Biosaintifika 11 (2) (2019) 243-248

Biosaintifika

Journal of Biology & Biology Education

http://journal.unnes.ac.id/nju/index.php/biosaintifika

The Effect of Turmeric and Ginger Powder on Japanese Quail (*Coturnix coturnix*) Serum Lipid Profile

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DOI: http://dx.doi.org/10.15294/biosaintifika.v11i2.19228

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History Article

Submitted 15 May 2019
Revised 22 June 2019
Accepted 5 July 2019

Keywords

Lipid profile; Japanese quail; Organic feed

Abstract

Lipids are essential fatty acids. Lipids function as a source of energy and structural constituent components of Japanese quails. Japanese quail (*Coturnix japonica*) is one of the livestock sectors that is efficient in providing nutrients, both from eggs and meat. However, this animal has high cholesterol levels. This study aimed to determine the effect of organic feed on the cholesterol, triglyceride, HDL (High Density Lipoprotein), and LDL (Low Density Lipoprotein) level of Japanese quail. This study used an experimental method with a completely randomized design (CRD). The test animals were 30 females Japanese quail which were divided into 3 groups (2 individuals each) with different treatments i.e. P0: control (commercial feed); P1: standard organic feed (corn, soybean, bran and fish meal); P2: special organic feed (corn, soybean, bran, fish meal, cassava leaves, turmeric and ginger powder). Each treatment consisted of 5 replications. Feed was given for 2 months and at the end of the treatment, the blood was collected for analysis. Data obtained were analyzed using analysis of variance (ANOVA) and continued with Duncan test with a confidence of 95% (α=0.05). Analysis was performed using SPSS software 16.0 for windows. The results showed that the effect of organic feed containing cassava leaves, turmeric and ginger powder is significantly different on live weight, and not significantly different on feed consumption and drinking consumption. Moreover, the provision of that special organic feed was able to stabilize the cholesterol and HDL levels, and reduce LDL levels in Japanese quail (*Coturnix japonica*).

How to Cite

Sulastri, M. P., & Basri, H. (2019). The Effect of Turmeric and Ginger Powder on Japanese Quail (*Coturnix coturnix*) Serum Lipid Profile. *Biosaintifika: Journal of Biology & Biology Education*, 11(2), 243-248.

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p-ISSN 2085-191X
e-ISSN 2338-7610

INTRODUCTION

Lipids are essential fatty acids. In the body, lipids are in the form of phospholipids which play a role in maintaining the integrity and function of cellular and subcellular membranes, regulating cholesterol metabolism, as precursor of compounds that function as physiological regulators such as prostaglandin, thromboxane, and prostacyclin (Peter & Kathleen, 2009). Lipid has a function as energy sources and structural components of cells (Murray et al., 2009). Excess lipids are stored as energy reserves in the form of triglyceride in adipose tissue and constituents of myelin membrane in nerve fibers (Peter & Kathleen, 2009). Lipid acts as an electrical insulator that causes rapid depolarization wave propagation along nerve fibers that can become a heat insulator in subcutaneous tissue and around the visceral organs (Grahame, 2012).

Japanese quail (*Coturnix japonica*) is one of the efficient livestock sectors in providing nutrition, both from eggs and meat that contain high animal sources (Basri et al., 2018; Handarini et al., 2008). Quail eggs are nutritious and good for consumption because they contain proteins (16.0%), fat (31.5%), carbohydrates (0.2 - 1.0%), ash (1.8%), Ca (51.89 mg/100gr), Fe (2.65 mg/100gr), Cu (0.104 mg/kg) and Zn (1.04 mg/kg) (Stadelman & Cotteril, 1995; Basri, 2018) Quail eggs also contain 543 µg vitamin A (per 100g), 0.44% omega-3 and 1.62% omega-6 (Dudusola, 2010; Suripta et al., 2006).

Listiyowati & Roospitasari (2007) explained the benefits of quail farming i.e. rapid production, does not require sufficient fund, easy maintenance and can be cultivated on limited land. However, Japanese quail has high cholesterol indicated by cholesterol levels in Japanese quail's blood that reaches 700 mg/dl that results in increased cholesterol levels in Japanese quail's meat and egg yolks (Rahmat & Wiradimaja, 2011). Cholesterol levels in Japanese quail (*Coturnix japonica*) can be reduced by replacing the standard commercial feed with organic feed containing herbal ingredients.

