Growth performance of weaner rabbits fed dried *Moringa oleifera* leaf meal

D P Zendrato¹, R Ginting², Warisman², D J S Siregar², A Putra², I Sembiring³, Hamdan³, J Ginting³ and Y L Henuk³*

¹Master and ²Doctor Candidates of the Faculty of Agriculture, Universitas Sumatera Utara, Medan 20155 Indonesia
³Lecturers of the Faculty of Agriculture, Universitas Sumatera Utara, Medan 20155 Indonesia

Email: *profesorhenuk@gmail.com*

**Abstract.** An experiment was conducted to study growth performance of weaner rabbits fed dried *Moringa oleifera* 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 conversion 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 T₀, T₁, T₂ and T₃ with 0, 20, 40 and 60% MOLM, respectively. Result showed that the average of feed intake for each treatment T₀; T₁; T₂ and T₃ (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 gave 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 *ad libitum*. 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 T0, T1, T2 and T3 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 fed 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 initial 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<sub>0</sub> | T<sub>1</sub> | T<sub>2</sub> | T<sub>3</sub> |
| 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

|    | CP (%)            | 16.21       | 16.2562     | 16.26       | 16.995     |
|    | ME (Kkal/kg)      | 2352        | 2621.968    | 2835.436    | 3121.664   |
|    | CF (%)            | 8.017       | 9.096       | 10.46       | 11.3306    |
|    | Fat (%)           | 3.928       | 4.294       | 4.588       | 4.9195     |
|    | Ca (%)            | 0.4146      | 0.3837      | 0.3615      | 0.3370     |
|    | P (%)             | 0.7564      | 0.5716      | 0.498       | 0.3127     |

Price of ingredients (Rp/kg)

|    | MOLM             | 0           | 1,200       | 1,200       | 1,800       |
|    | Corn meal        | 1,560       | 1,000       | 1,000       | 888         |
|    | Rice bran        | 875         | 630         | 630         | 350         |
|    | Coconut meal     | 525         | 175         | 175         | 17.5        |
|    | Soybean meal     | 1,710       | 475         | 475         | 28.5        |
|    | Top Mix          | 160         | 160         | 160         | 160         |
|    | Molasses         | 350         | 350         | 350         | 350         |
|    | TOTAL            | 5,180       | 3,990       | 3,990       | 3,594       |

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

| Treatments | FI (g/head/day) | BWG (g/head/day) | FCR | IOFC (Rp/head) |
|------------|-----------------|------------------|-----|----------------|
| T<sub>0</sub>  | 104.96          | 18.87            | 5.57| 57,012.73<sup>b</sup> |
| T<sub>1</sub>  | 110.06          | 22.35            | 4.95| 73,197.77<sup>a</sup> |
| T<sub>2</sub>  | 109.34          | 21.60            | 5.08| 72,525.36<sup>a</sup> |
| T<sub>3</sub>  | 107.04          | 21.51            | 5.06| 74,435.32<sup>a</sup> |

Notes: a,b means with different superscript on the different column are significantly different (P<0.05).

The poorer average of BWG was found in the control animals (T<sub>0</sub>). Then, the suggestion of T<sub>0</sub> treatment for diet will be not good in quality compared to the MOLM diets usage (T<sub>1</sub> - T<sub>3</sub>). Normally, an increase in CP in diets should result in 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 (Table 1) for the experimental diets were increasing slightly along with the increase 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 (T1 - T3) than for those in the control diet (T0).

Actually, the vitamin A is important for the growth of rabbit, where it was reported that the MOLM contain a high vitamin A [16]. The control diet T0 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 increase in the daily FI from the treatment of T0 to T3. 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 increase might 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 (Table 2) 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 in accordance to the increase of the MOLM inclusion level from T0 (0% MOLM) to T3 (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.

