Carcass Yields of Broiler Chickens Fed Banana (*Musa paradisiaca*) Leaves Incubated by *Trichoderma viride* in Diets

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***Abstract*--The effect of supplementation in increasing level of banana leaves incubated by *T. viride* in several term on feed intake, daily weight gain, feed efficiency and carcass yield of broiler chicks was studied. A total of 180 Hubbard broiler chicks aged 3 weeks were used for the research. The birds were randomly allocated into four treatments of long day of incubation (factor A) designated 0d, 5d, 10d, and 15d of incubation, and each group was fed on 5, 10 and 15% banana leaf meal (factor B) respectively, using completely randomized design in factorial arrangement. Each treatments was subdivided into three replicates of five chicks each, making a total of 36 replicates and 180 birds. The experiment terminated after 4 weeks at the age of 7 weeks, during which, feed intake, body weight gain, feed efficiency and carcass yield were measured. All experimental data were subjected to the analysis of variance test (ANOVA) followed by least significant difference test (LSD). Results showed that the daily feed intake was significantly (P<0.01) affected by incubation and levels of banana leaves, and the values was highest on treatment level 10% incubated 10 days (A10B10 =125.10 g/d). Also, the daily weight gain, feed efficiency and carcass yield were significantly (P<0.01) affected by dietary treatments and incubation, and the values of daily weight gain, feed efficiency, and carcass yield were highest on treatment A10B10 (58.03 g/d, 0.46, 74.58, respectively). Survivability was 100% for all of the treatments. It can be concluded that banana leaves could be acceptable up to 10% levels that was incubated 10 days in broiler diets.**

***Keywords*: Banana leaves, incubation, carcass, broiler**

I. INTRODUCTION

Poultry feedstuffs are expensive, therefore less the growth of poultry industry in the tropics. In order to less supplying of animal protein in developing countries need to study the potency of some novel local produced feed resources for productive animals such as leaf meal. Leaf meal could be included into the poultry diets in order to sustain the poultry enterprises and to improve the profit margin through reducing the use of conventional protein sources [1]. Banana leaf meal are among the leaf meals that could be used as feed alternatives in poultry.

Banana is the second largest produced fruit after citrus, that contribute about 16% of the world's total fruit production. Banana is one of the most widely grown indigenously in tropics and subtropics, and cultivated over 130 countries [2], [3]. Banana is not seasonal fruit and available a longtime as the highest production in Indonesia compared to other not seasonal fruits as avocado, oranges, pineapple and papaya. Processing of banana will be resulted many waste of banana [4]. Three common of banana (Musa) are *M. cavendishii*, *M. paradisiaca* and *M. sapientum* that widely grown in the world [2].

Musa paradisiaca (L.) (Musaceae) was a perennial tree like herb grown indigenously in tropics and subtropics. In many other places in the world, plantain (*M. paradisiaca*) serves as a major staple food and was particularly desired for the variability in the stages of ripeness and in cooking [5]. Its leaves were evergreen. Rural people used leaves extensively for weaving baskets, mats, food wrapper for marketing and cooking, coverings over food, tablecloths, and plates for eating as well as for drinking soup. Reference [6] reported that various parts of plants, such as leaves, bark, rhizome, roots and sap,

constitute these home remedies. These plants are readily available, have little or no apparent side effects to animals, and are cheaper than conventional veterinary drugs. Traditionally, the green leaf of plantain was very useful for treating diabetes. The whitish fluid that showed when plantain leaf was cut is very effective for the treatment of wounds especially fresh wounds [2], [3], [7]. Reference [6] reported that the banana plant (*M. paradisiaca*) have some coccidiostatic properties. Phytochemical study showed that the presence of rutin in the leaves as a major compound indicated potential anti-diabetic properties that can regulate the glucose homeostatic [8]. Then, aquaeous leaf extract of *M. paradisiaca* has an ulcer healing property against experimentally induced ulcers in rats [9]. Another research showed that quality phytochemical screening of the extract showed the presence of alkaloids, flavonoids, proteins, carbohydrates, saponins, tannins, fat and oil, steroids and terpenoids. This indicated that the leaves of *M. paradisiaca* possessed nutritional and health, and might be useful in curbing the harmful effects of free radicals in human health [10].

On global basis, banana leaf and stem may be one of the major substitutes of roughage left after getting the fruits. It has been reported that banana leaves were a good source of lignin. Leaf blade and leaf sheaths have good amount of pentosans, but also high in cellulose (20.4 – 37.3%) [2]. Protein content in leaf blade was substantial. And hence could be ideal for cattle feed. It has been reported that leaves can be given to ruminants with addition of some protein extract for better digestibility [11]. Reference [12] found in their study that plantain peels can play important roles in controlling spread of infectious disease agents and improve broilers' health. However, research about utilization of banana leaf in broiler chickens was not available in literature. The reason is that may because of the cellulose content of the leaf. Effect of the leaf on poultry may significant if cellulose content was decreased by fermentation. The objective of this study was therefore to evaluate the effects of banana leaves incubated by *T. viride* on the performance of broiler chickens.

