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The Effects of Dietary Inclusion of Miana Plant Flour (*Plectranthus scutellarioides* (L.) R. Br. on Serum Lipid Profile and Organ Weights of Broiler Chickens

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ABSTRACT

Miana plant (*Plectranthus scutellarioides* (L.) R. Br. contains active compounds (such as steroids, flavonoids, saponins, and tannins) which can have several health benefits, including lowering cholesterol LDL and triglyceride as well as increasing feed consumption, body weight, and carcass weight of broilers. Therefore, the current experiment was conducted to evaluate the effect of Miana plant flour (*Plectranthus scutellarioides* (L.) R. Br. in the diet on blood serum lipid profiles and physiological organs of broilers. The experiment was performed on 100 day-old broiler chickens from strain Arbor Acres CP-707. The experiment was designed in a completely randomized design with five different levels of Miana plant flour (0%, 5%, 7.5%, 10%, and 12.5%) in broiler's diets as treatment, and each treatment was repeated four times. The diet was arranged iso-protein (21%) and iso-energy (2900 kcal/kg). The serum lipid profile measurement included the analysis of total cholesterol, triglycerides, high-density lipoprotein (HDL), and low-density lipoprotein (LDL). Physiological organ analysis entailed the percentage of liver weight, pancreas weight, gizzard weight, small intestine weight, and length of parts of the small intestine (duodenum, jejunum, and ileum) of broilers. The results showed that the inclusion of Miana plant flour in the broiler's diet could significantly affect total cholesterol, triglycerides, HDL, and LDL in the serum of broiler chickens, and it affected duodenum length significantly. Furthermore, the inclusion of Miana plant flour in the broiler's diet had an insignificant effect on the percentage of liver weight, pancreas weight, gizzard weight, small intestine weight, and length of each part of the small intestine (jejunum and ileum) on broilers. In conclusion, the inclusion of Miana plant flour as much as 12.5% in broiler's diets reduced total cholesterol, triglycerides, and LDL, and increased the HDL and duodenum length without adverse effects on the other physiological organs of broiler chickens.

Keywords: Broiler, Lipid profile, Lipoproteins, Miana plant, Physiological organs

INTRODUCTION

Plectranthus scutellarioides (L.) R. Br. plant is widely grown in Asian countries. This plant is known by local names in Indonesia, such as Miana, Jawer Kotok, and Iler. According to the Decree of the Indonesian Minister of Agriculture, it is mainly used for medicinal properties and included in 66 biopharmaceutical plant commodities (Salim and Munadi, 2017). Previous researchers reported that Miana plants have pharmacological activities, such as antimicrobial, anthelmintic, antifungal, antibacterial, anti-inflammatory, antioxidant, antidiabetic, and antihistamine activities (Muljono et al., 2016; Novanti and Susilawati, 2017; Wakhidah and Silalahi, 2018).

Miana plants contain active compounds, such as tannins, saponins, anthocyanins, flavonoids, essential oils that can reduce plasma cholesterol and triglyceride levels (Al-Temimi and Choudhary, 2013; Warditiani et al., 2015; Kusuma et al., 2016). Tannin was reported to inhibit cholesterol biosynthesis, reduce cholesterol absorption in the intestine, and so cholesterol can be excreted out of the body (Al-Temimi and Choudhary, 2013). Furthermore, saponins compound was reported to bind cholesterol in the intestinal lumen, prevent cholesterol reabsorption, and bind bile acids to reduce the enterohepatic circulation of bile acids leading to increased cholesterol excretion (Alkanji et al., 2009; Khyade and Vaikos, 2009).

The compounds in the Miana plant are expected to make the digestive tract of broilers healthier because they can kill harmful worms and microbes so that digestive organs, such as the small intestine can develop properly. However, some of the active compounds found in Miana plants, such as tannins, alkaloids, and saponins, have been reported to be anti-nutritive at certain levels in poultry diets, and affect their physiological organs. Wicaksono et al. (2015) reported that damage found in the widening of the central vein of mice was thought to be caused by alkaloid compounds. The administration of 10% *Calliandra calothyrsus* leaf flour containing tannins reduced ration consumption, body weight

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gain, protein consumption, and increased ration conversion of broilers (Wati et al., 2018). Furthermore, Mahata et al. (2021) reported Miana plant flour could be used up to 12.5% without adverse effects on broilers' performance.

Blood is a transporter of food substances and other substances obtained from absorption in the digestive tract to be distributed throughout the body. The lipid content in the blood serum can determine the lipid disposition in the cells of the body organs, including physiological organs. If the lipid content in the serum is too high, it may harm the physiological organs and interfere with livestock health. The accumulation of fat causes an increase in triglycerides that enter the spleen, thereby increasing the size and activity of the spleen (Windoro et al., 2020)

Based on the description of the active compounds in the Miana plant and the beneficial role of active compounds in animal health, the present research was carried out to evaluate the effect of Miana plant flour (*Plectranthus scutellarioides* (L.) R. Br. in the diet on blood serum lipid profiles and physiological organs of broiler chickens.

