Bambang Hartoyo et al./Animal Production. 25 (3): 165-170, 2023
Accredited by Kemendikbudristek Dirjendiktiristek No 225/E/KPT/2022. E-ISSN 2541-5875

Enhancing Blood Profile and Performance of Broiler Chickens with Biopeptide from Chicken Feet

Bambang Hartoyo* Titin Widyastuti, Sri Rahayu, R. Singgih Sugeng Santoso

Faculty of Animal Science, Jenderal Soedirman University, Purwokerto, Indonesia
***Corresponding author email: bambang.hartoyo@unsoed.ac.id**

Abstract. Feed manipulation by feeding additives aimed to produce safety and healthy livestock product. Bioactive peptide from chicken feet as one of solution to increase immune function without give any effect to host. This study aimed to evaluate addition of biopeptide from chicken feet to blood profile and performance of broiler. Two hundred one-day-old commercial broiler chicken and assigned to four treatments (0, 2, 4, and 6 %) with ad libitum water during research to evaluate treatment to parameter tested such as feed consumption, weight gain, leucocyte, lymphocyte, erythrocyte and monocyte. Five replication and ten trial unit of broiler used. Addition biopeptide from chicken feet until 6 % did not give any effect ($p>0.05$) to feed consumption, but there was significant ($p<0.05$) effect on daily weight gain, statistically. Meanwhile, 40 % dosage of biopeptide from chicken feet increased ($p<0.05$) quantity of lymphocyte of broiler. It is concluded that the addition of biopeptide enhanced immune of broiler without give any negative effect of broiler performance

Keywords: feed additive, immune, performance, lymphocyte, bioactive peptide

Abstrak. Manipulasi pakan dengan penambahan pakan aditif bertujuan untuk menghasilkan produk peternakan yang sehat dan aman untuk dikonsumsi. Salah satu solusi yang ditawarkan untuk meningkatkan fungsi imun tanpa memberikan efek negatif pada ternak adalah penggunaan bioaktif peptida asal ceker. Penelitian ini bertujuan untuk mengevaluasi penambahan biopeptide asal ceker sebagai pakan aditif terhadap profil darah dan performa pada broiler. Sebanyak 200 ekor ayam broiler dan terbagi menjadi empat perlakuan (0, 2, 4 dan 6 %) dengan perlakuan minum ad libitum selama masa percobaan seperti konsumsi, pertambahan bobot badan, leukosit, limfosit, eritrosit dan monosit. Lima ulangan dengan masing-masing 10-unit percobaan digunakan. Penambahan biopeptide asal ceker ayam hingga 6 % tidak memberikan ($p>0.05$) efek negatif pada konsumsi namun berdampak signifikan ($p<0.05$) terhadap penambahan bobot badan secara statistik serta penambahan sebanyak 4 % mampu meningkatkan ($p<0.05$) jumlah limfosit pada ayam broiler. Disimpulkan bahwa penambahan penambahan biopeptide meningkatkan fungsi imun pada broiler tanpa memberikan efek negatif pada performa.

Kata kunci: Silase daun salak, pakan komplit, kecernaan, karakteristik fermentasi, in vitro

Introduction

Pandemic is a condition where all elements of society and the government must comply with health protocol rules to avoid the spread of the covid 19 outbreak. The most important prevention is maintaining health, specially building the body's immune system by one way to consume healthy and quality food that can fulfilled from livestock products such as meat, milk and eggs. Meat, milk and eggs contain essential amino acids which are very necessary for the metabolism of the body's immune system, but these products are very susceptible to damage both physically, chemically and biologically. Technology is needed to maintain product safety in terms of upstream (on farm) and downstream (market).