II. MATERIALS AND METHODS

A. Sample preparation

Banana leaves were obtained from local plantations from the area of Minahasa distric of Indonesia. The leaves were washed and sun-dried to constant weight for 3-5 days. Part of the leaves then was ground to fine powder using mortar and pestle, then milled and mixed with *Trichoderma viride* to incubate on four term of incubation, that is 0d, 5d, 10d, and 5d respectively. After that, mixed with other ingredients to compound the feeds

B. Experimental birds, design and managemen

A total of 180 Hubbard broiler chicks aged 3 weeks were used for the research. The birds were randomly allocated into four treatments of long day of fermentation (factor A) designated 0d, 5d, 10d, and 15d of fermentation, and each group was fed on 5, 10 and 15% banana leaf meal (factor B) respectively, using completely randomized design in factorial arrangement. Each treatments was subdivided into three replicates of five chicks each, making a total of 36 replicates and 180 birds.

Based diet contained 54% yellow corn, 7.5% rice bran, 10% coconut cake, 12% soybean cake, 16% fish meal and 0.5% top mix. The diets used in the experiment and the nutrient analysis banana leaf are presented on Table 1. and Table 2. The birds were subjected to standard broiler management procedure. At the beginning of the experiment, the initial weights of the birds were taken and subsequent body weights and feed intake were measured weekly, and feed efficiency were used to determine the growth performance at the end of overall of experimental period. At the end of experiment, final body weight was measured then a bird from each pen was randomly selected. Birds were weighed and slaughtered by serving of the artery in a single cut and bled. After slaughter, carcass weight measured on the chilled carcass after removal of feather, head, lungs, gastrointestinal tractus, liver, kidney, abdominal fat, dissected and collected. Carcass calculated as the percentage of fasted live body weight.

The data collected during the experiment included daily feed consumption, weight gain, feed efficiency and carcass yield of the diet groups. The experiment terminated after 4 weeks at the age of 7 weeks.

C. Statistical analysis

All experimental data were subjected to the analysis of variance test (ANOVA) followed by least significant difference test (LSD) [13].

TABLE 1
NUTRIENTS OF BASED DIET AND BANANA LEAF

Nutrients	Based Diet	Banana Leaf Incubated			
		A0 (unincubated)	A1 (5d incubated)	A2 (10 d incubated)	A3 (15d incubated
Crude Protein (%)	21.52	9.24	11.47	13.82	14.42
Fat (%)	6.9	11.35	11.60	11.68	11.88
Crude Fiber (%)	4.26	18,74	18.40	12.70	10.22
Nitrogen Free Extract (%)	-	45.16	45.56	47.08	47.86
Ash (%)	-	15.52	12.97	14.72	15.62
Ca (%)	0.88	0.19	0.17	0.21	0.22
P (%)	0.76	0.33	0.30	0.38	0.40
Energy (Kcal/kg)	3029	3810	3811	3900	3915

TABLE 2
COMPOSITION AND NUTRIENTS OF TREATMENTS

Treatments		Nutrients of the Diets (%)					ME (Kcal/Kg)
A (term)	B (%)	Crude Protein	Crude Fiber	Fat	Ca	P	
0	5	20.90	4.98	7.12	1.01	1.03	3030.86
	10	20.29	5.71	7.34	0.96	0.97	3031.76
	15	19.68	6.44	7.57	0.91	0.94	3032.66
5	5	21.01	4.97	7.14	0.99	1.00	3030.90
	10	20.51	5.68	7.37	0.94	0.95	3031.84
	15	20.02	6.39	7.61	0.88	0.90	3032.78
10	5	21.13	4.68	7.14	1.03	1.08	3034.46
	10	20.75	5.11	7.37	0.98	1.02	3038.96
	15	20.37	5.53	7.62	0.92	0.97	3043.46
15	5	21.16	4.56	7.15	1.03	1.10	3035.06
	10	20.81	4.86	7.39	0.98	1.04	3040.16
	15	20.46	5.16	7.65	0.93	0.99	3045.26

Notes: A = term of incubation; B = level of banana leaves

III. RESULTS AND DISCUSSION

The result of proximate analysis of banana leaves is presented in Table 1. These crude protein value was higher than the value reported by [2], [14], and was higher than the most of the grasses present in the natural grassland [15]. Moreover, the chemical composition of the banana leaves after incubation were shown in Table 1. The results indicated that the values of crude protein become more greater after incubation with *T. viride*, and the value of crude fiber was more lower than unincubated. The results indicated that banana leaves can be used as a feedstuff in broiler diets.

