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(RESEARCH ARTICLE)

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Growth and blood lipid profile of native chickens given noni juice (*Morinda citifolia*) via drinking water

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Abstract

The concept of phytogenic feed additives refers to natural medicinal products derived from herbal plants to promote the growth and health of poultry. This study aims to examine the inclusion of Noni fruit juice (NFJ) in drinking water on the growth and blood lipid profile of native chickens. A total of 160 native chickens aged 2 weeks with homogeneous body weight were randomly divided into 4 treatment groups and 4 replications, each repetition with 40 chickens. Chickens were given treatment, namely: chickens were given drinking water without NFJ (A), drinking water with 4% NFJ (B), drinking water with 4.5% NFJ (C), and drinking water with 5% NFJ (D). The results showed that NLJ supplementation in drinking water had no significant effect ($P>0.05$) on chicken growth and feed efficiency. Blood cholesterol and HDL levels showed significant differences ($P<0.05$) between treatments. The lowest blood cholesterol levels were found in group C chickens and the highest in group A chickens. On the other hand, the highest HDL levels were found in group C chickens and the lowest in group A chickens. It was concluded that supplementation of 4.5% NFJ in drinking water had no impact on growth, but significantly reduced cholesterol content and increased HDL concentrations in native chicken blood.

Keywords: Blood profile; Growth; *Morinda citifolia*; Native chickens

1. Introduction

In the world of animal husbandry, there are many ways to improve poultry performance, and one of them is the use of various kinds of feed additives, either through drinking water or mixed into the feed. Generally used are antibiotics. However, with the prohibition of the use of antibiotics, it will have a less good impact on the productivity or performance of poultry. Efforts that can be made to avoid this are by switching to using natural feed additives made from herbal ingredients through drinking water. The concept of phytogenic feed additives refers to natural medicinal products derived from herbs used in livestock nutrition to improve livestock performance and health [1]. Generally, phytogenic feed additives are used to improve overall poultry health and help digest feed, thereby increasing feed efficiency [2].

The phytochemical compounds contained in noni fruit are: polysaccharides, scopoletin, ascorbic acid, β-carotene, L-arginine, proxeronine and proxeroninas [3]. The beta-carotene compound is an active substance for carcass color [4,5]. Supplementation of herbal leaves in feed can improve growth, nutrient digestibility, blood profile and reduce gas emissions in pigs and broilers [6,7]. Noni plant (*Morinda citrifolia*) is a native Indonesian herbal plant that is used for medicinal purposes. This material is very good for increasing endurance, appetite and reducing fat. Some researchers report that supplementation of herbal leaf meal in feed can increase the production and quality of chicken eggs [8,9,10,11,12], improve growth performance and feed digestibility in ducks [13]. Cui et al. [14] stated that supplementation of herbal leaf meal (*Moringa*) in feed could improve meat quality, oxidative stability and breast muscle color in broilers.

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The purpose of this study was to examine the efficacy of Noni fruit juice given through drinking water on the growth and blood lipid profile of chickens.

2. Material and methods

2.1. Material

This research was carried out at the Research Station, Faculty of Animal Husbandry, Udayana University and was approved by the Research Ethics Commission from the Faculty of Veterinary Medicine, Udayana University. The chemicals used to analyze blood lipid profiles are chloroform, acetate anhydrous and concentrated H_2SO_4 and hexane alcohol with a ratio of 3:1. The tools used consist of analytical balances, vortexes, waterbaths, steam or test tubes, centrifuge tube, Erlenmeyer flask, micropipette, and spectrophotometer.

The ration provided was standard for native chicken produced by PT. Charoen Phokphan, Tbk., Indonesia, in crumble form.

2.2. Methods

A total of 160 native chickens aged 2 weeks with homogeneous body weight were randomly divided into 4 treatment groups and 4 replications, each repetition with 40 chickens. Chickens were given treatment, namely: chickens were given drinking water without NFJ (A), drinking water with 4% NFJ (B), drinking water with 4.5% NFJ (C), and drinking water with 5% NFJ (D), respectively. All chickens were placed in cages made of bamboo slats and bird wire. Each cage with dimensions: length x width x height (1.2x1.0x0.5 m^3). All cage plots were equipped with plastic feed and drinking bowls with a volume of 5 liters.

Measurements of body weight and body weight gain of ducks were carried out every week. All ducks were fasted for 12 hours before weighing, but drinking water was still given ad libitum. Feed conversion ratio (FCR) is a comparison between feed consumption and body weight gain in the same unit of time. Blood lipid profile was analyzed following the method[15].

2.3. Morinda fruit juice.

Making *Morinda* fruit juice was done by blending 1 kg of *Morinda* fruit which was ripe with 1 liter of clean water. After being crushed, the *Morinda* fruit juice was then filtered through gauze and put into a 1 liter capacity plastic bottle. *Morinda* fruit juice was then stored in the refrigerator and ready to be given to the chickens through drinking water according to the treatment level (0 cc; 4 cc; 4.5 cc; and 6 cc per 100 cc of drinking water).

All data were analyzed by one-way ANOVA, if there was a significant difference ($P<0.05$) between treatments followed by Duncan's multiple range test.

