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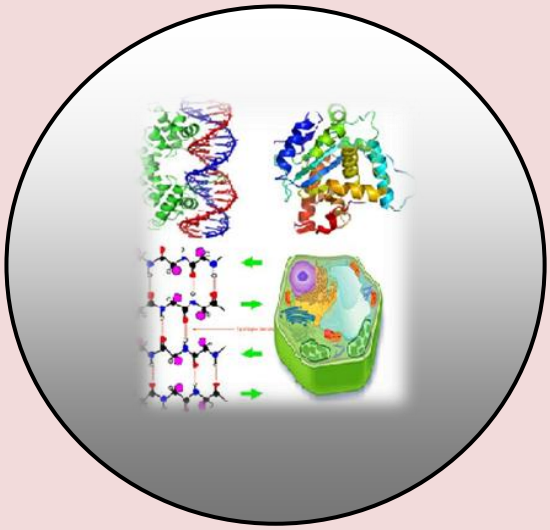

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The Effect of Water Extract of Turmeric (*Curcuma domestica* Val.) Leaf on Egg Production and Yolk Cholesterol Levels in Egg Laying Hens

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ABSTRACT
This study aims to learn the effect of water Turmeric leaf extract (Curcuma domestica Val.) on egg production and yolk cholesterol contents of Lohmann Brown laying hens. The experiment design used of Completely Randomized Design (CRD) with three treatments and ten replicates, with six Lohmann Brown aged 60 weeks in each replicated. The treatments were Lohmann Brown chicken given drinking water without of Turmeric leaf extract as control (A), Lohmann Brown given 2% extract of Turmeric leaf water through drinking water (B), and Lohmann Brown given 4% extract of turmeric leaf water through drinking water (C). The variables observed in this study were phytochemical compounds contained of Turmeric leaf water extract, feed consumption and drinking water consumption, number of eggs, total egg weight, Feed Convertion Ratio (FCR), dry matter content of egg yolk, fat content of egg yolk, egg yolk protein content and cholesterol levels of egg yolk. The results showed that the phytochemical compounds of Turmeric leaf water extract were curcumin, alkaloids, flavonoids, terpenoids, steroids, phenolics, tannins, and beta carotene. Result showed Turmeric leaf extract in drinking water showed significantly different (P<0.05) on total egg weight, yolk fat content, yolk protein content, and yolk cholesterol levels. It can be concluded that water extract of Turmeric (Curcuma domestica Val.) leaf on drinking water can improve feed efficiencies, total egg weight, and egg protein levels, but reducing fat and cholesterol levels of egg yolk Lohmann Brown laying hens.
Keywords: Curcumin, Beta-Carotene, Cholesterol and Eggs.

INTRODUCTION
Consuming products with excessive high cholesterol is one of the risk factors for generative disease. Consuming cholesterol in foods should not exceed the standard 200 mg/dl threshold and Low Density Lipoprotein (LDL) is lower than 100 mg/dl (Oetoro, 2009). Based on this, efforts need to be made to reduce the fat and cholesterol levels of chicken eggs and to enrich other nutrients needed and be able to produce chicken eggs free of pathogenic microbes (especially *Salmonella sp* and *Escherichia coli*) and free of antibiotics or chemicals. On the other hand, the use of Antibiotic Growth Promoter (AGP) in Indonesia has been banned since January 1, 2018, because the administration of antibiotics can cause resistance to various bacteria. Giving antibiotics to consume with excessive doses can also cause residues in livestock products.

