Dietary supplementation of milk powder can enhance the gonad development in African catfish, Clarias gariepinus

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Abstract
Pellets are most important for growth of aquatic fish and pellets with high in protein can help in every internal development. There are many types of pellets with different protein content, but for this study it focusses on broodstock pellet with content of 28-30 % protein. The study was focus on the broodstock of *C. gariepinus* catfish with observations on the gonads of broodstock. The objective was to identify the effectiveness of pellet for gonad maturity in male and female of *C. gariepinus*. Three tanks were used in the study and each tank was placed 1 male and 2 females. The duration of experiment was 30 days and *C. gariepinus* were fed with commercial pellet, 5% pellet with addition of milk (M5) and 10% pellet with addition of milk (M10). The study showed M5 was more successful than M10 and commercial pellets because of based on the colour of the gonad in *C. gariepinus*. From the gonad weight, M5 (45.0 g) have heavier gonads than M10 (43.0 g) and commercial pellets (20.3 g). As a conclusion, pellets with addition of milk can be used in female of *C. gariepinus* for gonad development and artificial breeding.

Keywords*:* Milk consumption, gonad, *Clarias gariepinus*

1.0 Introduction

The fishing industry in Malaysia is an industry that is well developed and always in high demand. In addition, the fish raised are increasing day by day, and grow quickly when feeding a good and balanced pellet. Pellets are the common foods used by farmers to give to fish. There are three types of pellets; starter, grower and finisher but the main pellet to faster the maturity of the gonads is still less on the market. Apart from that, pellets also have different contents, for example, there are pellets that contain fish meal soybean meal and so on. Gonads are the reproductive organs in fish that produce eggs in females and sperm in males. Fish generally have a pair of gonads. African catfish or the scientific name, *Clarias gariepinus* is considered as an important food source for all income groups around the world. *C. gariepinus* is a native species to Africa where the range is very widespread

from all corners of Africa. It comes from the Nile to the Orange River. This species is very popular in the aquaculture industry all around southeast Asia countries including Indonesia, Malaysia, Thailand, and Vietnam (Muchlisin et al., 2010). Moreover, *C. gariepinus* is a very suitable species to breed because of its growth and it is also easy to breed because catfish are durable (Zainal et al., 2014).

Pellet is very important for the density and health of fish. In addition, there are many types of pellets that contain different nutrient depending on the type of pellet. Pellet for broodstock has milk powder which contains docosahexaebaic acid (DHA), eicosapentaenoic acid (EPA), arachidonic acid (ARA). All these nutrients are very important and can faster the maturity of gonads because DHA, EPA and ARA are indeed the nutrients needed to ripen the gonads proved by the study (Huang et al. 2010). The obvious problem with the fisheries industry is that the production of pellets that focus on maturity for fish stocks is less. This is because, pellets for brood stock fish need high additional nutrients to accelerate the maturity of the gonads in order to reduce the use of hormones in industry. In addition, breeders also like to give raw food to catfish, it will cause the occurrence of foul-smelling ponds and water that is toxic to fish. In addition, by providing such food will cause the brood stock to be of poor quality due to unclean food care.

The importance of this study is to reduce the use of hormones by injection in the brood stock catfish to faster the maturation of the gonads. This project is only for catfish brood stock only. This step is to reduce the chemicals present in the use of hormones by injection. Faster the maturation of the gonads is important to the industry, economy and fish farmers. According to authentic sources, half of the country's income comes from own fish farming instead of fishing. In 2017, the aquaculture sector contributed RM 14.3 billion, an increase of 10.1 % in value compared to 2016 (Azmi, 2018). That value contributed 0.8 % to domestic production. This clearly shows the great contribution of the fisheries sector in the development of the country. Next, fish is an important source of protein in humans. It also requires sufficient and continuous allocation to manage the national fisheries resources so that they remain at the highest level of sustainable care. The demand is expected to increase in tandem with the population. The request should be balanced with sufficient supply. However, excessive exploitation caused production declines. At the same time, the Government also encouraged the Community to venture into the fishery industry as it would be more secure in terms of quantity and quality than to find fish in the waters. Thus, the objectives of the present study were to identify the effectiveness of fish feed for gonad maturation in male and female catfish (*C. gariepinus*).

