



EFFECT OF WATER EXTRACT SUPPLEMENTATION OF INDIGOFERA LEAVES IN DRINKING WATER ON PERFORMANCE, CARCASS, AND GUT MICROFLORA IN BALI DUCKS

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ABSTRACT

The purpose of this research is to determine the effect of giving of aqueous extract leaf of *Indigofera* (ILE) via drinking water on the performance, carcass, and gut microflora in the intestines of Bali ducks. A total of 240 male Bali ducks aged two weeks were assigned to 4 groups and 6 replicates. Each group consisted of 40 ducks with homogeneous body weight. The first group was drinking water without ILE as a control (A); the second, third and fourth groups, are drinking water with 2%; 4%; and 6% ILE, respectively. *Indigofera* leaf water extract supplementation at the level of 6 cc/100 cc via drinking water, significantly different ($P < 0.05$) increased body weight gain, feed efficiency, carcass weight, carcass percentage and meat protein mass. On the other hand, significantly different ($P < 0.05$) decreased feed consumption, serum cholesterol, and *Coliform* bacteria. It can be concluded that supplementation of 6% ILE in drinking water can improve the performance and carcass of ducks, on the other hand, reduce pathogenic bacteria in the intestines.

KEYWORDS: *Indigofera*, carcass, cholesterol, pathogenic bacteria, duck.

INTRODUCTION

In supporting the national food security program in Indonesia, poultry is the first commodity to fulfill meat consumption in Indonesia, which is 56%^[1]. Duck is one of the waterfowl that needs to be increased its productivity. Duck population in Bali fluctuates due to: (i) the price of duck feed is expensive; (ii) the selling price of ducks does not match the production costs; and (iii) the existence of market competition^[2].

Indigofera zollingeriana is a type of leguminous plant that is widely grown in Indonesia, because of its drought resistance, waterlogging resistance, and resistance to salinity regardless of season, and survive the dry season. Utilization of *Indigofera* leaves as a source of phytochemical compounds is a strategic step that can increase the productivity of poultry and reduce production costs. In addition, this plant is resistant to pruning, so it is very potential as a quality food crop^[3]. *Indigofera* leaves contain phytochemical compounds, namely: flavonoids, tannins, saponins, sterols, and quinones which have physiological functions, high nutritional value, as anti-bacterial and contain β -carotene^[4]. According to^[5], the components of phenolic compounds, namely flavonoids, phenylpropanoids, phenolic acids, anthocyanins, quinone pigments, melanin, lignin, and tannins, in plants can act as appetite

enhancers and increase digestive activity, so as to improve their production performance.

Supplementation of herbal leaf in poultry significantly improved performance and carcass weight, but significantly reduced serum cholesterol levels, body fat, and populations of pathogenic bacteria (*E.coli* and *Coliform*) in the intestine^[6,7,8,9,10,11]

The antioxidant capacity contained in the water extract of *Indigofera* IC 50 leaves is 943.67 ppm, which indicates that the plant is capable of counteracting free radicals. Antioxidants are substances that can delay, slow down and prevent the oxidation process or neutralize free radicals^[4]. In addition, free radicals are also involved in inflammation, calcification of bones, digestive disorders, impaired liver function, increasing levels of low density lipoprotein (LDL), which then causes the accumulation of cholesterol in the walls of blood vessels, causing atherosclerosis. Reported by^[12] administration of Turmeric water extract and Tamarind fruit can maintain kidney health in broilers.

The purpose of this research is to determine the effect of *Indigofera zollingeriana* leaf water extract given through drinking water on the performance, carcass, and

population of pathogenic bacteria in male Bali ducks aged 2-8 weeks.

MATERIALS AND METHODS

Two hundred and forty Bali ducks (*Anas sp.*) two weeks old, were randomly assigned to four treatment groups, and 6 replicates. Each treatment group consisted of 40 ducks with homogeneous body weight. The four treatment groups were the duck group that was given drinking water without ILE as a control (A); 2% ILE (B); 4% ILE (C); and 6% ILE (D), respectively.