This is in line with the opinion of Soeripto (2002) that excessive use of antibiotics or in low doses, but given continuously can leave a residue in livestock products. Eggs are livestock products that have the potential to contain antibiotic residues when antibiotics are used excessively or continuously. Efforts to reduce the use of chemical antibiotics need to find alternatives, one of which is to use herbal plants. Many studies have been carried out on herbal plants as natural antibiotics and reduce cholesterol levels (Bidura *et al*., 2017; Santoso *et al*., 2015; Wibawa *et al*., 2017; Siti *et al*., 2017; and Restiayanti *et al*., 2014). The same thing was also conveyed by Ardika *et al*. (2017) that giving 2% *Moringa* leaf powder in laying rations can increase the consumption and weight of chicken eggs and reduce feed conversion and cholesterol values of egg yolk. In addition to *Moringa* leaves, other herbs that can reduce cholesterol levels in eggs are Garlic. Wibawa *et al*. (2017) states that the addition of 0.20-0.60% Garlic extract (*Allium sativum*) in drinking water of Lohmann Brown chicken aged 40-50 weeks can increase egg weight, number of eggs, weight of egg yolk, and feed efficiencies, but reducing yolk cholesterol levels in laying hens. Another potential herbal plant as a natural antibiotic is turmeric leaves. Turmeric (*Curcuma domestica* Val) includes plants that thrive and wild. The part of Turmeric that is often used is rhizomes and roots, other body parts also have many benefits but are rarely used, namely in the leaves (Winarto and Lentera, 2004). Turmeric can be used as a natural antibiotic because it has the ability to suppress pathogenic microbes, provide immunity and endurance, and also improve the appearance of production caused by the presence of *curcumin* in Turmeric (Natsir *et al*., 2016). *Curcumin* contained in Turmeric plants in addition to having antibacterial properties, can also stimulate the gall bladder wall to remove bile so that it can facilitate fat metabolism. Other active compounds contained in Turmeric are alkaloids, flavonoids, essential oils, and tannins (Sunanti, 2007). Research on giving extracts of turmeric leaf water through drinking water is still rare. Turmeric body parts that are often used are rhizomes and roots. Research conducted by Amo *et al*. (2013) in the ration addition of Turmeric flour showed that the addition of 7% Turmeric in the ration have good results on egg weight, eggshell thickness, and egg yolk color. Based on this, the researchers wanted to examine the effect of Turmeric leaf water extract (*Curcuma domestica* Val.) on drinking water for the production and egg quality of Lohmann Brown laying hens.

MATERIAL AND METHODS

Research design: The research design used was Completely Randomized Design (CRD) with three treatments and ten replications, so that there were 18 experimental units. Each experimental unit uses 6 hens, so the total hens used is 3 x 10 x 6 = 180 hens. The three treatments are as follows: A = Lohmaan Brown chicken which was given drinking water without extract of turmeric leaf water (*Curcuma domestica* Val.). B = Lohmaan Brown Chicken which is given 2% extract of turmeric leaf water (*Curcuma domestica* Val.) Through drinking water. C = Lohmaan Brown Chicken which is given 4% extract of turmeric leaf water (*Curcuma domestica* Val.) Through drinking water.

Location and Time of Research: The research was conducted in a farmer's enclosure in Animal Nutrition and Food Laboratory and Laboratory of Bioscience and Biotechnology at the Faculty of Animal Husbandry, Udayana University.

Research variable: The variables observed were phytochemical compounds of turmeric leaf water extract, ration consumption, drinking water consumption, number of eggs, total egg weight, Feed Convertion Ratio (FCR), dry matter content of egg yolk, egg yolk fat content, egg yolk protein content, and levels yellow cholesterol Chicken The chickens used in this study were 54 Lohmann Brown laying hens aged 60 weeks.

Research cages: the cage used is a cage with a battery of 18 plots. The cage material used consists of bamboo blades. Each plot has a length, width and height of 100 cm, 100 cm, and 40 cm. All plots are located in a building measuring 8 mx 3 m, stretching from east to west with roofs made of asbestos and concrete floors. The equipment used is a place to feed and drink a place made of paralon pipes with a length of food and drink is 40 cm. Under the cage there is a base made of plastic carpet to hold chicken manure. Cleaning cages is done twice a week.

Turmeric leaves: Turmeric leaves (*Curcuma domestica* Val.) used are Turmeric leaves that are still green and fresh, then washed using clean water. Turmeric leaves are obtained from the farmer's garden in Tabanan Village, Bali-Indonesia.

Ration and drinking water: ration and drinking water are given in *ad libitum*. The ration given is the comercial feed layer concentrate for the layer with ration constituent consisting of 34 % concentrate; 48.20 % yellow corn; rice bran 16.70 % and minerals 1.10%. Drinking water given is water with a mixture of Turmeric leaf water extract at the level of 2 % and 4 %.

