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The influence of *Aspergillus niger* inoculum dosage on nutritive value and metabolizable energy of apu-apu meal (*Pistia stratiotes L.*) on broiler chicken

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Abstract. Apu-apu lives at tropical and subtropical fresh waterways. The apu-apu meals ultization as feed still limited. The problem of ultization apu-apu meals as ingredients is a high crude fiber and need a treatment to decrease crude fiber. This study aim to find out the influence of Aspergillus niger inoculums dosage on apu-apu meal (Pistia stratiotes L.) on metabolizable energy on broiler chicken. This research used completely randomize design (CRD). The treatments consists of Aspergillus niger inoculum dosage (CFU/g) such as P0 (0), P1 (10^4 CFU/g), P2 (10^6 CFU/g), and P3 (10^8 CFU/g). The variable were observed : apparent metabolizable energy (AME), true metabolizable energy (TME), apparent metabolizable energy nitrogen corrected (AMEn) and true metabolizable energy nitrogen corrected (TMEn).The results showed that the dosage of Aspergillus niger increase nutritive value of Aspergillus niger. Dosage of Aspergillus niger also influence ($P<0.05$) metabolizable energy of apu-apu meals. Dosage 10^8 CFU/g had metabolizable energy significantly higher than other treatments. Conclusion of this research is the Aspergillus niger at the dosage 10^8 CFU/g increased nutritive value and metabolizable energy of apu-apu meal.

1. Introduction

In composed an animal feed was always based on the balance of energy and protein. One of the origin of vegetable protein, namely plant apu-apu (Pistia stratiotes L.), which live on freshwater waterways, measuring approximately 5 cm-10 cm, shape slightly rounded of the color green and white roots are a bit dirty. The leaves on these plants with delicate feathery. This plant grows as a weed in rice field acreage mainly rice and many farmer not yet know that these plants can be used as animal feed, especially poultry. So after the rice harvest, usually these plants join the cleaned along with the processed of land for planted the next rice.

According to Sutama [1], plant the apu-apu is potentially as constituents of feed because it contains crude protein 19.5%, ash 25.6%, fat 1.3% crude fibre 11.7% and 37.0% NNE. Crude fiber of high will be hard to digest by broilers, because thedigestion do not secretion the enzyme cellulase. Utilizing of crude fibers that are high in food can decrease the components easy to digest and decrease enzyme activity and solve the food substances like enzyme that help digestion of carbohydrates, proteins and fats [2]. Therefore the processing needs to be done in order to make use of apu-apu (Pistia stratiotes L.)

as material feed poultry can be optimum. One of the feed processing technique that was doing the fermentation.

Fermentation is the process of chemical change of organic compounds in either aerobic or anaerobic circumstances, through the work of enzymes produced by the microbes [3].

One of the factors which affect the fermentation was inoculum dosage. The right of Inoculum dosage was important to know because too much inoculum in the substrate would cause competition in obtaining food and affect to the ability of microorganisms in fermentation. Too much density of inoculum can also cause the death of microbes.

The mold used for the fermentation of starch apu-apu was Aspergillus niger. This mold was used because it can grow quickly and already used commercially. The existence of the cellulase enzyme produced by Aspergillus niger were able to degrade cellulose is chemically reducing crude fiber. The process of fermentation apu-apu meals can decrease crude fiber and increase the nutritive of apu-apu meals.

According to Mc Donald et al[4], metabolizable energy is the energy that is ready to be utilized by livestock in a variety of activities such as physical activity, maintaining body temperature, metabolism, tissue formation, reproduction and production. Therefore important to knowed the nutritional feed ingredients to determine a ration needs energy metabolis which will be consumed by livestock.

2. Materials And Methods

This research has been carried out in the Microbiology Laboratory and Livestock Biology Laboratory, Animal Husbandry Department, Agriculture Faculty University of North Sumatra.

Broiler chickens, apu-apu (Pistia stratiotes L.), Aspergillus niger as fermentator, Potatoes Dextrose Agar (PDA) as a growth medium, water, hot plate, spiritus, pumpkin elemenyer, sterile cotton wool, aluminium foil, ose, test tubes, petri dish, clear plastic, electronic scales, ovens and stationery, cages metabolism sized 52 x 25 x 45 cm by as much as 23, each comprising 1 Coop chickens. This enclosure equipped place drinking water and excreta container.

The experimental design used in this study was experimentally by using random design complete with 4 treatments and five replicates. As for the treatment as follows:P0 = Apu-apu meals without fermentation of Aspergillus niger; P1 = Aspergillus niger Fermentation 10^4 CFU/g; P2 = Aspergillus niger Fermentation 10^6 CFU/g; P3 = Aspergillus niger Fermentation 10^8 CFU/g.

Observations include proximate analysis (dry matter, ash, crude protein, fat and crude fiber) and metabolizable energy(Apparent metabolizable energy (AME), true metabolizable energy (TME), apparent metabolizable energy nitrogen corrected (AMEn), and true metabolizable energy nitrogen corrected (TMEn).