There were 24 cages in total with a length of 2 m, a width of 1.5 m, and a height of 0.5 m. Each cage was occupied by 10 ducks. All cage plots were equipped

with feeding and drinking places. All cage plots were in one room with controlled temperature.

All experimental ducks were given a commercial complete feed (Crude protein: 18%; Metabolizable energy: 2900 kcal/kg). Commercial complete feeds are obtained from the Poultry Shop. Once a week, body weight and ration consumption were calculated.

Indigofera plants were specially grown at the UPT Forage for Animal Feed, Department of Agriculture, Bali Province. Before being extracted with water, *Indigofera* leaves were crushed into small pieces and then 1 kg is weighed and mixed with 1 kg water (1:1, w/w), then blended with an electric blender (Fig.1).



Fig 1: The process of making *Indigofera* leaf water extract with the ratio of leaves and water is: 1:1 (weight/weight)

Live performance.

Feeding and drinking water were given twice a day, every morning and evening. At night, the cage is equipped with fluorescent lighting. Once a week for 6 weeks of the experimental period (from 2-8 weeks of age), body weight (BW), total feed intake (FI) for a week, live weight gain (LWGs), and feed conversion ratio were carried out (comparison between feed intake and LWGs; w/w).

Slaughter procedures

Slaughter of ducks to find carcass weight was carried out at the end of the study. Fifty percent or as many as 120 experimental ducks were slaughtered to obtain carcass weight and carcass percentage. Ducks that have been slaughtered, to clean their feathers, first the ducks were dipped in hot water at 75°C for one minute, then the feathers were cleaned with a feather plucking machine. Determination of total cholesterol levels was analyzed by Lieberman-Burchard^[13] method. Samples of breast meat

were finely ground and 10 g were taken to analyze the protein content.^[14]

One-way analysis of variance was used to analyze the data obtained. Duncan's test to determine the significant difference in the probability $P = 0.05$.

RESULTS

Table 1, showed that ILE supplementation at the level of 2-6 cc/100 cc of drinking water, significantly different ($P < 0.05$) increased final body weight (BW), weight gain (LWGs), and feed efficiency (FI/LWGs). On the other hand, significantly different ($P < 0.05$) decreased the feed intake (FI).

Table 1: Final body weight, LWGs, FI and FCR of male Bali ducks aged 2-8 weeks that were added *Indigofera* leaf water extract via drinking water.

Variabel	ILE level in drinking water (cc/100 cc)				SEM
	0	2	4	6	
Initial body weight (g/bird)	362	364	368	361	4.45
Final body weight (g/bird)	1.406 ^a	1.451 ^b	1.473 ^b	1.603 ^c	16.97
Live body weight (g/bird/6 weeks)	1.044 ^a	1.086 ^b	1.106 ^b	1.242 ^c	16.99
Feed intake (g/bird/days)	109.40 ^a	106.90 ^b	104.21 ^b	98.93 ^c	0.231
Drinking water (ml/bird)	223.07 ^a	236.02 ^b	237.23 ^b	249.71 ^c	2.270
Feed Conversion Ratio (FCR)	4.41 ^a	4.20 ^b	4.05 ^b	3.40 ^c	0.080

Note:

SEM = *Standar Error of the Treatmen Means.*

^{abc} The mean with the different superscript were significantly different at probability P = 0.05

Supplementation of ILE with 4-6 cc/100 cc drinking water produced significantly (P<0.05) lower serum cholesterol contents. Drinking water supplementation of ducks with ILE also increased breast meet protein mass.

Table 2: Carcass weight and blood serum cholesterol levels of ducks given ILE through drinking water.