3. Results and discussion

3.1. Growth performance

Table 1 shows the results of the study on the effect of NFJ supplementation in drinking water on the growth of native chickens aged 2-8 weeks. NFJ supplementation through drinking water had no significant effect ($P>0.05$) on final body weight (FBW), weight gain (LWG), and feed conversion ratio (feed intake: weight gain). However, supplementation of 4.5% NFJ in drinking water significantly reduced feed consumption or feed intake (FI). There is a tendency to increase the growth of chickens with the provision of NFJ through drinking water. This increase is inseparable from the presence of phytochemical compounds contained in NFJ. As reported by [8,13] that supplementation of aqueous extracts of herbal leaves (*Carrot* and *Papaya*) in drinking water significantly increased the growth of ducks. According to [13], active compounds in herbal plants (*Carrot*) can suppress the population of pathogenic bacteria in the intestine, so that the absorption of nutrients can be optimal. The same thing was reported by [16] that herbs and medicinal plants (*Rhus verniciflua*) have an influence on nutrient digestibility and broiler growth.

Table 1 Growth performance of native chickens aged 2-8 weeks given drinking water with NFJ supplementation

Variable	NFJ supplementation in drinking water (cc/100 cc)				SEM
	0	4	4.5	5	
Initial body weight (g/head)	104.06	108.06	104.81	106.56	1.18
Final body weight (g/head)	750.13	774.06	777.44	776.38	9.33
Live weight gains (g/head/42 days)	648.25	665.94	677.19	672.94	9.21
Feed intake (g/head)	45.00[a]	44.25[a]	43.50[b]	44.50[a]	0.12
FCR (FI:LWGs)	2.55	2.40	2.35	2.43	0.03

Note: [a,b]Values with different letters in the same row are significantly different (P<0.05); SEM= Standard error of the treatment means

The decrease in feed consumption in the administration of 4.5% NFJ, allegedly due to the presence of tannins, caproic acid, capric acid and caprylic acid contained in noni fruit and seeds [3] can affect appetite.

3.2. Blood lipid profile

Table 2 The effect of NFJ supplementation in drinking water on the blood lipid profile of native chickens

Variable	NFJ supplementation in drinking water (cc/100 cc)				SEM
	0	4	4.5	5	
Cholesterol (mg/dL)	85.00[a]	79.00[b]	75.00[c]	81.00[b]	0.59
Triglycerides (mg/dL)	20.75[b]	21.25[b]	23.75[a]	22.00[ab]	0.32
High Density Lipoprotein (mg/dL)	51.75[c]	53.00[b]	56.50[a]	54.75[b]	0.44
Low Density Lipoprotein (mg/dL)	30.25[a]	27.75[b]	26.00[b]	29.00[a]	0.39

Note: [a,b]Values with different letters in the same row are significantly different (P<0.05); SEM= Standard error of the treatment means

The effect of NFJ supplementation in drinking water on the blood lipid profile of chickens is presented in Table 2. Supplementation of 4-5% NFJ in drinking water of chickens had a significant effect (P<0.05) on the blood lipid profile of chickens. The group of chickens that received 4.5% NFJ had the best impact on the blood lipid profile of chickens. Supplementation of 4.5% NFJ or 4.5 cc of NFJ per 100 cc of drinking water (chicken group C) had the lowest cholesterol concentration and had the highest HDL concentration compared to other treatments (chicken group A, B and D).

The decrease in cholesterol levels was due to the presence of flavonoid compounds in NFJ. As reported by [17] that flavonoids can lower cholesterol by reducing cholesterol synthesis by inhibiting the activity of the enzyme acly-CoA cholesterol acly transferase (ACAT) found in $HepG_2$ cells which has the function of reducing cholesterol esterification in the intestine and liver, as well as inhibit the activity of the enzyme 3-hydroxy 3-metyglutaryl-CoA which causes inhibition of cholesterol synthesis. This result is inversely proportional to the study of [18] that the administration of *Announa muricata* leaf powder which also contains flavonoids up to a level of 15% has not been able to change triglyceride levels in drake. The results of this study are the same as those reported by [19] that supplementation of herbal (*Indigofera*) juices through drinking water significantly reduced the blood cholesterol content of ducks.

HDL blood serum levels of ducks increased significantly with the addition of NFJ in drinking water. The same thing was reported by [20] that the administration of herbal leaf powder (*Pistia stratiotes*) in the basal ration increased HDL levels of native chickens. In contrast, Hasibuan [21] reported that the administration of *Pistia stratiotes* leaf meal in rations was not able to increase HDL levels in ducks. According to [22], HDL levels in the blood have a positive correlation with LDL levels, and both are affected by blood cholesterol levels. The level of HDL in the blood is related to cholesterol levels and the activity of synthesizing steroid compounds and bile salts [23]. The decrease in blood HDL cholesterol levels can be caused by the influx of cholesterol from lipoproteins with low cholesterol potential (LDL) to the cell membrane, and the use of HDL for the synthesis of steroid compounds such as hormones or bile salts in the liver. Tugiyanti et al. [18] reported that administration of *Announa muricata* leaf powder up to a level of 15% was not able to reduce LDL levels

in ducks. In contrast, Sutama [20] reported that the provision of *Pistia stratiotes* flour could reduce LDL levels of native chickens.

4. Conclusion

It was concluded that NFJ supplementation in drinking water did not have a negative impact on the growth of native chickens aged 2-8 weeks. However, it can significantly improve blood lipid profiles, namely: decreased cholesterol levels and increased HDL levels in native chicken blood.

Compliance with ethical standards

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Disclosure of conflict of interest

This manuscript has no conflict of interest with any party.

Statement of ethical approval

Approved by the Research Ethics Commission from the Faculty of Veterinary Medicine, Udayana University.

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