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EFFECTS OF DIETARY SUPPLEMENTATION OF TURMERIC AND BLACK CUMIN POWDER ON PERFORMANCE AND BLOOD PARAMETERS OF NATIVE CHICKENS

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ABSTRACT: This study was conducted to determine the effect of supplementation of a mixture of turmeric and black cumin powder on the production performance, blood parameters, and quality of native chicken eggs. Ninety-six female native chickens aged 17 weeks were randomly allocated in a completely randomized design into four treatments. The four treatments were differentiated based on the level of supplementation of a mixture of turmeric (TP) and black cumin powder (BCP), namely T0: Control (without a mixture of TP and BCP); T1: (2.5 g TP + 2.5 g BCP)/kg ration; T2: (5 g TP + 5 g BCP)/kg ration and T3: (7.5 g TP + 7.5 g BCP)/kg ration. Each treatment was repeated 3 times, using 8 native chickens. The variables measured were blood parameters including Hemoglobin (Hb), hematocrit, total red blood cells (RBC), white blood cells (WBC), blood cholesterol and triglycerides; and also, the performance variables of feed consumption, egg production (HDA), body weight at 34 weeks, egg weight, egg mass, feed conversion, yolk weight, shell weight, shell thickness, yolk color index, cholesterol, LDL and HDL of yolks. The Data were collected for 16 weeks and analyzed by variance analysis. The results showed that supplementation with a mixture of TP and BCP increased feed consumption; HDA; body weight; egg mass; shell weight, thickness, and yolk color ($P<0.05$). Egg weight and yolk weight were not significantly different. TP + BCP supplementation significantly reduced feed conversion, cholesterol level, HDL, and LDL. Increased TBCP supplementation increased Hb, hematocrit, red blood cells and white blood cells and significantly decreased cholesterol, lipoproteins, and triglycerides in the blood ($P<0.05$). It was concluded that TBCP mixture supplementation could improve production performance, some of blood parameters, and quality of native chicken eggs.

Keywords: Black cumin, Native chicken, Performance, Turmeric, Yolk

INTRODUCTION

The native chicken provides a significant contribution to the economy of the Indonesian people, not only as a source of meat but also of eggs. The population of native chickens in Indonesia in 2020 has reached 305,4 million heads and was able to produce 270.2 thousand tons of meat and 358,9 thousand tons of eggs (DJPKH, 2021). The pattern of farming of native chickens in Indonesia, some are developed intensively by being confined and using rational feed.

The utilization of herbal ingredients to improve poultry productivity has grown rapidly since the restrictions on the use of antibiotics in feed (Diaz-Sanchez et al., 2015). The utilization of herbal products as natural antibiotics (phytobiotics) to improve livestock performance was considered safer because it has low toxicity, is free of residues, is inexpensive, and can improve livestock performance (Diaz-Sanchez et al., 2015; Alagawany et al., 2021). The utilization of herbal ingredients in livestock has a positive effect because they contain antioxidants, can increase antibody titers, improve growth and feed conversion, suppress the growth of harmful bacteria, reduce triglycerides and cholesterol (Jouybari et al., 2009; Houshmand et al., 2012).

Black cumin (*Nigella sativa L.*) was a perennial herb from the Ranunculaceae family, which commonly found in Central Asia and Europe. Black cumin was widely used for the treatment of several diseases, has anti-cancer effects and lowers blood sugar levels (Seidavi et al., 2020). Black cumin has antibacterial and antioxidant features and provides an immune effect (Raheem et al., 2021; Zaky et al., 2021). Black cumin contains thymoquinone which known as a powerful antioxidant that contributed in disease prevention and anti-cancer (Manjunath et al., 2020). There were 18 compounds that can be identified from black cumin consisting of 99.14% of the total essential oil, namely aldehydes (23%), gamma terpine (14.5%), acetic acid (10.9%), and 1,3,8-p-menthatriene (7.9%) (Jalilzadeh-Amin et al., 2011). Other compounds found in black cumin were sabinene, carvon, carveol, flavonoids (Qinna et al., 2012), coumarins and cumin aldehyde which has antifungal activity (Yalçin et al., 2007), antisposmodic (Jalilzadeh-Amin et al., 2011), pain relief, anti-inflammatory, and anticoagulant (Mandegary et al., 2012). The usage of black cumin seeds at a dose of 1 g/kg in broiler rations could improve body weight and feed conversion (Erener et al., 2010). In laying hens rations, the usage of black cumin could protect the magnum and uterine cells (Dhama et al., 2015). At a level of 3%, it could improve the production of laying hens and lower cholesterol levels (Aydin et al., 2008).

