

# Effect of decocted turmeric on performance, hematological parameters

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## Effect of decocted turmeric on performance, hematological parameters and carcass traits of broiler chickens

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### ABSTRAK

Penelitian ini bertujuan mengkaji pengaruh pemberian dekok kunyit terhadap performa, parameter hematologis dan karakteristik karkas ayam broiler. Pada umur 11 hari, ayam didistribusikan secara acak ke dalam lima kelompok perlakuan, yaitu T0 (ayam diberi minum 100% air), T1 (25% dekok kunyit + 75% air), T2 (50% dekok kunyit + 50% air), T3 (75% dekok kunyit + 25% air) dan T4 (100% dekok kunyit). Penelitian menggunakan rancangan acak lengkap (RAL), dengan parameter yang diamati meliputi performan, profil leukosit dan biokimia darah (total protein, albumin, globulin, asam urat, glukosa). Data dianalisis keragamannya pada taraf 5%. Pemberian dekok kunyit tidak memberikan pengaruh terhadap pertambahan bobot badan, konsumsi pakan dan air serta konversi pakan ayam broiler. Proporsi limfosit lebih tinggi ( $P < 0,05$ ) pada ayam perlakuan T1, T2 dan T4 dibandingkan dengan T0 dan T3. Rasio heterofil terhadap limfosit (H/L ratio) lebih rendah pada ayam yang diberi minum dekok kunyit dibandingkan dengan kontrol. Konsentrasi globulin lebih tinggi ( $P < 0,05$ ) dan rasio albumin terhadap globulin (A/G ratio) lebih rendah ( $P < 0,05$ ) pada ayam perlakuan T2, T3 dan T4 jika dibandingkan dengan ayam T0 dan T1. Perlakuan tidak berdampak terhadap proporsi heterofil and konsentrasi total protein, albumin, asam urat dan glukosa pada serum. Jika dibandingkan dengan kontrol, bobot daging dada lebih tinggi pada ayam T3 dan lebih rendah pada T4. Sebagai kesimpulan, pemberian dekok kunyit melalui air minum dapat membantu memperbaiki respon stres dan meningkatkan daging dada ayam broiler

*Kata Kunci: ayam broiler; biokimia darah, dekok kunyit, karkas, profil darah,*

### ABSTRACT

This study aimed to investigate the effect of decocted turmeric on performance, haematological parameters and carcass traits of broilers. Broiler chicks at 11 days of age were allotted to five groups, including T0 (birds drinking 100% water), T1 (25% decocted turmeric + 75% water), T2 (50% decocted turmeric + 50% water), T3 (75% decocted turmeric + 25% water) and T4 (100% decocted turmeric). The study was arranged based on a completely randomized design (CRD), parameters investigated was performance and blood chemistry (leukocyte, total protein, albumin, globulin, uric acid, glucose). The data were subjected to analysis of variance at 5% probability. Decocted turmeric did not affect weight gain, feed and water consumption and feed conversion ratio of broilers. Lymphocytes proportion was higher ( $P < 0.05$ ) in T1, T2 and T4 than in T0 and T3 birds. The heterophils to lymphocytes ratio was lower ( $P < 0.05$ ) in birds receiving decocted turmeric than control. Globulin concentration and albumin to globulin ratio were higher and lower ( $P < 0.05$ ), respectively, in serum of T2, T3 and T4 than T0 and T1 birds. The proportion of heterophils and concentration of serum total protein, albumin, uric acid and glucose were not different among treatments. The weight of breast meat was higher and lower ( $P < 0.05$ )

in T3 and T4 birds, respectively, compared to the control. In conclusion, providing decocted turmeric through drinking water helped to improve stress responses and increased the weight of breast meat of broiler chickens.