MATERIALS AND METHODS

Ethical approval

The broiler chickens in the current research were treated following the guidelines passed by the institutional ethics committee for the care of animals and were approved by the Animal Ethics Committee of the Universitas Andalas, Padang, Indonesia, with a code of 439/UN.16.2/KEP-FK/2021.

Experimental birds

A total of 100 male day-old broiler chickens (DOC) of strain Arbor Acres CP-707 was purchased at a poultry shop in West Sumatra Province, Indonesia, for the current study.

Experimental design

This experiment was conducted in a completely randomized design with different levels of Miana plant flour as treatments (0%, 5%, 7.5%, 10%, and 12.5%) in the broiler's diet, and each treatment was repeated four times. Miana plant flour was mixed with other feed ingredients according to the predetermined treatment level until homogeneity was reached and became the treatment feed in the current study.

Experimental diet

The treatment diets were self-prepared, including soybean meal, meat flour, yellow corn, coconut oil, Bravo CP 511 (commercial diet), top mix, Miana plant flour (*Plectranthus scutellarioides* (L.) R. Br. (Table 1). All ingredients were mixed homogeneously before feeding the broiler. Broiler chickens were reared for an adaptation period from the second day up to day seven of DOC by giving a commercial diet (Bravo Cp 511) and it was then continued with a treatment diet containing Miana plant flour from 8-35 days.

Table 1. Composition of experimental diets used for different groups of broiler chickens

Feedstuffs	Composition of experimental diets				
	A	B	C	D	E
Yellow corn	53.50	48.75	46.75	44.75	42.75
Soybean meal	10.00	9.50	9.00	8.50	8.00
Coconut oil	0.00	0.75	1.25	1.75	2.25
Meat flour	14.00	14.00	14.00	14.00	14.00
Top mix	2.50	2.00	1.50	1.00	0.50
Miana plant flour	0.00	5.00	7.50	10.00	12.50
Bravo Cp 511	20.00	20.00	20.00	20.00	20.00
Total	100.00	100.00	100.00	100.00	100.00
Diet nutrients content (%) and metabolizable energy (kcal/kg)					
Crude protein	21.30	21.40	21.36	21.32	21.28
Crude fiber	3.19	4.12	4.58	5.05	5.51
Crude fat	4.05	5.13	5.80	6.47	7.15
Calcium	0.73	0.75	0.76	0.76	0.77
Available phosphorus	0.36	0.37	0.38	0.38	0.38
Metabolizable energy	2992.75	2948.94	2944.58	2940.21	2935.85
Crude protein	21.30	21.40	21.36	21.32	21.28
Lysin	0.22	0.20	0.17	0.14	0.12

A: 0% Miana plant flour, B: 5% Miana plant flour, C: 7.5% Miana plant flour, D: 10% Miana plant flour, E: 12.5% Miana plant flour

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Preparation of Miana plant flour

Miana plant was collected from several areas in West Sumatra Province, Indonesia. Miana plant was cut by pruning 25 cm height from the soil surface, cleaned, and dried in an oven at 60°C until the water reached 14%, then mashed. Miana plant flour furthermore was ready to use for poultry feed Modified method of (Bradley, 2010).

The measured parameters

Total cholesterol

The blood samples were taken from one broiler chicken of each replicate for the evaluation of serum parameters. Broiler blood samples were taken from each chicken in each treatment at the end of the study. The broiler chickens were slaughtered through the esophagus, trachea, and blood vessels carotid artery and jugular vein. Blood from each broiler was collected using 20 vacutainers with a volume of 10 ml for each treatment. Furthermore, the vacutainer was put into a cooler box and then taken to the laboratory. Blood from each vacutainer was centrifuged with a cold centrifuge at 4°C at a speed of 3500 rpm for 10 minutes. Then, the yellowish blood serum was separated at the top of the vortex tube from the red blood platelets at the bottom of the vortex tube. Furthermore, the blood serum was placed in an Eppendorf tube to analyze the content of total cholesterol, LDL, triglycerides, and HDL.

Total cholesterol in the blood serum of broiler chickens was measured by enzymatic colorimetric method/Cholesterol Oxidase-Peroxidase Aminoantypirin/CHOD-PAP Method (Laboratory Stanbio, 2011). Blood serum was pipetted as much as 10 µl, and then 1000 µl DiaSys KIT LO reagent 60128 for cholesterol analysis was added. Serum and reagent were shaken to mix thoroughly and incubated for 10 minutes at 37°C, then read with a UV-1800 spectrophotometer (Shimadzu USA MFG Inc serial number A116349) at a wavelength of 546 nm. Cholesterol standards were prepared by mixing 10 µl of LOT 26521 cholesterol standard solution with DiaSys KIT LOT reagent 60128448 as much as 1000 µl. In the next step, it was homogenized and incubated at 37°C for 10 minutes, then read with a UV-1800 spectrophotometer (Shimadzu USA MFG Inc serial number A116349) at a wavelength of 546 nm. The total cholesterol was calculated using formula 1.

$$\text{Total cholesterol (mg/dl)} = \frac{\Delta \text{ a sample}}{\Delta \text{ a standard}} \times \text{standard concentration (mg/dL)} \qquad \text{(Formula 1)}$$

Where, Δ a sample signifies sample absorbance, Δ a standard accounts for standard absorbance, and Standard concentration is 200 mg/dL (Laboratory Stanbio, 2011).