2.0 Literature review

2.1 African catfish (*Clarias gariepinus*)

C. gariepinus is a widespread African freshwater fish species which occurs naturally from the Nile to the Orange River. Being a very hardy species, it will have a major impact on a range of aquatic, amphibian and avian biota (Cambray, 2010). Catfish are freshwater fish and easy to breed. Wild catfish are easy to find. For example, most paddy fields, ditches and so on. But it is

also easier to find in the trenches of wet soil areas or in some locations. *C. gariepinus* can be farmed in water reservoirs such as ponds, fiber glass (cement glass), cement tanks and canvas. Induction breeding techniques for induced breeding, it is necessary to know the differences that exist between the male and female breeds. The male catfish stomach remains slim, if the stomach is massaged (while being pressed slowly) semen will come out (sperm) when the female's stomach is slightly swollen (Hernowo, 2010). *C. gariepinus* need time for achievement and growth depending on the influence of water temperature. Water temperature is known to effect of fish the hemotological parameter. When blood parameters are negatively affected, this in turn affects the overall growth and well-being of the fish. The results showed that the temperature of 25 - 28 ° C is the appropriate temperature range for the growth and well-being of *C. gariepinus*. However, temperatures above 40 ° C can be very deadly to fish (Ogunji & Awoke, 2017)

2.1 Pellet in aquatic animal

Suitable nutrition in aquatic animal production systems is very important to economical production of a healthy, high-quality product. In fish farming, nutrition is critical because feed typically represents approximately 50 % of the variable production cost. Fish nutrition has advanced dramatically in current years with the development of new, balanced commercial diets that promote optimal fish growth and health (Craig et al., 2017). There are two types of commercial fish diets such as extruded (floating or buoyant) and pressure-pelleted (sinking) pellets (Craig et al., 2017).

Currently, fish meal, soyabean meal, fish hydrosylate, skim milk powder, legumes, and wheat gluten are excellent sources of protein. Besides, other important ingredient in fish diets is a binding agent to provide stability to the pellet and reduce leaching of nutrients into the water. In addition, beef heart has traditionally been used both as a source of protein and as an effective binder in farm-made feeds. Carbohydrates and various other polysaccharides, such as extracts or derivatives from animals (gelatine), plants and seaweeds are also popular binding agents (Royes and Chapman, 2003).

From previous study by Aryani and Suharma (2015), throughout the adaptation of green catfish (*Hemibagrus nemurus*) fed with commercial (pellets) with proximate composition are water content (% dry weight) 12.0%, crude protein 28.0%, lipid 5.5%, crude fiber 6.2% and crude ash 13.0%. The study conducted on green catfish female gonad maturity stage one with four groups (with different protein content such as 20%, 27%, 32% and 37% and three replications (Aryani and Suharma, 2015).

3.0 Material and method

3.1 Sample and experimental design

This study was conducted at Fish Propogation House (FPH), Politeknik Jeli Kelantan. Species of fish used in this study was *C. gariepinus* and the average of brookstock were 385.89 ± 98.66 g (body weight) and 40.56 ± 5.81 cm (body length). Nine broodstock (three males and six females) of *C. gariepinus* were bought from Kota Bharu and Bachok, Kelantan and cultured

in 0.5 tons fibre tanks (1 m width x 1.1 m length x 1 m depth). The experiment was started with re-pellet the commercial pellet (Dindings (Catfish feed) with crude protein: 32 %, fat: 4 % and moisture: 11 %) with 5 % and 10 % milk powder (brand for milk powder was Anmum Materna (Protein with 29.4 g per 100 g powder). After the re-pellet, the pellet was given to female and male broodstock of *C. gariepinus*. Three different treatments (one treatment with only one tank) were the commercial pellet as a control, 5% pellet with addition of milk (M5) and 10% pellet with addition of milk (M10)) and each tank has one male and two female of *C. gariepinus* (one treatment have three replicates). Broodstock of *C. gariepinus* were fed for one month and then, the body weight (BW), body length (BL) and gonad weight were determined. Feeding was done daily for two times; in the morning (08:00 am) and evening (05:00 pm). In addition, the water quality (temperature (27-30 ^{o}C), pH (6.5-8.5), and DO > 3.0 ppm) was monitored and changed if necessary during the period study.