**Keywords :** blood count, broiler chick, carcass, decocted turmeric, serum biochemistry

## INTRODUCTION

Turmeric (*Curcuma longa*) has widely been used for medicine both in humans and farm animals for long time. This plant may function as nematocide (Kiuchi *et al.*, 1993), antibacterial, antifungal, antiprotozoal, antiviral and antioxidants (Chattopadhyay *et al.*, 2004). Turmeric may also function as immunomodulatory (Ammon *et al.*, 1993; Antony *et al.*, 1999) and hypocholesteremic agents (Chattopadhyay *et al.*, 2004). There are a number of active components in turmeric that can exert pharmaceutical effects, including tetrahydrocurcuminoid (Osawa *et al.*, 1995), curcumin, demethoxycurcumin and bisdemethoxycurcumin (Wuthi-udomler *et al.*, 2000). In poultry, several studies on turmeric (Al Sultan, 2003; Emadi and Kermanshahi, 2006; Arslan *et al.*, 2017), have been conducted to improve the growth performance and health of broiler chickens. For instance, addition of 0.5% turmeric starch in the rations improved growth performance of broiler chickens (Al Sultan, 2003). The addition of 0.75% turmeric also decreased feed conversion ratio of broilers in the study of Emadi and Kermanshahi (2006). Moreover, supplementation of turmeric powder in the ration could improve antioxidant status and liver function, as well as decreased abdominal fat index without decreasing broiler performance (Hosseini-Vashan *et al.*, 2012). More recent study further showed the efficacy of turmeric in improving the immune responses of broiler chicks (Arslan *et al.*, 2017).

Commercial broiler farming is associated with a number of stresses that can ultimately compromise the health and productive performances of chicks (Surai, 2016). In such case, antioxidants is essential to protect the birds from oxidative damage (Sugiharto *et al.*, 2017a). Broiler feeds available in the market have actually been supplemented with antioxidants. However, improper feed handling on the farm such as storage conditions may decrease the amounts and activity of antioxidant in feeds (Aviagen, 2014). The latter condition have encouraged the farmers to provide additional synthetic antioxidants that

commercially available in the market. Indeed, there are several controversies regarding the use of synthetic antioxidants in broiler production, as they may have tumor-promoting activities and anti-carcinogenic properties (Baszczyk *et al.*, 2013). Hence, any alternative for synthetic antioxidants for broilers are crucial. Taking the antioxidant capacity of turmeric into consideration, this medicinal plant may be beneficial for alleviating the negative effect of multiple stress on the growth performances and health of modern broiler strains.

Turmeric has generally been administrated in poultry rations in the form of extract (Sugiharto *et al.*, 2011) or powder (Hosseini-Vashan *et al.*, 2012). Turmeric extract is generally regarded more effective than powder. However, more effort and cost are needed to produce the extract of turmeric. For the latter reason, the use of turmeric extract in large-scale commercial broiler farming seems impractical. Boiling is a simple method that can be employed to enhance the functional properties of turmeric. In the previous study, Borde (2011) reported that boiling resulted in increased antioxidant activity of turmeric. Indeed, boiling may enhance the release of active compounds from the plant tissues. In relation to boiling, Simbo (2010) suggested that decoction (i.e., simple method of extraction by boiling plant materials and the remaining liquid is used for particular purpose) could be a preferred method to produce medicinal plant. Taking the advantages of boiling and the simple method of extraction, in the present study turmeric was decocted in water to produce "decocted turmeric". The latter product was provided to broiler chickens through drinking water. It was expected that decocted turmeric gave benefits to broiler chickens comparable to turmeric extract and better than turmeric powder. The aim of this present study was to investigate the effect of decocted turmeric on the performance, haematological parameters and carcass traits of broiler chickens.

## MATERIALS AND METHODS

### Materials

Fresh turmeric was obtained from a local



market in Semarang. After being washed, turmeric was pounded with a pestle. Ten grams of pounded turmeric in 600 mL water was decocted for 10 min (Tantalo, 2010). The remaining liquid was then filtered using cheese cloth and let to cool. The product (decocted turmeric) was frozen until use. A total of 200 Lohmann (MB-202) 1-day-old broiler chicks were used in the present study. The chicks were raised in an open-sided naturally ventilated broiler house according to the standard rearing procedure of broiler chicks in Indonesia. From day 0 to 10, the chicks were raised in a communal brooder.

