EFFECT OF LASER PUNCTURE INDUCTION TO INCREASE GSI AND HSI
MALE CATFISH BROODSTOCKS

Dyah Hariani*a, Erlix Rachmad Purnamaa, Tarsan Purnamaa. Mohamad Fadjarb

aDepartment of Biology, Faculty of Mathematics and Natural Sciences, Universitas Negeri Surabaya, Surabaya, Indonesia 
bAquaculture Dept., Fac. of Fisheries and Marine Science, University of Brawijaya, Malang, Indonesia

* Corresponding author: dyahhariani@unesa.ac.id

Abstract

Induction of laserpuncture in the male catfish broodstock has a positive influence by increasing reproductive activity which is very helpful for the process of gonadal maturation. The contribution of laser puncture induction in accelerating gonadal maturation can be seen with an increasing in the value of Gonado Somatic Index (GSI) and Hepato Somatic Index (HSI) indicators. The purpose of this study was to examine the effect of laser puncture induction on increasing the value of GSI and HSI male catfish broodstock. This experimental study used 48 broodstocks of one year old male catfish with a body weight of 1000-1200 g maintained in a concrete pond. The treatment consisted of 2 groups i.e. without induction and induction of laser puncture, each treatment was repeated 4 times. Laser puncture induction was performed every 15 days at the point of reproduction for 15 seconds until the 75th day. The parameters observed were GSI and HSI. The results showed that there was a highly significant increase (P <0.002) in the value of GSI and HSI in male catfish after induced by laserpuncture. The results showed there was laserpuncture induction at the point of reproduction in male catfish can accelerate gonadal maturation with indicators of increasing GSI and HSI values.

Keywords: Laserpuncture induction, male catfish, GSI, HSI

INTRODUCTION

Laserpuncture induction at the point of reproduction and the duration of proper induction will have a positive effect on reproductive activity which is very helpful in the process of gonadal maturation (testis), especially for catfish cultivation indicated by rapid testicular maturation rather than laser catfish without induction male catfish must be fed specifically for the catfish broodstock [1]. In general, catfish hatchers fail with the production of low-quality sperm and the maturation process is relatively long. This can be happen because hatchers pay less attention to the management of broodstock feed so it can affect their reproductive
performance [2]. Special feed for catfish broodstock is most important for optimal reproductive performance and performance [3,4]. Feed given to broodstock catfish must be of high quality. [5] suggested that feed quality is related to the nutrients they contain and their digestibility, how much feed is given and the frequency of feeding. [6] emphasizes that the provision of quality feed on the male broodstock fish has been shown to improve sperm quality and can also accelerate the development of gonads of male broodstock.

Feed can stimulate the reproduction of male catfish to speed up the maturation of the gonads. The process of gonadal maturation is influenced by environmental factors (such as photo-period), feed will also affect reproductive hormones [7]. The key regulator in the reproductive cycle of fish lies in the brain-pituitary-gonadal axis that regulates the production of reproductive hormones. The hypothalamus will release Gonadotropin Releasing Hormone (GnRH). GnRH stimulates the pituitary to release Gonadotropin Hormone (GtH-I and GtH-II) [8,9]. GtH-I in male fish plays a role in stimulating spermatogenesis and GtH-II plays a role in producing androgen hormones through the role of interstitial cells or Leydig cells. Both of these reproductive hormones flow through blood vessels to the gonads. GtH-II is what determines the maturation of gonads. The more levels of GtH-II in the blood, the gonad maturity in the male broodstock fish increases [10]. In addition, to speed up the maturation of gonads in the male broodstock catfish, other technologies can be used, namely laser puncture technology.

Helium-Neon laser puncture (He-Ne) is a short-wave light with a strength of 4-5 mw, area of light output of 0.2 cm² and a wavelength of 632.8 nm which is still safe to use as biostimulation [11,12]. This induction of laser puncture can give rise to biostimuli in the brain-pituitary-gonad-liver axis associated with reproductive activity. [17] have proven that female catfish broodstock induced by laser puncture at the point of reproduction can stimulate the gonad to mature more quickly for about 3 weeks and are confirmed by [18] for mature catfish about 4 weeks.