Triglycerides

Triglycerides in the blood serum of broiler were measured by the Glycerol Phosphate Oxidase (GPO-PAP, Fossati and Prencipe, 1982). This method is based on the enzymatic determination of glycerol using the enzyme glycerol phosphate oxidase (GPO) after hydrolysis by lipoprotein lipase. In this regard, 10 µl of blood serum was pipetted, and 1000 µl of DiaSys KIT LOT 60128416 reagent was added. Serum and reagents were shaken to mix well, then incubated for 10 minutes at 37°C. Furthermore, it was read using a UV-1800 spectrophotometer (Shimadzu USA MFG Inc serial number A116349) at a wavelength of 546 nm. The triglyceride standard was made by mixing 10 µl of standard solution for triglycerides LOT 24313, followed by adding 1000 µl of DiaSys KIT LOT 60128416 reagent, homogenizing and incubating for 10 minutes. In the next step, it was read by a UV-1800 spectrophotometer (Shimadzu USA MFG Inc serial number A116349) at a wavelength of 546 nm. The triglycerides were calculated by formula 2 as below:

$$\text{Triglycerides total (mg/dL)} = \frac{\Delta \text{ a sample}}{\Delta \text{ a standard}} \times \text{standard concentration (mg/dL)} \qquad \text{(Formula 2)}$$

Where, Δ a sample signifies sample absorbance, Δ a standard accounts for standard absorbance, and Standard concentration is 200 mg/dL (Laboratory Stanbio, 2011).

High-density lipoprotein

High-density lipoprotein (HDL) in the blood serum of broiler was measured by the enzymatic colorimetric method/Cholesterol Oxidase-Peroxidase Aminoantypirin/CHOD-PAP Method (Laboratory Stanbio, 2011). The volume of 250 µl blood serum was pipetted, then DiaSys KIT LOT 60128539 reagent was added for HDL analysis of 500 µl, then centrifuged for 10 minutes 2500 rpm, then centrifuged for 10 minutes at 2500 rpm. The supernatant formed after centrifugation was pipetted as much as 100 µl, and added with 1000 µl cholesterol reagent DiaSys KIT LOT 60128448. Furthermore, the solution mixture was incubated at 37°C for 10 minutes and read by a UV-1800 spectrophotometer (Shimadzu USA MFG Inc serial number A116349) at a wavelength of 546 nm.

The HDL standard was made by mixing 100 µl cholesterol standard (LOT 26521) with 1000 µl of DiaSys KIT LOT reagent 60128448. Furthermore, it was homogenized and incubated for 10 minutes at 37°C, then read with a UV-1800 spectrophotometer (Shimadzu USA MFG Inc. serial number A116349) at a wavelength of 546 nm. The HDL was calculated by formula 3 as below:

$$\text{HDL (mg/dL)} = \frac{\Delta \text{ a sample}}{\Delta \text{ a standard}} \times \text{standard concentration (mg/dL)} \qquad \text{(Formula 3)}$$

Where, Δ a sample signifies sample absorbance, Δ a standard accounts for standard absorbance, and Standard concentration is 200 mg/dL (Laboratory Stanbio, 2011).

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Low-density lipoprotein

The LDL in the blood serum of broiler was measured by using the formula 4 of Friedewald et al. (1972) as below:

LDL = Total cholesterol – HDL – 1/5 Triglycerides (Formula 4)

Physiological organs

Sampling and measurement of physiological organs of broilers were carried out at the age of 35 days.

Sample collection of physiological organs of broiler was taken from one bird for each treatment. This experiment consisted of 5 treatments and each treatment was replicated four times so that the total sample for physiological organs analysis was 20 samples. It was randomly selected from 100 chickens that were weighed and slaughtered following animal welfare laws. Before slaughter, the chickens fasted for 8 hours. After slaughter, physiological organs, such as the liver, pancreas, gizzard, small intestine (duodenum, jejunum, and ileum) were separated and weighed on a 0.001 g digital scale. Percentage of the weight of each physiological organ, calculated by the formula of Relative weight = (weight of organs/live weight) × 100% (Nastain et al., 2021). Furthermore, the lengths of the duodenum, jejunum, and ileum (cm) were measured.

Statistical analysis

All data obtained in this experiment were statistically processed by analysis of variance (ANOVA). Differences among treatments were followed by analysis with Duncan's Multiple Range Test (Steel and Torrie, 1991). P value less than 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

Statistical results of total cholesterol, triglycerides, HDL, and LDL are shown in Table 2. The liver, pancreas, gizzard, and small intestine weight in percentage are depicted in Table 3. Furthermore, the analysis of the length of the parts of the small intestine (duodenum, jejunum, and ileum) is presented in Table 4. The inclusion of Miana plant flour in broilers' diets had a significant effect on total cholesterol, triglycerides, HDL, LDL in blood serum, and duodenum length of broilers ($p < 0.05$). In contrast, it had no significant effect on the liver weight, pancreas weight, gizzard weight, small intestine weight, jejunum length, and ileum length ($p > 0.05$).