3.2 Growth performance parameters

The following growth performance was determined:

3.2.1 Percentage of weight gain

= (Final weight - Initial weight/Initial weight) x 100 %

3.2.2 Gonadosomatic Index (GSI)

= (gonad weight/body weight) x 100

4.0 Results and discussion

4.1 Results

4.1.1 Body weight (BW), body length (BL) and percentage of weight gain after feeding for 30 days

Based on Figure 1, there were the difference in the initial and final BW of the *C. gariepinus*. BW for *C. gariepinus* in all three tanks was initially 550 g and below. After, being fed for 4 weeks, BW in *C. gariepinus* were changes in all treatments. The initial BW in control, 5% pellet with addition of milk (M5) and 10% pellet with addition of milk (M10) were 384 g, 465 g and 388 g. While the final BW in control, 5% pellet with addition of milk (M5) and 10% pellet with addition of milk (M10) were 329 g, 484 g and 410 g (Figure 2). The initial body length of *C. gariepinus* in control, M5 and M10 were 36 cm, 40.7 cm and 45 cm. While the final BL of *C. gariepinus* in control, M5 and M10 were 37.7 cm, 53.3 cm and 53.7 cm. Thus, M5 was the highest in BW and BL in the present study compared control and M10. Besides, the percentage of weight gain for control, M5 and M10 were 9.19, 4.09 and 5.58.

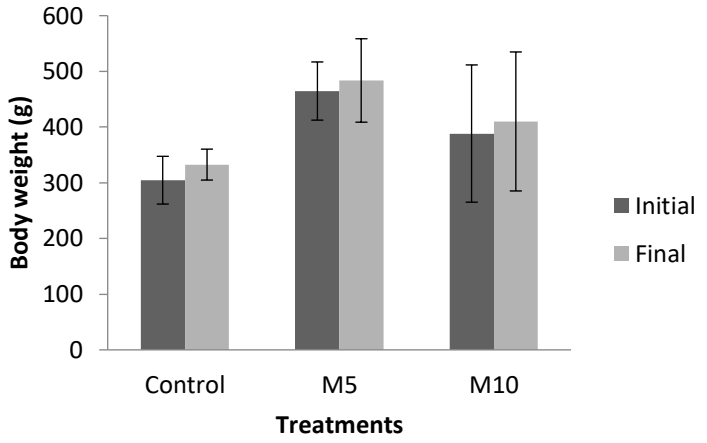

Figure 1: Initial and final body weight in African catfish, *Clarias gariepinus*

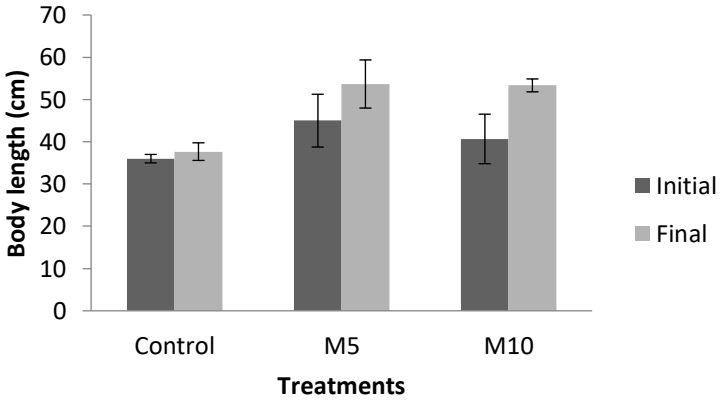

Figure 2: Initial and final body length in African catfish, *Clarias gariepinus*

4.2 Gonad weight and gonadosomatic index (GSI) in female and male after feeding for 30 days

The gonad weight in female for control, M5 and M10 after feeding for 30 days were 55.0 ± 7.1 g, 63.5 ± 6.3 g and 106.5 ± 0.7 g (Figure 3). While the gonad weight in male for control, M5 and M10 were 5 g, 9 g and 7 g (Figure 4). Figure 5 showed the GSI for all treatments in control, M5 and M10. There is no significant difference ($p>0.05$) in male and there is significant difference ($p<0.05$) in female of GSI for all treatments. For figure 6 (A), when the gonad is dissected, it is small and the colour is about to fade. In addition, this control treatment showed that it can mature the gonads only its maturity level is not fast and takes a long time. For figure 6 (B), the colour on the gonads indicates a mature greenishness like a normal mature gonad. This indicates M5 successfully matures the gonads by only taking one month. While figure 5 (C), the colour on the gonads showed a light green as well as a dull and less greenish maturity than M5. However, this 10% pellet shows almost succeeded in becoming a mature green colour but it may take more than a month. For figure 5 also the colour of gonad in male showed the pale milky white in gonad (D), milky white (E) and gray and a few parts of the gonad are milky white colour (F). The result showed M5 has more egg content than M10 and control.