Statistical analysis: The data obtained were analyzed by variance and if there were significant differences (P<0.05) between treatments, then multiple distances were tested from Duncan (Steel and Torrie, l993).

RESULTS AND DISCUSSION

Turmeric plants (*Curcuma domestica* Val.) include plants that thrive and are wild. Turmeric body parts that are often used are rhizomes and roots, but other body parts also have many benefits but are rarely used, namely in leaves. Turmeric leaves grow frayed about 35 cm, 14 cm wide, green, and each plant consists of 9-10 leaves (Winarto and Lentera, 2004). The composition of turmeric leaves includes 2.20% protein; 2.04 % fat; and 1, 8-cineol essential oil. Based on the screening profiles of phytochemical compounds, the phytochemical compounds contained in turmeric leaves are curcumin, alkaloids, steroids, terpenoids, phenolics, flavonoids, and tannins and beta carotene through spectrophotometric tests as listed in Table 1. Similar opinions from Suryanto and Katja (2009) that turmeric leaves contain bioactive compounds such as flavonoids, tannins and phenolics which have many benefits. Phenolic compounds in turmeric leaves will interact with bacterial cell walls, then absorb and penetrate into bacterial cells, causing protein denaturation which results in bacterial cell membrane lysis. The phenol group is capable of damaging cell membranes, activating enzymes and denaturing proteins so that cell walls are damaged due to decreased permeability. Changes in permeability of the cytoplasmic membrane allow disruption of important organic ions into cells which result in inhibition of growth and even cell death (Damayanti and Suparjana, 2007). In high concentrations, the phenol content penetrates and disrupts bacterial cell walls and deposits proteins in bacterial cells. In lower concentrations, phenol activates important enzyme systems in bacterial cells (Oliver *et al*., 2001).

Table 1. Phytochemical Compounds of Turmeric Leaf Water Extract (*Curcuma domestica* Val.)

Phytochemical Compounds	Results	Methods
Curcumin	+	Phytochemical Profile Screening
Alkaloid	+	Phytochemical Profile Screening
Steroids	+	Phytochemical Profile Screening
Terpenoid	++	Phytochemical Profile Screening
Phenolic	++	Phytochemical Profile Screening
Flavonoid	++	Phytochemical Profile Screening
Saponin	-	Phytochemical Profile Screening
Tanin	+	Phytochemical Profile Screening
Beta-carotene (mg/100g)	375,04	Spectrophotometry

Source: Results of analysis of the Laboratory of Bioscience and Biotechnology at Udayana University
Noted: ++) a lot; +) exists; -) there is no

Curcumin is the main compound of turmeric which is grown in Indonesia and used as cosmetics, food coloring, spices, and traditional medicines (Oetari, 1996). Turmeric can be used as a natural antibiotic because it has the ability to suppress pathogenic microbes, provide immunity and endurance, and also improve the appearance of production caused by the presence of curcumin in turmeric (Natsir *et al*., 2016). It was also reported that curcumin contained in turmeric plants besides having antibacterial properties, curcumin can also stimulate the gallbladder wall to release bile so that it can facilitate fat metabolism. Other active compounds contained in turmeric are alkaloids, flavonoids, essential oils, and tannins (Sunanti, 2007). Flavonoids are compounds of phenolic groups commonly found in nature. This compound is responsible for red, purple, blue, and some yellow coloring in plants. In leaves, the content of flavonoid compounds serves to improve plant survival in protecting themselves from pathogenic fungal contamination and UV-B radiation (Cushnie and Lamb, 2005).

