Bulletin of Animal Science, Special Edition, 1995 *ISSN 01260 - 4400*

Effect of Feeding Leaf Protein Concentrate of Water Hyacinth on Growth and Nutrients Utilization in Broiler Cchiken

N. Suthama

Faculty of Animal Science, Diponegoro University, Semarang 50241, Indonesia

ABSTRACT: Protein digestibility, protein utilization, metabolizable energy, fiber digestibility and growth due to feeding effect of leaf protein concentrate (LPC) of water hyacinth were studied in broiler chicken. In the present study, one control diet (none of LPC, T_0) and 3 (three) experimental diets using LPC of 5% interval (5, 10 and 15%, expressed as T_1, T_2 and T_3, respectively) were fed *ad libitum* to 21 days old of birds. All diets contained 18.5% of crude protein. The experiment was terminated when the birds were 42 days old. Ninety six birds were devided into 4 groups of treatment (T_0, T_1, T_2 and T_3, as described above) in a Completely Randmomized Design. Body weight gain, feed consumption, protein intake, digestibilities of protein, neutral detergent fiber (NDF) and acid detergent fiber (ADF), Nitrogen retention and metabolizable energy (ME) were the parameters measured in the present study. Body weight gain, protein digestibility, Nitrogen retention and metabolizable energy were increased by feeding 5% of LPC (T_1). However, the decrease in body weight gain, protein digestibility, Nitrogen retention, metabolizable energy and NDF digestibility were due to the feeding effect of higher levels of LPC (T_2 and T_3). The improvement of body weight in the group of birds fed diet containing 5% of LPC is clearly due to the increase in protein digestibility, Nitrogen retention and metabolizable energy, although feed consumption, protein intake and fiber digestibility are not affected. On the other hand, when the higher levels of LPC are given growth is retarded, and this seems to be caused by the decrease in protein digestibility and Nitrogen retention. In poultry, especially broiler, the effect of feeding LPC of water hyacinth on growth is closely related to protein utilization, status of metabolizable energy and fiber digestibility.

Key Words : Leaf Protein Concentrate, Broiler, Growth, Nutrients Utilization

Introduction

Conventional diet for poultry is usually more expensive than inconventional feed. In order to reduce feed cost it is necessary to obtain an alternative feedstuff wich is nutritionally good in quality. The use of water hyacinth (*Eichhornia crassipes*) as animal feedstuff gives a good chance in the future, because its cost is cheap, available and good enough in nutritional contents. According to Soewardi and Utomo (1975) raw water hyacinth contains 13% of protein, 1% of fat, 24% of ash and 26% of Nitrogen free extract. However, because of its high content in crude fiber (21%), a given process is needed in order to reduce fiber, thus, it will become a satisfactory feed.

Leaf protein concentrate is one kind of processed water hyacinth. The extraction of raw water hyacinth reduces fiber and secondary substancies such as natural toxic (Susana and Tangendjaja, 1988). As a comparison, preliminary study on chemical analysis indicated that leaf protein concentrate of water hyacinth contains 30% of crude protein, 3% of fat and 8% of crude fiber. From the viewpoint of nutritional value of leaf protein concentrate of water hyacinth support an idea to evaluate its feeding effect based on biological test in broiler chicken.

In addition, the use of leaf protein concentrate of water hyacinth as an animal feed is connected with integrated effort in physically controlling water weed.

Experimental Procedures

General. Ninety six birds of broiler chicken were used in the present study. Experimental aminals were devided into 4 (four) groups according to dietary treatment. The experiment was started when the birds were 21 days old and it was terminated when the broilers were 42 days of age.

Birds were housed in a 2.0 x 0.4 x 0.6 m of battery- system cage. Cage was devided into 8 units, and 1 (one) bird was placed in one unit.

In order to determine metabolizable energy, 0.3% of chromic oxide (Cr_2O_3) was mixed in the diet and the caculation was based on the method of Scott et al. (1982).

Protein digestibility, Nitrogen retention, metabolizable energy, fiber digestibility (neutral detergent fiber/NDF and acid detergent fiber/ADF), feed and protein consumptions, and body weight gain were the parameters measured in the present study. NDF and ADF were determined according to the method of Van Soest (1982).

Experimental diets. Experimental diets were composed based on the level of leaf protein concentrate (LPC) used in the diet as follows : T_0 = control diet (without LPC), T_1 = diet using 5% of LPC, T_2 = diet using 10% of LPC, T_3 = diet using 15% of LPC. All diets were formulated to achieve iso-protein (19%) and fed *ad libitum*. Calculated metabolizable energy of the diet ranged from 2809 to 2811 kcal/kg (Table 1).

