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Hematology of *Osphronemus gouramy* Fed with Turmeric (*Curcuma domestica* Val) and Maggot (*Hermetia illucens*) Enriched Pellets

Hematologi Ikan Gurami (Osphronemus gouramy) yang Diberi Pakan Mengandung Kunyit (Curcuma domestica Val) dan Tepung Maggot (Hermetia illucens)

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Abstract

Osphronemus gouramy is a widely cultivated fish because it has economic value in the community and is high in protein. The addition of turmeric powder and maggot flour can increase the nutritional value of gurami fish feed. The study was conducted from January to May 2025 at the Parasite and Fish Disease Laboratory, Faculty of Fisheries and Marine Sciences, Universitas Riau. The objective of this study was to determine the effect of adding turmeric powder (*Curcuma domestica* Val) and maggot meal (*Hermetia illucens*) to the feed on the hematology of *O. gouramy* infected with *Aeromonas hydrophila*. The method used was an experiment with a completely randomized design with one factor and five treatments, namely Kn (feeding without the addition of maggot meal and turmeric powder without infection with *A. hydrophila*), Kp (feed without maggot meal and turmeric powder, infected with *A. hydrophila*), P1, P2, and P3 (feed with 0.9 g/kg turmeric powder and 20, 30, and 40 g/kg maggot meal, then infected with *A. hydrophila*). Feeding was carried out three times a day to satiation. On day 32, the fish were infected with *A. hydrophilla* at a density of 10^8 CFU/mL, 0.1 ml. The results showed that feed containing 0.9 g/kg turmeric powder and 30 g/kg maggot meal resulted in a total erythrocyte count of 1.91×10^6 cells/mm, hematocrit of 38%, hemoglobin 9.06 g/dL, total leukocytes $11.15x10^4$ cells/mm³, phagocytosis activity 25.66%, absolute weight gain 11.71 g/fish, specific length 5.74 cm, and survival rate 80%. Water quality during the study was as follows: temperature ranging from 27.6-29°C, pH 6.51-7.61, and DO 4.6-5.9 mg/L. Based on the data, it can be concluded that adding turmeric and maggots to pellets can increase the growth and immunity of *O. gouramy* infected with *A. hydrophila*.

Keywords: Hemoglobin, *Motile Aeromonas Septicemia*, *Hermetia illucens*

Abstrak

Gurami merupakan ikan yang banyak dibudidayakan karena memiliki nilai ekonomis di masyarakat dan memiliki kadar protein yang tinggi. Penambahan bubuk kunyit dan tepung maggot dapat meningkatkan nutrisi pakan ikan gurami. Penelitian dilakukan bulan Januari sampai Mei 2025 di Laboratorium Parasit dan Penyakit Ikan Fakultas Perikanan dan Kelautan Universitas Riau. Penelitian ini bertujuan untuk mendapatkan pengaruh penambahan bubuk kunyit (*Curcuma domestica* Val) dan tepung maggot (*Hermetia illucens*) dalam pakan terhadap hematologi gurami dengan diinfeksi *Aeromonas hydrophila*. Metode yang digunakan adalah eksperimen dengan Rancangan Acak Lengkap satu faktor lima perlakuan yaitu Kn (Pemberian pakan tanpa penambahan tepung maggot dan

