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Effect of *Andrographis paniculata* a Phytobiotic on Consumption, Feed Conversion and Mojosari Duck Egg Production

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Abstract: The aim of this research was to investigate the effect of *Andrographis paniculata* leaf powder as a phytobiotic on feed consumption, feed conversion and egg production of the Mojosari duck (*Mojosari anas plathryncos*). One-hundred 24-month-old Mojosari ducks were given basal feed with different concentrations of *Andrographis paniculata* leaf powder as a feed additive. Experiments were arranged with a completely random design, with five leaf powder concentrations, each replicated four times; *A. paniculata* leaf powder was added to rations in the following concentrations: 0% (P_0), 0.2% (P_1), 0.4% (P_2), 0.6% (P_3) and 0.8% (P_4). Data was analyzed using analysis variants and if there was a difference between treatments, those data were further subjected to a least significant difference test; variables included feed consumption, daily egg production and feed conversion. Results showed that *A. paniculata* leaf powder significantly affected ($p<0.05$) feed conversion and egg production of Mojosari ducks. However, *A. paniculata* leaf powder had no significant effect ($p>0.05$) on feed consumption. Average feed consumption per treatment (P_0, P_1, P_2, P_3, or P_4) was 136.77, 137.82, 135.8, 139.47 and 138.97 g/bird/d, respectively. Average feed conversion values were 9.35 (P_0), 5.92 (P_1), 4.93 (P_2), 7.01 (P_3) and 13.50 (P_4) and average egg production percentage per treatment was 23.18% for P_0, 33.73% for P_1, 42.22% for P_2, 28.25% for P_3 and 14.61% for P_4. It was concluded that 0.4% *A. paniculata* leaf powder was optimal for its phytobiotic actions on Mojosari ducks.

Key words: *Andrographis paniculata* leaf powder, phytobiotics, Mojosari duck (*Mojosari anas plathryncos*)

INTRODUCTION

Ducks play an important role in supporting the availability of cheap animal protein sources that are easy to obtain. Thus, duck farming as an alternative source of income has surged in both rural and peri-urban communities. In fact, duck eggs constituted more than 180,000 tons (16%) of the national egg production in Indonesia in 2005. Moreover, duck meat made up 38,700 tons (3%) of the national production of poultry meat or about 2% of national meat production in Indonesia. Generally, ducks traditionally rising with the breed quality are not selected, irregular supply of feed and grazing from one place to another. Mojosari duck (*Mojosari anas plathryncos*) egg production rates are still relatively low at between 100-150 eggs/year compared with intensively reared ducks (Ketaren, 2007).

Mojosari duck germplasm has the potential contribution greatly to available sources of animal protein for the people of Indonesia. This local indigenous duck is found in the Mojokerto District in East Java (Indonesia). Production of this duck is higher than that of Tegal ducks. Thus, Mojosari ducks have the potential to be developed as a commercial egg laying duck in both traditional and intensive rearing. The body of these ducks is relatively smaller than other egg laying ducks, but their eggs are quite large, tasty and popular with Indonesian consumers. Interestingly, ducks are more resistant to diseases and parasites than other fowl types, allowing the concentration of drugs and other additives in duck feed to be lower than that for chickens and turkeys. But the development of drugs added to feed ducks in order to prevent the outbreak of diseases, such as colibacillosis, fowl cholera, salmonellosis and necrotic enteritis (JETACAR, 1999).

Since the 1970s, when farms began to grow in Indonesia, the use of antibiotics as growth promoters and to improve feed efficiency emerged. However, a problem that has arisen from these practices in livestock has been shown to indirectly impact human health (Soeharsono *et al*., 2010). As a result, European countries have restricted the use of antibiotics as growth promoters in animal feed and have started to invite all producers and breeders around the world to use alternative materials. Phytogenic medicinal plants represent natural antibiotic alternatives that have been gaining attention from the public and researchers alike. Phytogenic additives, plant extracts, essential oils, prebiotics and probiotics have been widely studied as a

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replacement for antibiotics (Toghyani *et al*., 2011). Herbal plants have been reported to have antibacterial activity against pathogenic microorganisms (Vincent, 2002). The use of medicinal plants either as antibiotic feed additives or medical treatments is likely to increase with the increase in antibiotic resistant microorganisms. Traditional medicinal plants that have long been associated with disease prevention in humans also have a variety of other beneficial properties, making them potentially useful as multifunctional natural food additives (phytobiotics) for livestock. Furthermore, medicinal plants have been shown to improve the condition of the digestive tract (pH and microflora balance), feed conversion, the digestibility of nutrients, weight, immunity and reproductive performance, reduce morbidity and mortality rates and prevent and treat diseases of domestic cattle (Ulfah, 2006).

