three times. Then wait up to 72 hours to find out the development of oocytes. The results showed that the best treatment for egg diameter with a dose of 1.25 mL / kg with an egg size of 1.04 mm, whereas in fecundity with a hormone dose of 1.5 mL / kg produced 23,612 eggs.

Keyword: Hormone, *Pregnant Mare Serum Gonadotropin* (PMSG), Egg diameter, Fecundity, *Channa striata*.

I. Introduction

The level of food needs in the form of animal protein sourced from fish will continue to increase in line with the increase in population. There are many freshwater fish commodities in Indonesian waters, there are several fishes that need to be developed in terms of increasing and enriching high protein food. This is what needs the existence of a domestication and seed multiplication in terms of fish reproduction that needs to be developed in technical cultivation (Wise, 2012). For this reason, it is necessary to have a hormonal engineering on fish hatcheries, especially for types of fish with high economic value (Aryani, 2011). One of the fish that has a high protein content and high economic value and hormone intervention can be performed in increasing the gonad maturity, namely Channa striata.

The development of cork fish farming techniques, especially in the field of fish reproduction, is increasingly rapid, with the ongoing effort to procure seeds, it is hoped that hormone induction techniques will be an alternative for the development of cork hatchery techniques. Nowadays cork fish production both consumption fish and seeds still depend on the availability of nature, so with the existence of hormonal engineering it is expected to help in the development of cork fish culture. Hope fish can produce eggs that have good quality and quantity, so in the process it would be better to use hormone manipulation, namely through the injection of various hormones as an effort to ripen fish gonads (Davy and Choinard, 1980 in Adi, 1999). According to Hanifa et al., (2000) Spawning from Murrel C. Striata can be caused by nature and injection of synthetic hormones where one of the hormones that are widely used to increase gonad maturity in fish is pregnant mare serum gonadotropin (PMSG). PMSG hormone contains many elements of

the work power of Folicle Stimulating Hormone (FSH) which plays a role in the maturation of the early gonads or vitelogenesis (Bolamba et al., 1992), so it is hoped that there will be an impact of the process of vitelogenesis in the form of increased egg diameter.

According to Nikolsky (1963) in Unnus et al., (2010) explained that one of the parameters to determine reproductive potential is to know the variation in diameter and number of eggs in the ovary, while According to Rudiana et al., (2000), revealed that PMSG horomon influences on the development of egg diameter in catfish (Clarias sp), this is one of the references in the development of egg diameter due to an increase in vitellogenin content in eggs. While Rahmatia (2013) states that PMSG has a role in stimulating the formation of follicles because it contains a lot of FSH and a little LH, where the strong function of FSH on the gonadotropin hormone will stimulate the ovaries for egg maturation in fish. Based on the results of several studies on the function of PMSG hormones, it is expected that hormonal induction in this study will be known to what extent the effectiveness of PMSG hormone doses to the development of egg diameter and fecundity in broodstock female broodstock.

Method

This research was conducted at the Laboratory of Fish Reproduction of Universitas Brawijaya Malang, 18 female mothers were selected with a length of 30-40 cm and a weight of 500-700 g were placed in an aquarium and fed floating with protein 30-33%. With the length, weight and age it is assumed that the parent used has the same level of gonad maturity. Parent collected obtained from fish farmers in the district. Malang, East Java. The female parent criteria are as described by Haniffa et al. (1996) that cork fish broodstock can spawn with a mother age of about 9 months at a minimum size of about 21 cm. The hormone used is the PMSG hormone with the trademark Oodev® developed by the Fish Reproduction and Genetics Laboratory, Department of Aquaculture, Faculty of Fisheries and Marine Sciences, Bogor Agricultural University.

This study used a complete randomized design method with five treatments, and three replications for each treatment. Where each treatment and repetition there is one female parent induced by PMSG hormone. Treatment A: 0.75 mL / kg; B: 1.0 mL / kg; C: 1.25 mL / kg; D: 1.5 mL / kg; E: control without PMSG hormone induction. All treatments were observed for 72 hours and then data collection was carried out. Female broodstock used in this study were in the same level of gonad maturity, so that the difference in results after being induced would be compared with the control treatment.

Method of collecting data

Before the fish is hormone-induced first the body weight of the female parent is weighed after 72 hours of treatment and observation. Egg diameter is measured by taking an egg sample by taking an ovary in the female parent. The eggs are taken, fixed with a solution of formalin buffer. Furthermore, the frequency distribution of egg diameter was made (Tamaru et al. 1991).

The diameter of the egg is then measured under a binocular microscope with the aid of an ocular micrometer which is listed in mm units that can see the size of the egg diameter. Egg diameters can be calculated using the following formula (Rodriquez et al., 1995)

$$Ds = \sqrt{D \times d}$$

Ds = actual egg diameter (mm),
D = egg diameter horizontally (mm),
d = egg diameter vertically (mm).