bubuk kunyit tanpa diinfeksi dengan *A. hydrophila*), Kp (Pemberian pakan tanpa penambahan tepung maggot dan bubuk kunyit diinfeksi *A. hydrophila*), P_1, P_2, dan P_3 pemberian pakan dengan penambahan bubuk kunyit 0,9 g/kg pakan dan tepung maggot 20, 30 dan 40 g/kg pakan, kemudian diinfeksi dengan *A. hydrophila*. Pemberian pakan dilakukan 3 kali sehari secara *ad satiation*. Pada hari ke 32 ikan diinfeksi dengan *A. hydrophila* dengan kepadatan 10^8 CFU/ml sebanyak 0,1 ml. Hasil penelitian menunjukkan bahwa pakan yang mengandung bubuk kunyit 0,9 g/kg dan 30 g/kg tepung maggot, total eritrosit $1{,}91x10^6$ sel/mm, hematokrit 38%, hemoglobin 9,06 g/dL, total leukosit $11{,}15x10^4$ sel/ mm^3, aktivitas fagositosis 25,66%, pertumbuhan bobot mutlak 11,71 g/ekor, panjang spesifik 5,74 cm, kelulushidupan 80%. Kualitas air selama penelitian adalah suhu berkisar antara 27,6-29°C, pH 6,51-7,61, DO 4,6-5,9 mg/l. Dari hasil penelitian dapat disimpulkan penambahan kunyit dan maggot pada pakan mampu meningkatkan pertumbuhan dan imunitas ikan gurami yang terinfeksi *A. hydrophila*

Kata kunci: Hemoglobin, *Motile Aeromonas Septicemia*, *Hermetia illucens*

1. Introduction

Giant gourami are widely farmed because they have economic value in the community and are high in protein. Adding turmeric powder and maggot meal can improve the nutritional content of the giant gourami. The protein content in maggots is quite high at 44.26%, with a fat content of 29.65%, making them an ideal raw material for animal feed (Sulistia & Ambarsari, 2021). *Aeromonas hydrophila*, the cause of MAS (*Motile Aeromonas septicemia*), is often found in freshwater fish farming. Feeding fish with added maggot meal can also improve their growth. In a study conducted by Sepang et al. (2021), feeding a combination of artificial feed (pellets) and maggots resulted in the best FCR value for tilapia, with the addition of maggot meal yielding a value of 1.2 compared to 1.9 for fish fed without maggot meal. Maggots not only have the potential to increase fish growth but also to boost immunity.

An alternative to preventing MAS disease in fish is to increase fish immunity using natural ingredients such as turmeric. Turmeric contains main components such as curcuminoids, polyphenols, and flavonoids. Curcumin has antibacterial properties. This is also supported by Ginting et al. (2021), who stated that turmeric can prevent *A. hydrophila* infection. Feeding dumbo catfish with turmeric at a dose of 0.9 g/kg of feed can prevent *A. hydrophila* infection. Blood tests can indicate the severity of a disease. Haematological studies are important criteria for diagnosing and assessing fish health (Lestari et al., 2017). Based on the above description, it is necessary to conduct haematological research on giant gourami fed a diet containing turmeric (*Curcuma domestica* Val) and maggot flour (*Hermetia illucens*).

2. Material and Method

2.1. Time and Place

This research was conducted from January to May 2025 at the Parasite and Fish Disease Laboratory, Faculty of Fisheries and Marine, Universitas Riau.

2.2. Methods

The method used was a complete randomised design (CRD) experiment with one factor and five treatments, as follows: Negative control (Kn): Feed without the addition of maggot meal and turmeric powder was not tested against *A. hydrophila*. Positive control (Kp): Feed without maggot meal or turmeric powder was tested against *A. hydrophila*. P1 feeding with 20 g/kg of maggot meal added and tested against *A. hydrophila*, P2 feeding with 30 g/kg of maggot meal added and tested against *A. hydrophila*, and P3 feeding with 40 g/kg of maggot meal added and tested against *A. hydrophila*.

2.3. Procedures

2.3.1. Research Container Preparation

The maintenance containers used were 15 units of 40x30x30 cm aquariums, arranged in a completely randomised design (CRD). Before use, the aquariums were cleaned and filled with water, then treated with a 25 ppm $KMnO_4$ solution for 24 hours to eliminate pathogenic microorganisms. The aquariums were then rinsed with water until clean and dried for 24 hours. After cleaning, each aquarium was filled with 30 L of water, allowed to settle, and aerated for 2 days.