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Turmeric plant (*Curcuma longa*) was a medicinal plant from the ginger family and grows widely in South and Southeast Asia (Sanghvi et al., 2020). The turmeric plant produced a yellow pigment called curcumin and was very potential as a natural antioxidant (Osawa et al., 1995; Rajput et al., 2013). In addition to containing curcumin, turmeric also contains demethoxycurcumin, methoxycurcumin, and taetrahydrocurcuminoid compounds (Kiuch et al., 1993). Curcumin could be used as a therapeutic and treatment including as an antioxidant, anti-inflammatory, inhibiting lipid peroxidase, antimicrobial, anti-viral, anti-tumor and nematocidal (Kiuch et al., 1993; Osawa et al., 1995; Sharma et al., 2005). In Indonesia, turmeric was used as a kitchen spice, traditional medicine in the form of "*Jamu*" and natural food coloring, improving taste, and food preservatives. Turmeric could be supplemented as feed additives to improve poultry performance. Turmeric powder supplementation at the level of 4% could improve the production and quality of duck eggs (Ismoyowati et al., 2022). Turmeric could stimulated digestive enzymes and pancreatic lipase so that it increased the digestibility and absorption of nutrients (Ammon et al., 1993; Platel and Srinivasan, 2000). A study by Rajput et al. (2013) showed that curcumin supplementation at a dose of 0.2 g/kg in broiler chicken rations could increase the length and weight of the duodenum, jejunum, and broiler ceca, which led to improved nutrient digestibility. Turmeric powder supplementation would improve egg production, egg weight, feed conversion (Gumus et al., 2018). Curcumin has the activity of inhibiting the absorption of dietary cholesterol in the gastrointestinal tract (Arafa, 2005). Curcumin supplementation will also lower blood cholesterol and triglyceride levels in quail eggs (Saraswati and Tana, 2016). Turmeric powder contains phytoestrogens of 7.97% and was estrogenic so that it stimulated the development of ovarian follicles (Saraswati et al., 2014; Azouz, 2020). The usage of mixed herbs would provide a complementary effect, so it was better than single administration. Turmeric and fenugreek powder together could improve egg production and quality, compared to single administration (Azouz, 2020). Supplementation of a mixture of turmeric and fenugreek could improve egg production and quality of chicken eggs because it increases availability (Azouz, 2020). The mixture of cinnamon and thyme in the quail ration improves egg mass and eggshell thickness (Vali and Mottaghi, 2016). A study by Suwarta and Suryani (2019) concluded that by supplementing a mixture of turmeric and cinnamon in quail rations at the level of 40g/kg could improve egg production, feed conversion, increase egg weight and increase color index. On this basis, current study was performed to examine the supplementation of a mixture of turmeric (TP) and black cumin powder (BCP) in the ration on blood composition, production performance and egg quality of native chickens.

MATERIALS AND METHODS

Ethical approval

The study was carried out without killing livestock and was carried out under the supervision of the livestock production laboratory at Universitas Mercu Buana, Yogyakarta. This research was conducted under the supervision of Teaching Farm Laboratory No. 15/KEP/TF/III/2022.

