Effect of supplemental fermeherbafit on total blood lipid and cholesterol in broiler chickens

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Abstract. The quality of the meat have been the need in the modern intensive broiler production nowadays including total lipid and cholesterol in the blood. Fermeherbafit is believed to decrease total lipid and cholesterol in the blood. Therefore, the major objective of this study was to investigate the effect of fermeherbafit supplementation in feed on total lipid and cholesterol of broiler's blood. A total of 100 male one-day-old Lohmann 202 broiler chickens were used in this study. The treatments were R0 = control (fermeherbafit 0%), R1 = fermeherbafit (2%), R2 = fermeherbafit (4%), R3 = fermeherbafit (6%) in a Completely Randomized Design. Data were analyzed using analysis of variance. Under this investigation, fermeherbafit supplementation had a significant effect on total blood cholesterol of broiler (P<0.05). That is allegedly due to the fiber content which inhibits cholesterol synthesis in the blood. However, the treatments had no significant effect on total blood lipid (P>0.05). In conclusion, fermeherbafit supplementation resulted the similar total blood lipid levels relatively, whereas the supplementation of fermeherbafit can lower total blood cholesterol as high as 22.6% in broiler chickens.

1. Introduction
Modern intensive broiler production has been in the efficient and economical production of high quality and safe chicken meat and eggs [1]. In the study of meat supply chain, the quality of the meat from on-farm to slaughter including blood content was emphasized as one of reflections of feeding and handling management [2]. Lot of works have been carried out to lower the level of cholesterol in chicken meat starting from the blood by using additives, feed supplements, etc [3][4][5][6][7]. It is substantial to suggest that some of herbal plants have positive effects [8] on total lipid and cholesterol in the blood [2], because the excessive lipid and cholesterol leads to cardiovascular diseases [9][10]. A number of researchers have reported the use of herbal mixture on total lipid and cholesterol in broiler chicken. A number of 0.4 and 0.6% extract of ginger supplementation [11], 200 or 400 IU of a-tocopherol with 10% garlic paste and supplementation reduced total cholesterol [12], 5% crude noni extract and leaf extract of M. citrifolia supplementation decreased total cholesterol [13], 20% of
Moringal leaves [14], and 0.5-1.5 g/kg turmeric meal supplementation [15] decreased total cholesterol up to 14% in broiler, while 1% of ginger powder decrease total lipid up to 7% [16]. Although extensive research has been carried out on reducing total lipid and cholesterol in some animals, no single study exists which study the effect of mixture of those five herbal plants as fermeherbafit on broiler. The term “fermeherbafit” covers the abbreviation for fermented herbals as feed additives. Thus, this paper aimed to investigate the effects of fermeherbafit on total blood lipid and cholesterol in broiler chickens.

2. Materials and Methods

2.1 Herbal supplement preparation

The ingredients of fermeherbafit are 100 g turmeric, 100 g ginger, 50 g noni, 25 g garlic, 25 g moringa leaves, 10 g red sugar and 200 ml water. Those herbals then chopped and added with lactic acid bacteria (LAB) to be incubated for 7 days in an anaerobic condition. Those herbals was in form of mash after drying and blending. Fermerhebafit then analysed in laboratory of animal feeding and nutrition Faculty of Animal Science, Jenderal Soedirman University. The nutrient contents of fermerhebafit are 2200 kcal metabolizable energy, 11.9% crude protein, 3.84% crude fat, 14.51% crude fiber, 0.07% calcium, and 1.4% phosphor.