The control diet (0% Miana) and inclusion of Miana (*Plectranthus scutellarioides* (L.) R. Br. plant flour as much as 5% had no significant effect on reducing total cholesterol, however, when Miana increased to 7.5%, 10%, and 12.5%, the total cholesterol in blood serum decreased. The decrease of total cholesterol in the current experiment was due to some compounds, such as tannins, saponins, anthocyanins, flavonoids, and essential oils, in the Miana plant that can reduce plasma cholesterol and triglyceride levels (Al-Temimi and Choudhary, 2013; Warditiani et al., 2015; Kusuma et al., 2016). Miana plant contains 18.15% tannin, which could inhibit cholesterol biosynthesis and reduce cholesterol absorption in the intestine leading to cholesterol excretion (Al-Temimi and Choudhary, 2013). As Zaubaidah et al. (2014) stated, tannin inhibits HMG-CoA reductase activity in cholesterol synthesis in cells so that HMG-CoA can not convert to mevalonate compound and cholesterol synthesis is inhibited. Saponins bind cholesterol in the intestinal lumen, prevent cholesterol reabsorption, bind bile acids to reduce the enterohepatic circulation of bile acids, and increase cholesterol excretion (Alkanji et al., 2009; Khyade and Vaikos, 2009). Furthermore, Miana plant (*Plectranthus scutellarioides* (L.) R. Br. contains anthocyanins as much as 0,435 mg/g (Ayu et al., 2018), while Jatmiko (2015) reported the anthocyanin content of Miana leaves as 441.97 ± 34.22 mg/100 g. Kusuma et al. (2016) reported the inclusion of Dayak onion extract containing anthocyanins could reduce cholesterol and triglyceride blood in male rats. In addition, flavonoids were reported lowering cholesterol by reducing HMG-CoA reductase activity, acyl-CoA cholesterol acyltransferase (ACAT) activity, and reducing cholesterol absorption in the digestive tract (Rumanti, 2011; Sumardika and Jawi, 2012). It was predicted that the activity of some compounds found in the Miana plant reduced total cholesterol in the blood serum of broilers in the current experiment.

The active compounds in Miana plants, such as tannins and flavonoids, are reported to reduce triglycerides in the blood serum of broiler chickens. Miana plants contain active compounds, such as tannins, saponins, anthocyanins, flavonoids, essential oils that can reduce plasma cholesterol and triglyceride levels (Al-Temimi and Choudhary, 2013; Warditiani et al., 2015; Kusuma et al., 2016). The levels of Miana plant flour at 0% and 5% did not reduce triglycerides in the blood serum of broilers in this experiment. When levels were increased to 7.5%, 10%, and 12.5% in diets, triglycerides in the blood serum of broiler reduced, however, levels of 10% and 12.5% did not show another decline. According to Meirindasari et al. (2013), tannin compounds reduce triglycerides by decreasing the absorption of cholesterol and triglycerides in the small intestine and increasing the excretion of bile acids. The other mechanism of tannin reduces triglyceride by inhibiting adipogenesis and absorption in the intestine (Rosyadi, 2014). Flavonoid compounds were also reported to inhibit the fatty acid synthase enzyme activity, which is very important in fat metabolism (Tian et al., 2011). Inhibition of fatty acid synthase can directly reduce the formation of fatty acids, thereby reducing the appearance of triglycerides.

Including Miana plant flour in the broilers' diet at a level of 12.5% was the best level to increase HDL in the blood serum of broiler chickens, but the lower levels of Miana flour decreased HDL in the blood serum of broilers. Flavonoid compound increased HDL of blood serum by influencing the synthesis of apolipoproteins (apolipoprotein A-1 and apolipoprotein A-2) as components of HDL. According to Zychlinski and Kleffmann (2014), apolipoprotein A-1 and apolipoprotein A-2 are the main structural protein components of high-density lipoprotein (HDL). Flavonoids also reduce plasma cholesterol and the formation of very-low-density lipoprotein (VLDL) synthesized by the liver, and consequently, increase HDL cholesterol levels (Narita, 2015).

The inclusion of Miana plant flour at the range of 7.5-12.5% significantly reduced LDL in the blood serum of the broilers in the current study. According to Babu and Liu (2008), flavonoid compounds could inhibit the synthesis of apolipoprotein B, one of the LDL constituent compounds; the higher the level of flavonoid content in the diet, the less the formation of apolipoprotein B, thereby suppressing the formation of LDL. According to Wang et al. (2006), flavonoids cause bile acids to be bound in the intestine so that the blood cannot reabsorb them, then the liver produces more bile to replace the lost bile using LDL cholesterol in the blood, thereby reducing the amount of LDL cholesterol in the blood. As Yunarto and Aini (2015) mentioned, flavonoid compounds reduce LDL by increasing bile acid excretion.

