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BLOOD DESCRIPTION OF STRIPED CATFISH (*Pangasianodon hypophthalmus*) MAINTAINED BY AQUAPONIC SYSTEM AND PHOTOPERIOD MANIPULATION

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ABSTRACT

Environmental conditions and nutrient input greatly affect the physiological condition of fish. The growth of *Pangasianodon hypophthalmus* is improved by rearing it in short photoperiod. To maintain fish health, water quality must be maintained by applying aquaponics. The application of an aquaponic system can maintain water quality. To understand the blood condition of *P.hypophthalmus* reared in an aquaponic system and manipulated of photoperiod has been conducted in June-August 2021. The fish was reared in a bucket of 100 L water, 30 fishes/bucket (6-8 cm TL). Treatment with aquaponics system and filters as well as 24-hour dark photoperiod and natural photoperiod. The parameters measured were the erythrocytes total, leukocytes total, hematocrit, leukocrit, and leukocyte differential of *P. hypophthalmus*. The result showed that in general the blood condition of the fish there was no abnormality. Differentiation leukocytes are still relatively normal. The blood condition of all fish treated were erythrocyte total was 1.76-1.85 $x10^6$ cells/mm^3, leucocyte was 5.45-5.66 $x10^4$ cells/mm^3, hematocrit were 21.3-37.2% and leukocrit were 0.5-1 %. Based on the data obtained, it can be concluded that with aquaponic system and manipulated photoperiod do not negatively affect the health status of fish in general.

Keywords: Striped catfish, Hematology, Photoperiod, Aquaponic

I. INTRODUCTION

Striped catfish (*Pangasianodon hypophthalmus*) is one of the leading freshwater fishery commodities. Based on data from the Directorate of Aquaculture of the Ministry of Maritime Affairs and Fisheries, the national catfish production in 2018 was 391,151 tons, up 22.25% from 319,966 tons in 2017, and 22,369 tons in 2020.

Manipulation of a short photoperiod or irradiation (light is only briefly but dark is longer), then the catfish will actively eat for a longer time and the feed given will be eaten optimally. Nocturnal fish such as catfish kept in dark conditions show that fish can grow faster than fish reared in normal conditions. Fish kept in dark conditions are calmer, don't move much, but the fish's response to the feed given is very good. Furthermore [1] stated that the growth and survival of catfish the longer the dark time given the better the growth and survival,

The use of an aquaponic system in fish farming is a solution in maintaining water quality. Technology aquaponics is a combination of aquaculture and hydroponics which aims to cultivation fish and plants in one connected system. In this system, the waste produced by fish is used as fertilizer for plants, then the water that

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flows through the recirculation system from the fish rearing media is cleaned by plants so that it can be reused by fish [2].

2. RESEARCH METHOD

Time and Place

This research was conducted in June - August 2021, at the Fisheries Biology Laboratory, Faculty of Fisheries and Marine, Universitas Riau.

Method

The method used in this study is a two-factor factorial experiment method. The factors applied are as follows:

1. Aquaponic factor, which consists of K (Water spinach) and F (Filter)
2. Photoperiod factor, which consists of 24G and N (Natural)

The number of repetitions used was 3 times with a total of 12 experimental units. The containers were placed randomly, then the code was divided by drawing lots. The treatment combinations in this study can be seen in Table 1.

Table 1. Treatments Used in Research

$_{Aquaponics}$/Photoperiod	24 Hours Dark	natural
(K) Kale	24GK	NatK
(F) Filters	24GF	NatF

Note: Nat is natural with only photoperiod treatment without dark hour treatment

Data Analysis

The hematology data obtained is displayed in tabular form and then discussed descriptively. Furthermore, it was analyzed using the SPSS application version 23. Data analysis used One Way Anova and seen its homogeneity. If the results of the analysis show an effect, then it is further tested using Student Newman Keuls (SNK).