Table 1. Composition and nutrien contents of basal diet

| Feedstuffs       | R₀ % | R₁ % | R₂ % | R₃ % |
|------------------|------|------|------|------|
| Corn             | 50   | 50   | 50   | 50   |
| Bran             | 15   | 13   | 11   | 9    |
| Soybean meal     | 20   | 20   | 20   | 20   |
| Fish meal        | 10   | 10   | 10   | 10   |
| Coconat oil      | 3.5  | 3.5  | 3.5  | 3.5  |
| Topmix           | 0.5  | 0.5  | 0.5  | 0.5  |
| Lime             | 0.5  | 0.5  | 0.5  | 0.5  |
| Lysin            | 0.25 | 0.25 | 0.25 | 0.25 |
| Methionin        | 0.25 | 0.25 | 0.25 | 0.25 |
| Fermeherbafit a  | 0    | 2    | 4    | 6    |
| Total            | 100  | 100  | 100  | 100  |

| Chemical composition b |
|------------------------|
| Crude protein (%)      | 21.20 | 21.21 | 21.21 | 21.22 |
| Metabolized Energy (kkal/kg) | 3086 | 3086 | 3086 | 3086 |
| Crude fat (%)          | 4.05  | 4.03  | 4.01  | 3.99  |
| Crude fiber (%)        | 4.20  | 4.25  | 4.30  | 4.35  |
| Calcium (%)            | 0.96  | 0.96  | 0.96  | 0.96  |
| Phosphor (av) (%)      | 0.50  | 0.50  | 0.50  | 0.50  |
| Lysin (%)              | 0.79  | 0.79  | 0.79  | 0.79  |
| Methionin (%)          | 0.54  | 0.54  | 0.54  | 0.54  |

a The results of the analysis in the Laboratory of Animal Nutrition and Feedstuffs Faculty of Animal Science Universitas Jenderal Soedirman (2014).
b Calculation based on the calculation result [17]

2.2 Birds and housing

A total of 100 male one-day-old Lohmann 202 broiler chickens obtained from a local commercial hatchery were randomly allocated to 4 groups with 5 replicates of 4 birds. All the birds were reared up to 35 d of age and fed with starter (1 to 21 d) and grower-finisher (22 to 35 d) basal diets consisting of corn, bran, concentrate, and fermeherbafit. Fermeherbafit consisted of turmeric, ginger, noni, garlic,
and moringa leaves. All diets were fed 3 times a day in a mash form. The proximate analysis of ration is shown in Table 1. The birds were kept in standard environmental rearing conditions; in 20 raised floor pens with rice hulls as a bedding material.

2.3 Experimental design
Each of the four dietary treatments assigned to five replicate pens containing 4 chicks with a total of 20 pens commencing from day one. The dietary treatments were:
1. $R_0$ = Control (fermeherbafit 0%)
2. $R_1$ = fermeherbafit (2%)
3. $R_2$ = fermeherbafit (4%) and
4. $R_3$ = fermeherbafit (6%)

2.4 Analysis of total lipid and cholesterol in blood and measurements
Total lipid and total cholesterol in the blood was analysed and measured based on standard procedure and calculation [18][19].

2.5 Statistical analysis
This study employed a completely randomized design (CRD) with 4 treatments and 5 replicates. The experimental unit regarded as pen. Microsoft excel were employed in statistical analyses. Orthogonal Polynomial test separated means when ANOVA revealed significant effects [20]. Treatment means differed significantly at P≤0.05.

3. Results and Discussion
3.1 Results
As shown in Table 1 below, there were no differences (P>0.05) in total blood lipid. Surprisingly, the treatments had no significant effect in lowering the total lipid in the blood of broiler. Similar findings about no alteration in total lipid of broiler blood fed those five herblas mixed were reported by researchers [21][22]. In contrast, few researchers found it significant on total lipid in the broiler’s blood [23][15][16][24]. However, it can be seen from the data in Table 2 that there was a significant differences (P<0.05) in total blood cholesterol. These results, with some differences, are in agreement with other studies in which those five mixed herblas resulted in total cholesterol reduction in broiler chicks [22][25][16][14][26][27]. In contrast, other study have shown no any significant effect on total cholesterol [28][21]. Hatice and Mustafa (2005) reported that the normal range number of total cholesterol in the blood of chicken is 55-148 mg/dl [29]. It means that blood cholesterol levels are still in the normal range.

