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Hematological Parameters in Broiler Chicken Consumed Lauric Acid and Feed Fiber

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ABSTRACT

Livestock productivity cannot be separated from their physiological status. Hematological tests are not only used to diagnose diseases in livestock but can be used to monitor health. Besides that, hematological parameters can also be used to as[18]s stress levels by nutritional factors and become important information for the immune status of this livestock. The purpose of this study was to determine the effect of lauric acid and dietary fiber in the ration on hematological parameters. This research was conducted on 360 unsex broiler chickens which were divided into 36 experimental units. The study design followed a completely randomized design with a factorial pattern. Lauric acid (LA) was applied with different levels consisting of 1.30[11](A1); 1.95% (A2), and 2.6% (A3). While, crude fiber in the ration was also applied with different level consisting of 5% (B1), 6% (B2), 7% (B3), and 8% (B4). Each experimental unit was repeated 3 times. Blood samples were taken at the age of 35 days for the measurement of erythrocytes, hemoglobin concentration, hematocrit, leukocytes, and indices erythrocytes. General linear model on Minitab (version 19) was used to analysis of diversity on the data obtained. Tukey simultaneous test (HSD) was tested a difference between treatments means, and the significance was evaluated at the leve[22] P<0.01 and P<0.05. The results showed that different levels of lauric acid and crude fiber on ration had no effect (P>0.05) on hemoglobin concentration (Hb). Meanwhile, and packed cell volume (PCV). erythrocytes, leukocytes, and indices of erythrocytes showed s[2]nificant differences. Although there were differences between treatments, they were still within the normal range for chickens. The results of this study indicate that the use of lauric acid and fiber in the ration did not affect the health of the chickens.

Keywords: *Lauric acid, Broiler chicken, Feed fiber, Hematological parameters,*

1. INTRODUCTION

The production of animal is determined by its physiological status. Animals' hematological profiles may reveal information about their production potential. Hematological examination is used to monitor livestock health and to determine stress levels depending on dietary parameters, in addition to diagnosing disease. This is crucial information for determining the immune status of livestock. Normally, genotype, age, physiological conditions, sex, nutrition, micro and macro climatic conditions, maintenance methods, and pathological factors influence the value of blood contents [1,2]. In clinical research, significant changes in these indicators are utilized to make conclusions.

Antibiotic growth promoters have been used sparingly in the Indonesian chicken farming industry. Searching for natural compounds that provide almost the same function is one of the strategic strategies to anticipate this. The addition of lauric acid (LA) combined with fiber to broiler chicken feed is designed to improve performance. A suitable combination for producing broiler chicken feed is LA as an organic acid alternative for antibiotic growth boosters and feed fiber to help nourish the digestive tract [3]. Organic acids, commonly known as acidifiers, are naturally occurring acids that have been employed as feed preservatives to prevent bacterial and fungal contamination. Crude fiber is an important food element in poultry rations because it stimulates the peristaltic activity of the digestive tract, ensuring that food substances are properly digested. Although research on broiler chicken performance has yielded positive results, physiological indicators, particularly hematological testing, must be understood.

2. MATERIAL AND METHODS

2.1. Material

This research was conducted on 360 unsex broiler chickens which were divided into 36 experimental units. Broiler chicks were randomly distributed into twelve dietary treatments having three replications with ten chicks per replicate. The level of LA was equivalent with application coconut oil in feed that is 3%, based on lauric acid content. The LA used on this study was pure (99.5%) produced by Sinar Mas (Sinar FA 1299). Nutrient content of the diet as fed basis presented on Table 1. The ration was arranged at an energy level of 3100-3200 kcal kg^{-1} with a crude protein of 20%. Each treatment was given diet from 14 to 35 day of age during the experimental period. Ration and drinking water were provided *ad libitum*. The feed ingredients that make up the ration consist of: yellow corn, rice bran, soybean meal, fish meal, meat and bone meal bone meal), commercial feed BR-21F, CaCO3, vitamin-mineral mix (from PT Trouw nutrition), DL-methionine, and NaCl.

2.2. Methods

2.2.1. General

The study design followed a completely randomized design with a factorial pattern. The use of LA were applied in different levels consisting of 1.30% (A1), 1.95% (A2), and 2.6% (A3). While crude fiber in ration was applied in different levels consisting of 5% (B1), 6% (B2), 7% (B3), and 8% (B4). Each experimental unit was repeated 3 times. Blood samples were taken at the age of 35 days for the measurement of erythrocytes (red blood cell, RBC), hemoglobin concentration, hematocrit, leukocytes (white blood cell, WBC), and indices erythrocytes. At the end of the experiment, the birds were fasted for 8 h and their blood was taken for hematological analysis. Blood samples were taken from two chickens for each experimental unit used. Hematological data was collected using a 3 mL disposable syringe, through the jugular vein in chicken wing and then immediately transferred to 72 sterile test tubes containing the anticoagulant ethylene diamine tetra acetic acid (EDTA).