On-farm technology is technology of feeding manipulation with the addition of feed additives given with the aim of producing livestock products that are safe and healthy for consumption. One of the solutions offered is the use of bioactive peptides (biopeptides) which have the function of maintaining the livestock immune system which can be seen in other substances like phytochemical (Prihambodo et al, 2021) and probiotic and its derivates (Hartoyo et al. 2023). Bioactive peptides are specific protein fragments that have a positive impact on body function and condition (1) Functional properties associated with the system circulatory system (cardiovascular system),

nervous system (nervous system), digestive system (gastrointestinal system) and immune system (2) Bioactive peptides are being developed at this time because they are relatively safer and can be tolerated by the body, function as antioxidants and antibacterial.

Addition of bioactive peptides in feed causes healthy livestock and increase their immune system. Bioactive peptide is reported to have biological activity as antihypertensive, antioxidant, antibacterial, antithrombotic and immunomodulatory compounds (Murray & Fitzgerald, 2007). Chicken feet are mainly composed of skin and bone tissue which contains large amounts of collagen, the collagen contained in chicken claws is 12.08%. Collagen is an important protein mainly formed by the amino acid, glycine (33%), proline and hydroxyproline (22%) in the form of a triple alpha-helix formed by three chains. Hydrolysis of collagen produces smaller gelatin proteins, and further hydrolysis of gelatin produces small peptides (3-6 kDa) which are soluble and have antioxidant and antimicrobial activity. Bioactive peptides produced from claw collagen and added to rations can improve livestock performance such as increasing the immune system and reducing the population of pathogenic bacteria. This study aimed to evaluate addition of biopeptide from chicken feed to blood profile and performance of broiler.

Materials and Methods

Experimental Design and Treatment

200-day-old commercial broiler chickens without sexes were divided into 4 groups, each with 21 broilers. Bioactive peptide obtained from chicken feet by extraction method. Buffer tris and papain enzyme were added and mixed by rice bran and sterilized. Experimental diet divided into four treatments with the following treatments: P0, basal diet; P1, basal diet + 2% of chicken feet (CF); P2, basal diet + 4% of CF and P3, basal diet + 6% of CF. Feed with average protein and energy were 23.18 % and 2964 kcal kg^{-1}, respectively. Feed formulation during research can be seen in Table 1.

Performance Measurement

Feed consumption was measured daily by calculate the residual feed. Body weight was measured weekly

Table 1. Basal diet formula and calculated diet analysis fed to broiler

Feed Material	P0 (%)	P1 (%)	P2 (%)	P3 (%)
Maize	42	41.18	40.38	39.62
Rice bran	21	20.59	20.19	19.81
Soybean meal	23	22.55	22.12	21.70
Fish meal	10	9.76	9.47	9.43
Oil	3	2.94	2.88	2.83
Mineral mix	0.8	0.78	0.77	0.75
Lysin	0.1	0.10	0.10	0.09
Metionin	0.1	0.10	0.10	0.09
Biopeptide	0	2	4	6
Total	100	100	100	100
Nutrient Composition				
Crude protein, %	22.76	23.04	23.32	23.60
Metabolic energy, kcal kg^{-1}	2969	2963	2963	2963
Fat, %	6.87	7.15	7.42	7.70
Crude Fiber, %	5.84	6.20	6.57	6.93
Calcium, %	0.72	0.88	0.88	0.88
Phosphor, %	0.56	0.64	0.64	0.64
Lysine, %	1.18	1.32	1.32	1.32
Methionine, %	0.39	0.59	0.59	0.59

Blood Profile Measurement

Blood samples were taken to prepare the serum and plasma in the proper tubes, and on day 35, EDTA-blood samples were utilized to analyse the leucocyte, lymphocyte, erythrocyte, and monocyte population

Statistical Analysis and Model

Five replications of each of the four treatments were done using a random complete block design. The analysis of variance (ANOVA) was used to analyse the data. When performing the Tukey test, differences in measurement means reveal substantial differences in the analysis.