### Table 2. The average of total blood lipid in broiler chickens

| Treatment | Total blood lipid (g/ml) | Standard of deviation (Sd) |
|-----------|--------------------------|---------------------------|
| $R_0$     | 2,00                     | ±0,71                     |
| $R_1$     | 2,40                     | ±1,52                     |
| $R_2$     | 2,80                     | ±2,49                     |
| $R_3$     | 1,80                     | ±1,30                     |

Description: $R_0$ = 0% fermeherbafit in feed; $R_1$ = 2% fermeherbafit in feed; $R_2$ = 4% fermeherbafit in feed; $R_3$ = 6% fermeherbafit in feed. ns: non significant
Table 3. The average of total cholesterol in blood of broiler chickens

| Treatment | Blood cholesterol (mg/dl) | Standard Deviation (Sd) |
|-----------|---------------------------|-------------------------|
| R<sub>0</sub> | 110.8<sup>a</sup> | ±17.02 |
| R<sub>1</sub> | 95.2<sup>b</sup> | ±5.54 |
| R<sub>2</sub> | 89.2<sup>b</sup> | ±9.23 |
| R<sub>3</sub> | 88.2<sup>b</sup> | ±12.76 |

Description: R<sub>0</sub> = 0% fermeherafit in feed; R<sub>1</sub> = 2% fermeherafit in feed; R<sub>2</sub> = 4% fermeherafit in feed; R<sub>3</sub> = 6% fermeherafit in feed. Column with no common superscript differ significantly (P<0.05) in Honesty Significant Difference (HSD) 5%.

3.2 Discussion
Administration of fermeherafit up to 6% in diet was not able to decrease total lipid of broiler’s blood. It was reported that a similar total blood lipid level is caused by the function of lipid to fulfill the energy need of the body [30]. Energy requirements in the body can be met by utilizing lipid in fatty tissue [31]. Xeronin contained in noni was reported that it has a high activity in on the formation of insulin hormone [32][33][34]. Insulin and insulin-like molecules have played a key role in energy homeostasis [35]. Thus, total lipid in the blood remained in the similar level. In contrast with the result of total lipid, administration of fermeherafit up to 6% could lower blood cholesterol level up to 22.6% (Figure 1). Few researchers believed that fiber played an important role in lowering cholesterol [36][37][38]. It is thought that soluble fiber lowers blood cholesterol by binding bile acids, which are made from cholesterol to digest dietary fats, and then excreting them [39].

Possible mechanisms of lowering cholesterol is the regulation of the gut microbial flora and the enzymes [40][41]. Inhibitors of 3-hydroxy-3-methylglutarylcoenzyme A (HMG Co-A) reductase, an enzyme, have changed the treatment of hypercholesterolemia and is believed as the most effective agents to reduce plasma cholesterol [42].

Attribute to capacity of HMG Co-A reductase inhibitors in reducing the endogenous cholesterol synthesis is the beneficial effects of the enzyme by competingly inhibiting the principal enzyme involved [43]. Inhibition of this key enzyme may result in pleiotropic effects since mevalonate, the product of HMG Co-A reductase reaction, is the precursor not only for cholesterol, but also for many other nonsteroidal isoprenoidic compounds. There are two categories, involving: directly lipids, or intracellular signaling pathways. Mechanism of the first category is by inhibiting biosynthesis of cholesterol, increasing uptake and degrading low density lipoprotein (LDL), and inhibiting the scavenger receptors expression [44]. The present findings seem to be consistent with other research which found HMG-CoA reductase was inhibited by herbal plants.
4. Conclusion
In this study, feeding and handling management is well-reflected in total blood cholesterol of broiler. Fermeherbafit has a significant effect on total blood cholesterol. However, total blood lipid levels are relatively similar. Supplementation of fermeherbafit lowers total blood cholesterol in broiler chickens up to 22.6%. It would be interesting to assess the effects of fermeherbafit on lipid profile of the blood.

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