Research design

The research was conducted at the Livestock Production Laboratory, Mercu Buana University, Yogyakarta, Indonesia. The main materials of the study were turmeric powder (*Curcuma longa*), black cumin powder (*Nigella sativa*), research rations, and 8 female native chickens aged 17 weeks with a body weight of 1436±22.2 g. Turmeric powder and black cumin powder are made from turmeric rhizome and black cumin seeds purchased from a local market in the city of Yogyakarta. Turmeric (TP) is made from turmeric rhizome, sliced crosswise with a thickness of 3 mm then dried in the oven at 60 degrees Celsius for 30-36 hours, until the water content reaches 14 percent, then ground and sieved through a 25-mesh sieve. Black cumin seed powder (*Nigella sativa*) (BCP) is made from local cumin seeds which are dried at a temperature of 60-70^{o} Celsius, then ground and sieved with a size of 25-mesh. Native chickens were adapted using treatment rations for 1 week at 17 weeks of age. The treatment started at 18 weeks of age and ended at 34 weeks of age. Treatment ration formulated isoprotein and isoenergy. The composition and nutrient content of the treatment rations are presented in Table 1. Drinking water and rations were given *ad libitum*. Native chickens were kept in cages, measuring length, width, height (160×80×45 cm), and given light for 15 hours using LED lamp with an intensity of 120 lux.

The study was designed in a completely randomized design, with mixed TP and BCP supplementation treatment variations. Ninety-six native chickens were allocated to twelve research cages, each with 8 chickens. Every three research cages were used for one treatment, so there were 4 treatments. Each treatment was differentiated based on the supplementation of a mixture of turmeric and cumin powder, namely T0 (control), T1 (0.5 g TP + 0.5 g BCP)/kg ration, T2 (5 g TP + 5 g BCP) /kg ration, T3 (7.5 g TP and 7.5 g BCP)/kg ration. Performance data retrieval was carried out for 16 weeks from the age of 18 to 34 weeks. The variables of performance observed included production variables, namely feed consumption, egg production (HDA), egg weight, egg mass, feed conversion measured from each replication every week. Egg quality variables include yolk weight, shell weight, shell thickness, egg color index, cholesterol, and lipoprotein. Egg quality was observed at weeks 24, 28, and 34, where in each replication 3 eggs were taken randomly. Egg quality variables here included yolk color and egg yolk color fan (Roches, Switzerland). Egg cholesterol levels were measured from egg production at the end of the 34th week, where for each replication 3 eggs were taken using the Liebermann–Burchard method. At week 34, the final body weight of the chickens was also measured. Blood parameters were observed when the chickens were 34 weeks old, by taking 2 ml from the wing vein. The blood parameters observed included the number of red blood cells and white blood cells (hemocytometer method), hematocrit value (microhematocrit method),

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Hb (cyanmethemoglobin method), and blood cholesterol (CHOD-PAP method).

Data analysis

The data collected were analyzed using analysis of variance, followed by Duncan's Multiple range Test using SPSS version 22, with a significance level of <0.05.

Table 1 - Composition and nutrient content of treatment rations

Feed ingredients (kg) \ Treatment (%)	T0	T1	T2	T3
Corn	46.00	46.00	46.00	46.00
Rice bran	22.00	22.00	22.00	22.00
Soybean meal	23.00	23.00	23.00	23.00
Fish meal	6.00	6.00	6.00	6.00
Bone meal	2.00	2.00	2.00	2.00
$CaCO_3$	1.00	1.00	1.00	1.00
Total	100	100	100	100
Turmeric + black cumin powder (TBCP)	0	2.5g +2.5g/kg ration	5g+5g/kg ration	7.5g+7.5g/kg ration
Crude protein (%)	17.2	17.2	17.2	17.2
Metabolized energy (kcal/kg)	2720	2720	2720	2720
Crude fiber (%)	4.98	4.98	4.98	4.98
Ether extract (%)	3.98	3.98	3.98	3.98
Ca (%)	2.72	2.72	2.72	2.72
P (%)	0.86	0.86	0.86	0.86
Methionine (%)	0.56	0.56	0.56	0.56
Lysine (%)	1.16	1.16	1.16	1.16