The flavonoids contained in turmeric leaves are a group of phenolic compounds that can inhibit the growth of microbes or bacteria. Flavonoids are water-soluble compounds for antimicrobial and antiviral work (Naiborhu, 2002). The use of turmeric leaves on food aims to inhibit bacterial growth and improve physical and chemical quality. Tanin acts as a protein denaturation and prevents the digestion process of bacteria, while flavonoids are water-soluble compounds for antimicrobial and antiviral work. Its mechanism of action in inhibiting bacteria is done by denaturing proteins and damaging bacterial cell membranes by dissolving fats found on cell walls. This compound is able to migrate from the liquid phase to the fat phase. Damage to cell membranes results in inhibition of specific enzyme activity and biosynthesis needed in metabolic reactions and this condition which ultimately causes death in bacteria (Naiborhu 2002). Beta carotene is one of the antioxidants that make up vitamin A. Antioxidants are compounds that can protect the body from free radicals (Madhavi *et al*., 1995). Beta carotene is one of the carotenoid products that has the highest vitamin A activity. Karatenoid is a class of fat-soluble pigments and is found in almost all types of plants. In karatenoid plants have two functions, namely as additional pigments in photosynthesis and as dyes in flowers and fruit (Harborne, 1996). The results of the study on the effect of using Turmeric leaf extract (*Curcuma domestica* Val.) on Lohmann Brown chicken production are presented in Table 2. The results showed that the results did not differ significantly from ration consumption where Lohmann Brown chicken ration was fed drinking water without adding extract turmeric leaves. (A) is 6,213.83 grams/ head/56 days (Table 2). Consumption of Lohmann Brown chicken ration given by drinking water with the addition of 2% turmeric leaf extract (B) and drinking water by adding 4% (C) turmeric leaf extract 1.26% and 0.82% respectively not significantly different (P > 0.05) compared to treatment A. Consumption of Lohmann Brown chicken ration treated with C 0.43% was not significantly different (P> 0.05) lower than treatment B.

Table 2. The Effect of Turmeric (*Curcuma domestica* Val.) Leaf Water Extract in Drinking Water on egg production of Lohmann Brown's laying hens.

Variable	Treatment[1)]			SEM[2)]
	A	B	C	
Feed consumption (g/head/56hr)	6.213,83[a3)]	6.291,83[a]	6.264,83[a]	34,00
Drinking water consumption (l/head/56hr)	16,66[a]	17,31[a]	17.26[a]	0,41
Feed Convertion Ratio (FCR)	2,21[b]	2,16[a]	2,14[a]	0,01
Number of eggs (egg/head/56hr)	42,93[a]	43,15[a]	43,29[a]	0,24
Total egg weight (g/head/56hr)	2.814,96[a]	2.911,30[b]	2.924,78[b]	17,21

Noted: 1) Drinking water without the addition of turmeric leaf extract as a control (A); drinking water with the addition of 2% (B) turmeric leaf aqueous extract; and drinking water with the addition of 4% (C) turmeric leaf aqueous extract

2) SEM: Standard Error of Treatment Means

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

Consumption of drinking water on Lohmann Brown given treatment A was 16.66 liters/ head/56 days (Table 2). Lohmann Brown laying hens were given treatment B and treatment C consumption of drinking water was 3.90% and 3.60%, respectively, not significantly different (P> 0.05) with treatment A. Consumption of drinking water from Lohmann Brown chicken treated with C 0, 29 % were not significantly different (P> 0.05) lower than treatment B. The administration of turmeric leaf extract (*Curcuma domestica* Val.) In each treatment did not significantly affect the consumption of rations and drinking water. This is because the nutrition content of the three treatments is the same so that the nutritional needs of the chicken in the second phase are fulfilled with the ration given. This is in accordance with the opinion of Bidura *et al*. (2017) that the provision of herbal extracts (Katuk leaves and Garlic) as much as 5 cc/100 cc of drinking water does not significantly affect the consumption of rations and drinking water. Wibawa *et al*. (2016) also reported that administration of herbal plant extracts (garlic) through drinking water at a concentration of 2.5-5% did not significantly affect the consumption of rations and drinking water. The Lohmann Brown Feed Convertion Ratio (FCR) given treatment A was 2.21 (Table 2).