One indicator to find out whether or not the catfish broodstock is gonadal mature or not by looking at the Gonado Somatic Index (GSI) and the Hepato Somatic Index (HIS). GSI = gonad mass / body mass × 100 HIS = hepar mass / body mass × 100 [19]. GSI is used to monitor the development of gametogenesis in teleost fish [20,21]. The main feed research on GSI and HIS has been carried out a lot, but quality feeding combined with induction of laser puncture in the male broodstock catfish that has not been spawned has not been widely done. For this reason, this research is needed. This study aims to examine the effects of induction of laser puncture on male broodstock catfish to GSI and HIS.

**MATERIAL AND METHOD**

Using 48 male catfish which had never spawned with a weight of 1000-1200 g. Fish was got from UPBAT Kepanjen, Malang, East Java. Fish was fed with 38% crude protein feed for broodstock.

Research aids consist of one He-Ne soft laser unit measuring 4.5 mw, light output area of 0.2 cm² and λ 632.8 nm [11], cement pond measuring 3.5 m x1.5m x1.5 m as much as 3, scales digital capacity of 5 kg, tools and section boards, like a large triangle. The research was conducted in UPBAT Kepanjen, Malang, East Java from April 2018 to July 2018.

This experimental study used a randomized block design consisting of two groups: the control group and the group induced by laser puncture and 4 replications were needed.

Research procedure can be explained as follows:

1. The samples used were 48 male catfish broods inserted into the concrete pond and acclimatization for 10 days. The catfish broodstock was given a special commercial feed for catfish male broodstock as much as 4% of their body weight with twice a day feeding frequency, namely 08.00 WIB and 16.00 WIB. After completed the acclimatization, all catfish broodstock were fasted 1 x 24 hours. All the fish were weighed and collectively taken four (4) tails to observe GSI and HIS by: weighing and dissecting them for the gonad and the liver. Weighed the gonads and liver. The first data collection was
considered as the 0th day.

2. In a random manner, the 48 catfish broodstock on day 0 were divided into two groups, namely the control group and the laserpuncture induced group, each group consisting of 24 tails. For the laserpuncture induced group after the acclimatization process, all 24 male catfish broodstock were taken and weighed. Laserpuncture was then induced at the point of reproduction precisely in 2/3 of the ventral part of the body for 15 seconds /15 daily to 75 days and as a comparison control group, every 15 daily was taken and weighed only [1].

3. Every 15 times all male catfish broodstock, both control and treatment groups, were taken and weighed to gain weight. Sampling was taken for 4 control groups and laserpuncture induced groups on the 0, 15th, 30th, 45th, 60th and 75th days weighed and dissected to obtain gonadal and hepatic weights for GSI and HSI values. Before collected the data, all fish were fasted to reduce stress levels.

4. The effect of laserpuncture induction to GSI and HSI was analized using SPSS Ver 15.0 software for Windows. If the results are significant, proceed with the Duncan test at a confidence level of 95%.

RESULT AND DISCUSSION

From the results of this study indicate that both the GSI value and the HSI value have two peaks namely on the 30th day and 75th day both groups without induction or induction of laser stroke but on the 30th day it reaches the highest GSI and HSI values compared to 75th day both in the control group and those induced by laserpuncture and the lowest GSI and HSI values were obtained from day 0 (Table 1).