The inclusion of Miana plant flour in broiler diets did not affect the liver weight percentage. The content of essential oils found in Miana plants can function as antioxidants that protect liver cells from free radicals. Lee et al. (2005) and Hussain et al. (2008) found that the essential oil in basil leaves is anti-oxidant that can protect body cells from free radicals, including liver cells (hepatoprotective). Besides, the flavonoid, orientin, eugenol, and vicenin in basil leaves have hepatoprotective properties because they are also anti-oxidants that can protect liver cells from free radicals. Thus, the content of essential oils, flavonoids, and eugenol in the Miana plant in this study is thought to protect broilers' livers from the influence of other active substances, such as alkaloids that can increase the liver size. In the current study, it was revealed that the substances found in Miana plant flour did not harm the broiler's liver.

The flavonoids, tannins, and saponins found in Miana plant flour did not interfere with the pancreas weight percentage. Rohmah et al. (2016) stated that giving soursop leaf (*Annona muricata* L.) containing flavonoid, tamarins, tannins, and saponins did not affect the weight of the pancreas, and this was possible because these compounds were not directly related to the performance of the pancreas, whose function was to produce enzymes. The low tannin content in soursop leaf flour does not interfere with enzymes produced by the pancreas gland. The high tannin content in the diet can cause enlargement of the pancreas (Darmawan, 2008). In the current study, it was predicted that the concentration of saponins and tannins contained in Miana plant flour was still low, so broilers could tolerate it and no enlargement of the pancreas was observed.

The inclusion of Miana plant flour in the diet did not interfere with the gizzards and small intestines weight percentage of broilers. Active compounds in Miana plant flour, such as tannins, saponins, alkaloids, steroids, essential oils, and eugenol, act as anthelmintic, antimicrobial, and antibacterial compounds (Ridwan et al., 2006; Sangi et al., 2008; Muljono et al., 2016). Among the active compounds in Miana plant flour, such as tannins, saponins, alkaloids, are known to have anti-nutritional properties, and it is feared that they will affect the weight of the gizzard. Pangesti et al. (2016) reported that the inclusion of 5% jackfruit seed flour in feed containing saponin and tannin compounds had a very significant effect on gizzard weight. However, saponins and tannins concentration in Miana plant flour in the current study did not show any significant effect on gizzard weight. It was suspected that the dose of saponins and tannins in Miana plant flour given up to 12.5% in broiler's diet was still low, so that gizzard weight was not affected. The compounds in the Miana plant are expected to make the digestive tract of broilers healthier because they can kill harmful worms and microbes. Chaudhary et al. (2018) state that saponin compounds can increase the immunity, gut health, production, and meat quality, of poultry. Thus, the digestive organs, such as the small intestine, can develop properly, and their weight becomes more significant. Aji et al. (2017) stated that the small intestine weight of broilers fed noni fruit extract containing flavonoid compounds increased significantly; this was due to the ability of flavonoid compounds to improve microflora found in the broiler digestive tract. In the current study, the increase in the level of Miana plant flour in broiler diets did not show a difference in the intestine weight percentage. It is suspected that the dose of the active compound contained on Miana plant flour inclusion in broiler diets is still low, so it does not show a difference in the percentage of small intestine weight. The presence of microflora in the small intestine will affect the health and development of the small intestine and increase nutrient absorption.

The inclusion of Miana plant flour in the broilers' diet affected the duodenum length but did not affect the jejunum and ileum length of the broilers. This shows that the inclusion of Miana plant flour with different levels in the diets affects the length of the broiler duodenum. It is suspected that there is an influence of active substances, such as alkaloids, flavonoids, and tannins, in the Miana plant. Lenhardt and Mozes (2003) reported that the duodenum length is

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closely related to the length of the villi and the relative weight of the duodenum, where the more extended the intestinal villi, the wider the surface for nutrient absorption and optimal absorption so that the duodenum is also heavier and longer. Other studies about the inclusion of guava leaves containing alkaloids, flavonoids, and tannins in broilers have been reported to lengthen the duodenal villi (Martinez et al., 2012; Fratiwi, 2015). The jejunum and ileum length of broilers fed Miana plant flour in the current study were not disturbed by the active substances found in the Miana plant.

Table 2. The serum lipid profile parameters of broiler chickens fed with different levels of Miana plant flour

Treatments (Miana plant flour%)	Total cholesterol (mg/dL)	Triglycerides (mg/dL)	HDL (mg/dL)	LDL (mg/dL)
A (0)	170.17[a]	151.24[a]	46.64[c]	93.28[a]
B (5)	168.25[a]	153.52[a]	41.56[d]	95.98[a]
C (7.5)	154.30[b]	135.95[b]	52.02[b]	70.35[b]
D (10)	148.85[c]	131.71[c]	48.87[bc]	73.64[b]
E (12.5)	139.96[d]	131.48[c]	57.41[a]	56.26[c]
SE	1.33	1,03	1.06	1.55
P value	0.01	0.01	0.01	0.01

SE: Standard Error, HDL: High-density lipoprotein, LDL: Low-density lipoprotein. Different lowercase superscripts in the same column show a significant effect ($p < 0.01$).

