

## Fresh liquid turmeric (*Curcuma longa*) to Pekin ducks under small scale management

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International Journal of Science and Technology Research Archive, 2025, 08(01), 088-093

Publication history: Received on 10 November 2024; revised on 02 February 2025; accepted on 05 February 2025

Article DOI: <https://doi.org/10.53771/ijstra.2025.8.1.0075>

### Abstract

The objective of this study was to determine the appropriate concentration of dietary supplementation of turmeric, and its effect on growth performance and carcass characteristics. One hundred and twenty 1-day-old Pekin ducks were allocated into four groups with 3 replicates of 10 birds per cage. Birds were fed a commercial diet supplemented fresh liquid turmeric from 0 to 21 d, then a conventional formula based local feed stuff was assigned. The fresh liquid turmeric treats were at 0 (control, Tur- 0), 150 mg/kg (Tur-150), 250 mg/kg (Tur-250) and 350 mg/kg (Tur-350) levels for 56 days. All birds were kept in wire floor cages under small holder management. The results revealed that dietary supplementation of turmeric at 350 mg/kg improved live body weight and feed efficiency at 56 d of age.

**Keywords:** Growth performance; Carcass characteristics; Pekin ducks; Liquid Turmeric

### 1. Introduction

Pekin ducks as a meat producer in West Nusa Tenggara (WNT) are showing a decline in both population and production. According to Central Bureau of Statistics (2022), the duck population or production in 2021 increased by 5.58% from 2020, but in 2022 there were no change or an increase of 0%. This data explicitly shows the duck crisis in WNT so that a solution is needed to support tourism development and at the same time provide employment and income for the small farmer community. Preliminary research showed that the potential for Pekin ducks in Lombok is quite large (Indarsih et al., 2016a). In developing countries like Indonesia, feed costs are not only the largest production cost but also the biggest challenges for small holders. They also face low production performance and high mortality. In fact, these are not the only problem, but after harvesting, the antibiotic-free product is a big challenge that is not easily solved by small farmers. WHO (2020) strongly confirms that antibiotic resistance is one of the biggest threats to global health. The use of herbs in animal medicine is traditionally a widely accepted practice in various countries, with regional preference for herbs depending on their availability (Zeng et al., 2015). The use of these herbs in livestock, especially poultry, has become more widespread recently since the use of antibiotics was banned. in the European Union in 2006 (EC, 2005) and in Indonesia it was also banned effectively at the beginning of 2018. Turmeric is one of the herbs classified as phytochemical (Murugesan et al., 2015) with significant bioactivity as antimicrobial Moghadamtousi et al., 2014), antioxidant (Gandhi et al., 2011), anti-inflammatory (Kim et al., 2020), improves digestive nutrition, metabolism, and prevents biliary syndrome and anorexia in humans and livestock (Chattopadhyay et al., 2004), stimulates the secretion of bile acids through the hepatic blood vessels and the activity of lipase, amylase and protease, which have an important role in metabolism and improve digestion (Platel and Srinivasan, 2004). Turmeric also improves and helps restore liver function and lowers serum triglycerides, LDL cholesterol and blood glucose levels (Gandhi et al., 2011).

Turmeric has been comprehensively studied in laying hens (Hassan, 2016; Gumus et al., 2018; Lagana et al., 2019), broiler chickens (Attia et al., 2017; Kafi et al., 2017), ducklings (Ismoyowati et al., 2015) and quails (Al-Shammari et al., 2019; Suwarta & Suryani, 2019). Research on laying hens, offering turmeric powder up to a level of 0.4% per kg of feed was not able to increase egg production and quality (Lagana et al., 2019). In broiler chickens, however, turmeric powder

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1g/kg feed increased body weight by 15.1% and reduced abdominal fat by 0.7% (Attia et al., 2017). In laying quail, a mixture of turmeric and curcumin increases egg production performance and albumen weight (Suwarta & Suryani, 2019). This valuable information does not reach small farmers particularly Pekin duck farmers.

From existing literature studies, there is no information about offering fresh liquid turmeric to Pekin duck feed to improve their performance. Liquid turmeric in drinking water has proven to be ineffective according to the Sadeghi's study (2012). However, liquid turmeric mixed with feed for waterfowl needs to be proven because the advantage of liquid turmeric is that it does not require drying technology. Therefore, this study was carried out to improve the performance of Pekin ducks in producing antibiotic free meat at marketing age.