Variabel	ILE level in drinking water (cc/100 cc)				SEM ¹⁾
	0	2	4	6	
Carcass weight (g)	810 ^a	854 ^b	909 ^b	1.024 ^c	20.46
Carcass percentage (%)	57.89 ^a	59.29 ^a	62.65 ^b	64.50 ^b	1.00
Breast (% carcass weight)	37.94	36.80	37.35	38.45	0.87
Breast meat protein mass (g)	38.65 ^a	36.36 ^a	38.53 ^a	60.07 ^b	2.24
Cholesterol total (mg/dl)	207.43 ^a	207.03 ^a	200.41 ^b	194.08 ^b	3.67

Note:

SEM = *Standar Error of the Treatmen Means.*

^{abc} The mean with the different superscript were significantly different at probability P = 0.05

Supplementation of ILE via drinking water in duck grup B, C, and D, were significantly (P<0.05) reduced the population of *E. coli* and *Coliform* bacteria. The lowest population of *E.coli* and *Coliform* bacteria was found in the group D (Table 3).

Table 3: Bacterial pathogens in the intestines of male Bali ducks given ILE from 2-8 weeks of age via drinking water.

Variabel	ILE level in drinking water (cc/100 cc)				Population Normal (cfu/g)
	0	2	4	6	
<i>E. coli</i> bacteria (CFU x 10 ³)	5.94a	3.22b	2.94b	2.42c	10 ⁴ - 10 ⁵
<i>Coliform</i> bacteria (CFU x 10 ³)	6.08a	4.24b	3.58c	3.76c	4.0 x 10 ⁶ - 9.4 x 10 ⁶

Note:

Cfu = cell form unit

^{ab} The mean with the same superscript were significantly different at probability P = 0.05

DISCUSSION

The results showed that the administration of *Indigofera* leaf water extract at the level of 2-6 cc/100 cc of drinking water significantly increased BW, LWGs and FCR in male bali ducks aged 2-8 weeks. On the other hand, FI significantly decreased. The increase in body weight was due to the fact that *Indigofera* leaves contain a lot of phytochemical compounds, such as saponins, flavonoids, and tannins which have antimicrobial activity, such as saponins^[15].

The decrease in the number of pathogenic bacteria, will increase the absorption of nutrients, so as to improve the performance of ducks. According to^[16,17], supplemented of herbal leaves in the diet were improved BW and FCR. This result is supported by^[18], that the application of 2% *Moringa oleifera* flour in diets were improved LWGs and FCR in broiler chickens. Supplementation of herbal

leaf water extract (*Moringa*) through drinking water, significantly increases nutrient absorption, so that it has an impact on increasing laying hens production performance.^[19,20,21] Furthermore, according Siti^[8], that supplemented of 2% *Morinda* leaf extract were increased BW, LWGs, and FCR in male bali duckling.

The administration of *Indigofera* leaf water extract at the level of 2-6 cc/100 cc of drinking water to ducks from 2-8 weeks of age was found to reduce FI. This is in accordance with the results of several researchers, as reported by^[22] who found that FI significantly decreased in chickens that were supplemented with carrot herb leaf powder compared to chickens that were not given supplements. Same has reported by^[7], herbal leaf supplemented in broilers diet had no effect on feed intake, but was able to improve FCR and LWGs.

Herbal leaves are very potential to be used as supplements in poultry feed because they can improve feed efficiency^[23]. Herbal extracts can increase nutrient absorption, so that it can stimulate the growth of ducks. Ossebi^[24] reported that the administration of herbal leaves in chicken rations significantly improved the absorption of protein, energy, and minerals. The results of the research of^[25] reported that supplemented of *Moringa* leaf flour in diets were improved egg production, egg mass, number of eggs, and FCR compared to control in laying hens. Also reported by^[9] that supplementation of 5% herbal extract can improve production performance and feed efficiency. However, research by^[26] reported that the use of carrot leaf herbal powder of more than 4% in the diet resulted in WG loss, while FI and FCR had no significant effect.