RESULTS

Table 2 below summarizes the effect of various levels of TPBC supplementation on feed consumption, HDA, body weight, egg mass, egg weight, yolk weight, color index, shell thickness, and also cholesterol and lipoprotein levels. The rations supplemented with TBCP at various levels of 5 g/kg (T1), 10 g/kg (T2), and 15 g/kg (T3) resulted in feed consumption, egg production, body weight at 34 weeks, egg mass, shell weight significantly higher (P<0.05) than control (T0). The highest egg production, egg mass, weight and shell thickness were obtained in treatment T3 (15 g/kg). The highest egg production was obtained at T3 (62.90%) and the lowest was at control (57.53%). TBCP supplementation significantly reduced the conversion of feed, cholesterol, and lipoproteins. Feed conversion between treatments T1, T2, and T3 was not significantly different and significantly lower than control (T0). The lowest feed conversion was obtained at T3 (3.59) and the highest at T0 (3.88). TBCP supplementation at various levels (T0, T1, T2, T3) resulted in egg and yolk weights that were not significantly different (P<0.05). Cholesterol and lipoproteins level in the yolk between treatments T1, T2, and T3 were not significantly different but significantly decreased compared to control (T0). The lowest yolk cholesterol was obtained at T3 (316.5 mg/100g) and the highest was in the control (337.7 mg/100g).

The results in Table 3 show that TBCP supplementation increased the value of hematocrit, Hb, red blood cell (RBC) and white blood cell (WBC) values, and significantly decreased blood cholesterol, LDL, HDL, and triglyceride levels (P<0.05). The highest hematocrit, Hb, RBC and WBC were obtained at T3, where respectively: hematocrit (28.23%), Hb (7.8 mg/dl), RBC (1.48×106/µl) and WBC (30.83 x103/µl). T3 produces the lowest blood plasma cholesterol (121.53 mg/dl).

Table 2 - Performance of native chickens at various levels of supplementation with a mixture of turmeric and black cumin powder

Performance \ Treatments	T0	T1	T2	T3
Feed consumption (g/head/day)	94.93±1.03^{a}	96.53±0.31^{b}	97.13±0.70^{b}	97.60±0.46^{b}
HDA (%)	57.53±1.03^{a}	59.60±1.06^{b}	62.23±0.38^{c}	62.90±0.46c
Body weight age 34 weeks (g/head)	1546±22.74^{a}	1563±25.79^{ab}	1601±8.50^{b}	1598±36.39^{b}
Egg weight (g/egg) (ns)	42.87±0.31	43.50±0.36	42.70±0.66	43.44±0.38
Egg mass (kg)	2.74±0.07^{a}	2.90±0.06^{b}	2.96±0.04^{bc}	3.06±0.01^{c}
Feed conversion	3.88±0.13^{a}	3.73±0.07^{b}	3.65±0.04^{b}	3.59±0.02^{b}
Yolk weight (g/egg) (ns)	13.13±0.31	13.15±0.16	13.15±0.21	12.98±0.07
Egg shell weight (g/egg)	4.47±0.10^{a}	4.58±0.11^{ab}	4.61±0.10^{b}	4.44±0.04^{c}
Shell thickness (mm)	0.264±0.004^{a}	0.268±0.006^{ac}	0.270±0.002^{bc}	0.280±0.004^{c}
Yolk color	3.67±0.12a	3.73±0.58^{ab}	3.83±0.58^{ab}	3.93±0.15^{b}
Cholesterol (mg/100 g)	337.7±10.12^{a}	320.3±5.22^{b}	317.9±0.95^{b}	316.5±1.75^{b}
HDL (mg/100 g)	46.7±0.75^{a}	44.9±0.70^{b}	44.8±0.37^{b}	44.0±0.72^{b}
LDL (mg/100 g)	61.36±1.75^{a}	58.05±0.76^{b}	57.94±0.28^{b}	57.31±0.35^{b}

$^{a, b, c}$ in the same line shows significantly different results (P<0,05)