Andrographis paniculata is one such plant that has natural phytobiotic potential and can be administered as a powder. The active substances in this bitter plant are andrographolides which function as antihepatotoxic, anti-allergy, anticancer (hepatoprotective), anti-inflammatory, antimicrobial, larvicidal and ovicidal compounds, as well as testicular toxins. While the xanthone constituents of this plant act as antiplasmodics, its neoandrographolide and diterpene phytoconstituents have antidiarrheal activity. Furthermore, the presence of 14-deoxyandrographolide and 14-deoxy-11,12-dehidroandrographolide makes this plant an effective antioxidant (Chowdhury, 2012). A study by Tipakorn (2002) showed that the use of 0.4% *A. paniculata* leaf powder in feed decreased mortality rates and injuries in the intestinal tract of broilers caused by coccidiosis. Accordingly, Triyanto (2006) examined whether higher doses could improve the appearance of broiler production, including body weight gain and feed conversion. This study showed that 0.6% *A. paniculata* leaf powder conferred the best performance to broiler production. Alamsari *et al*. (2001) suggested that *A. paniculata* reduced aflatoxin content in feed, prevented the flu and improved stamina. In addition, Sambiloto can also serve as an antiviral and improve symptoms associated with coccidiosis (Yamin, 2009). However, there is still a lack of information regarding the use of *A. paniculata* leaf powder in duck feed. Therefore, the current study investigated the potential effects of *A. paniculata* as a feed additive on Mojosari duck production.

MATERIALS AND METHODS

The materials used in this study were:

1: 100 Mojosari ducks during the egg laying period.
2: Basal feed was based on the nutrient needs of ducks during the egg laying period, PK = 17-19%, EM = 2700 kcal/kg, 0.37% methionine, 1.05% lysine, 2.9-3.25% calcium and 0.6% phosphorus (Sinurat *et al*., 2000). The composition of the basal feed is presented in Table 1.
3: *A. paniculata* leaf powder was produced by the Materia Medica District of Kejayan, Pasuruan (Indonesia). The chemical composition of *A. paniculata* leaf powder is presented in Table 2.

This study had a completely randomized design, examining five *A. paniculata* leaf treatment concentrations in four replicates; each replicate consisted of five ducks. Experimental treatments were as follows:

P_0: Basal feed+0% *A. paniculata* leaf powder (control)
P_1: Basal feed+0.2% *A. paniculata* leaf powder
P_2: Basal feed+0.4% *A. paniculata* leaf powder
P_3: Basal feed+0.6% *A. paniculata* leaf powder
P_4: Basal feed+0.8% *A. paniculata* leaf powder

Feed and water were provided *ad libitum*.

Research variables:

1: Consumption of feed (g/bird/d)
2: Feed conversion
3: Daily egg production (%)
4: Egg weight (g)
5: Egg mass (g)

RESULTS

Average feed consumption (g/bird/d) and daily egg production (%) are presented in Table 3. Average egg weight (g), egg mass (g) and feed conversion are presented in Table 4.

DISCUSSION

Based on the results of the current study (Table 5), administration of *A. paniculata* leaf powder to feed did not significantly affect the feed consumption of Mojosari ducks ($p<0.01$), but rather, it is caused by consuming poultry feed according to its energy needs. Ducks require 2700 kcal/kg of metabolizable energy during the egg laying period (Sinurat *et al*., 2000). Adding *A. paniculata* leaf powder to the feed, however, did significantly affect the average daily egg production ($p<0.01$). Bitter components of *A. paniculata* contain active compounds (i.e., andrographolides) which function as antihepatotoxins, anti-allergy, anticancer, anti-inflammatory, antimicrobial, larvacidal and ovicidal compounds, as well as testicular toxins (Chowdhury, 2012). The concentration of active andrographolide compounds in *A. paniculata* leaf powder was 18.43 mg/g or 1.84%. This result was consistent with the findings of Tipakorn (2002) who stated that the content of the highest andrographolide compound contained

Table 1: Composition of feed ingredients in basal rations

Feed ingredients	Percentage (%)
Corn	54.45
Rice bran	15.46
Soybean meal	18.61
Fish meal	2.65
Shirmp waste meal	2.45
Bone meal	3.00
Coconut oil	1.22
$CaCO_3$	1.75
DL methionine	0.07
L Lysin	0.29
Premix	0.22
Mineral	0.18
Nutrients	
Gross energy (kkal/kg)[1]	3,409.97
Dry matter (%)[1]	85.82
Crude protein (%)[1]	17.98
Crude fiber (%)[1]	7.24
Extract eter (%)[1]	4.74
Ash (%)[1]	13.44
Ca (%)[2]	2.77
P (%)[2]	0.56