Table 3. The percent body weight of internal organs in broiler chickens fed with different levels of miana plant flour

Treatments (Miana plant flour%)	Liver weight percentage (%)	Pancreas weight percentage (%)	Gizzard weight percentage (%)	Small intestine weight percentage (%)
A (0)	2.00	0.23	2.19	3.54
B (5)	2.15	0.25	2.29	3.15
C (7.5)	2.07	0.22	2.17	3.42
D (10)	1.83	0.21	2.14	3.41
E (12.5)	1.60	0.19	1.93	3.32
SE	0.19	0.02	0.19	0.26
P value	0.05	0.05	0.05	0.05

SE: Standard Error

Table 4. Intestinal morphometric parameters of broiler chickens fed with different levels of miana plant flour

Treatments (Miana plant flour%)	Duodenal length (cm)	Jejunum length (cm)	Ileum length (cm)
A (0)	25.04[b]	76.03	84.28
B (5)	27.60[ab]	63.85	84.00
C (7.5)	28.38[a]	73.13	70.80
D (10)	28.48[a]	70.13	74.93
E (12.5)	28.61[a]	70.38	74.88
SE	0.72	3.02	4.50
P value	0.05	0.05	0.05

SE: Standard Error. Different lowercase superscripts in the same column (duodenal length) show a significant difference ($p < 0.05$).

CONCLUSION

The inclusion of Miana plant flour as much as 12.5% in broilers' diets, reduced total cholesterol, triglycerides, and LDL, increased the HDL and duodenum length without adverse effects on the other physiological organs consisting of liver weight, pancreas weight, gizzard weight, small intestine weight, length of jejunum, and ileum in broiler chickens.

Competing interests

All authors declare that they have no competing interest concerning the work presented in this manuscript.

Authors' contributions

Maria Endo Mahata participated in all stages of the research, namely the research design, the conduct of the experiment, sample analysis, data analysis, writing, and editing of articles. Misra Weni participated in conducting the investigation, Yola Gusnanda was responsible for data analysis. Takayuki Ohnuma and Yose Rizal participated in the research and editing of the article. All authors participated in writing the article and checking the statistical analysis and finally approved the last version of the article for publishing.

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Ethical considerations

Ethical issues (including plagiarism, consent to publish, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy) have been checked by the authors.

REFERENCES

Aji HIS, Yudiarti T, and Isroli (2017). The effect of duration of giving *Spirulina platensis* in feed on the weight of lymphoid organs and small intestines of broiler chickens. Proceedings of the National Seminar on Sustainable Livestock Development, pp. 298-302. Available at: http://eprints.undip.ac.id/65160/1/Jurnal_(4)_Semnas_Unpad_2017.pdf

Alkanji MA, Ayorinde BT, and Yakubu MT (2009). Anti-lipidaemic potentials of aqueous extract of *Tapinanthus globiferus* leaves in rats. Chemistry and medicinal value. Studium Press LLC, pp. 1-8. Available at: https://www.cabdirect.org/cabdirect/abstract/20093054971

Al-Temimi A, and Choudhary R (2013). Determination of antioxidant activity in different kinds of plants *in vivo* and *in vitro* by using diverse technical methods. Journal of Nutrition and Food Science, 3(1): 1-9. DOI: http://www.dx.doi.org/10.4172/2155-9600.1000184

Ayu AC, Ida M, Moelyono M and Fakhriati SG (2018). Total Anthocyanin Content and Identification of Anthocyanidin From *Plectranthus Scutellarioides* (L.) R. Br Leaves. Research Journal of Chemistry and Environment, 22 (1): 11-17. Available at: https://worldresearchersassociations.com/specialissuejan2018/3.pdf

Babu PVA, and Liu D (2008). Green tea catechins and cardiovascular health: An update. Current Medicinal Chemistry, 15(18): 1840-1850. DOI: https://www.doi.org/10.2174/092986708785132979

Bradley JRL (2010). Moisture and total solids analysis. Chapter 6. Suzanne Nielsen editor. Food Analysis, pp. 88-89. Available at: https://e-l.unifi.it/pluginfile.php/1048771/mod_resource/content/1/Cap%206_Moisture%20and%20total%20solids%20analysis.pdf

Chaudhary SK, Rokade JJ, Aderao GN, Singh A, Gopi M, Mishra A, and Raje K (2018). Saponin in poultry and monogastric animals: A Review. International Journal of Current Microbiology and Applied Sciences, 7(7): 3218-3225. DOI: https://www.doi.org/10.20546/ijcmas.2018.707.375

Darmawan A (2008). The effect of giving Sembung leaf flour (*Blumea balsamifera*) in the ration on the percentage of carcass weight, internal organs, and abdomen fat of broiler Thesis. Bogor Agricultural University. Available at: https://repository.ipb.ac.id/handle/123456789/10204

Fossati P, and Prencipe L (1982). Serum triglycerides determined colorimetrically with an enzyme that produces hydrogen peroxide. Clinical Chemistry, 28(10): 2077-2080. DOI: https://www.doi.org/10.1093/clinchem/28.10.2077

Fratiwi Y (2015). The potential of guava leaf (*Psidium guajava* L.) for diarrhea. Journal Majority, 4(1): 113-118. Available at: http://juke.kedokteran.unila.ac.id/index.php/majority/article/view/510

