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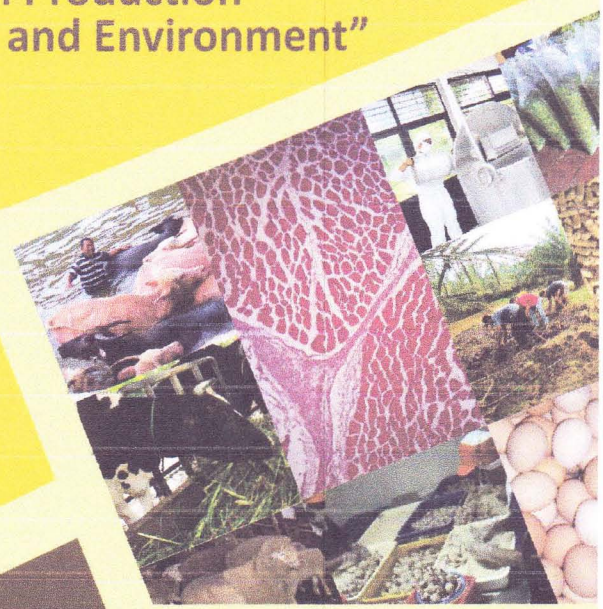

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The Study of Jack bean (*Canavalia ensiformis*) Addition on the Performance of Rats as Animal Model

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Abstract

The purpose of this study was to examine the addition of Jack Bean (Canavaliaensiformis) in the diet to performances of rats (Rattusnovergicus) as an animal models to predict post-ruminal absorption. This study useds a randomized complete block design with 3 replication, each replication consisted of 7 rats/ block from 105 male rats on the growth-phase with an average weight 117.84±23.52, with 5 treatments of ration: R0 = control diet, R1 = R0 + 10 % Jack bean flour, R2 = R0 + 20 % Jack bean flour, R3 = R0 + 30 % Jack bean flour, R4 = control diet + GHR1000). Data were analyzed by analysis of variance (ANOVA). The tested parameter were feed consumption, daily gain, feed conversion ratio, and chemical quality of the meat as dry matter, protein, fat as well as protein and fat meat ratio. The results showed that addition of Jack beanflour as much as 20% in the diet did not affect the consumption diet, but increased daily gain 1.98 g/day ($P<0.01$) and produced the best feed conversion ($P<0.05$) and resulted 10 fold of protein and fat meat ratio ($P<0.01$). As conclusion, addition of 20% Jack bean in the diet of rats which as an animal models to predict the post-ruminal absorption gave the best performance of rats as well as its meat quality. This means, if Jack bean will be contained in cattle diet, as much 20% Jack bean should be absorbed in post-ruminal digestive of cattle to produce high performance and high quality of meat.
Keywords: jack bean (Canavaliaensiformis), meat quality, performance, post-ruminal digestive, Rattusnovergicus

Introduction

Indonesia is a famous country that has abundant biological resources such as legumes. Jack bean (*Canavalia ensiformis*) is one of legumes that can be used as a source of protein. Protein content of jack bean is 28.51%, 2.57% fat and 5.75% fiber. Unfortunately, jack bean has not been used as source of protein and energy. Nowadays jack bean is only used as food alternative to soybean and untapped as source of energy and protein feed for livestock. Nutrional content in jack bean is possible to be used as feed source of protein and energy, but high nutrient content also causes problems, especially for livestock performance. Therefore, it is necessary to develop an innovation to treat jack bean for feed protein and energy source purposes.

This research aimed to evaluate the protein used for beef cattle both small and large ruminants derived from jack bean in increasing muscle mass. Therefore, this study was conducted in the rat as animal model to describe the post-ruminal absorption. The purpose of this study was to examine the addition of jack bean (*Canavaliaensiformis*) in the diet on performances of rats (*Rattusnovergicus*) as an animal models to predict post-ruminal absorption.

Materials and Methods

The experiment used 105 male rats on the growth-phase with an average weight of 117.84±23.52 g. Feed was given in pellets every morning and evening as well as water provided ad libitum. This study used a randomized complete block design with 5 treatments and 3 replications, each replication consisted of 7 rats. The treatments of ration were: R0 = control (negative) diet, R1 = R0 + 10 % Jack bean flour, R2 = R0 + 20 % Jack bean flour, R3 = R0 + 30 % Jack bean flour, R4 = control (positive) diet, GHR1000, is a synthetic growth promoter). Data wereanalyzed by analysis of variance (ANOVA) and Duncan analysis. The parameters were feed consumption, average daily gain (ADG), feed conversion ratio (FCR), and chemical quality of the meat such as dry matter, protein, fat,protein and fat meat ratio.The compositionof feed was presented in Table 1 and the nutrient content of dietwas presented in Table 2.

Feed intake recorded daily by weighing the amount of given feed and the feed residual. Feed intake was calculated as :

Feed intake (g) = The amount given feed (g) – Residual feed (g)

Measurement of body weight of rats was carried out every week during maintenance. The average of daily gain (ADG) was calculated based on formula as follows:

$$\text{ADG (g/h/day)} = \frac{\text{Final body weight/week (g)-initial body weight/week (g)}}{\text{7 days}}$$

The feed conversion ratio was calculated by the amount of feed intake divided by the average daily gain as follows:

$$\text{FCR (\%)} = \frac{\text{Daily Feed intake (g/day)}}{\text{Daily body weight gain (g/day)}} \times 100\%$$

Chemical analysis of meat refers to AOAC 1984. The calculation of the ratio of protein and fat meat is calculated by the amount of meat protein content divided by the total fat content of meat.

