Use of Pistia stratiotes in diets of Kampong chicken

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Use of *Pistia stratiotes* in diets of Kampong chicken

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Abstract

This study was on the use of *Pistia stratiotes* meal in diets of Kampong crossbred chicken (KCC). 140 KCC 3-week old chicken with average body weight of 199 ± 27.9 g were allocated in a Randomized Block Design to 4 treatments and 5 replications. The treatments were rations containing 0, 6, 12 or 18% *Pistia stratiotes* with 7 chickens in each treatment-replicate

Dried *Pistia stratiotes* leaves can be included at up to 12% in the diet of Kampong chicken with no loss of performance in terms of weight gain and feed conversion and with benefits for human health as indicated by lower levels of cholesterol in the meat.

Keywords: *alternative feed, water plants*

Introduction

In Indonesia, the demand for local chicken meat is expected to continue to increase (Santoso and Setiadi 2016). Kampong Chicken Crossbred (KCC) is the popular local chicken raised in Indonesia. There is an increasing demand for KCC meat from 34,000,000 kg in 2017 to 37,450,000 kg in 2018. Based on the data, the demand for KCC meat is still considerably high.

Photo 1. Kampong Chicken Crossbred

Setiadi et al (2016) stated that KCC plays an important role in rural areas in Indonesia. One of the problems in KCC raising is feed. The KCC rearing system is faced with high cost of feed, as the main ingredients such as maize and soybean meal are still imported from other countries.

Duckweed as an alternative feed for poultry has been studied by many researchers (Becerra et al 1990; Becerra et al 1995; Leng et al 1995; Hang 2013; Men et al 1995; Sugiharto et al 2019). *Pistia stratiotes* is another water plant that can be considered as a alternative feed ingredient for poultry. *P istia stratiotes* are plants floating on the surface of the water—stoloniferous herbal plants—that are commonly found in stagnant water. In Indonesia, these plants are known as water cabbage. *P istia stratiotes* reproduction runs rapidly with vegetative propagation by releasing stolons. The seasons plant density which varies from less than 100 per m^2 to more than 1,000 per m^2 (Langeland et al 2008). Some studies were conducted on utilizing water plant (Alalade et al 2006; Amerah et al 2013; Anderson et al 2011; Dwiloka et al 2015; Leterme et al 2009; Leterme et al 2010; and Mukherjee 2010). *Pistia stratiotes* has potential as a substitute for the main ingredient of feed, mainly due to their high content of protein.

Photo 2. *Pistia stratiotes*

The content of polyunsaturated fatty acids (PUFA) in aquatic plants is thought to be quite high, according to the study of Gena et al (2014). This is also in line with the findings of Santoso et al (2017), which identified the nutritional content of *Pistia stratiotes* as 16.0% crude protein, 5.10% crude fat, 11.1% fiber and 22.2% ash.

The s present study aimed to determine the effect of the use of *Pistia stratiotes* (*Pistia stratiotes*) meal in feed on the technical performance performance of KCC.

Materials and methods

This study was conducted in the Faculty of Animal and Agricultural Sciences, Diponegoro University for 7 weeks. Pistia stratiotes was harvested from Rawa Pening lake, Semarang district. The leaves were dried with sunlight for 3 days then ground to a fine powder prior to analysis (Table 1)

Table 1. Proximate compositions *of Pistia stratiotes*

Compositions (%)	Pistia stratiotes, leaf meal
Moisture	5.61
% in DM	
Crude protein	15.1
Crude fat	3.61
Crude fiber	14.3
Ash	35.4

140 KCC at the age of 3 weeks old, with average body weight of 199 ± 27 g were allocated to 4 diets (Table 2) containing 0, 6, 12 or 18% *P Pistia stratiotes* (DM basis) with 7 chickens in each treatment-replicate. Feed and water were given ad libitum.. Body weight measurements were carried out every week