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Table 2: Chemical composition of *Andrographis paniculata* leaf powder

Chemical composition	Percentage (%)
Gross energy (kkal/kg)[1]	2943.49
Dry matter (%)[1]	90.28
Crude protein (%)[1]	6.99
Crude fiber (%)[1]	35.50
Extract eter (%)[1]	0.91
Ash (%)[1]	14.77
Total chlorophyl (mg/g)[2]	1.96
Ca (ppm)[2]	310.00
P (ppm)[2]	12.40
Andrografolid (mg/g)[2]	18.43

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Table 3: Average of feed consumption and daily egg production (DEP)

Treatment	Feed consumption (g/bird/day)	DDP (%)
P_0	128.20	23.18^b
P_1	133.74	33.73^b
P_2	130.15	42.22^c
P_3	130.55	28.26^b
P_4	139.49	14.61^a

$^{a,b}p<0.01$

Table 4: Average egg weight, egg mass and feed conversion

Treatment	Egg weight (g)	Egg mass (g)	Feed conversion
P_0	60.83^a	14.11^b	9.35^b
P_1	67.13^b	22.63^d	5.92^a
P_2	63.00^a	26.58^e	4.93^a
P_3	66.25^a	18.73^c	7.01^a
P_4	71.05^c	10.35^a	13.49^c

$^{a,b}p<0.01$

within *A. paniculata* leaves was 2.39%. This discrepancy is likely because the simplicia of *A. paniculata* leaf powder used in the present study was contaminated by the stems and twigs of the plant, thereby lowering the andrographolide concentration detected.

Andrographolides function as antimicrobials which help to maintain the balance of microflora within the digestive tract. Ideally, more than 90% of the microflora population in the digestive tract should be beneficial bacteria, such as *Lactobacilli* and *Bifido bacteria* and only a very small proportion of potentially damaging bacteria should be present, such as *E. coli* and *Staphylococci*. A previous study has shown that the active ingredients of many medicinal plants inhibit growth of food-borne and other pathogens and fungi in the digestive tract (Guthter and Ulfah, 2003). The positive influence of such inhibitory mechanisms is the prevention of nutrient degradation by microbes, increasing their bioavailability in livestock. Furthermore, medicinal plants are also known to increase the digestibility of nutrients, nitrogen metabolism, amino acids, glucose and energy conversion (Ulfah, 2006), all of which increase egg production. However, adding 0.6% *A. paniculata* leaf powder to feed was found to reduce egg production in the current study, presumably because andrographolides are known to be ovicidal (Chowdhury, 2012). A study conducted by Krisnamoorthy *et al*. (2011) showed changes in the structure of oogonia, yolk content, oocyte wall structure and composition of columnar cells and tunica albugenea of the ovaries with *A. paniculatas* treatment.

Based on current results, addition of *A. paniculata* leaf powder to duck rations significantly affected Mojosari duck feed conversion ($p<0.01$). The lowest feed conversion obtained using 0.4% *A. paniculata* leaf powder was 4.93. The yearly feed efficiency of egg laying ducks is usually measured by the FCR and is still very poor (range, 3.2-5.0) compared with egg laying chickens [range, 2.4-2.6] (Hy-Line International, 1986). Poor feed efficiency in egg laying and broiler ducks can be caused by various factors, including genetic factors, the amount of feed that is scattered and the nutritional content of feed (Ketaren, 2007). The phytobiotic feed additive *A. paniculata* affects the gastrointestinal tract microbiota ecosystem by inhibiting mechanisms of microbial pathogens. Increased digestive capacity in the small intestine is also an indirect effect on microflora eubiosis that supports the stability of the digestive tract of poultry. Phytogenic compounds have been shown to support livestock immunity in critical conditions and increase the absorption of essential nutrients that will help livestock grow according to their genetic potential (Hashemi and Davoodi, 2010). Considering addition of 0.4% *A. paniculata* reduced Mojosari duck production, it is likely

that the growth promoting compounds within this plant become toxic to the digestive tract at higher concentrations, affecting the stability of microflora populations therein.

Conclusion: The results of this study concluded that addition of *A. paniculata* leaf powder to basal feed affected Mojosari duck production and performance, including daily egg production, feed conversion, egg weight and egg production. The optimum level of *A. paniculata* leaf powder to use as an animal phytobiotic feed additive with Mojosari ducks was 0.4%. However, further research using *A. paniculata* leaf powder as a feed additive is required on Mojosari duck egg quality.

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