The growth performance of broilers at the finisher phase (3-7 weeks) as affected by banana leaves incubation were presented on Table 3. The results showed that the daily feed intake was significantly ($P<0.01$) affected by incubation and levels of banana leaves, and daily feed intake values was highest on treatment level 10% incubated 10 days (A10B10 =125.10 g/d). The daily weight gain was significantly ($P<0.01$) affected by dietary treatments and incubation, and the daily weight gain values was highest on treatment level 10% incubated 10 days (A10B10 =58.03 g/d). The feed efficiency was significantly ($P<0.01$) affected by incubation and levels of banana leaves, and the feed efficiency values was highest on treatment level 10% incubated 10 days (A10B10 =0.46). This result agrees with the report of [16]. The high amount of feed intake on A10B10 may be due to the fact that inclusion of 10% banana leaves fermented 10 days may influence the palatability of feed. These result was similar to [12] who found that inclusion of 10% banana peel powder to conventional feed significantly increased growth performance compared to the control. The efficiency of birds fed10% banana leaves fermented 10 days indicated that these treatments might be due to stimulation of digestive enzymes followed by better digestion and utilization of feed.

The carcass yield was significantly ($P<0.01$) affected by incubation and levels of banana leaves, and the carcass yield values was highest on treatment level 10% incubated 10 days (A10B10 =74.58%). Survivability was 100% for all of the treatments. The values of carcass yield affected by all of treatmenst were high and good value category. These indicated that all of treatments were good quality. There was no information about effect of banana leaves on broiler carcass. However, reference [17] finding that utilization of thyme leaves in broiler diet did not have significant effect on dressed carcass percentage. It can be recommended that the A10B10 treatment was the best treatment found the best carcass yield.

IV. CONCLUSIONS

Based on this result, it can be concluded that banana leaves could be acceptable up to 10% levels that was incubated 10 days in broiler diets.

TABLE 3
GROWTH PERFORMANCE OF BROILERS

Parameter	Terms of Incubated (TI) (A)	Levels of Banana Leaf (%) (B)			Interaction TI and Levels
		5	10	15	
Feed intake (g/d)	0	103.22 ± 0.62^{f}	115.57 ± 0.39^{e}	117.79 ± 0.65^{d}	p<0.01
	5	117.65 ± 0.29^{d}	117.82 ± 0.25^{d}	116.86 ± 0.22^{d}	
	10	122.62 ± 0.57^{b}	125.10 ± 0.11^{a}	119.75 ± 0.95^{c}	
	15	124.06 ± 0.56^{ab}	124.49 ± 0.17^{ab}	123.86 ± 0.49^{ab}	
Weight gain (g/d)	0	43.46 ± 0.74^{e}	48.50 ± 0.32^{d}	47.04 ± 0.96^{d}	p<0.01
	5	52.47 ± 0.22^{b}	54.25 ± 0.68^{b}	48.45 ± 0.32^{d}	
	10	53.27 ± 0.48^{b}	58.03 ± 0.32^{a}	50.24 ± 0.85^{c}	
	15	50.44 ± 0.51^{c}	46.15 ± 0.70^{d}	49.42 ± 0.89^{cd}	
Feed efficiency	0	0.42 ± 0.008^{c}	0.42 ± 0.002^{c}	0.40 ± 0.06^{c}	p<0.01
	5	0.45 ± 0.01^{ab}	0.46 ± 0.06^{ab}	0.41 ± 0.02^{c}	
	10	0.43 ± 0.04^{b}	0.46 ± 0.02^{a}	0.42 ± 0.07^{c}	
	15	0.41 ± 0.04^{c}	0.37 ± 0.06^{d}	0.40 ± 0.06^{c}	
Carcass (%)	0	68.42 ± 0.14^{c}	66.65 ± 0.62^{d}	67.95 ± 0.39^{cd}	p<0.01
	5	73,75 ± 0.76^{ab}	74.27 ± 0.62^{ab}	72.58 ± 0.44^{b}	
	10	72.24 ± 0.38^{b}	74.58 ± 0.27^{a}	72.60 ± 0.34^{b}	
	15	65.81 ± 0.20^{de}	73.03 ± 0.38^{ab}	71.67 ± 0.53^{c}	

Notes: TI = term of incubation; [a] in the same parameters are the best interaction

REFERENCES

[1] F. C. Iheukwumere, E. C. Ndubuisi, E. A. Mazi and M. U. Onyekwere. Performance, nutrients utilization and organ characteristics of broilers fed cassava leaf meal (Manihot esculenta Crantz). *Pakistan J. Nutr.* Vol 7. p13, 2008.