3. RESULT AND DISCUSSION

The study was conducted for eight weeks, the results obtained were changes in the blood description of catfish reared by the aquaponic system and photoperiod manipulation. As a whole, data hematology all fish have normal hematological conditions. For more details can be seen in Table 2.

Table 2. Description of Blood Catfish that are Reared by Aquaponic System and Photoperiod Manipulation

Treatment	Erythrocytes (cells/mm^3)	Leukocytes (cell/mm^3)	Hematocrit (%)	Leukocrit (%)	Hemoglobin (g/dL)
Beginning	1,856,667	55,233	21,3	0.5-1	9,3
Nat K	1,764,444	54,516	31	0.5-1	9
24G K	1,762,222	54,789	36	0.5-1	10
Nat F	1,787,778	55,119	37,2	0.5-1	8,7
24G F	1,846,667	56,680	34	0.5-1	10

Information:
Beginning: Beginning of Rearing Catfish in an Aquaponic System with Photoperiod Manipulation
Nat K : Natural water spinach Nat F : Natural Filter
24G K : 24 hours Dark water spinach 24G F : 24 hours Dark Filter

Total Erythrocytes

Measurement of total erythrocytes was carried out to see changes in total erythrocyte values of catfish reared by the aquaponic system and photoperiod manipulation. The average total erythrocytes of catfish after nine weeks of rearing ranged from 1.762.444-1.856.667 cells/mm^3. Observation results for total erythrocytes are presented in Table 2.

This is in accordance with the opinion of [3], where the normal number of erythrocytes in catfish ranges from 1.57-3.41×10^6 cells/mm^3. Factors that affect the number of erythrocytes are fish, differences

in brood stock, feed nutrition, size, physical activity, and age of fish [4].

Total Leukocytes

The white blood cells count in catfish reared by the aquaponics system and photoperiod manipulation is normal so it does not affect the fish's body systems. Due to the relatively low white blood cell count, the leukocrit levels were also low, indicating no infection in the fish in all treatments. So that the health status of catfish is in good condition during maintenance. This is in accordance with the statement of [5], which states that the number of white blood cells in healthy fish is below 150,000 cells/mL. According to [6], which states that an increase in the number of white blood cells occurs because, fish are trying to increase their body resistance from bacterial attacks, so that leukocytes move actively towards places affected by bacterial attacks.

Hematocrit and Leukocrit values

The results of observing the hematocrit and leukocrit values using the percentage hematocrit scale can only be estimated, for leukocrit the percentage is 0.5-1. Table 2 shows that the average hematocrit states that the percentage of hematocrit levels at the start of maintenance is normal. The hematocrit percentage of catfish tends to be good during the rearing period. At the end of maintenance the average amount of hematocrit NatK is 31%, 24GK is 36%, NatF is 37.2% and 24GF is 34%.the highest number of hematocrit was found in the NatF treatment of 37.2%. The results of this hematocrit value are in line with the proportion of hemoglobin. This is in accordance with the statement of [7], which states that there is a strong correlation between hematocrit and the amount of blood hemoglobin, the lower the number of red blood cells, the lower the hemoglobin content in the blood.

The number of red blood cells and fish hematocrit levels in this study was normal, this is in accordance with the statement of [8] which stated that normal fish hematocrit values ranged from 28-40%. As well as this shows that there is no significant difference between the number of erythrocytes and hematocrit levels of fish reared with natural photoperiod and treated fish, it seems that the treatment applied, namely the application of 24 hours dark and natural conditions, does not have a negative impact on the health of catfish. According to [3] the hematocrit value can change depending on the season, temperature and feeding and the impact of immunostimulants. Hematocrit values vary depending on nutritional factors, fish age, sex, body size, and spawning period.

Leukocrit is the percentage of leukocyte volume in fish blood. Catfish reared by photoperiod manipulation and aquaponic system for eight weeks ranged between 0.5-1%. Based on Table 3, it shows that the results of the leukocrit percentage of the catfish body are normal, this indicates the fish is in a healthy condition. This is in accordance with the opinion of [3], which states that the leukocrit value of catfish ranges from 1-3%.