Statistical analysis

Experiment was arranged in a Completely Randomized Design with 4 (four) replicates and 6 (six) birds in each replication. All data were subjected to analysis of variance, and when significant difference was found the test was continued to Duncan's Multiple Range Test.

Results and Discussion

Protein digestibility, metabolizable energy, and body weight gain were significantly increased ($P < 0.05$) by the feeding effect of LPC at 5% level when compared to control group as well as to other feeding levels of LPC (Table 2).

Table 1. Composition of experimental diets

Ingredients	Treatments			
	T_0	T_1	T_2	T_3
	----------(%)----------			
Yellow Corn	50.0	49.5	49.5	49.0
Rice Bran	23.0	21.0	18.5	17.0
Fish Meal	15.0	13.0	11.0	11.0
Soybean Meal	10.0	10.0	9.5	6.5
Leucaena Leaf Powder	1.0	0.5	0.5	0.5
Coconut Oil	1.0	1.0	1.0	1.0
LPC	-	5.0	10.0	15.0
Chemical composition				
Crude Protein	18.6	18.6	18.5	18.6
Fat	3.6	3.1	3.1	3.9
Crude Fiber	3.7	3.2	3.9	3.9
NDF	25.1	26.1	26.7	27.4
ADF	8.5	9.1	9.4	9.5
Metabolizable Energy*	2810.8	2809.4	2811.4	2809.4

* Calculated value (kcal/kg).

Table 2. Growth performance and nutrients utilization of broiler fed various levels of leaf protein concentrate of water hyacinth

Parameters	Treatments			
	T_0	T_1	T_2	T_3
Body weight gain (g/day/bird)	33.69^a	35.93^b	31.58^{ac}	30.46^c
Feed consumption (g/day/bird)	96.60	96.13	96.41	96.03
Protein consumption (g/day/bird)	17.94	17.78	17.81	17.87
Protein digestibility (%)	60.67^a	67.81^b	57.83^a	46.19^c
Nitrogen retention (%)	1.80^{ab}	2.02^a	1.71^b	1.38^c
Metabolizable Energy (kcal/kg)	2514^a	2638^b	2449^{ac}	2263^c
NDF digestibility (%)	70.29^a	63.08^{ab}	67.32^b	66.51^b
ADF digestibility (%)	47.54	47.58	46.17	44.77

a, b, c, Different superscripts in each row showing statistically different values.

Nitrogen retention, alhough tended to increase when 5% of LPC was fed, it was not significantly different as compared to control group, but it showed significantly higher than those of two other levels of feeding LPC. Fiber digestibility especially neutral ditergent fiber (NDF) was significantly decreased ($P < 0.05$) by feeding 10 and 15% LPC. However, feed consumption, protein consumption and digestibility of acid detergent fiber (ADF) were not affected by feeding LPC at whatever level. In general, feeding of higest level (15%) of LPC indicated the worst effect.

Performance of broiler in connection with nutrients utilization is closely related to the digestibility of fiber because poultry has a limited ability in digesting dietary fiber. Conventional teory stated that the higher fiber content in the diet resulted lower nutrients digestibility, and finally affected growth and/or perfomance of the animal (Wahyu, 1988 and Tillman et al., 1989). This phenomenon can be found when 10 and 15% of LPC were fed. Body wight gain was decreased due to the decrease in protein digestibility, Nitrogen retention and lower energy utilization. The decrease in nutrients utilization is correlated with the increase in fiber content in the diet, and the low digestibility of fiber. This is consistent with the report of Dvorak and Bray (1978) and Pramu *at al.* (1981) indicated that the decrease in the utilization of nutrients, especially protein, due to the effect of dietary fiber. Other fact reported by Evans (1981) that diet containing low fiber had higher nutrients (dry matter and energy) digestibility.

Most recently, Siri et al. (1992[a]) investigated that cellulose in a small amount can be digested by poultry. However, other fiber which possibly inhibits digestion and absorption should be given special emphasize and consideration. Component of fiber such as lignin, silica and pectin are undigested by non ruminant animal, especially poultry.