Table 2. Composition of diets

	Level of *Pistia stratiotes*, %			
	0	6	12	18
Feed ingredients	----- % -----			
Maize	55.0	52.9	51.1	50.5
Soybean meal	15.8	15.4	14.3	13.0
Rice bran	14.8	13.7	12.4	10.0
Pistia stratiotes	0	6.0	12.0	18.0
Fish meal	6.0	5.5	5.5	5.5
Coconut oil	0.5	0.5	0.5	0.5
$CaCO_3$	2.0	1.1	1.0	0.2
Premix	2.1	1.6	1.4	1.0
Methionine	1.6	1.6	0.6	0.4
Lysine	2.2	1.7	1.2	0.9
Analysis (% in DM)				
Crude protein	17.22	17.35	17.45	17.46
Crude fat	5.17	5.03	4.86	4.62
Crude fiber	6.99	7.41	7.78	7.83
Methionine#	1.80	1.80	0.90	0.72
Lysine#	2.56	2.15	1.74	1.50
Ca	2.51	1.85	2.01	1.49
P	0.51	0.50	0.50	0.48

 # Methionine and lysine were calculated based on the needs of broiler according to the Indonesian National Standard

Lipid profile of KCC meat

Total cholesterol

Cholesterol was analyzed after hydrolysis and enzymatic oxidation by cholesterol reagent kit (Ref 10028) from GmbH65205 Wiesbaden Germany using the CHOD-PAP method. This is an enzymatic colorimetric test.

HDL-cholesterol

Analysis of HDL-plasma cholesterol was determined in the supernatant after entrifugation by the HDL-CHOL RE (Ref 10018) reagent from Wiesbaden GmbH-65205 Germany.

LDL-cholesterol

LDL-cholesterol level was determined using the formula:

LDL = KT-HDL-TG / 5

Where:

KT = total cholesterol

TG = triglyceride

HDL = HDL-cholesterol

LDL = LDL-cholesterol

Triglyceride

Plasma triglyceride analysis was determined by the TG reagent kit (Ref 10720P) from GmbH-65205 Wiesbaden Germany using the GPO-PAP method This is an enzymatic colorimetric test.

Antioxidant activity

Antioxidant activity of KCC meat was assessed using the DPPH free radical assay (Fasseas et al 2008). The samples were reacted with the stable DPPH radical in an ethanol solution. The reaction mixture consisted of 0.5 mL of the sample, 3 mL of absolute ethanol, and 0.3 mL of DPPH radical solution in 0.5 ml ethanol. The antioxidant activity was presented in percent of inhibition.

Data Analysis

data obtained were analyzed by the ANOVA program in the as tested by analysis of variance (ANOVA) using the SPSS version 20 program. Regression analysis was used to determine the effect of increasing level of *Pistia stratiotes* on performance parameters.

Results and discussion

Feed intake was increased linearly as the proportion of *P istia stratiotes* in the diet was increased (Table 3; Figure 1). This was reflected in greater weight gain (Figure 2) but with no change in feed conversion (Table 3).

Table 3. Chicken performance

Items	Pistia stratiotes in the diet (%)				SEM	*p* value
	0	6	12	18		
Feed consumption (g/bird)	395[a]	401[a]	445[b]	448[b]	49.8	<0.05
Weight gain (g/bird)	269[a]	274[a]	308[b]	295[ab]	64.9	<0.05
FCR	1.47	1.46	1.44	1.52	0.03	0.20
Final weight (g/bird)	689[a]	681[a]	738[b]	689[a]	53.2	<0.05

FCR Feed intake/weight gain

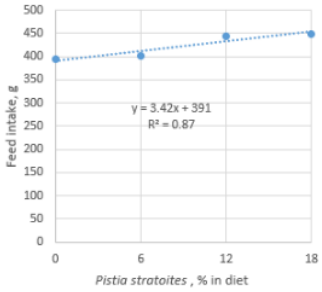

Figure 1. Feed intake of KCC with *Pistia stratiotes* in the ration

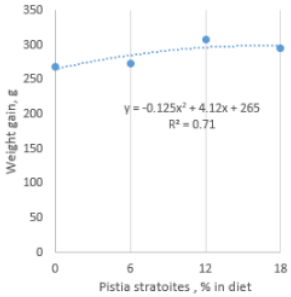

Figure 2. Weight gain of KCC with *Pistia stratiotes* in the ration

All indices in the lipid profile decreased as the concentration of *Pistia stratiotes* in the diet was increased (Table 4; Figures 3-6). The antioxidant level increased with up to 9% *Pistia stratiotes* in the diet then decreased (Figure 7).