2.2.2. Parameters Measured

Measurement of Hb parameters using complete reagent kit (Merckotest®), parameters packed cell volume (PCV) using Micro-Capillary Reader (USA). Measurement of RBC, and WBC performed using a hemocytometer. Determination of mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) values calculated using PCV, hemoglobin and values erythrocytes. The MCV value was obtained by dividing hematocrit percentage multiplied with 10 of the RBC number, while the MCHC obtained by dividing the hemoglobin concentration by hematocrit percentage.

2.2.3. Statistics

General linear model on Minitab (version 19) was used to analysis of diversity on the data obtained. Tukey simultaneous test (HSD) was tested a difference between treatments means, and the significance was evaluated at the level of $P<0.01$ and $P<0.05$.

3. RESULT AND DISCUSSION

Table 2 shows the average hematological value of experimental chickens. WBC, PCV, RBC, and erythrocyte index were all altered by LA and dietary fiber levels. The real interaction is indicated by these parameters. There was no significantly difference in Hb concentration. Hb levels in broiler chicks ranged from 9.23 to 10.53 g/100mL in this investigation. This range of levels falls within the range of chicken standard, which is 7.0–13.0 g/100mL [4]. The difference in Hb levels in this study is assumed to be attributable to factors that can affect it in similar situations.

Table 1. Nutrient contents of diets as fed basis

Item	A1 B1	A1 B1	A1 B1	A1 B1	A2 B2	A2 B2	A2 B2	A2 B2	A3 B3	A3 B3	A3 B3	A3 B3
Nutrient content												
ME (Kcal/kg)	3125	3157	3159	3125	3287	3169	3148	3205	3207	3200	3171	3219
CP (%)	20.4	20.3	20.1	20.5	20.5	19.9	20.3	20.3	20.2	19.9	20.4	19.5
EE (%)	5.8	5.9	5.9	6.0	6.7	6.6	6.5	8.0	7.1	7.2	7.2	8.0
CF (%)	5.1	6.3	7.2	8.1	5.1	6.2	7.2	8.2	5.1	6.2	7.2	8.1

ME: Metabolizable energy; CP: Crude protein; EE: Extract ether; CF: Crude fiber, 1 Premix supplied the following per ton of diet: iron 40 mg, Copper 26.16 mg, Zinc 40 mg, Manganese 44 mg; Selenium 0.08 mg, Cobalt 0.08 mg, Iodine 0.52 mg, Vit 12500 IU, Vit D3 35000 IU, Vit E 25 IU, Vit K3 4 mg, Vit B1 4 mg, Vit B2 8 mg, Vit B6 20 mg, Vit B12 50 mcg, Pantothenic acid 15 mg, Niacin 50 mg, Biotin 125 mcg, Calcuim D-pantothenate 16.30 mg, Folic acid 1 mg.

Table 2. Average of hematological value of broiler chicken consumed lauric acid and feed fiber

Parameters	Level LA (%)	Level of crude fiber (%)				Average
		5	6	7	8	
PVC	1.3	31.67±1.95	30.00±1.00	31.33±1.15	29.00±1.00	30.50±1.23
	1.95	30.33±2.18	29.67±0.58	33.67±3.51	28.33±1.15	30.50±2.27
	2.6	32.50±1.80	30.17±0.76	30.33±1.15	30.00±1.00	30.75±1.17
	Average	31.50±1.90^{A}	29.94±0.28^{AB}	31.78±1.17^{A}	29.11±0.80^{B}	
Hb (g/100mL)	1.3	9.35±1.64	9.23±0.38	9.83±0.91	9.43±0.21	9.51±0.25
	1.95	9.40±0.53	9.53±0.12	9.70±0.26	9.67±0.76	9.58±0.14
	2.6	10.53±0.12	10.23±0.74	9.33±0.12	9.43±0.38	9.88±0.59
	Average	9.82±0.62	9.67±0.51	9.62±0.26	9.51±0.10	
WBC (10^3/mm^3)	1.3	31.60±2.33^{B}	20.10±3.16^{BC}	22.06±1.45^{B}	19.57±0.06^{BC}	20.83±1.18
	1.95	21.22±1.29^{BC}	26.82±2.39^{A}	22.54±1.16^{AB}	18.21±0.49^{BC}	22.20±3.58
	2.6	19.69±1.19^{BC}	18.64±0.93^{BC}	16.97±1.73^{C}	17.13±0.94^{C}	18.11±1.29
	Average	20.84±1.01	21.84±4.36	20.52±3.08	18.31±1.22	
RBC (10^3/mm^3)	1.3	2.73±0.19^{A}	2.00±0.10^{B}	2.75±0.05^{A}	2.96±0.56^{A}	2.61±0.42
	1.95	2.34±0.14^{AB}	2.32±0.22^{AB}	2.83±0.16^{A}	2.48±0.24^{AB}	2.50±0.24
	2.6	2.43±0.27^{AB}	2.33±0.16^{AB}	2.73±0.18^{A}	2.06±0.32^{B}	2.39±0.28
	Average	2.50±0.21	2.22±0.18	2.77±0.05	2.50±0.45	
MCV (fl)	1.3	116.06±1.32^{BCD}	149.98±8.33^{A}	113.91±2.11^{CD}	100.03±3.22^{D}	117.92±22.21
	1.95	129.77±1.35^{ABC}	125.23±10.18^{ABC}	119.72±2.64^{BC}	114.53±6.83^{CD}	122.26±6.64
	2.6	128.85±8.56^{ABC}	130.05±8.92^{ABC}	111.24±3.15^{CD}	139.63±10.51^{AB}	127.44±11.83
	Average	124.85±8.56	135.08±13.12	114.89±4.22	118.06±20.03	
MCH (pg)	1.3	34.93±0.12^{AB}	46.18±3.33^{A}	35.72±2.67^{AB}	32.59±6.05^{B}	34.36±6.03
	1.95	40.23±0.12^{AB}	31.36±4.34^{AB}	34.37±2.79^{AB}	38.98±0.76^{AB}	38.74±3.07
	2.6	43.75±5.42^{AB}	44.16±4.84^{AB}	34.27±1.85^{AB}	46.58±8.58^{A}	42.19±5.43
	Average	39.64±4.44	43.90±2.42	34.79±0.81	39.38±0.77	
MCHC (%)	1.3	30.10±0.24^{B}	30.77±0.51^{AB}	31.34±1.80^{AB}	32.54±0.77^{AB}	31.19±1.04
	1.95	31.01±0.40^{AB}	32.15±0.89^{AB}	28.98±2.34	34.08±1.34^{A}	31.55±2.13
	2.6	32.47±1.49^{AB}	33.90±1.77^{A}	30.79±0.81^{AB}	31.44±0.50^{AB}	32.15±1.36
	Average	31.10±1.20	32.27±1.57	30.37±1.24	32.69±1.33	