## 2. Material and methods

### 2.1. Animal management and experimental design

A total of 120-day old ducklings (DOD) were placed in the brooding pen until they were 3 days old. Then they were reared in rearing cages with a solid earth floor filled with rice husk litter with a length x width of 1.5 m x 1 m or a density of 3 birds/m<sup>2</sup>. These day old ducks were randomly divided into pens based on a completely randomized design in 12 cage plots (10 birds/replicate) and equipped with a feeder and a drinker per pen. The grounded fresh turmeric liquid was prepared and included into the feed mixture according to the treatments namely: control, Tur- 0), 150 mg/kg (Tur-150), 250 mg (Tur-250) and 350 mg/kg (Tur-350) respectively. The treatments were repeated 3 times

Ducks in the starter period (1-3 weeks old) were fed a commercial broiler diet and at the age of 22 - 42 days, they were fed based on local feedstuff as the standard feeding of small holder management, namely a mixture of coarse bran, expired bread, fresh ground local fish and green algae (Table 1 and 2). All birds had free access to feed and water. The chemical composition of the feedstuff used here was based on the previous studies by authors (Indarsih et al., 2016<sup>b</sup>).

### 2.2. Preparing fresh liquid turmeric

Fresh turmeric was purchased from the local market, then the skin was removed, weighed and washed. According to the treatment, 150; 250 and 350 mg /kg feed based on dry matter were blended and mixed with 100 cc of water, squeezed, the water was taken. The nutritional content of turmeric was analyzed in the Animal Science laboratory, Mataram University.

**Table 1** Chemical composition of the experimental diet

Ingredient	ME (kcal/kg)	CP (%)	EE (%)	CF (%)	Ca (%)	P (%)
LFWF*	3078	44,13	14,38	11,4	1,14	0,9
CRB*	2950	8	3,06	20	0,7	0,07
EFB*	2857	7	2,6	5	0,07	0,019
GA*	2000	21,74	2,98	27,4	0,67	0,30

ME; Metabolizable Energy; CP-Crude Protein; EE: Ether Extraction; CF-Crude Fibre LFWF-Local fresh water fish; CRB Coarse rice bran\* EFB Expired factory bread; GA- Geen algae \*Indarsih et al. (2016b)

**Table 2** Formulation of the experimental diet

Ingredient	Composition %	ME (kcal/kg)	CP (%)	EE (%)	CF (%)	Ca (%)	P (%)
LFWF*	35	1077,3	15,4	5,033	3,99	0.342	0,27
CRB*	34	1003	2,72	1,0404	6,8	0.266	0,03
EFB*	30	857,1	2,1	0,78	1,5	0.021	0.006
GA*	1	20	0,21	0,0298	0,274	0.0134	0,003
Total	100	2957,4	20,5	6,8832	12,564	0,6424	0,336

ME; Metabolizable Energy; CP-Crude Protein; EE: Ether Extraction; CF-Crude Fibre LFWF-Local fresh water fish; CRB Coarse rice bran\* EFB Expired factory bread; GA- Green algae \*Indarsih et al. (2016b)

### 3. Results and discussion

Feed intake in the starter period (0-3 weeks) was not affected by including fresh liquid turmeric ( $p > 0.05$ ), but in the group given turmeric, tended to be lower than the control. In the period  $> 3$  to 8 weeks, the impact of mixing fresh liquid turmeric on feed intake was significant ( $p < 0.05$ ). Feed intake decreased along with increasing levels of turmeric administration. Total feed intake during the study (8 weeks) was influenced by turmeric administration ( $p < 0.05$ ). This means that ducks need time to adjust to consuming food that experiences changes, especially taste, smell and color. Taste is an important part of encouraging birds to meet nutritional needs and motivating feed consumption. Previous research has reported that chickens have a low number of taste buds so their taste acuity is low. However, more recent research suggests that chickens have a well-developed taste system. Chickens, as an animal model widely used in research, are also the main animal species in the poultry industry. Therefore, it is necessary to understand that the formation of taste organs in poultry has an influence on nutritional consumption and feed management. The recent research shows that poultry, especially chickens, have a good sense of taste and taste sensation (Kabata and Tabata, 2022). A review by Liu et al. (2018) also showed that chicken taste organs are better developed than previously thought and could serve as an ideal system for multidisciplinary studies including organogenesis, regenerative medicine, feeding, and nutritional choices. Ducks are a type of bird, and seem to have the same taste characteristics. Previous research has shown that the number of taste buds in young and adult chickens is similar. However, a more detailed analysis showed that the number of taste buds and taste groups changed with age. For example, the number of taste buds increases after hatching in broiler chickens, both female and male, and then decreases at later growth stages (Liu et al., 2018).