Determination of fecundity is done by taking female fish gonads, total fecundity is calculated using the sub-sample gonad weight method or called the gravimetric method. The way to get eggs is to take a female fish egg by lifting all of its gonads from the belly of the fish and weighing them. Then the gonad is taken in part to be weighed using an electric scale, then the egg granules are counted. The

gonads are preserved with Gilson's solution to dissolve the gonadal wall so that the egg grains are released. Gilson's solution can dissolve egg-covering tissues making it easier to calculate eggs (fecundity). (Unus and Omar, 2010).

Fish fecundity is determined using the gravimetric method with the formula (Effendie, 1997):

$$F = \frac{G}{Q} \times N$$

Keterangan :
F = fecundity (item);
G = body weight (g);
Q = gonad weights sample (g); dan
n = the number of eggs in the gonad sample (item).

Furthermore fecundity is associated with fish body length and body weight

Data analysis method

Each treatment with 3 replications will be tested statistically to determine differences in the results of egg diameter and fecundity of each treatment. This study uses PASW.18.2014 software with one way ANOVA to find out significant differences in each treatment

Results and discussion

The results showed an increase in egg diameter and cork fecundity in line with the increase in the dose of PMSG hormone given, where in each treatment showed a significant number.

A. Egg Diameter

Observations made during the study showed an egg dimater in treatment A of 0.77 mm, while in treatment B. 0.83 mm, 1.04 mm and 0.94 mm in treatments C and D. This indicates the effect of hormone induction PMSG for the development of egg diameter where each treatment has a significant increase in value when compared to control treatments. Observation data of egg diameter in each treatment is presented in the following tebel 1

Table 1. Results of Egg Diamater Every Treatment

Hormone (ml/kg)	Treatment	Egg diameter (mm)	average (mm)
0,75	A1	0,77	0,77
	A2	0,77	
	A3	0,79	
1	B1	0,8	0,83
	B2	0,87	
	B3	0,82	
1,25	C1	1,04	1,04
	C2	1,05	
	C3	1,05	
1,5	D1	0,94	0,94
	D2	0,94	
	D3	0,95	
Kontrol	C1	0.49	0,53
	C2	0.53	
	C3	0.59	

Furthermore, based on the egg diameter data shows the normal distribution of data, namely the results of the P-value 0.821 which means P> 0.05 then proceed with the Anova test to determine the difference in the average of each treatment of egg diameter Anova test from egg diameter data can be seen that the P-Value is 0.000 which means P-Value <α (0.05). It can be concluded that there are differences in the average dosage of egg diameter. To find out which treatment with the dosage that affects the egg diameter, further analysis is done by the Tukey Test. From the results of the Tukey test (P-Value <0.05) it appears that all of them have an influence for each average dose. So it can be concluded that there is a significant difference in the average of each dose given to the results of the size of the diameter of fish eggs.

Based on the observational data, the range of egg diameter is between 0.77 - 1.05 mm. Makmur (2003) revealed that the diameter of Cork Fish eggs in TKG (Gonad Maturity level III) ranged from 0.65 mm to 1.27 mm while TKG IV and V ranged between 0.65 mm - 1.34 mm. Based on this statement, the size of the egg diameter in the broodstock broodstock used in this study after being induced by the PMSG hormone has experienced mature gonads ranging from TKG IV and TKG V

The results of observations of the effect of administering PMSG hormone doses induced in Cork fish for treatment A, B and C can be said to have a directly proportional relationship. The higher the induced dose, it can stimulate the development of the diameter of the egg becomes increasingly large. Hafez

(1987) in Rudiana et al., (2000) which states that the PMSG hormone has a FSH biological activity that has a stronger effect than LH activity, the strong influence of FSH allows the influence of PMSG on egg cooking.

Effendie (1997) also states that the more the gonad develops, the greater the diameter of the egg as a result of the deposition of the yolk and the formation of oil grains. The eggs in the TKG III group will continue to develop into the TKG IV egg group. Then ovulated after experiencing the final stage of oocyte maturation. Based on this statement, it can be said that the higher the TKG, the larger the egg diameter, which in each treatment indicates an increase in gonad maturity.

Unlike the case of treatments A, B and C which have increased in egg diameter, in treatment D the diameter of the egg tends to decrease even though the dose induced in Cork fish is increasing. This is presumed that there is negative feedback from LH due to the high FSH content in the PMSG hormone induced. The LH hormone will suppress the performance of the gonadotropin hormone to synthesize FSH which affects the synthesis of estradiol 17β, which in turn will affect the performance of the liver that synthesizes estradiol 17β into vitellogenin (egg yolk) which fills the oocytes. Zairin (2000) revealed that changes in plasma estradiol 17β steroid levels illustrate the development of oocytes in Siamese Jambal fish, so that the egg diameter in treatment D has decreased.

