Effect of Cinnamon Extract on Energy and Protein Utilization Efficiency of Broilers Chickens

Ihsan Zain Nida[1], Aji Praba Baskara[1], Bambang Ariyadi[1], Nanung Danar Dono[1], and Zuprizal Zuprizal[1,*]

[1] *Department of Animal Nutrition and Feed Science, Faculty of Animal Science, Universitas Gadjah Mada, Yogyakarta, Indonesia 55281*
[*]*Corresponding author. Email: zuprizal@ugm.ac.id*

ABSTRACT
This study aimed to evaluate the effect of cinnamon extract (*Cinnamomum burmannii*) in drinking water on energy and protein utilization efficiency of broilers. 200 Lohmann W99 Grade-A broilers were randomly divided into 5 treatment groups and 5 replications, and each replication consisted of 8 chickens. The treatment groups were KN= control treatment, drinking water without any addition; AT= drinking water + antibiotic 45 mg/l; NK1= drinking water + cinnamon extract 0.025 ml/l; NK2= drinking water + cinnamon extract 0.05 ml/l; and NK3= drinking water + cinnamon extract 0.1 ml/l. The variables observed in this study were water intake, water and feed intake ratio, energy intake, protein intake, energy utilization efficiency and protein utilization efficiency. All data were analysed using analysis of variance (ANOVA) and the differences among the treatment groups mean were analysed using Duncan's new multiple range test (DMRT) at 5% probability level. All treatments with the addition of cinnamon extract as well as treatment with antibiotic had higher energy and protein utilization efficiency values compared to control treatments ($p<0.05$). Based on the results of the study it can be concluded that by adding the cinnamon extract to drinking water could increase the efficiency of energy and protein utilization in poultry production, especially broiler chickens.

Keywords: *Cinnamon extract, broiler chicken, energy, protein.*

1. INTRODUCTION

In Indonesia, the majority of smallholder farmers raise broiler chickens with an open house system. High environmental stress in open house cages, one of which is pathogenic microbes, can affect broiler chicken productivity. To improve feed efficiency, livestock growth, and livestock product quality, certain antibiotics have been widely used as feed additives [1]. The use of antibiotics or known as Antibiotics Growth Promoters (AGP) in livestock business has been prohibited because the use of AGP can cause antibiotic residues in livestock products that can cause health problems if consumed by humans, as well as the emergence of resistance to several types of pathogenic microorganisms to antibiotics [2].

Broiler chickens need feed that can meet the nutritional needs of their bodies so that they can produce good productivity. On the other hand, gut microbes affect nutrient availability, health, and growth performance of livestock due to the interaction of nutrient utilization and gastrointestinal development [3]. The duodenum, jejunum, and ileum have varying abilities in digestion and absorption of food substances which can be influenced by the intestinal epithelium surface area and the number of villi and microvilli that expand the absorption area [4].

Bioactive compounds in plants that can be used as an alternative substitute for antibiotics. Cinnamon (*Cinnamomum burmannii*) is a plant that has potential as a substitute for antibiotics because it is known to have antimicrobial activity like antibiotics in general. Microbial growth can be inhibited by giving Cinnamon because it contains cinnamaldehyde and also eugenol. The mechanism of inhibition of microbial growth is due to the cell surface and cytoplasmic membrane phospholipid bilayer and membrane-bound enzymes are damaged by the active components of cinnamon extract. [5]. This study aimed to evaluate the effect of cinnamon extract (*Cinnamomum burmannii*) in drinking water on energy and protein utilization efficiency of broilers.

2. MATERIALS AND METHOD

2.1. Experimental Design, Birds, And Diets

Table 1. Calculated nutrient content of the basal diet.

Calculated nutrient content	
Metabolizable Energy (kcal/kg)	3022
Crude protein (%)	21.7
Fiber (%)	2.34
Fat (%)	5.85
Calcium	0.87
Available Phosphorus	0.47

200 Lohmann W99 Grade-A broilers were randomly divided into 5 treatments with 5 replications, and each replication consisted of 8 chickens. The treatment groups were given through drinking water, consist of: KN= control treatment, drinking water without any addition; AT= drinking water + antibiotic 45 mg/l; NK1= drinking water + cinnamon extract 0.025 ml/l; NK2= drinking water + cinnamon extract 0.05 ml/l; and NK3= drinking water + cinnamon extract 0.1 ml/l. During the study, the temperature of the pen was maintained to meet the needs of broiler chickens. Each cage is equipped with a feeder and nipple drinker. The basal diet was formulated to meet or exceed the nutritional requirements of broiler chickens (Table 1). The basal diet consists of maize, meat bone meal, soybean meal, palm oil, trace mineral and vitamin mix, limestone ($CaCO_3$), L-Lysine HCl, DL-Methionine, and Di-Calcium Phosphate. Feed and drinking water were provided ad libitum.