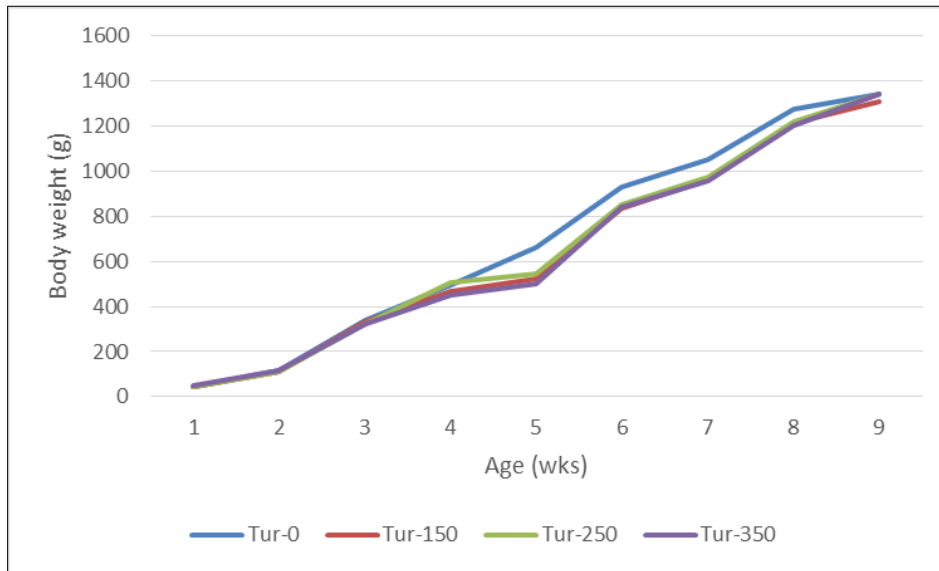
**Table 3** Growth Performance of Pekin ducks with fresh turmeric liquid as feed additive

Concentration of Turmeric (Treatment (mg/kg))					
Parameter	Tur-0	Tur-150	Tur-250	Tur-350	p-value
<b>Age (d) 0-21</b>					
Feed intake (g)	1878 ± 103	1725 ± 168	1704 ± 106	1547 ± 145	0.091
Body weight (g)	529 ± 25	490 ± 40	483 ± 31	448 ± 37	0.110
Weight Gain (g)	484 ± 26	445 ± 42	440 ± 26	400 ± 36	0.091
FCR	3.88 ± 0.01	3.87 ± 0.01	3.89 ± 0,02	3.86 ± 0,02	0.095
<b>Age (d) 22-56</b>					
Feed intake (g)	3833 ± 285 <sup>c</sup>	3505 ± 254 <sup>bc</sup>	2985 ± 129 <sup>a</sup>	3222 ± 71 <sup>ab</sup>	0.005
Body weight (g)	1513 ± 95.6 <sup>c</sup>	1392 ± 84.6 <sup>bc</sup>	1253 ± 20,8 <sup>a</sup>	1278 ± 52.04 <sup>ab</sup>	0.007
Weight gain (g)	985 ± 72.2 <sup>c</sup>	902 ± 64.4 <sup>bc</sup>	770 ± 32.7 <sup>a</sup>	830 ± 18.02 <sup>ab</sup>	0.005
FCR	3.89 ± 0.005 <sup>c</sup>	3.88 ± 0.005 <sup>bc</sup>	3.87 ± 0.005 <sup>a</sup>	3.88 ± 0.00 <sup>ab</sup>	0.015
<b>Age (d) 0-56</b>					
Feed intake (g)	5712 ± 380 <sup>b</sup>	5231 ± 336 <sup>ab</sup>	4890 ± 88 <sup>a</sup>	4770 ± 204 <sup>a</sup>	0.007
Body weight (g)	1513 ± 95.6 <sup>c</sup>	1392 ± 84 <sup>bc</sup>	1253 ± 20,8 <sup>a</sup>	1278 ± 52 <sup>ab</sup>	0.007
Weight gain (g)	1469 ± 96 <sup>b</sup>	1347 ± 85 <sup>ab</sup>	1210 ± 22,5 <sup>a</sup>	1230 ± 51.8 <sup>a</sup>	0.007
FCR	3.89 ± 0.00 <sup>b</sup>	3.88 ± 0.005 <sup>ab</sup>	4.04 ± 0.005 <sup>c</sup>	3.87 ± 0.005 <sup>a</sup>	0.032