Supplementation of 2-6% ILE can increase feed efficiency. Reported by^[27], that supplementation of herbal leaf extracts can improve the absorption of nutrients in the intestines of broilers. In addition, according to^[28] herbal extracts can improve the microenvironment of the digestive tract and the activity of pancreatic enzymes, so that nutrient absorption can be optimal in rats. It was also reported by^[24] that the addition of herbal leaves (*Moringa* leaves) in the diet could significantly increase the absorption of protein and minerals, thereby increasing the growth of chickens. Conflicting results were reported by^[29], The increasing the content of saponin compounds contained in herbal leaves can reduce the digestibility and absorption of nutrients, especially lipids in broiler chickens.

Carcass weight and carcass percentage were increased with the presence of *Indigofera* leaf water extract in drinking water, but breast meat was not affected ILE. The increase in carcass weight was due to the presence of antioxidant compounds, flavonoids^[30], carotenoids, amino acids, additional protein, and vitamins from *Indigofera* leaves. The characteristics of broiler carcasses increased with the supplementation of herbal leaves into the diet^[16,17]. Tang et al^[31] and^[32] reported that the increase in breast meat in ducks given ILE 6% was caused by increased consumption of protein and lysine.

According to^[33] and^[34], the increase in carcass weight and breast meat of treated ducks was caused by antioxidant and antimicrobial compounds in herbal leaves. As reported by^[16,17,35], that herbal supplementation of cold-pressed carrot can lead to an increase in carcass weight, and carcass percentage in broilers. Supplementation of 10% sweet potato leaf powder in the diet can increase the mass of protein and calcium in meat^[36]. In contrast to the results of the study^[37] which found that supplementation of 6% carrot waste flour in the diet, significantly reduced the protein mass of the meat.

Not many studies have examined the effect of *Indigofera* leaf water extract to decrease *E.coli* and *Coliform* bacteria in the intestine of poultry. *Indigofera* leaf feed for ruminants is commonly used by breeders as a forage protein source. ILE supplementation were reduced numbers of *E.coli* and *Coliform* bacteria. According to^[38], most of the phytochemical compounds in herbal plants can act as antibacterial pathogens, namely: saponins, flavonoids, and triterpenoids, as antibacterial^[39].

Phenolic compounds at high concentrations in the digestive tract of poultry can cause protein clumping and bacterial cell membranes to lyse. The same thing was also reported by^[41] who stated that phenolic compounds can play a role in inhibiting the growth of pathogenic bacteria (*S. aureus*). It was also reported by^[42] that the high level of tripernoid in the herbal extract (*Sauropus androgynus*) gave the extract antibacterial potential. Terpenoids can be antibacterial by damaging the bacterial cell membrane.

Sudatri's research^[12] reported that the flavonoid and tannin compounds contained in the herbal extracts of *Curcumin* and *Tamarindus* fruit have antibacterial activity of *E.coli*. Pambayun et al.^[43] reported that flavonoid compounds in herbal plants can act as antioxidants and antibacterials, by denaturing bacterial cell lipid membranes through hydrogen bonds, so that they become damaged and bacterial growth is inhibited^[44]. Meanwhile, tannin compounds have antibacterial and antidiarrheal properties^[45].

The use of herbal leaf powder in the diet, such as: *Turmeric*^[46], *Pennyroyal*^[47], and *Orange peel*^[48] in poultry, were decreased population of *E. coli* bacteria in the intestine of poultry. Likewise, other herbs, such as: *Moringa* and *Sauropus* leaves^[6] significantly increase performance and reduce cholesterol content in meat; *Kaempferia galanga*^[49] can be used as antidiabetes and anticholesterol; *Tamarindus indica*^[22] can suppress the population of pathogenic bacteria, increase the length of intestinal villi, and reduce cholesterol in broiler blood serum; Carvalho^[10], *Tamarindus* leaf water extract can reduce cholesterol and ammonia gas in laying hens. In contrast, ^[50], herbal leaves (Carrots) in rations did not affect gut microflora in the intestines of laying hens.

CONCLUSION

Based on the results of this study, supplementation of 6% ILE in drinking water can improve the performance and carcass of ducks, on the other hand, reduce *E.coli* and *Coliform* bacteria in duck intestines.

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