Results and Discussion

The results showed that treatment had a significant (P<0.05) effect on average daily gain with no significant effect (P>0.05) on feed consumption. The average results of the research can be seen in Table 2, which shows that biopeptide supplementation from chicken feet can improve the performance of broiler chickens. Feed consumption is relatively the same, and it can be said that supplementation of biopeptides from chicken claws can enhance nutrient absorption, resulting in better performance.

Relatively the same amounts of feed consumption in broiler chickens given biopeptides from chicken feet according to Karimzadeh et al. (2016) with the addition of biopeptides will result in relatively the same feed consumption quantity. Feed consumption is closely related to broiler body weight gain, the increase in feed consumption will be accompanied by an increase in body weight of chickens. This is consistent with Nugraha et al. (2017) that feed consumption greatly affects body weight gain, if feed consumption is disrupted, the growth of broiler chickens will also be disrupted.

Osho et al., (2019) reported that the higher the percentage of biopeptide supplementation, the higher the body weight growth of broiler chickens. The composition of protein and energy has increased with each increase in the percentage of biopeptide supplementation. Based on the results obtained, it proves that the better the balance of protein and energy, the better the performance of the chickens. This is in accordance with the opinion of Triawan et al., (2013) that the factors that influence body weight gain are gender, strain, environmental conditions, and the balance between protein and energy consumed.

According to Herlina et al., (2015) that broiler chickens will show a good growth rate if supported by a ration that contains all the nutrients needed by broiler chickens to produce according to their age and body size. Biopeptides derived from chicken claws have a role as antioxidants and antimicrobials in the body of chickens. According to Has et al., (2020) that body weight gain of broiler is strongly influenced by feed consumption and optimization of nutrient absorption in the digestive tract. Optimal body weight gain will lower the feed conversion value or FCR.

Table 2. Effect of biopeptide from chicken feet on performance broiler

Treatments	Feed consumption (g d^{-1})	Daily body weight (g $bird^{-1}$ d^{-1})
P0	2383.86	37.08^{b}
P1	2376.08	37.34^{ab}
P2	2398.12	35.90^{b}
P3	2379.83	42.22^{a}

$^{a-b}$Means within the same column with different superscripts differ (p<0.05); P0, basal diet; P1, basal diet + 2%; P2, basal diet + 4% and P3, basal diet + 6%

Table 3. Effect of biopeptide from chicken feet on blood profile of broiler

Treatments	Leucocyte (10^3 µL^{-1})	Lymphocyte (%)	Erythrocyte (%)	Monocyte (%)
P0	20.80	32.60^{ab}	1.99	3.60
P1	13.38	27.60^{b}	2.05	2.40
P2	14.24	33.80^{a}	1.88	2.40
P3	17.60	28.80^{ab}	1.72	2.40

$^{a-b}$Means within the same column with different superscripts differ ($p<0.05$); P0, basal diet; P1, basal diet + 2%; P2, basal diet + 4% and P3, basal diet + 6%

Isroli et al. (2009) stated that to determine the level of immunity can be seen from the blood variables in the form of leukocytes and complete leukocyte differential. According to Frandson (1992), blood is a parameter that reflects the physiological condition of livestock. The results of the analysis of variance (Table 3) showed that the claw collagen peptide supplementation had no significant effect on the number of leukocytes and monocytes, but had a significant effect on the number of lymphocytes. This shows that the number of lymphocytes formed is influenced by the presence of biopeptide supplementation. Treatment R2 (4% supplementation) showed the highest number of lymphocytes among other treatments. The results showed that the average number of leukocytes ranged from 13.38 ± 0.99 (10 3 /µL) to 20.08 ± 5.37 (10 3 /µL), lymphocytes ranged from 27.6 ± 16.3% to with 33.8 ± 6.7%, monocytes ranged from 2.4 ± 0.8% to 3.6 ± 2.8%.

