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Abstract. An experiment was conducted to study growth performane of weaner rabbits fed dried *Moringa oeifera* leaf meal. Twenty weaner rabbits (New Zealand White breed) with an average live weight of 918.42 ± 6.84g were used to evaluate the growth performance, daily weight gain (DWG), feed convertion ratio (FCR), and income over feed cost (IOFC) of weaner rabbits fed diets containing graded levels of moringa (*Moringa oleifera*) leaf meal (MOLM) in diets. The study lasted for eight weeks.The rabbits were assigned into four treatment groups and five replicates consisting of four rabbits per group in a complete randomised design and fed four diets designated T_0, T_1, T_2 and T_3 with 0, 20, 40 and 60% MOLM, respectively. Result showed that the average of feed intake for each treatment T_0; T_1; T_2 and T_3 (g/head/day) were:104.96; 110.06; 109.34; 107.04, DWG (g/head/day):18.87; 22.35; 21.60; 21.5; FCR: 5.57; 4.95; 5.08; 5.06, and IOFC (Rp/head): 57,012.73; 73,197.77; 72,525.36; 74,435.32, respectively. The statistical analysis indicated that the utilization of MOLM in diets gaves not significantly different (P>0,05) on the productive performances of weaner rabbits. Utilization of MOLM can be used up to 60% on diets and increased income from diets of weaner rabbits.

1. Introduction

Nowadays, the research interest has focused on the protein sweeping exploration under the utilized legumes and forages, which is caused by food acute shortage which is rich of protein, in the tropical and developing countries, caused by population the explosion and the high cost of animal protein. A lot of forages could be used in animal rations [1]. Green plants leaf ingredient with the crude protein content of fresh meal are used in the ration of the livestock to reduce cost of production, enhance reproductive performance, enhance health status and promote growth of farm animal, thus increasing overall livestock production when used as a feed component or additive [2].

One of such plants is moringa (*moringa oleifera* - MO) [3;4]. MO is thus one of the world's most useful plants for a variety of food and medicinal purposes in many countries in Africa, South East Asia, the Pacific and Caribbean Islands and South America [5]. Rabbit is the most productive meat producing animal among all domesticated animals. Rabbits also have several advantageous

characteristics to subsistence the farming system, such as the small size of the body and the short interval of generation with a short relative period of gestation which are 30-31 days [6;7].

MO leaf meal (MOLM) possess a good quality of dietary protein for the rabbits' optimal growth. In addition the MOLM can also be used to improve the daily weight gain and as the intake feed of the rabbits. Moreover, the MOLM can replace the soya bean meal in the diet up of teh rabbit to 15% of level of inclusion without any detrimental effect on the rabbits performance [8]. Weaned rabbits can utilize the MOLM at up to 45% inclusion level of diets with no effects of deleterious on the growth performance, the carcass yield and the organ characteristics [9]. This study aimed to determine the growth performance of weaner rabbits that was fed dried *Moringa oleifera* leaf meal.

2. Materials and Methods

The research was conducted in Besar II Village, Sub-district of Pantai Cermin, District of Serdang Bedagai, Province of North Sumatera, Indonesia. Twenty weaner rabbits (New Zealand White breed) with an average live weight of 918.42 ± 6.84 g were used in this study. The rabbits were housed in each cages made by wood individually that were raised from the floor. The research stages conducted by drying the MOLM in the air (air-dried), then milled and after that was incorporated into the diets in a pellet form and then analyzed. There were 4 formulated experimental diets to suffice the needs of rabbits' nutrient as recommended by [10], the analysis of proximate contain of the MOLM and the experimental diets was conducted (Table 1) using [11] method.

The experimental animals were fed by the experimental diets for eight weeks after the acclimatization period for two weeks. The feeds and clean water was provided *adlibitum*. The rabbits were assigned into four treatment groups with five replications, which were consisted of four rabbits per each group and analyzed using a complete randomised design and fed using the four diets designated T_0, T_1, T_2 and T_3 with 0, 20, 40 and 60% MOLM, respectively. The experimental diet contains 16.21 – 16.99mg crude protein (CP) and 2352–3121.664 kcal metabolisable energy (ME)/kg supplemented with 0%, 20%, 40%, and 60% MOLM, and the weaner rabbits were fed their diets with ingredients composition of experimental diets is presented in Table 1.

At the beginning of the experiment, all experimental rabbits were weighed before they were allocated to the treatments. The performance record of the rabbits was taken weekly throughout the period of the experiment. The daily feed was provided *ad libitum* in a pellet form as a known quantity of feed (70–120 g/rabbit/day) [12] and was offered to the animals twice daily. The consumed daily feed was recorded and the left feed over and/or wastage were weighed weekly before supplying fresh feed. Parameters determined included average feed intake (FI), average BWG, FCR, IOFC, and mortality. Record of average weekly FI and daily BWG was taken. The BWG (g) was calculated as the final BW minus the intial BW, and the FCR was calculated as the FI (g) per BW (g). The used ingredients prevailing market prices during the study period were used for the economic appraisal of IOFC which can be calculated using the following formula: price of rabbits sold (Rp) – price of rations fed (Rp). The data collected in this study were analyzed using Analysis of Variance [13], where the existed significant differences between each treatments and the least significant difference was used to separate them.

3. Results and Discussion

3.1. Performance of weaner rabbits fed graded level of MOLM

The rabbits had similar body weights during 8-weeks period of the experiment (Table 2). The FI and the total BWG increased along with the increasement of MOLM level, in contrast with the the differences of treatments mean that were not significant statistically ($P>0.05$). The daily FI and the FCR values also similarly improved along with the increasement of MOLM level, but the differences of treatments were not significant statistically ($P>0,05$). The daily BWG also increased along with the increasement of MOLM level and the control animals (T0) were not performed good ($p<0.05$)

compared to those which were fed by the MOLM inclusive diets. The MOLM increased the used feed unit cost. During the experiment, there was no animal died.