| Day to- | Control GSI (Average ± SD) | Laserpuncture Induction GSI (Average ± SD) | Control HSI (Average ± SD) | Laserpuncture Induction HSI (Average ± SD) |
|---------|---------------------------|------------------------------------------|---------------------------|------------------------------------------|
| 0       | 0.24 ± 0.13               | 0.24 ± 0.13                              | 1.14 ± 0.11               | 1.14 ± 0.11                              |
| 15      | 0.51 ± 0.19               | 0.56 ± 0.16                              | 1.60 ± 0.48               | 1.79 ± 0.55                              |
| 30      | 0.82 ± 0.43               | 0.94 ± 0.38                              | 2.34 ± 0.84               | 2.55 ± 0.42                              |
| 45      | 0.63 ± 0.28               | 0.70 ± 0.31                              | 2.02 ± 0.25               | 2.19 ± 0.44                              |
| 60      | 0.54 ± 0.08               | 0.58 ± 0.24                              | 1.97 ± 0.27               | 2.09 ± 0.71                              |
| 75      | 0.65 ± 0.35               | 0.75 ± 0.15                              | 2.15 ± 0.28               | 2.34 ± 0.23                              |

Information: *) Different superscript letters indicate statistical difference (p <0.05).

The result indicates that the administration of laserpuncture induction had a very significant effect on the increasing in GSI value (P <0.002). On the 30th day the broodstock of male catfish was treated with laserpuncture induction resulting in the highest GSI value of 0.94 ± 0.38 compared to other treatments. However, statistically GSI for days 0, 15th, 30th, 45th, 60th and 75th, were not significantly different for the laserpuncture induced group. However, for the group without GSI laserpuncture that was produced on the 0, 15th, 30th, 45th, 60th and 75th days the results were not significantly different, but the 30th and 75th days were higher than the others.

The administration of laserpuncture induction has a very significant effect on the increasing of HSI value (P <0.002). On the 30th day the male catfish treated with laser- puncture induction produced the highest HSI value of 2.55±0.42 compared to other treatments. However, the HSI values for days 30th and 75th were not significantly different for the laserpuncture induced group. However, for the group without HSI laserpuncture produced on the 30th day the results were higher at 2.34±0.84 compared to HIS on days 0, 15,45,60 and 75 (Table 1).

The result indicates that on the 30th day there is a maximum development of gonadal, which was indicated by the highest GSI value. This was possible because on the 30th day after the male catfish is fed with good combined with laser structure induction at the point of reproduction for 15 seconds, it can trigger the development and maturation of the gonad and the condition of the mature gonad ready to be spawned. It should be noted that the male catfish used for this study is the catfish broodstock that has never been spawned. It can be said that the male catfish broodstock just learned to reproduce. Of course it still takes time to
produce good gametes.

On day 0, 15th before the 30th day of feeding which was well combined with induction of laserpuncture, it is thought that the condition of the gonad is in the development stage and that on the 30th day the condition of the gonad is mature and ready to be spawned. On the 45th and 60th days there is a decrease in GSI, this is thought to be the gonad mature catfish (30th day) if it was not spawned there will be resorption of mature gonadal cells so that the gonad will shrink. As a result, the GSI dropped. Then the gonad will experience growth and development. On the 75th day there was an increasing in GSI. This indicates that the male catfish gonads are developing and maturing so that the GSI value increases, but the value is not as high as on the 30th day. Judging from the GSI value in the trend control group it was similar to laserpuncture induced, but the results were not statistically significant. Eventhought the result on the 30th and 75th day were higher than the 0, 15th, 45th, and 60th day result. It was assumed that on the 30th and 75th day the condition of the gonad was ripe and on the other day the feed given without inducing laserpuncture can trigger growth and gonads development also stimulating gonadal maturation.

The administration of laserpuncture induction has an effect on increasing the GSI value in male catfish broodstocks. This was possible because the induction of laserpuncture at the point of reproduction for 15 seconds was proven to be able to trigger reproductive physiological activity for the synthesis of gonadal growth and development (testicles) so that the gonads will be mature faster. However, to increase physiological activity, it must be balanced by providing quality feed for the process of development and maturation of the gonads. The process of accumulation of protein in the gonad causes the size of the gonad to increase and the gonad increases in weight so that the value of the GSI increases. The increased GSI value was influenced by the provision of quality feed with high protein content. A high GSI value can be associated with the level of gonadal maturity (TKG) in fish. So the GSI value can be used as an indicator that can be used to assess gonadal maturity. [22] states that one indicator that can be used to assess gonadal maturity is measuring the value of GSI. The catfish broodstock was said to mature gonads, if the GSI value was high.