Leukocytes are blood cells that protect the body against disease germs that attack the body by means of phagocytes, producing antibodies. Leukocytes consist of lymphocytes, monocytes, basophils, neutrophils/heterophiles, and eosinophils. Changes in the number of leukocytes in the blood circulation can be interpreted as the emergence of disease agents, inflammation, autoimmune diseases, or allergic reactions (Lestari et al., 2013). Normal leukocyte counts in broiler chickens are in the range of 12 – 30 × 10^3 /ml (Arfah, 2015). Leukocytes are one of the indicators used to determine the health status of livestock. This is in accordance with the opinion of Sugiaharto (2014) that leukocytes, white blood cells, and their differentiation are one of the indicators generally used to indicate the health status of livestock, including broiler chickens. According to Lestari et al. (2013), factors that determine the number of leukocytes include genetic factors and environmental factors, namely the presence of infection and feed. An increase and decrease in the number of leukocytes in the blood is a mechanism for the body's response to invading pathogens (Sjofjan et al., 2020). The number of erythrocytes in chickens ranges from 2.50 to 3.20 x 10^6 /mL, while the normal number of leukocytes is around 7,000-32,000/µL (Coles, 2006). Erythrocyte levels in the study were not too much different or relatively the same. Relatively the same results indicate that broiler chickens still have the ability to properly bind oxygen in the blood. This is in accordance with the opinion of Mahmud et al (2017) that hemoglobin levels have relatively the same value, indicating the ability of chickens to bind oxygen in the blood is still functioning properly. Normal hematology is expected to produce good meat performance and quality.

According to Mangkoewidjojo and Smith (1988) broiler chickens have normal erythrocyte levels ranging from 2.0 to 3.2 million/µl. This statement was reinforced by Zhang et al., (2007) who reported that broiler red blood cells in the lowlands (altitude 100 m) were 1.77 million/µL, lower than in the highlands (altitude 2900 m) which was 2 .86 million/µL. One of the factors that can make the number of erythrocytes in broiler chickens different is nutrient intake. This is in accordance with the opinion of Piliang and Djojosoebagio (2006) that intake of feed nutrients will affect the number of erythrocytes in the blood. According to Alfian et al (2017) that

the number of erythrocytes can vary based on feed, age, rearing patterns, environmental temperature, altitude, and climatic factors.

Other observed blood profiles were lymphocytes, monocytes, and total plasma protein in broiler chickens supplemented with biopeptides. Lymphocytes are an indicator parameter of heat stress in animals (Boonstra, 2004). According to Mahmud et al., (2017) normal levels of heterophils, eosinophils, basophils and lymphocytes indicate the process of formation of each type of leukocytes is running normally and the chickens are in healthy condition. Observation of blood profile to determine the existing immune system in broiler chickens. According to Sasmito (2017) the immune system (immunomodulator) in broilers is divided into three, namely as immunostimulants (boosting the immune system), immunorestoration (improving the immune system), and immunosuppressants (suppressing the immune system). According to Sismanto (2007) the normal number of monocytes ranges from 3 – 5% of the total leukocytes in the blood, explained by Harahap (2014) that monocytes are the second line of defense against infection, while a decrease in monocytes below the normal range can be caused by eating stress.

Conclusions

Addition of biopeptide enhanced immune of broiler without give any negative effect of broiler performance.

References

Alfian, Dasrul and Azhar. 2017. Total of Erythrocytes, Hemoglobin Levels, and Hematocrit Value of Bangkok Chicken, Kampung Chicken and Crossbreeding Chicken. JIMVET. 1(3), 533–539.

Boonstra R. 2004. Coping with Changing Northern Environments: The Role of The Stress Axis in Birds and Mammals. Integr. Comp Biol. 44: 95-108.

Coles BH. 2006. Essential of Avian Medicine and Surgery. Iowa. Blackwell Publishing

Harahap, RA. 2014. Profil Darah Ayam Broiler Periode Finisher yang Diberi Pakan Plus Formula Herbal. Institut Pertanian Bogor. Bogor.