Table 1. Ingredients composition of experimental diets (%).

No	Ingredients	Treatments			
		T_0	T_1	T_2	T_3
1	MOLM	0	20	40	60
2	Corn meal	36	33	25	22,5
3	Rice bran	24	17	18	10
4	Coconut meal	15	12	5	0,5
5	Soybean meal	18	11	2	0,3
6	Top Mix	2	2	2	2
7	Molasses	5	5	5	5
	TOTAL	100	100	100	100
		Nutrition composition			
1	CP (%)	16.21	16.2562	16.26	16.995
2	ME (Kkal/kg)	2352	2621.968	2835.436	3121.664
3	CF (%)	8.017	9.096	10.46	11.3306
4	Fat (%)	3.928	4.294	4.588	4.9195
5	Ca (%)	0.4146	0.3837	0.3615	0.33706
6	P (%)	0.7564	0.5716	0.498	0.31287
		Price of ingredients (Rp/kg)			
1	MOLM	0	1,200	1,200	1,800
2	Corn meal	1,560	1,000	1,000	888
3	Rice bran	875	630	630	350
4	Coconut meal	525	175	175	17.5
5	Soybean meal	1,710	475	475	28.5
6	Top Mix	160	160	160	160
7	Molasses	350	350	350	350
	TOTAL	5,180	3,990	3,990	3,594

Tabel 2. The performance characteristics of weaner rabbits fed dried MOLM

Treatments	Parameter			
	FI (g/head/day)	BWG (g/head/day)	FCR	IOFC (Rp/head)
T_0	104.96	18.87	5.57	57.012,73 [b]
T_1	110.06	22.35	4.95	73.197,77 [a]
T_2	109.34	21.60	5.08	72.525,36 [a]
T_3	107.04	21.51	5.06	74.435,32 [a]

Notes: a,b means with different superscript on the different coloum are significantly different (P<0,05).

The poorer average of BWG was found in the control animals (T_0). Then, the suggestion of T_0 treatment for diet will be not good in quality compared to the MOLM diets usage (T_1 - T_3). Normally, an increasement of CP in diets should resulted a higher daily BWG. However, the increased protein should be matched with the increased amino acids, such as methionine and lysine, which content are needed for growth but normally deficit in the rabbit diets which can be depressed the rabbit growth.

The CP values (Table1) for the experimental diets were increasing slightly along with the increasement of the inclusion level of MOLM. The recorded average BWG values in this study were higher than those reported by [14], who found that the inclusion of MOLM to higher level of 30%, resulted in the increased of BWG of 9.69; 13.48; 18.96 and 19.83 g/head/day. A higher weight gains may occur in the rabbits that were fed with the MOLM diets. Therefore, the feed should be partly due to a better protein quality, possibly arising from a higher supply of methionine and lysine [15]. Normally, the higher weight gain of animals resulted from the increased FI. This situation was observed in the present experiment. BWG increased along with the inclusion of MOLM level in the diet. However, the average daily BWG was not significantly ($p>0.05$) higher for the rabbits in the diet of MOLM (T_1 - T_3) than for those in the control diet (T_0).

Actually, the vitamin A is important for the growth of rabbit, where the it was reported that the MOLM contain a high vitamin A [16]. The control diet T_0 could have provided an insufficient vitamin A for the rabbits, so that resulted a poor growth, where the vitamin A aids in promoting the growth of rabbits. The deficiency of vitamin A in the rabbits' diets makes the rabbits exhibited a poor growth [17]. The superior FCR for the MOLM diets also contributed to the superior growth rate and BWG of the rabbits by using the MOLM diets if compared to the control treatment. The recorded average daily BWG values in this study were higher than those reported by [18].

Generally, the observed low growth rates in this study could be explained by the fact that the rabbits did not consume a lot of feeds to ensure a higher growth. The average daily FI did not show any significant ($p>0.05$) difference between the treatments. However, the rabbits showed a systematic increasement in the daily FI from the treatment of T_0 to T_3. The rabbits must be fed to meet the energy requirement to sustain a rapid growth and development, hence the increased feed intake. Generally, this assertion agrees with the report of [1] who reported higher FI in accordance to the CF level in the diets of rabbits. Another associated factor which caused the FI increasement could be due to a greater palatability of the MOLM diets as compared to the control diet. The depressed FI of rabbits in the control treatment may also be related to the aminoacid profiles of the feeds variation. The FCR values of 5.57, 4.95, 5.08, 5.06 (Table2) obtained in this study were higher than the values of 2.63- 4.00 reported by earlier researchers in the tropics [19].

Generally, the obtained poor FCRs were probably caused by the low growth rates. The genetic differences might have also contributed to the lower FCRs that was recorded. The IOFC level increased ini accordance to the increasement of the MOLM inclusion level from T_0 (0% MOLM) to T_3 (60% MOLM). This condition have been expected, since a higher MOLM diets contained a less expensive total price of ingredients (Table 1). The IOFC of feed per kg showed a significant difference ($P<0.05$) in the control treatment compared to the other treatments. The inclusion of MOLM up to 60% in the diets of weaner rabbits reduced the inclusion of other main ingredients in their diets such corn meal, rice bran, coconut meal, and soybean meal. Therefore, the cost of diets reduced which resulted in the increased of income for weaner rabbits.

4. Conclusions

The MOLM utilization can be used up to 60% on diets and on the increased income from diets of weaner rabbits.

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