Several types of herbal ingredients that have been used as research materials in reducing cholesterol levels are garlic (El-Sayyad et al., 2010), ginger and turmeric (Saraswati et al., 2013a). Turmeric contains curcumin compounds which can act as hepatoprotectors (Kohli et al., 2005). Ginger has the ability to increase appetite, strengthen the stomach, and improve digestion. The results of study by Setyanto et al., (2012) found that there was an effect of using ginger powder on feed rates. Harmono and Andoko, (2005) stated that the stimulation of the mucous membranes of the large stomach and intestine by essential oils released by the ginger rhizome resulting in the stomach becoming empty and the chicken will consume the feed.

Turmeric powder is one of the supplements that affects lipid levels. Provision of turmeric powder with a dose of 54 mg/head/day can reduce triglyceride levels by 24.94% compared to controls (Saraswati et al., 2013a). Curcumin can increase lipoprotein lipase activity, so that, it can reduce triglyceride levels in blood (Chattopadhyay et al., 2004). Turmeric powders also have an effect in decreasing the level of cholesterol because the curcumin contains in turmeric powders is able to stimulate the synthesis of LDL (Low Density Lipoprotein) receptor (Emadi et al., 2007). Decreased cholesterol and triglyceride levels in the blood due to the distribution of cholesterol and triglycerides to other tissues, such as follicle hierarchies (Putra, 2018).

The number of follicular hierarchies in Japanese quails that have been given turmeric powder supplements is more than controls (Saraswati et al., 2013b). The addition of turmeric powder supplements in Japanese quail feed of 54 mg/head/day before the period of sexual maturity can improve lipid metabolism, distribution to various organs through enterohepatic recirculation, ovarian follicles (Saraswati et al., 2013b), reduce abdominal and subcutaneous fat deposits (Putra et al., 2015), as well as reduce cholesterol levels in meat and egg yolk (Putra et al., 2016).

The addition of turmeric powder given with dose of 108 mg/head/day, increase vitellogenin, improve the quality of the eggs and increase the development of quail embryos (Saraswati & Tana 2016). Based on the background above, this study was conducted to analyze the effect of organic feed on Japanese quail lipid profiles. This study was expected to increase knowledge about the provision of organic feed containing cassava leaves, ginger and turmeric powder which can stabilize cholesterol, HDL (High Density Lipoprotein) and LDL levels in Japanese quail (*Coturnix japonica*)

METHODS

The study was conducted at the laboratory of Faculty of Mathematics and Natural Sciences, Al-Azhar Islamic University, Mataram; Laboratory of Animal Nutrition and Food Sciences, Faculty of Animal Husbandry, Mataram University; and Hepatika Laboratory, Mataram.

Study Design

This study was an experimental study with Completely Randomized Design (CRD). The test animals used in this study were 30 females Japanese quail (*Coturnix japonica*) randomly selected from 65 females Japanese quail. Selected Japanese quails were divided into 3 experimental groups; P0: control (commercial feed); P1: standard organic feed which ingredients were corn flour, soybean flour, bran and fish meal; P2: organic feed which ingredients were corn flour, soybean flour, bran, fish meal, turmeric powder, ginger powder and cassava leaves. Each experimental group consisted of 5 replications. Each treatment group consisted of 2 female Japanese quails. The organic feed ingredients used can be seen in Figure 1.

Figure 1. Ingredients of organic feed used in this study including (a) corn flour, (b) bran, (c) soybean flour, (d) fish meal, (e) cassava leaves, (f) ginger powder, and (g) turmeric powder.

Organic Feed Making

All ingredients were mixed and stirred until blended. Materials that had been mixed well were weighed and packed with a size of 1 kg each (with the aim to facilitate the calculation of the daily feed consumption). After weighing and packaging, the feed was ready for use and stored for Japanese quail food reserves.

Sterilization and Acclimation to Collective Cages

Collective cages with an area of 1 m^2 were prepared. The cages and equipment were then fumigated with disinfectants. Acclimation was carried out for 6 days. Japanese quail was inserted into the collective cage with the formation of 10 cages. A sugar solution with a concentration of 1 tablespoon in 1 liter of water was given to restore Japanese quail conditions.

Giving the Treatment

The treatment was given before the Japanese quails enter the period of sexual maturity. The first provision of feed was given at the age of 14 days, then subsequently given every day until 50 days.