On the other hand, in the case of feeding 5% of LPC performance of broiler, indicated by body weight gain, increased significantly ($P < 0.05$), although feed and protein consumptions were not affected. However, since protein digestibility, nitrogen retention and energy utilization were enhanced these are assumed to affect dominantly body weight gain. In relation to fiber digestibility and dietary fiber, it can be explained by the report of Siregar and Sabrani (1977) that a given level of fiber will function as a stimulant for the peristaltic movement of digestive tract of the fowl. Recent study showed that digestive tract develops optimally due to feeding fibrous diet at a given level (Siri *at al.*, 1992[b]). It was also reported that ricestraw powder added to the diet resulted higher weight of gizzard and this can be correlated with the improvement of whole nutrients digestibility.

Efficiency of gross energy utility into metabolizable energy, and the utilization of protein were the higest, although the digestbilities of NDF and ADF were not affected when 5% of LPC was given. However, since there was Nitrogen contribution from a certain component of fiber derived from LPC, thus, nitrogen retention was

getting higher. On the other hand, the higher nitrogen exretion, the lower nitrogen retention resulted, and more energy required for this physio-nutritional process. The results of the present study can be discussed that when 5% level of LPC was fed, higher dietary protein can be utilized, and on the other side, lower energy is required for the excretion of Nitrogen. Therefore, better performance is resulted because of higher efficiencies of energy and protein utilization. Principally, the higher fiber content in the diet and the lower fiber digestibilitty are associated with carrying capacity of the fiber on other nutrients, especially protein, to excreta, and cause low efficiency of nutrients utilization.

Implication

Feeding of leaf protein concentrate of waterhyacinth at the level of 5% indicates an optimal effect on nutrients utilization and performance in broiler chicken. When 10% of leaf protein concentrate is given, although affects neutral detergent fiber digestibility, there is no clear effects on nutrients utilization, acid detergent fiber digestibility and body weight gain.

The decrease in nutrients digestibility and growth are concomitant with the increasing level of feeding leaf protein concentrate, particularly when the level above 10% do not give a benefit to the animal physiologically as well as productivity.

Literature Cited

Dvorak, R. A. and D. J. Bray. 1978. Influence of Cellulosa and Ambient Temperature on Feed Intake and Growth of Chicks. Poultry Sci. 57 : 1351.

Evans, E. 1981. Effect of Dietary and Fiber Level on Rabbits. J. Appl. Rabbit Res. 4 (2): 41.

Pramu, S., A. P. Siregar and M. Sabrani. 1981. Teknik Beternak Ayam Ras di Indonesia. Margie Group, Jakarta.

Scott, M. L., M. C. Nesheim and R. J. Young. 1981. Nutrition of The Chicken. 3th Ed. M. L. Scott and Assoc, Ithaca New York.

Siregar, A. P. and M. Sabrani. 1977. Teknik Modern Beternak Ayam. PT Yasaguna, Jakarta.

Siri, S., Hisaya Tabioka, and Iwoa Tasaki. 1992[a]. Effect of Dietary Fiber on Utilization of Energy and Protein in Chickens. Japanese. Poultry. Sci. 29(1). 23.

Siri, S., Hisaya Tabioka, and Iwao Tasaki. 1992[b]. Effect of Dietary Fiber on Growth Performance, Development of Internal Organs, Protein and Energy Utilization and Lipid Content of Growing Chicks. Japanese. Poultry. Sci. 29(2). 106.

Soewardi, B., and I. H. Utomo. 1975. Kemungkinan Pemanfaatan Tumbuhan Air. Rawa Pening Masalahn Tumbuhan Pengganggu Air Rencana Pengendalian dan Penelitian. Inception Report. Doc No. Biotrop/P/75/61. Bogor.

Susana, I. W. R. and B. Tangendjaja. 1988. Konsentrat Protein Daun (KPD) Kalopo (*Calopogonoium caerulium*) dan Titonia (*Tihonia diversifolia*). Proc : Seminar Nasional Peternakan dan Forum Peternak Unggas dan Aneka Ternak II. Balai Penelitian Ternak, Badan Penelitian dan Pengembangan Pertanian, Departemen Pertanian, Bogor.

Tillman, A. D., S. Reksohadiprojo, S. Prawirokusumo, H. Hartadi, and S. Lebdosoekojo. 1989. Ilmu Makanan Ternak Dasar. Gadjah Mada University Press, Yogyakarta.

Van Soest, P. J. 1982. Nutrition Ecology of The Ruminant Metabolism Nutritional Strategies The Selulolityc Fermentation and Chemistry of Forage and Plant Fibers. Cornell University, New York.

Wahyu, J. 1988. Ilmu Nutrisi Unggas. Cetakan ke-2. Gadjah Mada University Press, Yokyakarta.