Note: a - b different superscripts on the same row indicate differences at  $p < 0.05$

The graph at Figure 1 shows that the group of Pekin ducks that were given turmeric up to 350 mg/kg experienced a decline at more than 3 weeks of age and were able to catch up with the body weight of the control group at week 8. The decrease in body weight was caused by the change in feed that occurred from commercial feed to conventional feed with a mixture of local ingredients with added turmeric (Table 1). The feed mixture consists of green algae, coarse bran, expired bread and local fish which was then added with liquid turmeric to create a pungent taste and smell which causes consumption to decrease and affects the body weight of Pekin ducks. In accordance with the statement by Fujianto et

al., (2023) turmeric contains essential oils with a distinctive odor, bitter and spicy taste. Pratikno (2010) also added that turmeric has a pungent aroma and is slightly bitter, so it can have an effect on reducing palatability.



**Figure 1** Body weight of Pekin ducks from day 1 to 9 wks. of age

The results of this study are in consonance with Sadeghi et al. (2012) that supplementation of turmeric powder in drinking water at 5.0 g/L or 0.5% in male broilers did not affect body weight and daily feed consumption (Sadeghi et al., 2012). This shows that turmeric concentrations at levels that cause feed consumption to decrease significantly will cause a decrease in body weight. In contrast to the research of Khodadadi et al. (2021) proved that the effect of turmeric on broiler chickens significantly increases body weight after 21 days of age. Thus, the low body weight of Pekin ducks in this study was caused by offering turmeric immediately after hatching which disrupted feed consumption. The body weight of Pekin ducks was lower than the standard body weight of Pekin ducks reported by Onbaşilar et al. (2011). The body weight of the ducks in this study at 8 weeks of age was around 1513 grams (control) and 1253 -1392 grams when given turmeric. Body weight at 8 weeks of age should be 2351 g for females (Onbaşilar et al., 2011).

Feed conversion was not influenced ( $p>0.05$ ) by giving liquid turmeric up to 350 mg/kg of the starter period (0-3 weeks). During the grower period ( $>3-8$  weeks) and during the 8 weeks of research, it was influenced ( $p<0.05$ ) by treatment. At a high level (350 mg) turmeric was able to improve the conversion rate slightly more efficiently (3.88 decreased from 3.87) (Table 3). Giving turmeric had a significant effect ( $p<0.05$ ) on the feed conversion value in the period  $> 3-8$  weeks and during the study (0-8 weeks). Better feed conversion is due to the influence of turmeric's performance as a feed additive. This study is also in accordance with the findings of Emadi and Kermanshahi (2007), who reported that *curcuma longa* increased FCR in broiler chickens and its beneficial effect may be increasing the secretion of amylase, trypsin, chymotrypsin and lipase enzymes (Platel and Srinivasan, 2000). The positive effects of turmeric on broiler chicken performance are attributed to its ability to increase nutrient absorption and utilization, improve immune function, and reduce oxidative stress. Curcumin has been shown to increase the activity of digestive enzymes in the gut, which can lead to better absorption and utilization of nutrients. In addition, curcumin is known to have immunomodulatory effects, which can improve the immune response of broiler chickens and help prevent infections. Lastly, curcumin has been shown to have antioxidant properties, which may reduce oxidative stress and improve overall health (Scazzocchio et al., 2020)

#### 4. Conclusion and suggestion

Fresh liquid turmeric as a feed additive at a level of up to 350 mg/kg for Pekin ducks has an effect on the growth performance. The control treatment had the best growth performance compared to the treatment that added up to 350 mg/kg liquid turmeric. Feeding with fresh liquid turmeric to birds should not be given after hatching

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

### *Statement of ethical approval*

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