Brown Lohmann chickens who received treatment B had a 2.26% FCR value significantly different (P <0.05) lower than treatment A and those receiving treatment C 3.17% significantly different (P <0.05) more low compared to treatment A. FCR Lohmann Brown which received treatment C 0.93% was not significantly different (P> 0.05) compared to treatment B. Conversion of ration in treatment B and treatment C showed lower results than treatment A due to administration Turmeric leaf extract can reduce pathogenic bacteria in the digestive tract. Decreasing pathogenic bacteria in the digestive tract will cause an increase in the efficiency of absorption of nutrients. Reduced pathogenic microbes due to the role of turmeric as a natural antibiotic. Natsir *et al*. (2016) stated that the content of turmeric curcumin is a natural antibiotic with the ability to suppress pathogenic microbes, provide immunity and endurance, and also in improving the appearance of production. In addition to containing curcumin, turmeric leaves also contain flavonoids. Flavonoids are water-soluble compounds for antimicrobial and antiviral work (Naiborhu, 2002). The flavonoids contained in turmeric leaves are a group of phenolic compounds that can inhibit the growth of microbes or bacteria. Antibacterial tests using turmeric powder rhizome (*Curcuma domestica* Val) caused a decrease in the growth of *Escherichia coli* bacterial colonies (Lestari, 2007). This is in line with Said (2001) opinion that active compounds in turmeric rhizomes can inhibit the growth of fungi, viruses, and bacteria, both Gram positive and Gram negative, such as *Escherichia coli* and *Staphylococcus aureus*, because turmeric contains various compounds including curcumin and essential oils. Decreasing pathogenic bacteria such as *Escherichia coli* and *Coliform* in the digestive tract will cause probiotic bacteria such as *Lactobacillus sp* to increase so that the efficiency of absorption of nutrients increases (Bidura, 2007). Jayne-Williams and Fuller (1971) stated that administration of antibiotics (antibacterial) causes thinning of the intestinal wall, and the increasing number of microbes that can increase absorption of nutrients, so that the efficiency of the use of nutrients can be better. Santoso (2001) also states that one possibility that causes ration efficiency is a change in the balance of microflora in the digestive tract. Other factors that can affect ration conversion include physical form of feed, chicken body weight, nutrient content in ration, maintenance environment, stress, and gender. Supported by Humik *et al*. (1977), the factors that influence feed conversion are egg production, egg weight and ration consumption. The number of eggs during the study did not show a significant difference (P> 0.05) in each treatment. The number of Lohmann Brown chicken eggs given by treatment A was 42.93 egg/ head / 56 days (Table 2). Lohmann Brown were treated with B and C, the number of eggs was 0.51% and 0.84% respectively, not significantly different (P> 0.05) compared to treatment A. The number of Lohmann Brown eggs treated C 0.32 % was not significantly different (P> 0.05) higher than treatment B. There was an increase in the number of eggs in treatments B and C although statistically the results were not significantly different. The increase in the number of eggs is caused by an increase in feed consumption and the use of efficient rations. Excessive consumption of rations with laying hens will be used to stimulate productivity in producing eggs, while drinking water consumption is directly proportional to consumption of rations. All nutrients contained in feed and drinking water processed chicken will interact with each other in the body of the chicken, so that the chicken is able to meet the basic needs of life and egg production. Sell *et al*. (1978) states that the excess metabolic energy (ME) consumed by laying hens to increase body fat levels, will be used to stimulate productivity in producing eggs. The total weight of Lohmann Brown eggs given by treatment A was 2,814.96 grams/head/56 days (Table 2). Lohmann Brown who received treatment B had a total egg weight of 3.42% significantly different (P <0.05) higher than treatment A and those who received treatment C 3.90% were significantly different (P <0.05) higher compared to treatment A. The total weight of Lohmann Brown chicken received treatment C was 0.46% not significantly different (P> 0.05) compared to treatment B. The total weight of eggs showed significantly different results between treatment A and treatment B and C caused by absorption of maximum nutrients will cause maximum ration efficiency so that it will affect the weight of the eggs produced. Providing turmeric leaf extract through drinking water will help absorb nutrients because of the active compounds contained in turmeric leaf extract. The most important plant bioactive compounds are alkaloids, flavonoids, tannins, and phenolics (Edeoga *et al*., 2005). These active compounds in the digestive tract of poultry will be able to help absorb food substances. Adibmoradi *et al*. (2006) stated that the active compounds of herbal plants such as garlic can increase villous height and crypto depth, and reduce epithelial thickness and the number of villous cells in the duodenum, jejunum, and poultry ileum.