2.3.2 Feed Mixing

The test feed components consisted of commercial pellets (pf-999), maggot meal, turmeric powder, and tapioca flour as a binder. The pellets containing turmeric powder and maggot meal were produced using the coating method (Windarti et al., 2022). The first step was to add 20 g of tapioca flour to 50 ml of water at normal temperature, then stir and add 50-75 ml of boiling water until the tapioca flour thickened. Leave it until the tapioca flour returns to normal temperature. Then mix 0.9 g of turmeric powder and maggot flour (P1: 20 g, P2: 30 g, P3: 40 g) into the thickened tapioca flour, stirring until evenly mixed, then mix with the pellets and stir until evenly mixed. After that, dry the feed in the sun until it is dry. While drying, remove any pellet grains that have stuck together by squeezing them apart. The dried pellets can be given directly to the fish or stored in a tightly closed container in a cool, dry place.

2.3.3 Test Fish Maintenance

The test fish were maintained for 46 days in an aquarium with a water volume of 30 L and a stocking density of 10 Giant gourami per litre. During the maintenance period, the fish were fed with feed enriched with turmeric powder and maggots. Feeding was carried out three times a day at 08.00, 13.00, and 18.00 WIB, ad libitum. Every 10 days, the weight and size of the test fish were sampled.

2.3.4 Testing and Blood Collection

The challenge test was conducted on day 32 using *A. hydrophila* at a dose of 0.1 mL/fish. Infection was performed intramuscularly using a 1 mL syringe. After the challenge test, the giant gourami were kept and fed until day 46, at which point clinical symptoms were observed. Blood samples were taken from the test fish three times: at the start of the rearing period, on day 30 of the rearing period, and 14 days post-infection (day 46) with *A. hydrophila*. Before blood collection, the fish were anaesthetised with 0.1 mL/L clove oil and left until unconscious. The syringe and Eppendorf tubes were then rinsed with 10% EDTA. Next, 1 mL of blood was collected from the caudal vein and placed in an Eppendorf tube for blood observation.

2.3.5 Measured Parameters

Measured parameters: clinical symptoms, total erythrocytes, hemoglobin levels, hematocrit values, total leukocytes, phagocytosis activity, absolute weight growth, absolute length growth, survival rate, and water quality

2.4. Data Analysis

Data on clinical symptoms observed in fish were analysed descriptively. Data obtained from the study, including total erythrocytes, hematocrit values, haemoglobin levels, total leukocytes, absolute weight growth, absolute length growth, and survival rate, were presented in tables or graphs. The data obtained were analysed using the Statistical Package for the Social Sciences (SPSS), including Analysis of Variance (ANOVA). If the results showed a significant difference ($P<0.05$), a Newman-Keuls follow-up test was performed to determine differences between treatments.

3. Result and Discussion

3.1. Clinical Symptoms of Giant Gourami (O.gouramy)

The clinical symptoms observed include the morphology and behaviour of the giant gourami. Changes in clinical symptoms in the giant gourami after challenge are shown in Table 1. It can be seen that fish in the Kn treatment did not show any clinical symptoms indicating damage, as they were not infected with *A. hydrophila. In contrast*, in Kp, clinical symptoms were observed more frequently than with other treatments, namely ulcers/sores, protruding eyes, fin rot, and haemorrhaging. Fish in P2 showed clinical symptoms that differed from those in the positive control (Kp), P1, and P3 treatments, namely red rashes (haemorrhages) on the infection sites, frayed tail fins, and exophthalmos. This was because the gurami fish in the P2 treatment had a better immune response than those in the other treatments. This indicates an increase in the immune system of fish originating from the addition of turmeric powder and maggot flour to pellets as gurami fish feed, as indicated by the closure of *A. hydrophila* infection wounds and brighter skin colour. This is due to the presence of curcumin with a concentration of 0.9 g/kg in the feed, which can boost the immune system. This is in line with Safia et al. (2023), who found that turmeric can cure and inhibit *A. hydrophila* in tilapia, as evidenced by cure rates and morphological changes in the fish, with wounds shrinking even several days after infection.

The fish's scars are not visible or are covered. Maggots, as a good source of nutrition, also contain high levels of protein, which is essential for the production of red and white blood cells in fish, thereby enhancing the fish's immune system and growth. This is consistent with Safia et al. (2023), who state that maggots contain high levels of protein and nutrients, which are excellent for accelerating growth and enhancing the fish's immune system.

