Digestibility and Nutritional Value of Gedi (*Abelmoschus manihot* (L.) Medik) Leaves Meal in the Diet of Broilers

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ABSTRACT: A study was carried out to determine the nutrient utilization and nutrient value of gedi (*Abelmoschus manihot* (L.) Medik) leaves meal, a native plant that abundant in the Northern-Sulawesi of Indonesia, when substituted at various levels in the diets. Sixteen adult broiler chickens Cobb-CP 707 35 days of age were conducted in metabolic cages and allocated in four groups of four birds each to determine AME and AMEn, crude protein and crude fibre digestibility. Birds were corresponded to four dietary treatments containing respectively 0, 5, 10, and 15% gedi leaves meal. Birds were weighed at the beginning and at the end, collected fresh excreta were weighed daily and the droppings were oven-dried at 55 °C and ground per bird for three days. Experimental diets and collected excreta were subjected to chemical analysis. The results showed that the gedi (*Abelmoschus manihot* (L.) Medik) leaves were relatively rich in crude protein (20.18%), crude fiber (17.53), calcium (3,29%), lysine NDF (20.76%) and positively have steroid and flavonoid. The inclusion of gedi leaves in the diet highly significant ($P<0.01$) decreased AME and AMEn and significantly ($P<0.05$) decreased crude protein and crude fiber digestibilty. Gedi leaves in diets improved the metabolizable energy utilization in birds fed the 5% level and improved crude protein and crude fiber utilization in birds fed 10% level inclusion diet. Gedi was rich in sticky mucilage, a soluble-polysaccharide, that affected to rate of passage of digesta. It can be concluded that gedi leaves meal can be fed to broiler chickens at up to 10%, and results suggested that adding gedi leaves to broiler diets may benefit after processing the mucilage.

Keywords: gedi, broilers, digestibility, nutritional value

INTRODUCTION

Poultry rations usually contain antibiotic growth promoters (AGP) to enhance performance of birds. However, the use of antibiotics as a growth promoter in chicken has been reported to cause some unwanted results (Botsoglou and Fletouris, 2001). Poultry nutritionists now are being challenged to develop an alternative for AGP. Considerable attention has been paid to medicinal herbs as replacements for AGP (Ibrahim *et al.,* 2005). As an alternative to AGP, medicinal plants are the most popular options (Durrani *et al*., 2008; Ocak *et al.,* 2008). That phytogenic feed additives have attracted as alternative feeding strategy to replace AGP (Salary *et al.,* 2014).

Gedi (*Abelmoschus manihot* (L.) Medik) has beneficial effects in medicine. Gedi, a native plant that abundant in the Northern-Sulawesi of Indonesia, has been consumed as a medicinal product in Asian countries, South and Southeast Asia, Pasific Island, tropical Africa, and tropical America (Preston, 1998). It showed anti-inflammatory and antibacterial (Jain dan Bari, 2010 1 and 2), analgesic effect (Jain dan Bari, 2011 1 and 2), anticonsulvant and anti depressant-like (Guo, *et al.*, 2011), anti-inflammatory and anti-diabetes (Sarwar *et al.*, 2011). Gedi contain high viscosity of mucilage (gum) that rich in polysaccharides and protein. Han *et al*. (2005) reported that polysaccharides of mucilage of the root of gedi consist of rhamnosa, galacturonate acid, glucuronat acid, glucose, arabynose, dan galactose.

There was slightly information about the utilization of gedi leaves as feedstuff in broiler ration, and whether their inclusion as a solid herb material would have growth promoting effects in live birds. So, there is need therefore to investigate the effect of these unconventional feed resources on the performance characteristics of broiler. The objective of this research was to determine the nutrient utilization and digestibility of gedi (*Abelmoschus manihot* (L.) Medik) in broilers diet for exploring the potential of this plant as a herb plant for a candidate of poultry feed.

MATERIALS AND METHODS

The harvested gedi leaves were air dried in shade under a shed until they were crispy to touch, while retaining their greenish colouration. The leaves were then milled to obtain a product as gedi leaf meal (GLM). Chemical analysis was also performed to determine the phytochemical and nutritional contents of gedi leaves.

In this experiment, 16 broiler chicks Cobb-CP 707 35 days of age were utilized for determination of apparent metabolizable energy and apparent metabolizable energy corrected for nitrogen (AME and AMEn, respectively), crude protein and crude fibre digestibility, through the standard total excretion collection method. Based diet was commercial complete based diet and dietary treatments were basal diet (R0), 95% basal diet + 5% gedi leaves meal =GLM (R1), 90% basal diet + 10% GLM (R2), and 85% basal diet + 15% GLM (R3). The experimental diets were formulated iso-protein and iso-calory, contained 22% CP and 2900 Kcal ME/kg. The experimental period was of 7 days: three for birds to adapt to cages, diets and management, one for fasting and three for total excreta collection. The experimental design was completely randomized, with four treatments and four replicates of one bird. Chicks were raised in metabolic cages fitted with mechanism for quantitative feeding and faecal collection. The excreta of all experimental units were collected daily on trays covered with plastic. The collected excreta were sprayed by 5% boric acid solution to prevent any loss in ammonia, then dried in an oven at 55 0C for 24 hours, then after weighed, finely ground and kept for chemical analysis according to AOAC (1990) methods.