Increased height of villi, and thickness of epithelium and cup in the duodenum, jejunum, and ileum will increase absorption of nutrients (Nusairat, 2007). Yolks have a more complete nutritional composition than egg whites and consist of water, fat, carbohydrates, minerals, and vitamins (Stadellman, 1995). Bell and Weaver (2002) also state that the composition of the yolk consists of 50% water, 32% -36% fat, 16% protein, and glucose 1% -2%. The results of the study on the effect of using turmeric leaf extract (*Curcuma domestica* Val.) are presented in Table 3.

The dry matter of Lohmann Brown yolk that received treatment A was 49.20% (Table 3). Lohmann Brown chicken was given treatment B and treatment C had dry content of yolk 0.45% and 0.41%, not significantly different (P> 0.05) with treatment A. Level of dry ingredients of Lohmann Brown yolk getting treatment C 0.04% was not significantly different (P> 0.05) compared to treatment B. The level of dried yolk given turmeric leaf extract increased compared to chickens not given turmeric leaf extract even though it did not have a significant effect.

Table 3. Effect of Turmeric (*Curcuma domestica* Val.) Leaf Water Extract in Drinking Water on the Egg Quality of Lohmann Brown Laying Hens.

Variable	Treatment[1)]			SEM[2)]
	A	B	C	
Dry matter of yolk (%)	49,20[a3)]	49,42[a]	49,40[a]	0,28
Fat content of yolk (%dry matter)	29,09[b]	27,17[a]	27,57[a]	0,21
Protein content of yolk (% dry matter)	16,49[a]	17,25[b]	17,17[b]	0,17
Yolk Cholesterol (mg/dl)	173,53[b]	159,01[a]	160,06[a]	1,32

Note:

1) Drinking water without the addition of turmeric leaf extract as a control (A); drinking water with the addition of 2% (B) turmeric leaf aqueous extract; and drinking water with the addition of 4% (C) turmeric leaf aqueous extract

2) SEM: Standard Error of Treatment Means

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

The increase in the dry matter content of yolk occurs due to an increase in the crude protein content of yolk. The higher the crude protein produced, the higher the dry matter of the egg. Turmeric leaves contain phytochemical compounds that function as antioxidants so they can counteract free radicals. Free radicals can interfere with the process of protein synthesis, the presence of curcumin in turmeric will counteract hydroxyl radicals. This is in line with the opinion of Priyadarsini *et al*. (2003) that the active ingredient of ginger in turmeric has a hydroxyll group which is easily oxidized, so it will be easy to donate hydrogen and electron groups to free radicals, so that free radicals that interfere with protein synthesis can be reduced. The fat content of Lohmann Brown yolk given treatment A was 29.09% of the% dry matter (Table 3). Brown Lohmann chickens who received treatment B had 6.60% yolk fat content significantly different (P <0.05) lower than treatment A and those who received treatment C 5.23% differed significantly (P <0.05) lower than treatment A. Fat The content of Lohmann Brown yolk that received treatment C was 1.47% not significantly different (P> 0.05) higher than treatment B. The content of curcumin in the leaves of turmeric as an antioxidant will help reduce levels fat. Curcumin, which is contained in turmeric, is an antioxidant that can suppress inflammation in fat, pancreatic, and muscle cells. This condition can help reduce the risk of blood pressure, cholesterol, blood sugar, and various other metabolic disorders. Natsir *et al*. (2016) stated that curcumin contained in turmeric plants in addition to having antibacterial properties, can also stimulate the gallbladder wall to release bile so that it can facilitate fat metabolism. The function of turmeric as a natural antibiotic can suppress pathogenic bacteria (*Escherichia coli* and *Coliform bacteria*) in the digestive tract so that the probiotic bacteria increase. Probiotic bacteria such as lactic acid bacteria can affect a number of processes of digestion and absorption of fat in the digestive tract. In the digestive tract, lactic acid bacteria are able to utilize energy derived from carbohydrate sources to reduce the pH of the digestive tract to 4.5 which causes the atmosphere in the digestive tract to become acidic. The acidic environment causes the activity of the lipase enzyme to be limited, so that fat digestion decreases and furthermore the formation of body fat decreases (Piliang *et al*., 1990).