Hemoglobin levels

The hemoglobin of catfish reared by photoperiod manipulation and aquaponic system for eight weeks had an effect between treatments, ranging from 8.7-10 g/dL. This shows that stocking density affects metabolic activity and competition in oxygen consumption and space. This is thought to stimulate the formation of new erythrocyte cells. In accordance with the opinion of [9] low oxygen concentration stimulates the formation of new red blood cells into the blood and causes an increase in hemoglobin levels. The amount of hemoglobin in catfish reared by the aquaponics system and photoperiod

manipulation under normal conditions is supported by the intake of catfish food during rearing, where the fish receive sufficient feed nutrition so that the hemoglobin condition of catfish is normal,

The number of erythrocytes and hematocrit can affect hemoglobin levels. The correlation between hemoglobin and hematocrit is that erythrocytes contain Hb, which functions to bind oxygen that is used for catabolic processes so that energy is produced. [10] Stated that an increase in Hb is closely related to an increase in the number of erythrocytes, this condition is caused by an increase in iron content and serum iron concentration in the blood. Hemoglobin determines the level of resistance of the fish's body, because of its close relationship with the binding capacity of oxygen by the blood. The level of hemoglobin in the blood is strongly correlated with the value of the hematocrit. The lower the number of red blood cells, the lower the hemoglobin level in the blood [11]. However, high levels of hemoglobin can help store oxygen and carry out the blood-buffering function in fish.

Leukocyte Differentiation

Calculation of leukocyte differentiation was carried out to see changes in the types of leukocytes that occurred after the catfish were reared by photoperiod manipulation and the aquaponics system for eight weeks. The results of measurements of leukocyte differentiation of catfish during the study were all in normal conditions, which can be seen in Table 3.

Table 3. Measurement Results of Leukocyte Differentiation (%) of Catfish During Rearing

Treatment	Parameter				
	Eosinophils (%)	Lymphocytes (%)	Platelets (%)	Monocytes (%)	Neutrophils (%)
Pre-Treatment	5,7	77,8	5,1	9,1	2,3
NAT K	6,9	76,7	4,9	10,1	1,4
24G K	6,8	76.9	4,6	9,8	1,9
NAT F	7,3	76,3	5,3	9,3	1,8
24G F	6,6	76.9	6,4	7,4	2,7

The range of leukocyte differentiation is still relatively normal. The number of lymphocytes indicates the fish is in good health. [12] Stated that the number of fish lymphocytes ranged from 71.12-82.88%. Moreover, this is in accordance with the opinion of [3] that states that lymphocytes in healthy *P.hypophthalmus* are around 70%. The increase in the number of lymphocytes is related to the emergence of immunity in the body.

During this study, it was known that lymphocytes, monocytes, neutrophils, eosinophil's, and platelets in catfish from all treatments indicated that the catfish looked healthy and there was no infection. According to [13] stated that platelets play an important role in the blood clotting process and function to prevent loss of body fluids due to infection on the body surface. Platelets increase when there is hemorrhage and injury. Platelets are produced to help the blood clotting process so that more bleeding does not occur. An increase in the number of platelets in the fish's blood is an indicator that can be used to suspect that the fish is in the wound healing process.

4. CONCLUSION

The results showed that rearing with the aquaponics system and photoperiod manipulation maintained the health status of the fish, indicated by the normal blood description of the catfish, seen from the total erythrocyte values 1.76-1.85 x106

cells/mm^3, total leukocytes 5.45-5.66 x104 cells/mm^3, hematocrit 21.3 -37.2 %, leukocrit 0.5-1%, and leukocyte differentiation is relatively normal.

Based on the research results, it can be suggested to be able to implement fish rearing with an aquaponic system and photoperiod manipulation.