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Table 2 - Chicken blood parameters at various levels of supplementation with a mixture of turmeric and black cumin powder

Blood parameters \ Treatments	T0	T1	T2	T3
Red blood cells (106/µl)	1.32±0.45[a]	1.39±0.15[b]	1.45±0.21[c]	1.48±0.025[c]
White blood cells (x103/µl)	23.93±0.64[a]	26.33±0.50[b]	28.53±0.70[c]	30.83±0.40[d]
Hb (mg/dl)	7.1±0.1[a]	7.4±0.3[b]	7.6±0.1[a]	7.8±0.2[a]
Hematocrit (%)	25.27±0.42[a]	26.20±0.26[b]	27.2±0.11[b]	28.23±0.15[b]
Blood cholesterol (mg/dl)	140.06±1.66[a]	136.13±0.31[b]	127.66±1.07[c]	121.53±2.59[d]
Blood LDL (mg/dl)	56.03±0.38[a]	53.23±0.93[b]	46.83±0.59[c]	42.87±0.31[d]
Blood HDL (mg/dl)	111.56±0.80[a]	98.20±1.63[b]	76.77±0.90[c]	58.03±1.00[d]
Blood triglycerides (mg/dl)	867.0±5.7[a]	801.1±9.2[b]	712.6±23.0[c]	589.7±3.0[d]

[a, b, c] in the same line shows significantly different results (P<0,05)

DISCUSSION

Increased supplementation of turmeric black cumin powder (TBCP) in the ration, significantly increased feed consumption (P<0.05). It is believed that this is associated to several the active compounds found in TP and BCP. Turmeric curcumin has activity to stimulate digestive enzymes, including amylase, trypsin, chymotrypsin, and lipase. Likewise, BC also contains several compounds that could stimulated the secretion of digestive enzymes thereby improving nutrient absorption (Akylidiz and Denli, 2016). Turmeric contains several active compounds curcumin, turmeric also contains demethoxycurcumin, methoxycurcumin and tetrahydrocurcuminoid compounds (Kiuch et al., 1993). In BC, there were 18 compounds that can be identified from black cumin oil consisting of 99.14% essential oils, namely aldehydes (23%), gamma terpinene (14.5%) acetic acid (10.9%) and 1,3,8-p-menthatriene (7.9%) (Jalilzadeh-Amin et al., 2011; Hashemi and Davoodi, 2011). Supplementation of curcumin at a dose of 0.2 g/kg would improve feed consumption and increase the length and weight of the duodenum, jejunum and ceca of broilers, which led to improved digestive process and increase nutrient utilization (Rajput et al., 2013). Black cumin, contains several compounds including essential fatty acids, and could affect the size of the villi and the composition of microbes in the gastrointestinal tract, and increase the secretion of digestive enzymes (Kumar et al., 2017; Kumar and Patra, 2017). Single use of BC would generally result in feed consumption not so significant (Aydin, 2006).

Increased supplementation of the TBCP mixture increased egg production, body weight at 34 weeks, and egg mass. This happens because nutrients are more available either due to increased feed consumption or increased nutrient digestibility and absorption. Turmeric contains several active compounds, especially curcumin, demethoxycurcumin and bisdemethoxycurcumin. BC contains the essential fatty acids linoleic, linolenic and arachidonic which are required for egg synthesis (Qader et al., 2020). Phytoestrogens in herbs affect poultry reproduction, through the mechanism of vitellogenin synthesis in hepatocytes so that it would increase the number and weight of yolks (Levi et al., 2009). In addition, these two herbs also have activity as anti-microbial, anthelmintic and antifungal (Azeem et al., 2014). According to Malekizadeh et al. (2012), supplementation of turmeric powder at the level of 10 and 30 g/kg ration did not affect the egg weight of SCWL chickens. The use of turmeric powder at the level of 4%, increased the egg production of laying hens significantly (Rahardja et al., 2016). A study by Park et al. (2012) showed that the usage of turmeric powder on Lohmann brown laying hens singly at the level of 0.01; 0.025 and 0.5% would increase egg production, weight and egg mass. Akhtar et al. (2003) also revealed that BC supplementation at the level of 1.5% could increase egg production from 59 to 77 percent. Aydin et al. (2006) stated that supplementation of BC level 2 or 3% could improve egg production and feed conversion. Hence, it can be said that mixing herbal ingredients gives a better effect. A mixture of phytobiotics is not only used to improve absorption, it can also be used to increase immunity so that it can improve growth (Hashemi and Davoodi, 2011).