Table 1. Clinical Symptoms of Giant Gourami after Infection with *A. hydrophila*

Treatment	Movement	Appetite	Body color	Fins	Eyes	Body surface
Kn	Active	Normal	Normal	Normal	Normal	Normal
Kp	Passive	Decreasing	blurred	- Caudal fin scraping -Anal fin scraping	Exophtalmia	- Ulcer injection scar - There is haemorrhaging in the fish's body. - the fish's belly swells
P_1	Passive	Decreasing	blurred	-Caudal fin scraping - Anal fin scraping	Exophtalmia	- Ulcer injection scar - There is a haemorrhage on the body - the fish's belly swells
P_2	Active	Decreasing	blurred	- Caudal fin scraping	Exophtalmia	- There is a haemorrhage on the body
P_3	Active	Decreasing	blurred	- Caudal fin scraping - Anal fin scraping	Exophtalmia	- Ulcer injection scar - There is a haemorrhage on the body

3.2. Erythrocytes

The total erythrocyte count of the giant gourami during the study is shown in Table 2.

Table 2. Total Erythrocytes of Giant gourami (*O. gouramy*)

	Total Erythrocytes (10^6 sel/mm^3)		
Treatment	Day-1	Day- 30	Day - 46
Kn	1,33	1,52 ± 0,35^a	1,54 ± 0,01^b
Kp	1,32	1,53± 0,35^a	1,44 ± 0,03^a
P_1	1,31	1,60 ± 0,02^b	1,64 ± 0,02^b
P_2	1,34	1,85 ± 0,03^d	1,91 ± 0,01^d
P_3	1,30	1,71 ± 0,02^c	1,74 ± 0,01^c

Treatment P2, with the addition of 0.9 g/kg turmeric powder and 30 g/kg maggot meal to the feed, increased the erythrocyte count in giant gourami. The addition of maggot meal to fish feed can increase the total number of erythrocytes in gurami fish because maggots are high in protein. High protein content can support hematopoiesis (blood cell formation), potentially increasing the number of erythrocytes. This is supported by Tirani et al. (2024), who found that feeding tilapia a combination of maggot meal and pellets can increase the total erythrocyte count. The normal erythrocyte count in giant gourami ranges from 1.05 to 3.0 × 10^6 cells/mm^3, according to Susandi et al. (2017). Based on Table 2, the average total erythrocyte count of giant gourami after infection with *A. hydrophila* ranged from 1.44 to 1.91 × 10^6 cells/mm^3. Group P2 had the highest erythrocyte count at 1.91 x 10^6 cells/mm^3, while the lowest was found in the positive control (Kp) at 1.44 x 10^6 cells/mm^3.

3.3. Hematocrit

The results of hematocrit observations on giant gourami during the study are shown in Table 3.

Table 3. Hematocrit Values of Giant gourami (*O. gouramy*)

	Hematocrit (%)		
Treatment	Day - 1	Day - 30	Day - 46
Kn	26,66	31,00 ± 0,00^a	33,33 ± 1,52^b
Kp	27,00	30,66 ± 1,15^a	27,00 ±1,00^a
P1	25,66	33,33 ± 1,52^b	34,00 ± 1,00^b
P2	26,33	36,00 ± 1,00^c	38,00 ±1,00^c
P3	26,00	35,00 ± 0,00^{bc}	36,33 ± 1,15^c