This study was supported by [23] that giving 40% feed protein to female African catfish had greater gonadal weight and GSI compared to feeding protein levels below 31% and [24] revealed that the GSI value could be used as an indicator to express development and maturation of catfish gonads.

The results of the study revealed that male catfish fed with quality feed and combined with laserpuncture induced at the point of reproduction for 15 seconds, the GSI value was higher compared to the control group and the gonad mature faster.

High protein feed is a basic ingredient to help the formation of enzymes and hormones, especially gonadotropin hormone (GtH-I and GtH-II) and accelerates gonadal maturation. In addition, due to laserpuncture induction at the point of reproduction for 15 seconds, it will stimulate active cells in the reproductive point area to carry out a series of reactions and there are many peripheral nerve endings. These active cells will experience a series of cellular activities. The light from laserpuncture contains the energy of electromagnetic waves at the point of reproduction thought to affect peripheral nerve endings that are between the epidermis and dermis in the skin tissue. The energy of this electromagnetic wave comes from this laser beam.

In the brain there will be a series of physiological reactions that eventually stimulate hypothalamic neurons to release Gonadotropin Releasing Hormone (GnRH). GnRH will stimulate pituitary neurons to release Gonadotropin Hormone (GtH-I and GtH-II) [16] play a role in stimulating growth, gonadal steroidogenesis and gametogenesis [25,26].

During the process of spermatogenic development, it will generally be followed by gonad weight gain in male catfish ranging from 5-10%. Catfish increase in size and body weight increases as well so that the GSI reaches will reach the maximum. The results of this study are in accordance with [27,28], stating that the GSI value reaches the maximum before spawning and then the GSI value decreases after spawning takes place.

Based on the results of the study, the
calculation of the HSI value was the same as calculating GSI but using the weight of the liver because the calculation was based on the total length and weight of the fish which will follow the development of gametogenesis in fish. It is supported by [29] that the pattern of GSI and HIS calculations is based on fish length and weight which will change the development of gametogenesis which automatically correlates.

Liver is a metabolic organ in the fish body, the HSI can be used as a biomarker as a general health indicator for fish and is responsible for integrated biological effects related to the function of physiological development or reproduction [30,31]. The HSI has proven to peak at 30 days. This happens for 30 days the male catfish is maintained by giving good feed will affect the development of the liver combined with induction laserpuncture at the point of reproduction for 15 seconds. Quality feeds are metabolized and circulated throughout the body and those that enter the liver are used, among others, for the production of steroid hormones, which play a role in gonadal maturation. In the liver lipids are needed as a raw material for the formation of steroid hormones. Of course the metabolic activity process is accelerated by the presence of laserpuncture induction. Thus in addition to the weight of the liver, the weight of the gonad also increases with the condition of the gonad in a mature state with a high GSI value. Thus there will be mobilization of nutrients in the liver. High and low HSI values along with gametogenesis activity related to GSI values. This is as expressed by [32] that the value of HSI can be high or low depending on the condition of the male broodstock fish actively storing lipids. This is due to nutrient mobilization during reproduction.

CONCLUSION

It can be concluded that administration of laserpuncture induction at the point of reproduction in male catfish can increase and accelerate gonadal maturation by looking at the GSI and HIS indicators. With the rapid maturation of the gonad catfish mother, it will accelerate gonadal maturation and spawning and the provision of catfish seeds can be available.

For the future, research on induction of laserpuncture associated with molecular activities to increase the reproductive potential of fish, especially catfish.

ACKNOWLEDGEMENT

Authors are thank to the DPRM Ristek Dikti for providing research grants so this research can be carried out well. Head of the Kepanjen UPBAT along with staff especially Mr. Moh Sori S.Pi who had provided assistance and the use of research facilities.

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