## Methods

The study was arranged based on a completely randomized design (CRD). At day 11, the chicks were weighed individually ( $247 \pm 2.60$  g) and then randomly distributed to 25 rice hull-littered pens ( $90 \times 60$  m) equipped with round bottom feeders and manual drinkers. Five pens (with 8 birds in each) per treatment were assigned to each of five experimental groups, including T0 (birds drinking 100% water), T1 (birds drinking 25% decocted turmeric + 75% water), T2 (birds drinking 50% decocted turmeric + 50% water), T3 (birds drinking 75% decocted turmeric + 25% water) and T4 (birds drinking 100% decocted turmeric). The feeds used in the present study were commercial feeds (Table 1) obtained from the local feed-mill industry. The birds were vaccinated with Newcastle Disease Virus (NDV) vaccine on day 1 and Gumboro vaccine on day 7 and 14 of the experiment. At day 28, blood was obtained from the bird's wing veins and collected in the vacutainer containing either ethylenediaminetetraacetic acid (EDTA) or no anticoagulant. The blood in EDTA-vacutainers were used directly to count heterophils and lymphocytes. The blood in vacutainer without anticoagulant was let to clot for 2 h at room temperature. After centrifugation at 2,000 rpm for 15 min, the serum was obtained and frozen until serum biochemistry analysis. The enumeration of heterophils and lymphocytes, and the analysis of serum biochemistry were determined according to Sugiharto *et al.* (2017b). At day 32, the birds were slaughtered, de-feathered and eviscerated. Immediately, carcass and commercial cuts weight of broilers were determined.

## Data Analysis

The study was arranged based on a completely randomized design, and the data

obtained were analysed accordingly (Steel and Torrie, 1997). Pen was regarded as the experimental unit. Significant differences among experimental groups were further analysed with Duncan's multiple-range test. A significant level of  $P < 0.05$  was implemented.

## RESULTS AND DISCUSSION

### Results

**Performance of broilers.** Data on the performances of broiler chicks are presented in Table 2. Drinking decocted turmeric did not affect the daily weight gain, feed consumption and feed conversion ratio of broiler chickens. The treatment also had no influence on the water consumption of broiler throughout the experimental period.

**Haematological parameters of broilers.** Table 3 shows the haematological parameters of broilers. In general, the proportion of lymphocytes was higher ( $P < 0.05$ ) in T1, T2 and T4 birds compared to that in T0 and T3 birds. The heterophils to lymphocytes (H/L) ratio was lower ( $P < 0.05$ ) in the birds receiving decocted turmeric than that in control. The concentration of globulin and albumin to globulin (A/G) ratio were higher and lower ( $P < 0.05$ ), respectively, in the serum of T2, T3 and T4 birds when compared with that in T0 and T1 birds. The treatments had no effect on the proportion of heterophils and the concentration of serum total protein, albumin, uric acid and glucose of broilers.

**Commercial cuts of broilers.** The data on commercial cuts of broiler chickens are presented in Table 4. The weight of breast meat was higher and lower ( $P < 0.05$ ) in T3 and T4 birds, respectively, when compared with the control birds. There was no significant effect of decocted turmeric with regard to other commercial cuts of broiler chickens.

### Discussion

In the present study, decocted turmeric did not have any effect on the final body weight, feed consumption and feed conversion ratio of broiler chicks. This present results were different from Rajput *et al.* (2013) reporting the enhancing effect of curcumin on broiler chickens. Indeed, our data were in accordance with Samarasinghe *et al.* (2003) showing the absence effect of turmeric root powder on weight gain, feed intake and feed

conversion ratio of broilers. Hosseini-Vashan *et al.* (2012), also reported that feeding turmeric powder did not affect weigh gain, feed intake, feed conversion ratio and production index of broiler chickens. Concomitantly, Wang *et al.* (2015) reported that turmeric rhizome extract had no significant effect on the body weight of Wenchang broiler chickens. The exact rationale for the discrepancy results above remains unclear. However, the different nature (extract, powder or decocted) and levels of turmeric as well as trial conditions may be responsible. It has been suggested that the taste of turmeric may negatively affect the intake, which in turn reduced or had no effect on the growth rate of broilers (Hosseini-Vashan *et al.*, 2012). However, the latter condition seemed not to occur in our study, as there was no difference in the water consumption among the treatment birds (turmeric

had no effect on water consumption).