Friedewald WT, Levy RI, and Fredrickson DS (1972). Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. Clinical Chemistry, 18(6): 499-502. Available at: https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.576.9802&rep=rep1&type=pdf

Hussain AI, Anwar F, Sherazi STH, and Przybylski R (2008). Chemical composition, antioxidant and antimicrobial activities of basil (*Ocimum basilicum*) essential oils depend on seasonal variations. Food Chemistry, 108(3): 986-995. DOI: http://www.dx.doi.org/10.1016/j.foodchem.2007.12.010

Jatmiko ST (2015). Colour stability of painted nettle (*Coleus scutellarioides* L. Benth var crispa) leaves extract by copigmentation using malang apple (*Malus sylvestris* Mill var rome beauty) extract. Thesis. Christian University of Satya Discourse. Salatiga. Available at: https://docplayer.info/54463099-Oleh-selva-travanti-jatmiko-nim-tugas-akhir.html

Khyade MS, and Vaikos NP (2009). Pharmacognostical and preliminary phytochemical studies on the leaf of alstonia macrophylla. Journal of Herbal Medicine and Toxicology, 3(2): 127-132.

Kusuma AM, Asarina Y, Rahmawati YI, and Susanti (2016). Effect of Dayak Garlic (*Eleutherine palmifolia* (L.) Merr) extract and sweet purple potato (*Ipomoea batatas* L) extract on lowering cholesterol and triglyceride blood levels in male rats. Jurnal Kefarmasian Indonesia, 6(2): 108-116. DOI: http://www.dx.doi.org/10.22435/jki.v6i2.6225.108-116

Laboratory Stanbio (2011). Stanbio cholesterol liqui color procedure No.1010. Stanbio Laboratory, Boerne. Available at: http://www.vitroscience.cl/pdf/stanbio/Colesterol.pdf

Lee SJ, Umano K, Sihibamoto T, and Lee KG (2005). Identication of volatile componennts in basil (*Ocimum basilicum* L.) and thyme leaves (*Thymus vulgris* L.) and their antioxidant properties. Food Chemistry, 91(1): 131-137. Available at: https://agris.fao.org/agris-search/search.do?recordID=US201301051675

Lenhardt L, and Mozes S (2003). Morphological and functional changes of the small intestine in growth-stunted broilers. Acta Veterinaria Brno, 72: 353-358. DOI: https://www.doi.org/10.2754/avb200372030353

Mahata ME, Putri DO, Arif, Ohnuma T, and Rizal Y (2021). The Performance of broiler chickens fed on miana plant flour (*Plectranthus scutellarioides*, L.) R. Br. Journal of World's Poultry Research, 11(3): 332-337. DOI: https://www.dx.doi.org/10.36380/jwpr.2021.39

Martinez Y, Escalona A, Martnez O, Olmo C, Rodriquez R, Isert M, Betancur C, Valieve M, and Liu G (2012). The use of *Anacardium occidentale* as nutraceutical in hypoprotein diets for laying hens. Cuban Journal of Agricultural Science, 46(2): 395-401. Available at: https://www.redalyc.org/articulo.oa?id=193027579010

Meirindasari N, Murwani HR, and Tjahjono K (2013). Effect of papaya seed juice (*Carica papaya* L.) on total cholesterol levels in *Sprague dawley* dyslipidemic rats. Journal of Nutrition College, 2(3): 330-338. DOI: https://www.doi.org/10.14710/jnc.v2i3.3434

Muljono P, Fatimawali, and Manapiring AE (2016). Antibacterial activity test of male mayana leaf extract *(Coleus atropurpureus Benth*) against *Streptococcus* Sp. bacteria growth. and *Pseudomonas* Sp. Jurnal e-Biommedik, 4(1): 164-172. DOI: https://www.doi.org/10.35790/ebm.v4i1.10860

Narita EAR (2015). Bay leaf dyslipidemia therapy. Jurnal Majoraty, 4(4): 64-69. Available at: https://adoc.pub/bay-leaf-in-dyslipidemia-therapy.html

Nastain FS, Mahardhika BP, Ridla M, and Mutia R (2021). Visceral organ weight of broiler chicken fed different level protein and protease enzyme supplementation diet. IOP Conf. Series: Earth and Environmental Science, 788: 012032. DOI: https://www.doi.org/10.1088/1755-1315/788/1/012032

Novanti H, and Susilawati Y (2017). Pharmacological activity of Iler (*Plectranthus scutellarioides* (L) R.Br) leaves. Jurnal Farmaka, 15(1): 146-152. Available at: https://www.doi.org/10.24198/jf.v15i1.13196.g6045

Pangesti UT, Natsir MH, and Sudjarwo E (2016). Effect of using jackfruit seed flour (*Artocarpus heterophyllus*) in feed on giblet weight of broilers. Jurnal Ternak Tropika, 7(2): 58-65. Available at: https://ternaktropika.ub.ac.id/index.php/tropika/article/view/286/262

Ridwan Y, Darusman LK, Satrija F, and Handaryani E (2006). Chemical compound of painted neltle (*Coleus blumei* Benth) leaves extracts and their anthelmintic activrry against chicken tapeworm. Available at: https://journal.ipb.ac.id/index.php/JIPI/article/view/13937