Table 1. Composition of feed

Feed Ingredients	The amount used (%)
Corn	56.32
Pollard	19.29
CGM	16.24
CPO	3
Tapioca flour	2.5
$CaCO_3$	1.5
DCP	1
Premix	0.1
Salt	0.05

Table 2. Nutrient content of diet control

Material	Nutrient content (%)					
	DM[1]	Ash[1]	Crude protein[1]	Crude fat[1]	Crude fiber[1]	NFE[1]
Control diet	88.54	4.25	18.40	5.42	2.35	58.12

[1]Analysis by Laboratorium Sumberdaya Hayati dan Bioteknologi PAU IPB (2014)

Results and Discussion

Data of rat performance such as feed consumption, average daily gain (ADG) and feed conversion ratio (FCR) were presented in Table 3.

Table 3. The performance of rats

Treatment	Variable		
	Feed intake (g/h /day)	ADG (g/h /day)	FCR
R0	13.97±0.03	1.09±0.12C	12.81±1.54b
R1	12.72±1.37	1.96±0.28A	6.48±0.97a
R2	13.15±1.14	1.98±0.35A	6.64±1.33a
R3	12.83±1.03	1.51±0.19B	8.49±1.37a
R4	13.33±0.83	1.53±0.21B	8.71±1.62a

Notes: R0 = control diet, R1 = R0 + 10 % Jack bean flour, R2 = R0 + 20 % Jack bean flour, R3 = R0 + 30 % Jack bean flour, R4 = control diet + OVR1000. ADG =averagedaily gain.FCR = feed conversion ratio. Means in the same column with different superscripts (small font) differ significantly ($P<0.05$). Means in the same column with different superscripts (large font) differ significantly ($P<0.01$).

To obtain the optimal production, the diet consumption should meet the nutritional requirement. In this study, addition of jack bean flour in rat diets (R1, R2 and R3) did not affect the feed consumption compared to negative control (R0) and positive control (R4). This phenomenon shown that addition of jack bean flour with different levels did not change the animal's palatability. Jack bean as well as soybean contains high protein that prefered by animal. Beside of fulfilling the protein requirement of animal, the bean also favourable to trigger the positive palatability.This is because the jack bean has a high nutrient content, such as protein, fat, fiber, and other nutritional content, and also carbohydrate content of 50.8% (Doss *et al*. 2011).

There was significantly different on daily gain of rats as well as FCR by addition of jack bean flour ($P<0.01$). As much 10 % and 20% of jack bean flour in diet had produced similarity in the daily gain of rats as well as in feed conversion rate. The highest concentration of jack bean in diet (30%) showed decreasing the daily gain or increasing FCR. The qualityandquantity of feedare the twofactors that affectfeed conversion ratio (Schmittows 1992).

Results of the analysis of the chemical quality of the meat during the study, such as protein, fat and protein and fat meat ratio provide a highly significant difference ($P<0.05$). The chemical analysis of meat can be seen in Table 4.

Table 4. Chemical quality of meat

Treatment	Variable			P/F ratio
	DM (%)	Protein (%)	Fat (%)	
R0	23.32±0.37	74.74±0.76A	16.78±0.98C	4.46±0.21B
R1	27.12±0.66	65.23±1.48B	12.19±1.27B	5.39±0.68B
R2	21.72±1.45	74.96±4.06A	7.46±1.41A	10.18±1.38A
R3	22.26±0.23	79.22±1.20A	14.47±0.46B	5.48±0.26B
R4	23.65±1.56	78.99±3.94A	13.35±0.60B	5.84±0.55B

Notes: R0 = control diet, R1 = R0 + 10 % Jack bean flour, R2 = R0 + 20 % Jack bean flour, R3 = R0 + 30 % Jack bean flour, R4 = control diet + GHR1000; DM = dry matter; P/F ratio = protein/fat ratio. Means in the same column with different superscripts (large font) differ significantly ($P<0.01$).

The addition of Jack bean in diet significantly influenced the meat protein content ($P<0.05$). Protein content of meat obtained in this study was inranges between65.23%-79.22%. According to Anggoro-di (1994), the largest component of the drymatter is a protein (75-80%).In this study, the meat protein might be deposited as a mass of meat proteins. Protein deposited into the meat is excess protein from protein absorbed and utilized by the body, for example for tissue repair (Jamilah *et al*. 2013). The fat content of meat in this study was ranged from 7.46%-16.78%. The lowest fat content was achieved in addition 20% jack bean ($P<0.05$). This is the positive result, because consumers tend to choose the meat with a low fat content. The highest of protein and fat meat ratio was achieved by addition 20% jack bean flour. Its ratio was 2.3 times larger than control. The feed source of protein can be used to produce high protein mass.This proves that the jack bean flour can be consumed by livestock, especially beef cattle as a source of protein ration to increase meat production with better quality.

Conclusion

The addition of 20% Jack bean in the diet of rats as animal models to predict the post-ruminal absorption gave the best performance of rats as well as its meat quality. This means, if Jack bean will be included in cattle diet, as much 20% Jack bean should be absorbed in post-ruminal digestive of cattle to produce high performance and high quality of meat.

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