The protein content of Lohmann Brown yolk given treatment A is 16.49% of the % dry matter (Table 3). Brown Lohmann chickens who received treatment B had yolk protein levels 4.61% significantly different (P<0.05) higher than treatment A and those who received treatment C 4.12% differed significantly (P<0.05) higher than treatment A. The protein content of Lohmann Brown yolk that received treatment C was 0.46% not significantly different (P>0.05) lower than treatment B.

Giving turmeric leaf extract can increase protein levels in yolk due to the presence of bioactive compounds in turmeric which act as antioxidants to ward off free radicals. This is in line with the opinion of Priyadarsini *et al*. (2003) that the active ingredient of ginger in turmeric has a hydroxyl group which is easily oxidized, so it will be easy to donate hydrogen groups and electrons to free radicals, consequently free radicals that interfere with protein synthesis will be reduced or suppressed by the active substance in turmeric. Turmeric in addition, decreasing pathogenic microbes in the digestive tract will optimize nutrient absorption. Natsir *et al*. (2016) stated that the content ofTturmeric curcumin is a natural antibiotic with the ability to suppress pathogenic microbes, provide immunity and endurance, and also in improving the appearance of production.

The cholesterol level of Lohmann Brown chicken yolk given treatment A was 173.53 m/dl (Table 3). Brown Lohmann chickens who received treatment B had 8.3% cholesterol yolk cholesterol significantly different (P <0.05) lower than treatment A and those who received treatment C 7.76% differed significantly (P <0, 05) lower than treatment A. The cholesterol level of Lohmann Brown yolk that received treatment C was 0.66% not significantly different (P> 0.05) higher than treatment B.

Giving turmeric leaf extract through drinking water can cause a decrease in egg cholesterol levels because it can stimulate bile and pancreatic secretion. This is in accordance with the opinion of Taryono (2001) which states that the function of turmeric in improving the work of the digestive organs of poultry is to stimulate the gallbladder wall, remove bile and stimulate the release of pancreatic sap containing amylase, lipase and proteases which are useful to improve digestion of feed ingredients such as carbohydrate oil and protein fat. Turmeric contains bioactive compounds such as beta-carotene, flavonoids and steroids which help reduce cholesterol levels in yolks. The content of beta carotene and flavonoids in turmeric leaves helps reduce cholesterol levels. Beta carotene has a relationship with a reduced risk of heart disease because of its ability to reduce cholesterol levels. However, some scientific evidence states that beta carotene is beneficial for the heart when combined with other antioxidants (Challem *et al*., 2005). Nuraini *et al*. (2008) stated that the greater the amount of beta carotene consumed, the lower cholesterol levels in eggs caused by beta carotene can inhibit the action of the HMG-CoA (*Hydroximal Glutaril-CoA*) reductase enzyme which plays a role in mevalon formation in biosynthetic cholesterol. If the consumption of beta carotene is greater than saturated fatty acids, the biosynthetic process by the HMG-CoA enzyme will be directed at the synthesis of beta carotene, so that saturated fatty acids are not converted to cholesterol (McGilvery and Goldstein, 1996). Besides beta-carotene, Ruel *et al*. (2006) stated that flavonoids can also reduce blood cholesterol levels, because flavonoids work to increase HDL cholesterol by increasing the production of apo A1. Turmeric leaves also contain steroid compounds that can help reduce egg cholesterol levels by increasing HDL content in the blood. This is similar to the opinion of Tumova *et al*. (2004) that administration of steroids derived from plants can increase HDL cholesterol and triglycerides in serum, and reduce the cholesterol content of eggs.

CONCLUSION

It can be concluded that phytochemical compounds contained in Turmeric leaf extract (*Curcuma domestica* Val.) are curcumin, alkaloids, steroids, terpenoids, phenolics, flavonoids, tannins, and beta-carotene. The administration of 2% and 4% Turmeric leaf extract (*Curcuma domestica* Val.) in drinking water can improve feed efficiencies, egg weight, and protein content of yolks, but reducing both yolk cholesterol and fat content of Lohmann Brown laying hens.

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