Rohmah N, Tugiyanti E, and Roesdiyanto (2016). The effect of dried soursop leaf meal *(Annona Muricata L*.) in rations on weight of intenstine, pancreatis and gizzard of male Tegal Duck). Agripet, 16(2): 140-146. DOI: https://www.doi.org/10.17969/agripet.v16i2.5957

Rosyadi AR (2014). Test the effect of ethanol extract 70% tamarind fruit peel (*Tamarindus Indica* L.) against total cholesterol and triglyceride levels in blood serum of male white rats (*Rattus Norvegicus*) wistar strain. Naskah Publikasi. Thesis. Universitas Muhammadiyah Surakarta. Available at: http://eprints.ums.ac.id/28326/

Rumanti RT (2011). Effect of propolis on total cholesterol level of high-fat model wistar rats. Jurnal Kesehatan Masyarakat, 11(1): 11-17. Available at: https://media.neliti.com/media/publications/151578-ID-efek-propolis-terhadap-kadar-kolesterol.pdf

Salim Z, and Munadi E (2017). Information on medicinal plant commodities. Agency for the study and development of trade, ministry of trade of the republic of Indonesia. pp. 11-12. Available at: http://bppp.kemendag.go.id/media_content/2017/12/Isi_BRIK_Tanaman_Obat.pdf

Sangi M, Runtuwene MRJ, Simbala HEI, and Makang VMA (2008). Phytochemical analysis of medicinal plants in North Minahasa Regency. Chemistry Progress, 1(1): 47-53. DOI: https://www.doi.org/10.35799/cp.1.1.2008.26

Steel RGD, and Torrie JH (1991). Statistical principles and procedures of a biometric approach. 2nd edition, translated by Bambang Sumatri. PT. Gramedia Pustaka Utama, Jakarta, Indonesia, pp. 168-205. Available at: https://opac.perpusnas.go.id/DetailOpac.aspx?id=249306

Sumardika IW, and Jawi IM (2012). Water extract of sweet potato leaf improved lipid profile and blood sod content of rats with high cholesterol diet. Medicina, 43(2): 67-70. Available at: https://ojs.unud.ac.id/index.php/medicina/article/view/5053

Tian W, Ma X, Zhang S, Sun Y, and Li B (2011). Fatty acid synthese inhibitor from plants and their potential application in the prevention of metabolic syndrome. Clinical Oncology and Cancer Research, 8(1): 1-9. DOI: https://www.doi.org/10.1007/s11805-011-0550-3

Wakhidah AZ, and Silalahi M (2018). Ethnopharmacology of miana (*Coleus scutellariodes* (L.) Benth) plants in the community of West Halmahera, North Maluku. Jurnal Pro-Life, 5(2): 567-578. DOI: https://www.doi.org/10.33541/jpvol6Iss2pp102

Wang T, Carroll W, Lenny W, Boit P, and Smith D (2006). The analysis of 1-propanol and 2-propanol in humid air samples using selected ion flow tube mass spectrometry. Rapid Communications in Mass Spectrometry, 20(2): 125-130. DOI: https://www.doi.org/10.1002/rcm.2285

Warditiani NK, Indrani AAIS, Sari NAPP, Swasti IAS, Dewi NPAK, Widjaja INK, and Wirasuta IMAG (2015). Effect of the terpenoid fraction of katuk (Sauropus androgynus (L.) Merr) leaves on the lipid profile of white male rats (Rattus novergicus (L.) Wistar strain induced by fat-rich diet. Jurnal Farmasi Udayana, 4 (2): 66-71. Available at: https://ojs.unud.ac.id/index.php/jfu/article/view/17931

Wati AK, Zuprizal, Kustantinah, Indarto E, Dono ND, and Wihandoyo W (2018). Performance of broiler chickens with the addition of *Calliandra calothyrsus* leaf flour in feed. Sains Peternakan 16(2): 74-79. DOI: http://dx.doi.org/10.20961/sainspet.v16i2.23260

Wicaksono HS, Narayani I, and Setyawati I (2015). structure of mice liver after giving red calliandra leaf extract. Jurnal Simbiosis, 3(1): 258-268. Available at: https://ojs.unud.ac.id/index.php/simbiosis/article/view/14405

Windoro DPJ, Kasiyati, Djaelani MA, and Sunarno (2020). Effect of *Moringa oleifera* lam. leaves meal as feed additive on the weight of several internal organs and abdominal fat of pengging duck (*Anas platyrhyncos*). Buletin Anatomi dan Fisiologi, 5(2): 109-118. Available at: https://ejournal2.undip.ac.id/index.php/baf/article/view/9137

Yunarto N, and Aini N (2015). Effect of purified gambir leaves extract to prevent atherosclerosis in rats. Health Science Journal of Indonesia, 6(2): 105-110. DOI: https://www.doi.org/10.22435/hsji.v6i2.4768.105-110

Zychlinski A, and Kleffmann T (2014). Dissecting the proteome of lipoproteins: New biomarkers for cardiovascular diseases. Translational Proteomics, 7: 30-39. DOI: http://dx.doi.org/10.1016/j.trprot.2014.12.001

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