Besides being used to improve egg production and egg mass, increasing TBCP supplementation will also improve feed conversion. This was due to improvements in digestibility as well as increased nutrient utilization. The same condition was also shown in a research done by Suwarta and Suryani (2019) that TCP supplementation would increase egg production and feed conversion in quail. The usage of black cumin seed powder in broiler chickens at levels of 2 g/kg and 4 g/kg can improve feed efficiency (Toghyani et al., 2010). Aydin et al. (2006) stated that the utilization of BC in laying hens could increase egg production. Seidavi et al. (2020) highlight that supplementation of cumin oil in quail rations by 2 and 5 percent could improve growth and egg production.

Increased TBCP supplementation did not affect egg weight and yolk weight, but improved color index, shell weight and thickness index. This is different from BC which can increase egg weight, but the yolk weight is not significantly different (Tahan and Bayram, 2011). BC supplementation at the level of 1% and 2% in the ration of laying hens produced egg weights that were not significantly different (Aydin et al., 2006). Likewise, 4% turmeric supplementation did not affect egg weight (Rahardja et al., 2016). Supplementation of a mixture of turmeric and sumac in each ration at the level of 0.25% resulted in an egg weight that was not significantly different (Gumus et al., 2018).

The increase in yolk color index was due to the presence of a yellow pigment from curcumin which was deposited in the yolk. The use of BC alone could not improve the color of the yolk, but when combined with parsley (*Petroselinum crispum*), it increased the color index of the yolk (Tahan and Bayram, 2011). The use of 1% turmeric flour will increase the

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color of the yolk from 18.87 to 15.62% (Radwan Nadia et al., 2008). Hassan (2016) stated that the utilization of turmeric powder could be used to improve the color of laying hen's yolks if used at 4% in the ration of laying hens. Suwarta and Suryani (2019) concluded that supplementation of a mixture of turmeric and cinnamon at a level of 10 g/kg to 40 g/kg could improve yolk color.

TBCP supplementation would increase the weight and thickness of the shell. The increase was in accordance with some previous studies. Supplementation of turmeric powder at the level of 150 mg, would increase the strength and thickness of Hy-line brown chicken shells (Liu et al., 2020). BC supplementation in laying hens rations at levels 2 and 3%, increased shell thickness and weight (Aydin et al., 2008). Cumin seed supplementation of 1.5% also increased the thickness of the shell from 0.32 to 0.34 mm in chicken eggs (Akhtar et al., 2003). Cumin seed supplementation of 1.5% also increased the thickness of the shell from 0.32 to 0.34 mm in chicken eggs (Akhtar et al., 2003). The utilization of 1% turmeric powder would numerically increase the weight of the shell (Radwan Nadia et al., 2008). Suwarta and Suryani (2019) highlight that supplementation of a mixture of turmeric and cinnamon each at 40 g/kg sausage could improve quail eggshell weight. Turmeric improves the condition of the uterus, in terms of calcium deposition so that it will affect the thickness and weight of the eggshell. Turmeric supplementation in duck rations can improve the internal condition of the oviduct, especially in eggshell calcification, so that the eggshell of the ducks increased from 0.43 mm to 0.51 mm (Radwan Nadia et al., 2008; Ismoyowati et al., 2022). The increase in eggshell thickness was due to the increase in Ca intake due to increased feed consumption, and also curcumin can reduce the heat stress (Liu, 2020). Aydin et al. (2008) showed that BC supplementation at levels of 2 or 3% could improve eggshell thickness and strength.