Increasing plant fiber in the diet reduces the absorption of glucose in the intestinal tract and this lowers the blood insulin level, leading to an increased level of glucagon and triggering lipolysis in the tissues (Reimer et al 2012) leading to lower levels of cholosterol as observed in this study Dwiloka et al (2015) also stated that increasing plant fiber in feed could reduce cholesterol levels in duck meat.

Table 4. Mean values for lipid profile in the meat of Kampong chicken

Items	Pistia stratiotes in the diet (%)				SEM	*p* value
	0	6	12	18		
Cholesterol (mg/100g)	130[a]	83[b]	87.1[b]	79[c]	10.8	<0.01
HDL (mg/100g)	30.2[a]	24.4[b]	27.4[ab]	11.1[c]	0.86	<0.05
LDL (mg/100g)	56.3[a]	31.1[b]	32.1[b]	30.8[b]	3.37	<0.05
Triglyceride (mg/100g)	332[a]	257[b]	189[c]	167[c]	9.49	<0.01
Antioxidant (%)	8.9[a]	13.2[b]	13.1[b]	8.3[a]	0.42	<0.05

abc Means in the same row without common superscript differ at p<0.05

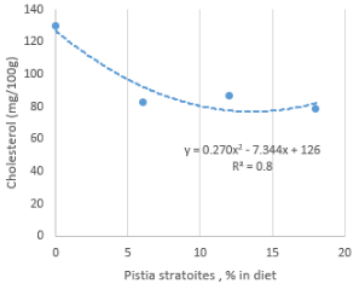

Figure 3. Total cholesterol in meat of KCC with *Pistia stratiotes* in the diet

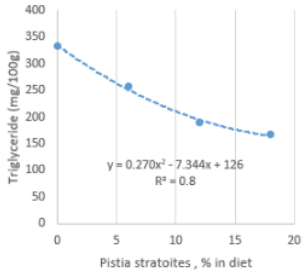

Figure 4. Triglyceride in meat of KCC with *Pistia stratiotes* in the diet

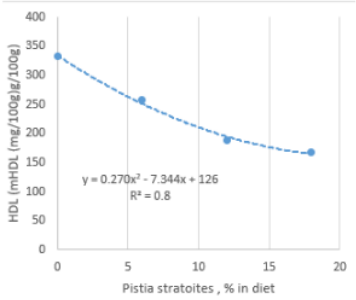

Figure 5. HDL cholesterol of KCC with *Pistia stratiotes* in the diet

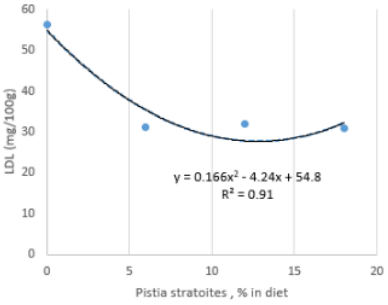

Figure 6. LDL cholesterol of KCC with *Pistia stratiotes* in theration

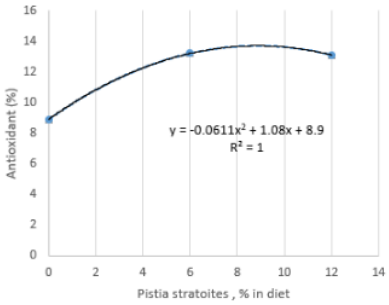

Figure 7. Antioxidant levels in the meat of KCC with *Pistia stratiotes* in the diet

Conclusions

- Dried *Pistia stratiotes* leaves can be included at up to 12% in the diet of Kampong chicken with no loss of performance in terms of weight gain and feed conversion and with benefits for human health as indicated by lower levels of cholesterol in the meat.

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