The data were used to calculate apparent metabolizable energy (AME), apparent metabolizable energy corrected for nitrogen (AMEn) values according to the following formula (Zarei, 2006), as follow:

1. $AME = [(Fi \times GEf) - (E \times GEe)] / Fi$
2. $AMEn = [(Fi \times GEf) - (E \times GEe) - (NR \times K)] / Fi$

AME: Apparent Metabolizable Energy (kcal/gm)
AMEn : Apparent Metabolizable Energy corrected for nitrogen (kcal/gm)
Fi : Feed intake (gm)
E: Excreta (gm)
GEf : Gross Energy of feed sample (kcal/gm)
GEe : Gross Energy of excreta (kcal/gm)
NR: NR = (Fi x Nf) - (E x Ne) Nitrogen Retention (gm)
Nf : Feed Nitrogen (%)
Ne : Faecal Nitrogen (%)
NR0 : Nitrogen Retention at zero level for control group (gm)
K: Nitrogen Retention corrected coefficient (8.73kcal/gm for each gm N)

The digestibility values for crude protein (CP) and crude fibre (CF) were calculated as nutrient intake minus nutrient excreted divided by nutrient intake multiplied by hundred (McDonald *et al*., 1995), with equations as follow:

$$\text{Apparent Nutrient Digestibility} = \frac{\text{Total Intake} \times \%\ \text{Nutrient Intake} - \text{Total Output} \times \%\ \text{Nutrient Output}}{\text{Total Intake} \times \%\ \text{CP Intake}} \times \frac{100}{1}$$

RESULTS AND DISCUSSION

Nutritional value. Results showed the nutritional value of gedi leaves, that were high in crude protein (20.18%), crude fiber (17.53%), calcium content (3.29%), amino acid lysine (425 mg/g), and positive bioactives steroid and flavonoid.

AME and AMEn. Results showed that the value of AME (Table 1)for R2 and R3 diets were significantly lower than control diet and R1 diet. Nadeem *et al*. (2005) reported that plant origin in diet contain high NSP (non-starch polysaccharide), such as arabinoxylan, glucan and pectin that are bonded to each other and it would be difficult to be digested by birds. Soluble NSP affect on digestibility and absorption of nutrients in poultry, because soluble NSP is able increase digesta viscosity. Caprita *et al.* (2010) reported that when digesta viscosity increases due to the NSP, the diffusion will decrease.

Insoluble NSP will form the bulk of the total fiber in the diet. These polysaccharides have the ability to absorb water in greater amounts (Saki *et al.,* 2011). That soluble NSP generally inhibit the digestive process while the insoluble NSP physically impede access endogenous enzymes on its substrate. High fiber in feed ingredients caused bulkiness of feed and lower energy concentration (Zarei, 2006). From this discussion it can be stated that soluble and insoluble NSP of 10% and 15% of GLM were used in the study contribute to lowering the AME value of this research.

Table 1. Effects of dietary gedi leaves meal on AME, AMEn, crude protein and crude fiber digestibility of broilers

Parameters	Dietary Treatments				p Value
	R0	R1	R2	R3	
AME (Kkal/kg)	2844 ± 81.44c	2775 ± 139.60c	2534 ± 27.90b	2081 ± 108.79a	<.001
AMEn (Kkal/kg)	2788 ± 77.00c	2722 ± 134.20c	2488 ± 28.37b	2057 ± 105.50a	<.001
N Retention (g)	6.4 ± 0.51	6.1 ± 0.65	4.7 ± 0.11	2.7 ± 0.38	
ACP Digestibility (%)	55.2 ± 4.29b	62.7 ± 6.61c	54.5 ± 1.22b	34.9 ± 4.70a	<.001
ACF Digestibility (%)	42.1 ± 5.55b	43.9 ± 9.93b	40.8 ± 1.58b	28.7 ± 5.14a	0.020

Notes: ACP = apparent crude protein; ACF = apparent crude fiber

The values of AMEn for R2 and R3 diets were significantly lower than control diet and R1 diet. McDonald *et al.* (2010) stated that the calculation of ME needs to be corrected for the amount of N that because of the ability of animals to utilize the gross energy of feed protein varies greatly.

Crude protein. Crude protein digestibility values significantly increased in administration of 5% gedi leaves (R1), but decreased in the provision of 10% and 15% of gedi leaves. Das *et al*. (2012) stated that the saponins lower the digestibility of proteins through the formation of saponin-protein complexes that are difficult to digest. The reducing of digestibility of crude protein in the treatment of 10% and 15% may be caused by the influence of saponins in the feed that is able to form complexes with proteins, so it becomes difficult to digest protein. Also probably was because of increasing of the NSP. This agrees with the submission of Delorme and Wojcik (1982) who reported that as dietary fibre increased, adequate protein nutrition becomes critical. The results of the present study are in contrast with the findings of Nabizadeh (2012) who reported that supplementation of herbal plants leaf extracts significantly improved crude protein digestibility of the rations. Also, Awad *et al* (2011) reported that supplementation of herbal plants extracts to broiler improved the crude protein digestion and absorption.

Crude fiber. Result showed there were no significant different of crude fiber digestibility values between R0, R1, and R2 diets, but between R2 and R3 was significantly decreased. In this research, gedi leaves in diets improved the metabolizable energy utilization in birds fed the 5% level and improved crude protein and crude fiber utilization in birds fed 10% level inclusion diet. Gedi was rich in sticky mucilage, a soluble-polysaccharide, so that affected to rate of passage of digesta. The result of present study are in contrast with the finding of Durrani (2008) who observed higher digestibility of crude fiber and dry matter in the birds fed diet supplemented with neem leafs infusion. Also, Biu *et al* (2009) reported that supplementation of ginger and kalongi improved the crude fiber digestibility in broiler fed supplemented diets.

CONCLUSION

From the results of this study, it can be concluded that gedi leaves meal can be fed to broiler chickens at up to 10%, and results suggested that adding gedi leaves to broiler diets may benefit after processing the mucilage.

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