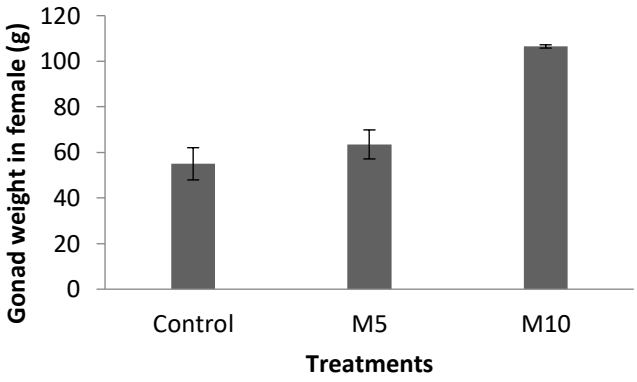

Figure 3: Final gonad weight in female of African catfish, *Clarias gariepinus*

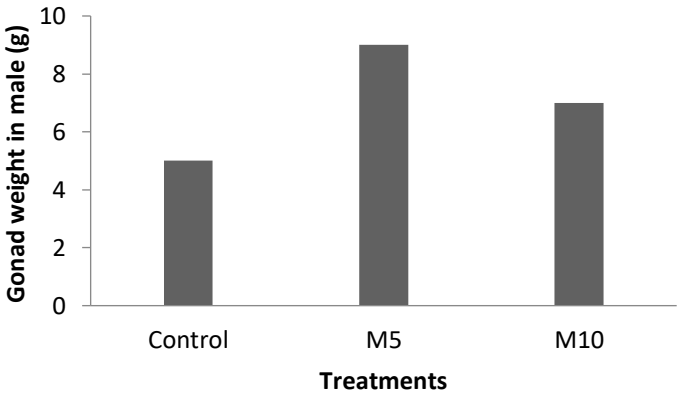

Figure 4: Final gonad weight in male of African catfish, *Clarias gariepinus*

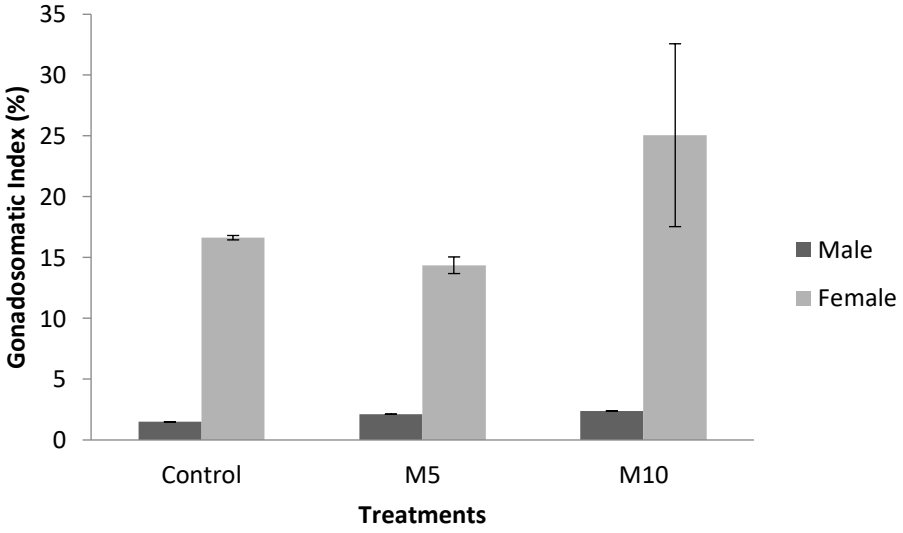

Figure 5: Gonadosomatic Index (GSI) for all treatments; control, pellet with 5 % milk consumption (M5) and pellet with 10 % milk consumption (M10)