Based on Table 3, the hematocrit at the beginning of maintenance ranged from 25.66% to 27%. After 30 days of maintenance, it increased to 30.66-36.00%. On the 14th day after challenge, it ranged from 27.00 to 38.00%. The lowest hematocrit value after challenge was found in Kp (27.00%), and the highest hematocrit value was found in P2 (38.00%). According to Susandi et al. (2017), the normal erythrocyte count in gurami fish ranges from 1.05 to 3.0 x 10^6 cells/mm^3. The addition of 0.9 g of turmeric powder and 30 g of maggot flour to the pellets in treatment P2 was the optimal dose for increasing the hematocrit of giant gourami infected with A. *hydrophila*. As seen in the positive control (Kp), this bacterial infection can decrease hematocrit due to the fish's response to *A. hydrophila*. The addition of turmeric powder and maggot flour helps the fish overcome this infection more effectively, thereby reducing the decrease in hematocrit that usually occurs. This is in line with the statement by Susandi et al. (2017) that the low hematocrit value is due to the fish being infected with a disease. The addition of turmeric powder can enhance immune response through its antibacterial and anti-inflammatory effects. At the same time, maggot meal provides a high-quality protein source that supports fish growth and maintenance.

3.4. Hemoglobin

The results of giant gourami hemoglobin measurements are shown in Table 4.

Table 4. Hemoglobin Levels in Giant gourami (*O. gouramy*)

Treatment	Hemoglobin (g/dl)		
	Day -1	Day - 30	Day - 46
Kn	5,00	7,53 ± 0,11^{a}	7,80 ± 0,00^{b}
Kp	4,53	7,60 ± 0,20^{a}	7,13 ± 0,30^{a}
P_1	4,86	8,26 ± 0,11^{b}	8,46 ± 0,23^{c}
P_2	4,93	9,03 ± 0,45^{c}	9,06 ± 0,30^{d}
P_3	4,80	8,53 ± 0,11^{b}	8,60 ± 0,20^{c}

Based on Table 4, the initial hemoglobin levels ranged from 4.53 to 5 g/dl, and after 30 days of maintenance, they ranged from 7.53 to 9.03 g/dl. The highest post-treatment haemoglobin level was obtained in treatment P2 at 9.06 g/dL, and the lowest in treatment kp at 7.13 g/dL. According to Jernihtayanti et al. (2025), the haemoglobin levels of giant gourami resistant to *A. hydrophila* ranged from 6.0 to 9.5 g/dL. Curcumin in turmeric has anti-inflammatory and antioxidant properties that can help reduce stress and inflammation in fish. The addition of maggot flour contains protein that is very useful in the haemoglobin formation process, resulting in better treatment outcomes with the addition of turmeric powder and maggot flour compared to the Kp and Kn treatments. Protein is the main component in the formation of red blood cells and haemoglobin. Red blood cell formation requires a supply of nutrients in the form of protein and minerals (Susandi et al., 2017)

3.5. Total Leukocytes

Leukocyte observations conducted during the study are shown in Table 5.

Table 5. Total Leukocytes in Giant gourami (*O. gouramy*)

Treatment	Total Leukocytes (x 10^4 sel/ mm^3)		
	Day- 1	Day- 30	Day- 46
Kn	8,48	8,50 ± 0,12^{a}	8,93 ± 0,14^{a}
Kp	8,52	8,54 ± 0,17^{a}	9,98 ± 0,17^{b}
P_1	8,57	8,79 ± 0,14^{b}	10,45 ± 0,22^{c}
P_2	8,51	9,15 ± 0,10^{c}	11,15 ± 0,05^{d}
P_3	8,43	8,91 ± 0,08^{bc}	10,71 ± 0,08^{c}

Based on Table 5, the highest leukocyte count after challenge was observed in treatment P2 (11.15 x 10^4 cells/mm^3), while the lowest was observed in Kn (8.93 x 10^4 cells/mm^3). According to Susandi et al. (2017), the total leukocyte count in the blood of teleost fish ranges from 20.000 to 150.000 cells/mm^3. There was an increase in treatment P2 because turmeric powder contains the active compound curcumin, which has anti-inflammatory, antioxidant, and immunomodulatory properties. Meanwhile, high-protein maggot meal can increase the nutrients needed by fish to produce white blood cells. The addition of turmeric powder and maggot meal to pellets can affect the total leukocyte count in gurami, which plays a role in the fish's immune system. When a foreign object enters the body, the body sends a signal that triggers the production of large numbers of white blood cells, which are immediately directed to the site of infection to defend the body against disease.