[2] D. Mohapatra, S. Mishra, and N. Sutar. Banana and its by-product utilisation: an overview. *J. of Sci. & Indust. Res*., vol 69, May 2010, pp 323-329.

[3] S. Bera, S. Bhattachanya, J. N. Pandey, and M. Biswas. Acute and sub-chronic toxicity study of *Musa paradisiaca* leaf extracts in mice. *J. of Adv. Pharm. Edu. & Res*., vol. 3, issue 2, pp 90-93, Apr-June, 2013.

[4] T. Astuti, Y. S. Amir, G. Yelni, Isyaturriyadhah. The result of biotechnology by local microorganisms to banana peel on rumen fluid characteristics as ruminant feed. *J. of Adv. Agric. Tech*., vol 1, no 1, June 2014, pp 28-31.

[5] E. Oladele, and S. Khokhar. Effect of domestic cooking on the polyphenolic content and antioxidant capacity of plantain (*Musa paradisiaca*). *World J. of Dairy and Food Sci*. 6 (2):189-194, 2011.

[6] T. Matekaire, J. F. Mupangwa, E. F. Kanyamura. The efficacy of banana plant (*Musa paradisiana*) as a coccidiostat in rabbits. *Int. J. Appl. Res. Vet. Med*., vol. 3, no 4, pp326-331. 2005

[7] I. U. Nwanko, and R. C. Osaro-Mathew. Assessment of the phytochemical components of *Mangifera indica* (leaf) and *Musa paradisiaca* (root) extracts and their antibacterial activity against some common pathogenic bacteria. *IOSR - J of Pharm. & Biol. Sci*., vol. 9, issue 1, pp 08-11, Feb. 2014.

[8] V. D. Kappel, L. H. Cazarolli, D.F. Pereira, B. G. Postal, F. A. Madaglio, Z. Da S. Buss, F. H. Reginatto, and F. R. M. B. Silva. Beneficial effects of banana leaves (*Musa paradisiaca*) on glucose homeostatic: multiple sites ofaction. *Rev. Bras. Farmacogn*., vol 23, no 4, Sept. 2013.

[9] H. Mbagwu, C. Jackson, M. Ekpo, E. Okopedi, V. Anah, and C. Uguru. Gastroprotective effects of ethanolic leaf extract of *Musa paradisiaca* L. (Musaceae) in rats. *J. Chem Pharm. Res*. 2011. 3 (3):322-327.

[10] O. C. Enechi, C. E. Odo, and P. O. Agosi. Antioxidant vitamins, phytochemicals and proximate composition of the ethanol extract of the leaves of *Musa paradisiaca*. *Afr. J. of Pharm. & Pharmacol*., vol. 8 (18), pp. 464-468, May, 2014.

[11] C. B. Katangole, F. B. Bareeba, E. N. Sabiiti, and I. Ledin. Nutritional characterization of some tropical urban market crops wastes. *Anim. Feed Sci. Technol*. 142:275-291, 2008.

[12] B. N. Ukwah, I. M. Ezeonu, E. A. Eze, and J. O. Uguru. Assessment of prebiotic roles of *Musa paradisiaca* (plantain) peels for controlling spread of Salmonella and other infectious disease agents by broilers. *J. Biol. Chem. Res*., vol. 31, no 2, pp901-911, 2014.

[13] Steel, R.G.D. and J.A. Torrie. 1980. Principles and Procedures of Statistics. Mcgraw-Hill, New York.

[14] B. Sen, J. Singh, T. Verma, and P. R. Patel. Performance of growing calves fed on banana (*Musa paradisiaca*) stem. *The Bioscan*. 9 (1), pp 121-123, 2014.

[15] J. Singh. Performance of growing calves fed on forest grass hay and wheat bhusa. *Indian J. Anim. Res*. 32 (1), pp 23-29, 1998.

[16] A. A. Taiwo, A. D. Adejuyigbe, A. E. Adebowale, J. S. Oshotan, and O. O. David. Performance and nutrient digestibility of weaned rabbits fed forage supplemented with concentrate. *Nig. J. Anim. Prod*., vol. 31 (1), pp 74-78. 2005.

[17] M. Ayyola, O. A. Adedeji, and A. D. Oladepo. Effect of dietary thyme leaf on broiler growth performances, carcass characteristics and cooking yield of the meat. *Global J. of Sci. Res*., vol. 2 (2), pp 47-50, Feb. 2014.