References
[1] Odetola O M, Adetola O O, Ijadunola T I, Adedeji O Y and Adu O A 2012 Utilization of moringa (moringa oleifera) leaves meal as a replacement for soya bean meal in rabbit’s diets Schol. J. Agric. Sci. 2 12 pp 309-13
[2] Sarwatt S V, Milang’ha MS, Lukule F P and Madalla N 2004 Moringa oleifera and cotton seed cake as supplements for smallholder dairy cows fed napier grass Livest. Res. Rur.Dev. 16
[3] Aboidun A A and Olubisi E E 2017 Growth performance and organ indices of rabbit bucks fed Moringa oleifera leaf meal.World Appl. Sci. J. 35 (8) 1229-34
[4] Fuglie L J 2001 *The miracle tree: Moringa oleifera natural nutrition for the tropics* p 68 ed Fuglie L J (The Miracle Tree: The Multiple Attributes of Moringa) p 172

[5] Henuk Y L 2018 Many uses of moringa (*Moringa oleifera*) in human and animal nutrition *J. Agric. All. Sci.* 7 1 pp 42-6

[6] Safwat M A, Sarmiento-Franco L and Santos-Ricalde R H 2014 Rabbit production using local resources as feedstuffs in the tropics *Trop. Subtrop. Agroecosyst.* 17 pp 161-71

[7] Adeniji A A and Lawal M 2012 Effects of replacing groundnut cake with *Moringa oleifera* leaf meal in the diets of grower rabbits *Intern. J. Mol. Vet. Res.* 2 3 pp 8-13

[8] Alemede I C, Onyeji E A, Tsado D N and Shiawoya E L 2014 Reproductive response of rabbit does to diets containing varying levels of horseradish (*Moringa oleifera*) leaf meal *J. Biol. Agric. Healthcare.* 4 19 pp 62–8

[9] Bhatt R S and Sharma S R 2001 Nutrient utilization and growth performances of broiler rabbit fed oat plant meal and tall fescue hay *Asian-Austr. J. Anim. Sci.* 14 pp 1228-32

[10] Abubakar M, Ibrahim U, Yusuf A U, Muhammad A S and Adamu N 2015 Growth performance, carcass and organ characteristics of growing rabbits fed graded levels of *Moringa oleifera* leaf meal in diets *Bayero J. Pure Appl. Sci.* 8 2 pp 7–9

[11] National Research Council 1977 *Nutrient Requirement of Rabbits*. In: Nutrient Requirement for Domestic Animals 9th Edition (Washington, D.C., National Academy of Sciences)

[12] AOAC 1990 *Association of Official Analytical Chemists, Official Methods of Analysis* 15th Edition (Washington, D.C., Association of Official Analytical Chemists)

[13] Marhaeniyanto E, Rusmiwari S and Susanti S 2015 *Pemanfataan daun kelor untuk meningkatkan performa kelinci putih New Zealand [Use of Moringa leaves to improve the performance of New Zealand white rabbits]* (Malang: Faculty of Agriculture, Universitas Tribhuwana Tunggadewi)

[14] Steel R G D and Torrie J H 1995 *Principles and procedures of statistics* 2nd edition (London: McGraw-Hill International Book Company)

[15] Booth F E M and Wickens G E 1988 *Non-timber uses of selected arid zone trees and shrubs in Africa* (Rome, FAO Conservation Quide) pp 92-101

[16] Pond W G, Church D C and Pond K R 1995 *Basic animal nutrition and feeding* 4th edition (New York, USA: John Wiley and Sons Publication) pp. 495-504

[17] Farinu G O, Ojebiyi O O, Akinlade J A, Ajibola H O and Olaniyonu B I 2008 Evaluation of the nutritive potential of pigeon pea (*Cajanuscajan*) grain and leaf meals on growth performance of pre-pubertal rabbits *Bowen J. Agric.* 5 pp102-8

[18] Spreadburg D and Davidson J 1978 A study of fibre utilization by the growing New Zealand white rabbits *J. Sci. Food Agric.* 29 pp 640-8

[19] Forbes J M 1995 *Voluntary food intake and diet selection in farm animals* (Wallingford, UK, CAB International) pp 7-8