Drinking decocted turmeric resulted in increased proportion of lymphocytes in broiler chickens in the present study. This result was in accordance with the *in vitro* study by Lee *et al.* (2010) showing an increased lymphocytes proliferation (when compared with the control group) in spleen cells after exposure to turmeric powder. Considering the antioxidant (Chattopadhyay *et al.*, 2004) and immunomodulatory effects of turmeric (Ammon *et al.*, 1993; Antony *et al.*, 1999), the increased proportion of lymphocytes seemed therefore to improve the immune system of broilers in the current study. The latter inference was supported by the fact that turmeric was capable of increasing the concentration of globulin (precursor for immunoglobulin production) in broilers in the current study. Moreover, the lower A/G ratio in this study may further indicate the improvement of immune competence of decocted turmeric-drunk broilers. Sugiharto *et al.* (2016a) suggested that the lower A/G ratio implicates in a better immune competence and disease resistance of broilers. Interesting results was seen in the current study, in which drinking decocted turmeric was associated with the lower H/L ratio of chickens. This present finding was in agreement with that of previously reported by Hosseini-Vashan *et al.* (2012) when feeding turmeric rhizome powder to broilers under heat stress conditions. The H/L ratio has commonly been used as an indicator of stress and infections in broilers (Sugiharto *et al.*, 2016a; 2016b; 2017b). In this basis, decocted turmeric seemed beneficial in alleviating the stress and infections in broiler chickens. In this study, decocted turmeric did not influence the concentrations of total protein, albumin, uric acids

Table 1. Chemical Composition of Feeds<sup>†</sup>

Items (%)	Starter	Finisher
Moisture	13.0	13.0
Crude protein	21.0 – 23.0	20.0 – 22.0
Crude lipid	5.00	5.00
Crude fiber	5.00	5.00
Ash	7.00	8.00
Calcium	0.90	1.20
Phosphor	0.60	1.00

<sup>†</sup>Chemical compositions were obtained from feed-mill industry

Table 2. Performances of Broiler Chickens

Items	Treatments				
	T0	T1	T2	T3	T4
DWG (g/bird/day)	50.2 ± 0.82	51.3 ± 7.09	52.3 ± 3.08	51.3 ± 2.48	52.9 ± 5.14
DFI (g/bird/day)	79.3 ± 1.72	80.0 ± 1.84	81.7 ± 2.56	82.3 ± 2.68	81.2 ± 3.79
FCR	1.85 ± 0.07	1.86 ± 0.32	1.84 ± 0.14	1.90 ± 0.17	1.80 ± 0.16
DWI (mL/bird/day)	225 ± 17.7	209 ± 58.3	230 ± 30.9	229 ± 67.4	227 ± 111

T0: birds drinking 100% water; T1: birds drinking 25% decocted turmeric + 75% water; T2: birds drinking 50% decocted turmeric + 50% water; T3: birds drinking 75% decocted turmeric + 25% water; T4: birds drinking 100% decocted turmeric; DWG: daily weight gain; DFI: daily feed intake; FCR: feed conversion ratio; DWI: daily water intake.



Table 3. Haematological Parameters of Broilers

Items	Treatments				
	T0	T1	T2	T3	T4
Lymphocytes (%) <sup>†</sup>	51.8 ± 6.49 <sup>b</sup>	68.6 ± 8.26 <sup>a</sup>	69.8 ± 8.10 <sup>a</sup>	59.4 ± 12.2 <sup>b</sup>	67.4 ± 10.6 <sup>a</sup>
Heterophils (%) <sup>†</sup>	34.6 ± 2.70	24.0 ± 11.2	18.8 ± 5.80	23.2 ± 10.5	29.2 ± 9.09
H/L ratio <sup>†</sup>	0.67 ± 0.08 <sup>a</sup>	0.36 ± 0.19 <sup>bc</sup>	0.28 ± 0.11 <sup>c</sup>	0.43 ± 0.26 <sup>b</sup>	0.46 ± 0.24 <sup>b</sup>
Total protein (g/dL) <sup>‡</sup>	2.90 ± 0.25	2.63 ± 0.15	2.97 ± 0.33	3.10 ± 0.44	3.20 ± 0.28
Albumin (g/dL) <sup>‡</sup>	1.04 ± 0.11	0.92 ± 0.09	1.03 ± 0.09	0.99 ± 0.14	0.98 ± 0.12
Globulin (g/dL) <sup>‡</sup>	1.87 ± 0.22 <sup>b</sup>	1.71 ± 0.12 <sup>b</sup>	2.14 ± 0.26 <sup>a</sup>	2.11 ± 0.31 <sup>a</sup>	2.22 ± 0.17 <sup>a</sup>
A/G ratio <sup>‡</sup>	0.56 ± 0.08 <sup>a</sup>	0.54 ± 0.06 <sup>a</sup>	0.48 ± 0.04 <sup>b</sup>	0.47 ± 0.04 <sup>b</sup>	0.44 ± 0.03 <sup>b</sup>
Uric acid (mg/dL) <sup>‡</sup>	4.14 ± 2.40	4.06 ± 2.29	3.91 ± 2.31	2.84 ± 1.25	3.00 ± 1.38
Glucose (g/dL) <sup>‡</sup>	191 ± 22.8	217 ± 22.7	229 ± 35.4	201 ± 16.2	219 ± 62.4