Hartoyo, B., TR Prihambodo, Wahyuningsih, S Rahayu, FM Suhartati, M Bata, EA Rimbawanto. 2023. Lactobacillus as Growth Promoter: a Meta-Analysis of Performance, Histology and Microbiota on Broiler Tract Digestive. Advances in Animal and Veterinary Science. 11(6): 919-927.

Has, H., A Napirah, W Kurniawan, LO Nafiu and T. Saili. 2020. Utilitas Asam Organic Sari Belimbing Wuluh dan Asam Sitrat Sintetis sebagai Acidifier terhadap Performa Produksi Puyuh (*Coturnix japonica*) Fase Grower. Jurnal Ilmu dan Teknologi Peternakan Tropis. 7(2): 133-137

Herlina, B, R Novita and T. Karyono. 2015. Pengaruh Jenis dan Waktu Pemberian Ransum terhadap Performans Pertumbuhan dan Produksi Ayam Broiler. Jurnal Sains Peternakan Indonesia. 10 (2): 107 – 113

Isroli, S Susanti, E Widiastuti, T Yudiarti and Sugiharto. 2009. Observasi Beberapa Variabel Hematologis Ayam Kedu pada Pemeliharaan Intensif. Prosiding Seminar Nasional Kebangkitan Peternakan. Hal: 548-557

Lestari, S.H.A., Ismoyowati, dan M Indradji. 2013. Kajian Jumlah Leukosit dan Diferensial Leukosit pada Berbagai Jenis Itik Lokal Betina yang Pakannya Disuplementasi Probiotik. J. Ilmiah Peternakan 1 (2): 699-709.

Mangkoewidjojo, S. and JB Smith. 1988. Pemeliharaan, Pembiakan, dan Penggunaan Hewan Percobaan di Daerah Tropis. Jakarta: Universitas Indonesia.

Murray, B.A. and RJ FitzGerald. 2007. Angiotensin Converting Enzyme Inhibitory Peptides Derived from Food Proteins: Biochemistry, Bioactivity and Production. Current Pharmaceutical Design, 13(8), pp.773-791.

Nugraha, Y.A., N Khoirun, N Nikmah, FM Amrullah, dan DW Harjanti. 2017. Pertambahan Bobot Badan dan Feed Conversion Rate Ayam Broiler yang Dipelihara Menggunakan desinfektan Herbal. J. Ilmu-Ilmu Peternakan 27(2):19-24.

Osho, S.O., WW Xiao, and O Adeola. 2019. Response of broiler chickens to dietary soybean bioactive peptide and coccidia challenge. Poultry Science Association Inc : 5669- 5678

Piliang, W., and S Djojosoebagio. 2006. Fisiologi Nutrisi. Bogor: Institut Pertanian Bogor Press.

Prihambodo, T. R., MM Sholikin, N Qomariyah, A Jayanegara, I Batubara, DB Utomo, Nahrowi. 2021. Effect of Dietary Flavonoids on Performance, Blood Constituents, Carcass Composition and Small Intestine Morphology of Broiler: a Meta-Analysisi. Animal Bioscience.

34(3): 434-442. https://doi.org/10.5713/ajas/20.0379.

Sasmito, E. 2017. Imunomodulator Bahan Alami. Rapha Publishing. Yogyakarta

Sjofjan, O., DN Adli, and AF Muflikhien. 2020. Concept Replacing Feeding of Rice Bran on Hybrid Duck with Hump Flour on Carcass Percentage, Internal Organ and Abdominal Fat. Jurnal Nutrisi Ternak Tropis Dan Ilmu Pakan, 2(2).

Sugiharto, S. 2014. Role of Nutraceuticals in Gut Health and Growth Performance of Poultry. J. Saudi Soc. Agric. Sci. Hal: 1-13.

Zhang, H., CX Wu, Y Chamba and Y Ling. 2007. Blood Characteristics for High Altitude Adaptation in Tibetan Chickens. Poultry Science. 86(7).