3.6. Phagocytosis Activity

The results of observations of phagocytic activity in giant gourami leukocytes during the study are shown in Table 6.

Table 6. Results of Phagocytosis Activity Observations.

Treatment	Phagocytosis Activity (%)		
	Day- 1	Day- 30	Day- 46
Kn	19,67	21,00 ± 1,00^{a}	21,33 ± 0,57^{b}
Kp	20,33	20,66 ± 0,57^{a}	18,66 ± 0,57^{a}
P_1	20,00	22,66 ± 0,57^{b}	23,00 ± 1,00^{c}
P_2	20,33	24,33 ± 0,57^{c}	25,66 ± 0,57^{d}
P_3	20,67	23,33± 0,57^{bc}	23,66 ± 1,15^{c}

Based on Table 6, the phagocytosis activity of the giant gourami at the beginning of cultivation ranged from 19.67 to 20.67%. On the 30th day of cultivation, the phagocytosis activity of the giant gourami ranged from 20.66 to 24.33%. The phagocytosis activity of giant gourami after exposure to *A. hydrophila* ranged from 18.66 to 25.66%, with the lowest being in the Kp treatment (18.66%) and the highest in the P2 treatment (25.66%). In the Kp treatment, the number of cells performing phagocytosis decreased, whereas in the P1, P2, and P3 treatments, it increased. The addition of turmeric can repair damaged cells, support immune system function, and increase

direct phagocytosis of bacteria, while maggot flour provides protein that supports white blood cell production. The addition of turmeric powder and maggot flour can increase the number of phagocytic cells and enhance phagocytosis, enabling fish to fight *A. hydrophila* infection more effectively. Turmeric contains chemical compounds with antiseptic and antibacterial properties, including tannins, flavonoids, alkaloids, saponins, and curcuminoids (Susandi et al., 2017).

3.7. Absolute Weight Growth of Giant gourami (O. gouramy)

The results of the observations on the absolute weight growth of giant gourami during the study are shown in Table 7.

Table 7. Average Absolute Weight of Giant gourami (*O. gouramy*)

Treatment	Start (g)	End (g)	Absolute weight (g/fish)
Kn	4,23	13,39	$9,15 \pm 0,28^{a}$
Kp	4,22	12,90	$8,68 \pm 0,90^{a}$
P_1	4,32	14,85	$10,52 \pm 0,14^{b}$
P_2	4,24	15,95	$11,71 \pm 0,06^{c}$
P_3	4,23	15,11	$10,88 \pm 0,26^{b}$

The highest absolute weight gain during the study was observed in treatment P2 (11.71 g), and the lowest in Kp (8.68). This is because feeding fish with turmeric and maggot flour can increase their appetite and nutrient absorption. The increase in appetite is triggered by active compounds in turmeric extract, which can stimulate the activity of digestive enzymes involved in nutrient and other food substance absorption. Individual growth can occur when the body uses excess energy and protein from food for basic metabolism, movement, body maintenance, and the replacement of damaged cells (Santika et al., 2021). Fish growth is closely related to the availability of protein in feed, because protein is a nutrient that is very much needed by fish for growth (Syahputra et al., 2019).

3.8. Specific Length Growth of Giant gourami (O. gouramy)

The results of the absolute length measurements of the giant gourami during maintenance are shown in Table 8.

Table 8. Average Specific Length of Giant gourami (*O. gouramy*)

Treatment	Start (g)	End (g)	Specific length (cm/fish)
Kn	6,67	10,29	$3,62 \pm 0,22^{a}$
Kp	6,49	9,93	$3,43 \pm 0,40^{a}$
P_1	6,43	10,94	$4,50 \pm 0,13^{b}$
P_2	6,61	12,35	$5,74 \pm 0,39^{c}$
P_3	6,41	11,39	$4,98 \pm 0,92^{b}$

The highest specific length growth during the study was observed in P2 (5.74 cm), and the lowest in Kp (3.43 cm). This is because feeding fish with turmeric and maggot flour can increase their appetite and nutrient absorption from pellets. The increase in appetite is triggered by active compounds in turmeric extract that stimulate digestive enzyme activity, helping absorb nutrients and other food substances (Santika et al., 2021). The nutritional content of the feed greatly influences fish length growth. This is in line with Agustin et al. (2022), who found that fish growth is related to the availability of feed containing high protein, as protein is essential for growth.