<sup>†</sup>Assays were conducted in whole blood

<sup>‡</sup>Assays were conducted in serum

T0: birds drinking 100% water; T1: birds drinking 25% decocted turmeric + 75% water; T2: birds drinking 50% decocted turmeric + 50% water; T3: birds drinking 75% decocted turmeric + 25% water; T4: birds drinking 100% decocted turmeric; H/L ratio: heterophils to lymphocytes ratio; A/G ratio: albumin to globulin ratio.

Table 4. Carcass and Commercial Cuts of Broilers<sup>†</sup>

Items	Treatments				
	T0	T1	T2	T3	T4
Carcass (g)	836 ± 47.4	807 ± 104	851 ± 50.7	894 ± 80.6	773 ± 11.6
Wings (g)	112 ± 5.59	110 ± 9.04	111 ± 12.3	120 ± 12.3	108 ± 7.27
Breast (g)	375 ± 12.5 <sup>b</sup>	360 ± 41.6 <sup>bc</sup>	396 ± 23.2 <sup>ab</sup>	398 ± 42.8 <sup>a</sup>	337 ± 19.2 <sup>c</sup>
Thigh (g)	161 ± 20.2	152 ± 23.0	147 ± 31.6	168 ± 23.1	150 ± 8.26
Drum stick (g)	146 ± 11.6	144 ± 22.8	150 ± 3.63	162 ± 13.5	142 ± 5.80
Shoulder (g)	41.7 ± 7.39	40.5 ± 9.40	47.2 ± 5.34	45.8 ± 10.9	37.0 ± 4.72

<sup>†</sup>Data are presented as absolute weight

T0: birds drinking 100% water; T1: birds drinking 25% decocted turmeric + 75% water; T2: birds drinking 50% decocted turmeric + 50% water; T3: birds drinking 75% decocted turmeric + 25% water; T4: birds drinking 100% decocted turmeric

and glucose in the serum of broiler chickens. These findings were in accordance with Ukoha dan Onunkwo (2016) reporting no significant effect of turmeric powder (up to 3% from total diets) on the serum total protein, glucose and cholesterol of broilers. In other study, Hosseini-Vashan *et al.* (2012) also reported no effect of turmeric powder on serum total protein of

broilers.

Data in the current study showed that drinking decocted turmeric, especially for 75% decocted turmeric, increased the absolute weight of breast meat of broilers. This result was in agreement with Durrani *et al.* (2006) showing a higher relative weight of breast and thigh meats in turmeric powder fed broilers. Concomitantly,

Wang *et al.* (2015) reported that supplementation with turmeric rhizome extract increased the absolute and relative weight of breast muscle of Wenchang broiler chickens. Regarding the negative effect of decocted turmeric, when provided at 100% in the drinking water, on the weight of breast muscle, this result was in contrast to the most of published reports earlier (Hosseini-Vashan *et al.*, 2012; Wang *et al.*, 2015). The definite explanation for this condition remains unclear, but the high concentration of curcumin in decocted turmeric might promote fat oxidation (Ejaz *et al.*, 2009) in breast muscle, resulting in reduced weight of breast meats. This inference, however, should be taken with caution as breast muscle of broilers by nature contains less fat than other organs such as thigh, and therefore the effect of fat oxidation in breast muscle may be neglected. Apart from the significant effect on breast muscle, the effect of decocted turmeric was not significant with regard to other commercial cuts of broilers in the present study. The latter results were similar to those of previously reported (Durrani *et al.*, 2006; Wang *et al.*, 2015).

## CONCLUSION

In conclusion, providing decocted turmeric through drinking water helped to improve immune competences and stress responses as well as increased the weight of breast meat of broiler chickens.

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