Hormon (ml/kg)	Perlakuan	Fekunditas (butir)	Rata-rata (butir)
0,75	A1	13.853	15.849
	A2	18.042	
	A3	15.651	
1	B1	18.748	18.246
	B2	19.063	
	B3	16.926	
1,25	C1	23.309	20.977
	C2	18.389	
	C3	21.232	
1,5	D1	26.938	23.612
	D2	22.290	
	D3	21.607	
Kontrol	C1	1.991	1.815
	C2	1.600	
	C3	1.855	

Based on observational data on the measurement of egg diameter of Cork fish after being induced by the PMSG hormone, the most effective results obtained in the egg diameter size are in treatment C so that treatment C with a dose of 1.25 ml / kg is the best treatment of PMSG hormone induction on the parent of the channa Fish.

B. Fecundity

This study also looked at the effectiveness of PMSG doses on cork fish egg fecundity. After PMSG hormone induction, the observations showed a different trend in the increase of fukundity after hormone induction when compared to the results of observations on the egg diameter parameters. Where the higher the dose of the hormone that is given, the female cork fish fecundity also increases. Research results are presented in table 2 below:

Table 2. Fecundity Results for Each Treatment

The observations showed that the average fecundity value of each treatment was, among others, in treatment A. 15,8489, treatment B. 18,246 while increasing dose of hormones in treatments C and D were respectively 20,977 and 23,612 points. Details Based on the results of observations of fecundity data showing normal distribution, with the P-value nominality test results of 0.775, which means P> 0.05 for further Anova tested from fecundity data of Cork Fish brooders with a P-Value of 0.025, which means P-Value <α (0.05) . Based on these results it can be concluded that there is a difference in the average dose administration of Cork Fish fecundity, so to find out the influential treatment, Tukey Test is performed.

Analysis of the results of Tukey's test shows that the P-Value that rejects H0 (P-Value <0.05) is for hormone A with hormone D. This means the average administration of hormone A (0.75 ml) with hormone D (1.5 ml)

will affect fish fecundity. While the average comparison between the treatment of dosing A with B, A with C, and B with C tends to produce the same fecundity value.

Based on observations show that the average value of each treatment has an increasing trend with a linear graph, where each treatment with an increasing induction dose will have an impact on increasing the value of fecundity. These observations prove that the high FSH contained in PMSG will increase the formation of follicles in fish ovaries and will increase the number of eggs produced in each individual. Hardjopranjoto (1996) in Madyowati et al., (2013) said that the function of FSH increases the growth and development of follicles in the ovaries.

Makmur (2003) revealed in his research that looked at the reproductive biology of cork fish, stated that the fecundity of cork fish in his research fluctuated that it was possible that the fish used were not the same age, while Sukendi (2001) stated that the value of fish species fecundity was also influenced by the total length and total body weight of fish.

The relationship of the average total body length of Cork Fish to the value of fecundity in each treatment can be seen in Figure 1

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Figure 1. Body Length Curve and fecundity

Based on the figure above it is known that the relationship between total length and body weight of this study shows the potential for linear lines with a value of R2 = 0.93. The value of the correlation coefficient (R2) shows that there is a fairly strong relationship between fecundity and total length of fish, this can be seen in the average total length of the D treatment of Cork fish that is highest so that the fecundity value in treatment D is the highest. The curve shows that the higher the body length, the fecundity value also increases.

According to Wotton (1979) in Jayadi et al., (2010) the increase in fish body length will increase the amount of fecundity, because the body cavity where the ovaries will be even greater. So it can be concluded that in this study the PMSG hormone does not significantly affect the value of cork fish fecundity, but the total length is very influential from the number of eggs in the ovary Research on the effectiveness of the PMSG hormone on the value of fecundity shows that the higher the dose of the PMSG hormone given to female cork fish, the higher the fecundity value of cork fish, this pattern of increase is not seen in the egg diameter parameters. Observation of these fecundity parameters is possible due to the total length factor of the cork fish and the effect of the induced PMSG hormone.

Conclusions and Suggestions

Conclusions

Based on the results and discussion of the research on the effectiveness of PMSG hormone dose on egg diameter and cork fish function, the following conclusions can be drawn:

1. Treat the best dose on the observation of egg diameter is a treatment with a dose of 1.25 ml / kg of brood fish that produces an average egg diameter of 1.04 mm / grain assuming the gonad has matured around the TKG IV and TKG V
2. The higher the PMSG dose that is induced, the greater the value of fecundity with the best dose, namely in D dose at a dose of 1.5 ml / kg of mother fish and produce fecundity of 23,612 eggs / head of mother. It is also

influenced by the body length of the cork fish parent.

Suggestion

Reviewing the results of observing the effectiveness of PMSG doses in cork fish it can be suggested to enrich further research on the induction of PMSG hormones on female reproductive cork fish with more effective doses of susceptible 1.25 ml / kg to 1.5 ml / kg of mother fish in order get the optimal egg diameters and fecundity, besides that the uniformity of the length and weight of the parent becomes one of the factors considered.

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