All broiler chickens received a triple vaccine consisting of inject (Newcastle Disease (ND) killed vaccine and Infectious Bursal Disease (IBD) live vaccine) and spray (ND + infectious bronchitis (IB) live vaccine) at hatching. Chick-in (day 1), DOC was weighed to determine initial body weight and placed in a colony cage that acted as a brooder cage with rice husk litter 10 cm thick and cage density 20 kg/m^2. On the first week, a total of 8 birds per pen were placed into 25 pens with a size of 100×90x60 cm. The temperature was maintained according to the needs of broiler chickens.

2.2. Performance measurement

The broiler chicken performance analysis was calculated from the second week until the fourth week or day 28. The variables observed in this study were water intake, water and feed intake ratio, energy intake, protein intake, energy utilization efficiency and protein utilization efficiency.

$$EUE (\%) = (a/e) \times 100 \quad (1)$$

where EUE is the energy utilization efficiency; a is the body weight gain; e is energy consumption (kcal).

$$PUE (\%) = (a/p) \times 100 \quad (2)$$

where PUE is the protein utilization efficiency; a is the body weight gain; p is protein consumption (g).

2.3. Statistical Analyses

The data obtained were then analysed by one-way analysis of variance using IBM SPSS 19.0 (IBM Corporation, New York, USA). Mean differences between treatments were examined using Duncan's new multiple range test. The probability value assumed as statistical significance is $p<0.05$

3. RESULTS AND DISCUSSIONS

Compared to the control group, the NK1, NK2, and NK3 as well as antibiotic groups reduced the amount of water intake of broiler chickens (Table 2). All of the treatment groups given did not affect the water and feed intake ratio of broiler chickens. The water and feed intake ratio of broiler chicken with normal density were around

Table 2. The effect of treatments on broiler chicken aged 28 d.

Formulation	KN	AT	NK1	NK2	NK3	SEM	*P value*
Water intake (ml)	3537.50^a	3263.50^b	3324.00^b	3350.25b	3229.00^b	30.20	0.004
Water and feed intake ratio	1.89	1.96	1.94	2.00	1.91	0.02	0.518
Energy intake (kcal)	5633.07^a	5040.60^b	5165.05^b	5067.50^b	5085.79^b	58.96	0.001
Protein intake (g)	39810.23^a	35623.14^b	36502.63^b	35813.24^b	35942.47^b	416.71	0.001
Energy utilization efficiency (%)	22.29^a	24.21^b	23.99^b	24.66^b	23.70^b	0.25	0.020
Protein utilization efficiency (%)	3.15^a	3.42^b	3.39^b	3.49^b	3.35^b	0.04	0.020

Description: ^{a,b} means within a row with different lowercase superscripts indicate significant differences ($p<0.05$).

1.7 and increased with increasing density until it reached 1.85 [6]. In every aspect of broiler chicken metabolism, water plays an important role such as regulation of body temperature, feed digestion and removing digestive wastes [7].

Compared to the control group, the NK1, NK2, and NK3 as well as antibiotic groups decreased the amount of energy and protein intake (Table 2). Energy and protein are one of the main cost factors of poultry feed. Feed protein consumption not only affects growth but also affects the environment due to different nitrogen excretion rates. The energy metabolism strongly interacts with utilization of protein. Protein deposition in poultry is an energy-consuming process and can only be continued if adequate dietary energy is provided assuming other nutrients are met [8]. Table 2 shows that the effect of NK1, NK2, and NK3 KN3 as well as antibiotic groups reduced the energy utilization efficiency and protein utilization efficiency compared to the control group. If the consumption of chicken feed is equal to the physical capacity of the digestive system of chickens, then the efficiency of energy utilization in broilers can be achieved. The high efficiency of energy use will reduce feed consumption and then increase the speed of growth and production of chickens so as to cut production costs and ultimately increase profits [9].

The fact that the protein utilization efficiency decreases with each increase in dietary protein [10]. However, in this study, broiler chickens were only given one type of feed, so the increase in the protein utilization efficiency may be due to the bioactive compounds contained in cinnamon extract. Our recent study has shown that the bioactive compounds of cinnamon extract are efficacious for slowing digestion in the small intestine so that the efficiency of nutrient utilization can increase [11].

4. CONCLUSIONS

The present study concluded that the addition of cinnamon extract to drinking water could increase the efficiency of energy and protein utilization in poultry production, especially broiler chickens.

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