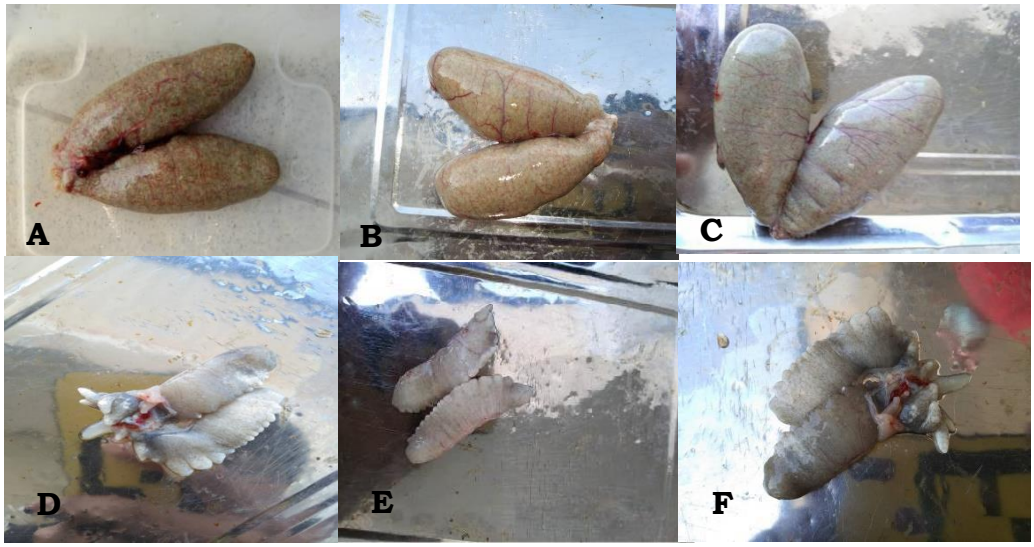

Figure 6: Colour of gonad in African catfish, *Clarias gariepinus* for female; A) Control, B) pellet with 5 % milk consumption (M5) & C) pellet with 10 % milk consumption (M10) and male; D) Control, E) pellet with 5 % milk consumption (M5) & F) pellet with 10 % milk consumption (M10)

4.3 Discussion

The present study showed the milk consumption with M5 and M10 were used in pellet of broodstock, *C. gariepinus* for feeding in 30 days. Zainal et al. (2010) showed the evaluated the effects of powder milk solution on the egg's adhesiveness and fertilization of *C. gariepinus*. Based on Helmizuryani et al. (2016), the female climbing perch (*Anabas testudineus*) using milk and soy solution through larval dipping is successful against cow's milk solution. According to Maidie et al. (2015) showed the climbing perch has cannibalistic at the age of six days after hatching. During the study carried out, climbing perch larvae were fed with live food such as bloodworm, artemia and rotifer. However, external factors such as environmental conditions and food can also make this experiment successful. From the results of the sex ratio of climbing perch larvae by using a method of immersion through natural ingredients that is with a solution of cow's milk for 10 hours to show a significant effect on the survival of climbing perch larvae estrogen content in cow's milk. According to Wedekind (2010), fish exposed to estrogen can influence and help to change the gonad of fish into females before they are males. This study is part of the reference of the study that has been implemented by changing the way the experiment by adding the milk content into the pellet for supplements for the brood stock catfish studied. Changing the use of the milk, put the milk in the pellet and give it to the catfish to faster the maturity of the gonad. With the addition of milk powder in pellet, there were more nutritional such as calcium, folic acid, DHA, iron, prebiotic and vitamins (A and D) that can contribute to enhance the gonad development in *C. gariepinus*. In the present study, the male of C. gariepinus has only need and better in M5 while the female of C. gariepinus has need M10 to enhance the gonad development because male only need a few nutritional than the female.

5.0 Conclusion

As a conclusion, M5 has a significant result in terms of BW, BL, the gonad weight in female and colour of gonad. The colour of gonad for M5 are showing a good result, for male catfish the gonad/sperm has a white colour while the female gonad/egg has a greenish colour. Different with pellet with M10, this pellet shows the weight of *C. gariepinus* are not showing a great result because the weight one of the catfish are decreasing. The gonad for this pellet is not showing a good result because for the male catfish the colour of gonad/sperm are gray that mean this gonad does not mature. For female gonad/egg the colour of it is light green this mean this gonad does not mature too, for control pellet the results are the same with pellet with 10% milk, all the gonads are not mature. The difference of the results can be seen between gonad from these two types of percentage of milk pellet and control pellet. For further study, need to take a long duration or period study to see the gonad development.

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