2.1. Implementation

Implementation of the research included the processing of apu-apu meals that was collecting, sorting, washing, drying, milling and proximate analysis.

Then the apu-apu meals had been packaged in clear plastic and then sterilized at temperature 121^0C for 15 minutes then cooled, after reaching room temperature, substrates were incubated with prepared inoculum suitable with the treatment of 10^4 CFU/g, 10^6 CFU/g and 10^8 CFU/g then blended in a tray then covered with a cling wrap and give a small hole then put into the laminar air flow. Then incubated at 28^0C for 4 days. Each combination is repeated 5 times. After incubation time is reached, the apu-apu meals was dried on oven at a temperature of 60^oC for 24 hours and constant weight is obtained. Then done the proximate analysis to knowed a nutritive value.

In the forced feeding, used a 20 broiler chickens have been fasted for 24 hours. Feed given forced as many as 25 g with the help of a funnel. Water given ad-libitum. After 24 hours the giving rations, excreta was collected and subsequent handling similarly as in feeding techniques without force.

3. Result And Discussion

3.1. Nutritive value of apu-apu meals

Table 1 shows that the best quality of nutrients in P3 crude fiber as 14.83% and crude protein as 16.95%. This shows that the fermented apu-apu meals using Aspergillus niger was decreased the crude fibers and increased crude protein. This statement suitable to Mangisah et al [5] that the Aspergillus niger capable to producing the enzyme cellulase and hemicellulase that will degrade cellulose and hemicellulose so that it is able to decrease the crude fibre in feed raw material and according to Hassanudin and Mujnisa [6] that results of sago pulp inoculation of Aspergillus niger contains a higher crude protein and lower crude fiber than was not inoculated with Aspergillus niger.

Table 1. Nutritive value of apu-apu meals

Treatment	% Dry matter	% Ash	% Crude protein	% Crude Fiber
P0	89.51	9.40	14.62	17.33
P1	92.36	9.20	16.83	14.95
P2	91.91	9.82	16.92	14.92
P3	92.58	10.25	16.95	14.83

3.2. Metabolizable energy

Metabolizable energy is a different within feed gross energy and excreta gross energy. Table 2 shows the different value of metabolizable energy in parameters. Based on the analysis of diversity showed that the apu-apu meals at P3 (10^8 CFU/g)give a different real influence ($P < 0.05$) against the apparent metabolizable energy (AME), true metabolizable energy (TME), apparent metabolizable energy nitrogen corrected (AMEn) and true metabolizable energy nitrogen corrected (TMEn) value compared with others treatment of pseudo compared on the dose on other treatments. However, P0, P1 and P2 did not show the real difference.This is caused by high levels of crude fibers at the P3 than other treatments in P3 so increased the feed digestibility that effect to metabolizable energy. This is in accordance with the opinion of Tillman et al[7] that increased the quality of the feed causes a high digestibility values, and the effect to increase the value of metabolizable energy. Laras[8] that a mixture of fermented onggok by Aspergillus niger increased the value apparent metabolizable energy (AME), true metabolizable energy (TME), apparent metabolizable energy nitrogen corrected (AMEn) and true metabolizable energy nitrogen corrected (TMEn). It predicted due to the role of the cellulase, Aspergillus niger's products which able to degrade cellulose into glucose. This is in accordance with the opinion of Sibbald [9] and Mc Donald et al[4].

Table2. Apparent metabolizable energy (AME), true metabolizable energy (TME), apparentmetabolizable energy nitrogen corrected (AMEn) and true metabolizable energy nitrogencorrected (TMEn) value of apu-apu meals

Treatments	Parameters			
	AME (kcal/kg)	TME (kcal/kg)	AMEn (kcal/kg)	TMEn (kcal/kg)
P0	$2496.73^{b} \pm 238.26$	$2663.23^{b} \pm 238.26$	$2496.48^{b} \pm 238.25$	$2662.99^{b} \pm 238.25$
P1	$2415.79^{b} \pm 48.98$	$2582.30^{b} \pm 48.98$	$2415.51^{b} \pm 48.98$	$2582.02^{b} \pm 48.98$
P2	$2443.94^{b} \pm 137.33$	$2610.44^{b} \pm 137.33$	$2443.67^{b} \pm 137.32$	$2610.14^{b} \pm 137.32$
P3	$2859.19^{a} \pm 447.42$	$3025.69^{a} \pm 22.83$	$2858.85^{a} \pm 22.82$	$3025.36^{a} \pm 22.82$
Average	2553,91±111,85	10881,68±447,42	2553,62±111,85	2720,13±111,85

Description: Different Superscript on the same line shows the real difference ($P < 0.05$)

4. Conclusions

Apu-apu mealsfermented Aspergillus niger increase crude protein and decrease crude fiber of apu-apu meals. Inoculum dose of Aspergillus niger on apu-apu meals significantly increase the value of metabolizable energy on broiler chicken with the best dose of 10^8 CFU/g than other treatments

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