Serum Sample Collection

Serum collection was done by taking the Japanese quail's blood from *jugular vein* during the decapitation process to get maximum blood amount. Japanese quail was conditioned in a relaxed state to avoid rigor when decapitation was conducted, so that there is no blockage of the arteries. As much as 5 ml of blood was collected in the venoject, then left for 2 hours in a tilted position, this was done to get the serum easier. The serum was taken with a pipette and put in a test tube. The serum was centrifuged for 20 minutes at 10,000 rpm, centrifugation was carried out to ensure that no blood deposits were mixed in the serum. The serum taken was plasma that does not contain fibrinogen or a blood clotting component. The resulting serum was put in an Eppendorf tube and stored in the refrigerator before being used to test the variables of profile of cholesterol, HDL (High Density Lipoprotein) and LDL (Low Density Lipoprotein).

Body weight was measured by weighing the quail using digital scales with a maximum capacity of 1000 g at the end of study following the procedure by Winata et al. (2017). Feed consumption was measured by calculating the difference between the feed given with the amount of feed remaining for 1 week of feeding so that the daily feed consumption can be obtained in units of g/head/day. The Ohaus scales used had a sensitivity of 0.1 g. Drinking consumption was measured by calculating the difference between drinking given with the amount remaining every day in units of ml/head/day using a measuring cup (Winata et al., 2017). Cholesterol was measured with the CHP-PAP method (Elwakked et al., 2012), HDL and LDL were measured with the CHO-PAP method (Ahlian, 2005).

Data Analysis

The data obtained were analyzed using analysis of variance (ANOVA) and continued with Duncan test at a significance level of 95% if there were significant differences. Analysis was performed using SPSS software 16.0 for windows (Mattjik & Sumertajaya, 2006).

RESULTS AND DISCUSSIONS

The results of the average live weight, feed consumption and drink consumption in Japanese quail after the provision of organic feed are pre-

sented in Table 1.

Results of statistical analysis of live weight showed significantly different results (P <0.05). Significantly different results were found in P0 compared to P1 and P2, while P1 and P2 was not significantly different. This is due to the protein content in treatment P0 that is higher (19-21%) than P1 (15.59%) and P2 (15.19%). The protein content in feed is one of the determining factors in increasing body weight. Factors that affect the final body weight of broiler chickens include; genetics, sex, protein ration, temperature, housing management and sanitation (Triyanto, 2007). The live weight in treatment P1 (152.00 gr) and P2 (156.00 gr) (Table 1), is still considered normal. The results of Aetin et al. (2017) showed that quail fed with standard organic feed had a weight of 128.55 g and those fed with standard organic feed containing turmeric powder and cassava leaf flour had a weight of 121,77 g. The study of Zulhaidar et al., (2017) showed the amount of quail feed consumption with the provision of turmeric powder (54 mg/head/day) amounted to 20.369 g/head/day).

The results of statistical analysis on feed consumption and drinking consumption were not significantly different (P> 0.05). This is caused by no extreme environmental activity, so that the physiological conditions of quail are still maintained as indicated by the consumption of feed and drinking that are still in a reasonable stage. In accordance with the results of a study conducted by Aetin et al., (2017) that quail (*Coturnix japonica* L.) that was given standard organic feed had feed consumption of 20.27 (g) and those fed with standard organic feed containing turmeric powder and cassava leaves flour reached 21.90 (g).

The results of the lipid profile cholesterol, HDL and LDL analysis of Japanese quail (*Coturnix japonica*) after being given organic feed are presented in Table 2.

The results of the statistical analysis showed that the provision of organic feed had no significant effect (P> 0.05) on cholesterol and HDL levels. This showed that the provision of organic feed with the addition of turmeric powder to Japanese quail (*Coturnix japonica*) can stabilize the cholesterol and HDL levels, with cholesterol levels in P2 is 243.40 and P0 is 279.60 (Table 2). One of the causes of increased serum HDL level sis because of the curcumin and phytoestrogens in turmeric. Saraswati et al., (2013b) stated that phytoestrogens level in turmeric were 6.73%. Curcumin has a role to optimize liver function in lipid metabolism (Sengupta et al., 2011) i.e. increasing the performance of lipoproteins to control cholesterol, lipid and triglycerides levels in the tissues (Grahame, 2012). Phytoestrogens have the same effect as estrogen which stimulates the activity of vitelogenin synthesis in the liver to utilize cholesterol as a precursor in vitelogenin synthesis (Levi et al., 2009).