LA: Lauric acid, PCV: packed cell volume, WBC: white blood cells, RBC: red blood cells, GP, ^{ABC} Means within the same column and row with different common superscripts differ

The number of WBC was significantly affected by the fiber level. In this investigation, the number of WBC broiler chickens ranged from 16.97±1.73 to 26.82±2.39. (10^3/mm^3). Normal WBC counts in chickens ranged from 20 to 30 x 10^3/mm^3 [5]. In this study, chickens were fed total of 8% of crude fiber supplement as a stimulus to reduce the quantity of WBC. The amount of WBC is heavily influenced by a variety of factors, including nutrition. The white blood cell (WBC) is an active component of the body's defense mechanism [6]. In this investigation, chickens were not stimulated to reduce the number of WBC by supplementing with 7% of crude fiber. This is a good sign that the chicken is healthy.

The PCV value was significantly affected by the crude fiber level. Increasing the crude fiber level up to 7% could produce the highest PCV value compared to the crude fiber level of 8%. In this investigation, the RBC value of broiler chickens ranged from 2.00±0.10 to 2.96±0.56. In this study, the interaction of LA and crude fiber had a substantial impact on the RBC value of broiler chickens. The normal hematological values for RBC and PCV in broiler chickens were 2.5-3.5 x 10^6/ mm^3 and 22.0-35.0%, respectively [5]. A 5-week-old broiler chicken with RBC levels of 1.77 x 1010 L-1 and PCV of 30.7% was studied [7]. A study utilizing 200 ppm vitamin E as an antioxidant in broilers with a PCV value of 30.62±1.08% was undertaken in another experiment [8].

The concentration of RBC in this study is slightly higher than that of [7], but lower than that of [5]. The PCV parameters in this study (29.11-32.50%) were similar to those in [7] and [8].

MCV, MCH, and normal MCHC of chickens ranged from 90-140 fl, 33-47 pg, 26-36%, respectively [4]. The MCV, MCH, and MCHC values in this study were 111.24±3.15 to 149.98±8.33 fl, 32.59±6.05 to 46.58±8.58 pg, and 28.98±2.43 to 34.08±1.34%, respectively. The interaction between LA levels and crude fiber levels in this investigation revealed a difference in the RBC indices value of experimental chickens. In this investigation, the RBC indices were still within the usual range for chickens. The size of the RBC will alter the viscosity of blood fluids, which might interfere with activity and smooth blood circulation, as shown by the MCV value. This is frequently influenced by the ambient temperature [8]. Chickens in tropical habitats, such as Indonesia, are susceptible to seasonal fluctuations in hot temperatures, and MCV can rise as a result of heat stress [2]. MCH was used to determine the RBC's Hb content, whereas the MCHC value was used to determine the RBC's Hb concentration [9].

4. CONCLUSION

The findings of this study show that feeding chickens a meal containing 1.95 percent lauric acid and 7% feed fiber had no effect on their health; while there were variances between treatments, they were still within the normal range for chickens.

AUTHORS' CONTRIBUTIONS

The authors confirm contribution to the paper as follows: study conception and design: J.J.M.R. Londok; data collection: J.J.M.R. Londok, J.E.G. Rompis; analysis and interpretation of results: J.J.M.R. Londok, J.E.G. Rompis; draft manuscript preparation: J.J.M.R. Londok. All authors reviewed the results and approved the final version of the manuscript.

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