3.9. Water Quality

Water quality affects fish health when conditions are unsuitable. The range of water quality for the giant gourami during the study is shown in Table 9.

Table 9. Water Quality for Giant gourami (*O. gouramy*)

Parameters	Start	End	Quality Standards *
Suhu(°C)	27,6-29	27,9-29	25-30
pH	6,51-7,93	6,85-7,61	6-8
DO(mg/L)	4,6-5,9	4,6-5,5	3-6

Description: *(Kristiyanto et al., 2023)

The water quality obtained during the study was ideal for maintaining giant gourami at 27.6-29°C, pH 6.51-7.93, and DO 4.6-5.9. DO is the amount of oxygen dissolved in water that can be utilized by farmed fish, one of which is the giant gourami. Good water quality enhances the gurami's resistance to bacterial attacks. The optimal conditions for gurami fish water quality parameters are 25-30°C, pH 6-8, and dissolved oxygen 3-6 ppm (Kristiyanto et al., 2023).

3.10. Survival Rate of Giant gourami (O. gouramy)

The survival rate of the giant gourami during 46 days of cultivation can be seen in Figure 1

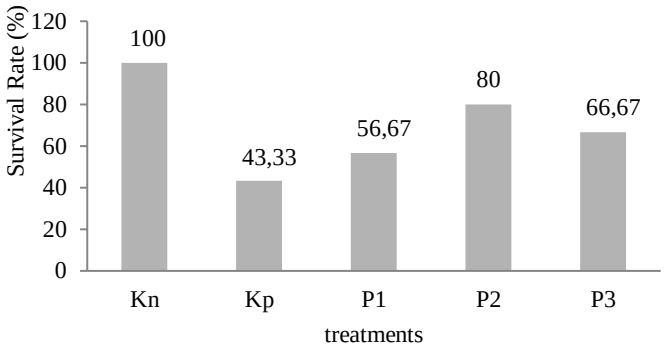

Figure 1. Survival rate

The survival rate of giant gourami during the challenge test was obtained at Kn (100%). This was because in the Kn treatment, the fish were not challenged by *A. hydrophila*. Judging from the survival rate of giant gourami in P1, P2, and P3, it was classified as good. This aligns with Lesmana et al. (2021), which states that a survival rate of ≥ 50% is considered good, 30-50% moderate, and < 30% poor. The highest survival rate for giant gourami was observed in P2, at 80%. Maggot flour and turmeric powder have properties that can boost fish immunity and improve their survival after infection with *A. hydrophila*. Pellets supplemented with maggot meal are rich in protein and nutrients that can boost the strength of the fish's immune system. The protein in maggot meal helps increase the production of white blood cells (leukocytes), which function to fight bacterial infections. Therefore, adding turmeric powder and maggot meal to fish feed can reduce the negative effects of *A. hydrophila* infection, thereby increasing gurami survival.

4. Conclusions

Based on the results of the study, it can be concluded that adding turmeric powder and maggot flour to the feed affects the hematology of giant gourami (*O. gouramy*) before and after challenge with *A. hydrophila*. The best results were obtained with treatment P2, which showed a total erythrocyte count of 1.91 x 10^6 cells/mm^3, a hematocrit of 38.00%, a hemoglobin level of 9.06 g/dL, a total leukocyte count of 11.15 x 10^4 cells/mm^3, and a phagocytosis activity of 25.66%. absolute weight gain of 11.71 g/fish, specific length gain of 5.74 cm, and survival rate of 80%. Water quality during the study was as follows: temperature ranged from 27.6 to 29°C, pH ranged from 6.51 to 7.61, and dissolved oxygen (DO) ranged from 54.6 to 5.9 mg/L.

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