Aetin et al., (2017) stated that the provision of organic feed containing cassava leaves and turmeric powder was able to reduce cholesterol and HDL levels compared to the commercial feed. Putra et al., (2015) reported that the addition of turmeric powder of 108 mg / head / day can reduce cholesterol levels in quail's blood. 4 g of turmeric powder to broilers decreased cholesterol levels by 162.5 mg/dl. Mehala and Moorthy (2008) stated that the provision of 0.6 g turmeric

Table 1. Results of statistical analysis of live weight, feed consumption and drink consumption in Japanese quail (*Coturnix japonica* L.) after the provision of organic feed.

Variable	Treatment		
	P0	P1	P2
Live weight (gr)	208.00^{a}±8.37	152.00^{b}±19.23	156.00^{b}±18.16
Feed consumption (gr/head/day)	21.39±2.03	22.79±3.40	21.81±1.84
Drink consumption (ml/head/day)	49.85-4.92	47.24-10.51	44.71-5.59

Superscripts with different lowercase letters on the same line show significant differences (P <0.05).

Table 2. Results of statistical analysis of cholesterol, HDL and serum LDL of Japanese quail (*Coturnix japonica*) after being given organic feed.

Variable	Treatment		
	P0	P1	P2
Cholesterol	279.60^{a}±33.20	252.80^{a}±78.35	243.40^{a}±74.98
HDL	53.00^{a}±11.75	50.00^{a}±48.76	72.80^{a}±87.50
LDL	26.80^{a}±4.02	61.60^{b}±26.88	24.60^{a}±14.33

Superscripts with different lowercase letters on the same line show significant differences (P <0.05).

can reduce cholesterol levels of broilers by 3.42 mg/dl.

Turmeric powder is one of the supplements that affect lipid levels. Turmeric powder contains curcumin. Curcumin in turmeric powder can stimulate LDL receptor synthesis activity (Emadi et al., 2007). Increased LDL receptors cause a decrease in the LDL levels in serum. The more LDL receptors, the more LDL is bound by LDL receptors, so that LDL levels in the serum decrease. Decreased cholesterol levels in the blood are also caused by the distribution of cholesterol to other tissues, such as the muscles and follicular hierarchy in the ovary (Saraswati, 2013a).

The results of the statistical analysis showed that the provision of organic feed on LDL levels was significant (P< 0.05). Based on study conducted by Aetin et al., (2017), organic feed containing cassava leaves and turmeric powder can lower LDL levels in the Japanese quail *(Coturnix japonica)* amounted to 54. 28 compared to control. Putra, (2018) stated that giving turmeric powder supplements at a dose of 108 mg/head/day can reduce serum LDL levels by 13.91 mg/dl in Japanese quail. Akbarian et al., (2012), supported this statement that the provision of 0.5 g/kg of turmeric powder causes a decrease in broiler blood LDL levels of 1.11 mg / dl. The decreasing of LDL level is due to an increase in LDL receptors which play a role in binding LDL which is then deposited by cells (Emadi et al., 2007). This matter causes the presence of excessive LDL on the network can be controlled. The novelty of this study was the combination of organic feed ingredients containing cassava leaves, ginger and turmeric powder for Japanese quail (*Coturnix japonica*) that did not affect the body weight but were able to stabilize the cholesterol and HDL levels as well as reduce the LDL levels.

The organic feed ingredients that were used in this study can improve the knowledge about organic material that can optimize cholesterol and HDL levels, and encourage the researcher to find other organic materials that can used to stabilize cholesterol levels in Japanese quail meat and eggs.

CONCLUSION

Provision of organic feed containing cassava leaves, turmeric powder and ginger powder can stabilize feed consumption, drink consumption, cholesterol and HDL levels and can reduce serum LDL levels by 37 mg/dl in Japanese quail (*Coturnix japonica*).

ACKNOWLEDGEMENT

We would like to show our gratitude to the Ministry of Research, Technology, and Higher Education and Institute for Research and Community Service (LPPM) of Al-Azhar Islamic University, Mataram for funding this study in Beginner Lecturer Research scheme in 2019 and for the people who supported and involved in the process of implementing this study.

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