REFERENCES

1. Setiawan, M.Y., Adriani, M., Murdjani, M. (2015). Pengaruh Fotoperiod Terhadap Aktivitas Pertumbuhan dan Kelangsungan Hidup Ikan Patin Siam (*Pangasianodon hypophthalmus*). *Jurnal Scientiea.* 5(10):27-35
2. Wahap, N., Estim, A., Kian, A.Y.S., Senoo, S., Mustafa, S. (2010). Producing organic fish and mint in an aquaponic system. *Borneo Marine Research Institue*, Sabah, Malaysia, 29-33
3. Lukistyowati, I., Windarti., Siregar, M.R. (2007). *Analisis Hematologi Sebagai Penentu Status Kesehatan Ikan Air Tawar di Pekanbaru*. Lembaga Penelitian Universitas Riau. Pekanbaru. 50 hlm
4. Emu, S. (2010). *Pemanfaatan Garam pada Pengangkutan Sistem Tertutup Benih Ikan Patin (Pangasius sp) Berkepadatan Tinggi dalam Media yang Mengandung Zeolit dan Arang Aktif. Tesis.* Sekolah Pascasarjana. Institut Pertanian Bogor. Bogor. 80 hlm
5. Ginting, K.D., Riauwaty, M., Syawal, H. (2021). Diferensiasi Leukosit Ikan Lele Dumbo (*Clarias gariepinus*) yang diberi Pakan Mengandung Kunyit (*Curcuma domestica* Val.) dan Diinfeksi Bakteri *Aeromonas hydrophila*. *Jurnal Ilmu Perairan (Aquatic Science)*, 9(2): 116-125
6. Maftuch, M., Nursyam, H., Sukarni, S. (2012). Kajian penggunaan Ciprofloxacin terhadap hematologi ikan botia (*Botia macracanthus*, Bleeker) yang diinfeksi bakteri *Aeromonas hydrophila*. *The Journal of Experimental Life Science*, 2(2),pp.65-69. http://dx.doi.org/10.21776/ub.jels.2012.002.02.02
7. Klontz, G.W. (2009). *Fish hematology*. AceLearning Company. California. 243p
8. Nursatia., Sarjito., Haditomo, A.H.C. (2017). Pemberian Ekstrak Bawang Putih dalam Pakan sebagai Imunostimulan terhadap Kelulushidupan dan Profil Darah Ikan Patin (*Pangasius* sp). *Journal of Aquaculture Management and Technology*, 6(3) : 234-241
9. Lavabetha, A.R.R., Hidayaturrahmah., Muhamat., Budi, H.S. (2015). Profil Darah Ikan Timpakul (*Periophthalmodon schlosseri*) dari Muara Sungai Barito Kalimantan Selatan. *Bioscientiae*, 12(1): 78-89
10. Purwanti, S.C., Suminto., Sudaryono, A. (2014). Gambaran Profil Darah Ikan Lele Dumbo (*Clarias gariepinus*) yang Diberi Pakan dengan Kombinasi Pakan Buatan dan Cacing Tanah (*Lumbricus rubellus*). *Journal of Aquaculture Management and Technology*, 3(2): 53-60
11. Lagler, K.F., Bardach, J.E., Miller, R.R., Passiono, D.R. (1977). *Ichtyology*. John Wiley and Sons Inc, New York-London
12. Preanger, C., Utama, I.H., Kardena, I.M. (2016). Gambaran ulas darah ikan lele di Denpasar Bali. *Indonesia Medicus Veterinus*, *5*(2): 96-103.
13. Santoso, B., Basuki, F., Hastuti, S. (2013). Analisa Ketahanan Tubuh Benih Hibrida Nila Larasati (*Oreochromis niloticus*) Generasi 5 (F5) yang Diinfeksi Bakteri *S.Agalactie* dengan Konsentrasi Berbeda. *Journal of Aquaculture Management and Technology*. 2(3): 64-75.