Cholesterol and lipoprotein levels decreased with increasing of TBCP supplementation. This was in accordance with previous research that the utilization of herbs could lower cholesterol levels of yolk. Park et al. (2012) stated that turmeric supplementation in laying hens at the levels of 0.10, 0.20, and 0.25% reduced cholesterol, triglyceride, and lipoprotein levels in the blood plasma of laying hens. Supplementation of BC powder in laying hens at a level of 1-2% could improve health in broilers and lower cholesterol in yolks (Al-Sanabani and Al-Hothaify, 2022). According to Aydin (2008), BC supplementation at levels 2 and 3% lowers cholesterol. BC oil supplementation at the level of 3 ml/kg ration would reduce triglycerides and cholesterol (Bölükbaşi et al., 2009). Likewise, BC supplementation at the level of 3% significantly reduced yolk cholesterol levels in laying hens (Aydin et al., 2008). Supplementation of a mixture of turmeric and cinnamon powder at a level of 15 g/kg could reduce quail egg cholesterol from 1303 to 1134.8 g/100 g (Suwarta and Suryani, 2019).

This was because curcumin could increase cholesterol-7 alpha-hydroxylase activity in the liver and increase cholesterol catabolism (Riasi, 2012). Alkaloids in curcumin and black cumin inhibit cholesterol absorption from the gastrointestinal tract and inhibit cholesterol synthesis in the liver (Ismoyowati et al., 2022). Curcumin inhibits cholesterol absorption from the feed (Arafa, 2005).

TBCP supplementation increased the value of hematocrit, hemoglobin, and also the number of red blood cells (RBC) and white blood cells (WBC). The increase is related to the presence of the active components of black cumin and turmeric. Black cumin contains thymoquinone and thymohydroquinone which have strong anti-oxidant activity (Arslan et al., 2017), as well as turmeric also contains the active compound curcuminoid which has activity as an antioxidant and as an immune modulator (Dalal et al., 2018). Antioxidants produce low levels of peroxides in the membrane, thereby reducing the degree of susceptibility to hemolysis in red blood cells (Arslan et al., 2017) . The value of PVC, hemoglobin, RBC and WBC in rats increased when supplemented with BC (Ekanem and Yusuf, 2008). Supplementation of herbal ingredients can increase the production of antibodies and immunoglobulins (Dalal et al., 2018), so that the white blood cell content increases. Increased TP and BCP supplementation reduced cholesterol, lipoprotein, and triglyceride levels in blood plasma. Antioxidants will affect catabolism and fat accumulation (Fallah and Mirzaei, 2016). The use of phytobiotics can reduce blood plasma cholesterol levels (Jouybari et al., 2009). The use of 1% turmeric will lower total cholesterol. Turmeric will inhibit the activity of HMG Co-A, stimulate the conversion of cholesterol into bile acids and increase cholesterol excretion (Dalal et al., 2018). Black cumin contains thymoquinone and is an active compound that plays a role in lowering cholesterol (Al-Sanabani and Al-Hothaify, 2022).

CONCLUSION

From this study it can be concluded that supplementation with a mixture of turmeric and black cumin powder (TBCP) at the level of 7.5 g/kg in native chicken rations will improve feed consumption, egg production, egg mass, feed conversion and body weight. TBCP supplementation did not affect egg weight and yolk weight but increased yolk color, shell weight and thickness, and reduced cholesterol and yolk lipoprotein levels. Blood parameters, namely RBC, WBC, Hematocrit and Hb will increase, while Cholesterol, Lipoprotein and triglycerides will decrease. In general, TBCP supplementation will improve the performance, egg quality and blood parameters of native chickens.

DECLARATIONS

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Authors' contribution

FX Suwarta contributes on research and the write up of the manuscript; Chatarina Lilis Suryani, Niken Astuti, and Lukman Amin contribute on ration formulation and analysis, statistical analysis, and logistics.

Conflict of interests

The authors have not declared any conflict of interests.

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