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Evaluation of Dry Matter, Organic Matter and Crude Protein Digestibility in New Zealand White Rabbits with Different Sludge Percentages

Derah Musci Warasi[1], Sri Minarti[2], Osfar Sjofjan[3]
[1] Student, Faculty of Animal Science, Universitas Brawijaya, Jl. Veteran Malang 65145 East Java, Indonesia
[2,3] Lecturer Faculty of Animal Science, Universitas Brawijaya, Jl. Veteran Malang 65145 East Java, Indonesia

ABSTRACT: This study aims to determine the effect of the addition of sludge with different percentages in the ration of New Zealand White rabbits on the digestibility of dry matter, organic matter and crude protein produced. sludge used comes from dairy cow feces which are then dried and ground before finally added to the ration. The research design used a group randomized design with five treatments and two groups. The groups used were rabbit body weight groups, namely small and large groups, while the treatments used included P0 (control), P1 (basal feed + 5% sludge), P2 (basal feed + 10% sludge), P3 (basal feed + 15% sludge) and P4 (basal feed + 20% sludge). This study was conducted for 7 weeks, of which the first week was the adaptation stage and the next 6 weeks was maintenance. Collection of feces to measure digestibility was carried out in the fifth week. The data obtained were analyzed using Analysis of Variance (ANOVA) followed by Duncan's Multiple Range Test (DMRT) if there were significant differences. The results showed a significant difference between treatments on dry matter digestibility, organic matter digestibility and crude protein digestibility. Based on the results obtained, it is concluded that the best percentage that can increase digestibility is P1 or the addition of sludge as much as 5% in the ration.

KEYWORDS: crude protein, dry matter, organic matter, sludge, digestibility.

INTRODUCTION

Rabbit farming has the potential to be developed as a meat producer by referring to the nutritional content in it. The common breed of broiler rabbit developed in Indonesia is the New Zealand White rabbit, although its growth is not as good as other rabbits such as Hyla and Hycole, this rabbit has a high adaptive capacity in tropical environments (Brahmantiyo, 2017). Rabbit meat has a lower fat, cholesterol and sodium content compared to other types of meat and a high protein content. Rabbit meat protein can serve as a source of bioactive peptide with angiotensin converting enzyme (ACE) inhibition (Zamaratskaia, 2023). Rabbit meat is known for its high protein content and low cholesterol. The expected level of rabbit productivity is supported by the availability of feed consumed with the appropriate quality and quantity. Despite its high nutritional content, the production of rabbit meat-based products is not very popular. Large companies prefer ungaged meat-based products that have similar nutritional content and much lower production costs (Honrado et al., 2013). The importance of alternative feeds with lower costs and can increase rabbit productivity so that the marketing price of rabbit products decreases (Ettaib & Bahar, 2021). Declining product prices will increase the population's demand to consume rabbit meat so as to increase farmer sales. To meet these needs, it is necessary to improve the quality and quantity of rabbit carcasses. Rabbit carcass quality is influenced by various factors including maintenance management, cage and environmental conditions, and the quality and quantity of feed provided. feed which has the highest operational cost in the livestock business requires farmers to look for alternative feed to meet the daily nutritional needs of rabbits.

The existence of waste cannot be prevented and is increasing every year, going hand in hand with the increase in population in Indonesia. Scattered waste comes from many sources, such as livestock waste, agricultural waste and household waste. Livestock waste is in the form of liquid and solid waste from livestock businesses such as feces, urine and feed residue. Accumulated feces result in air pollution, increased fly populations, decreased environmental quality, causing disease in livestock, farmers and the surrounding environment (Junus, 2015). The utilization of livestock waste that has accumulated can be used as organic fertilizer, biogas fuel to be used as animal feed while still paying attention to the amount of use and content in it. In addition to minimizing environmental pollution, the utilization of livestock waste can also be used as fish feed, animal feed, compost or biogas for household use.

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Livestock feces have varying contents depending on the type of livestock, the type of feed consumed, the physiological condition of the livestock, feces handling and environmental conditions including temperature and humidity. Cow feces contains N 26.2 kg/ton, P 4.5 kg/ton, K 13.0 kg/ton. Sujono (2014) said that the utilization of cow feces as animal feed has the potential to be done at a lower cost, high palatability and good quality. The better the quality of feed has a positive effect on rabbit productivity and reproduction. Absorption of feed nutrients is used for development and growth which can be known by calculating feed digestibility. In line with the statement of Waly et al., (2021) that better absorption of nutrients has a positive effect on the level of digestibility. There are two ways to calculate digestibility, namely directly and indirectly, with the level of digestibility influenced by the nutritional content of the feed, the level of administration and the amount of feed consumed. Generally, the higher the feed consumption, the higher the digestibility. The digestibility value is calculated to determine the level of absorption of animal feed nutrients and is an indication of the quality of the feed provided. Based on this, it is necessary to evaluate rabbit feed based on dairy cow feces sludge based on the digestibility value of dry matter, organic matter and crude protein.

MATERIALS AND METHODS

This study used 20 male New Zealand White rabbits (6-8 weeks old) with an average initial weight of 1000-1500g. The rabbits were divided into two groups, namely large and small groups based on the average initial body weight. Rabbits are kept in individual cages with a size of 60x50x50cm with the distance between the cage and the floor is 20cm. feed is given as much as 100g / head / day which is done twice a day at 07.00 am and 16.00 pm, while giving drinking water ad libitum. The initial stage of maintenance is the adaptation period for 7 days or 1 week which is then continued with maintenance for 6 weeks. The treatment given was the different percentage of sludge in the feed, namely P0: control, P1: 5% sludge, P2: 10% sludge, P3: 15% sludge and P4: 20% sludge. The nutritional requirements of rabbits can be observed in the following table.

Table 1. Rabbit nutrients requirements

Nutrients	Rabbit nutrients requirements			
	Basic life	Growth	Pregnancy	Lactation
Digestible Energy (kcal/kg)	2100	2500	2500	2500
TDN (%)	55	65	58	70
Crude fiber (%)	14	10-12	10-12	10-12
Crude protein (%)	12	16	15	17
Fat (%)	2	2	2	2
Ca (%)	-	0,45	0,40	0,75
P (%)	-	0,55	-	0,5

Source : NRC (1997)

Table 2. Feed ration of each treatment

Parameters (%)	Mean±sd				
	P0	P1	P2	P3	P4
Dry matter**	90,35±0,09^{b}	90,88±0,05^{bc}	91,41±0,44^{c}	87,41±0,17^{a}	91,11±0,12^{c}
Ash content**	11,65±0,13^{a}	11,73±0,12^{a}	11,94±0,12^{a}	12,23±0,11^{b}	13,07±0,26^{c}
Crude protein**	15,95±0,08^{b}	16,62±0,13^{c}	14,94±0,08^{a}	14,92±0,08^{a}	14,87±0,09^{a}
Crude fiber**	13,58±0,15^{a}	14,34±0,34^{b}	16,29±0,17^{c}	18,03±0,11^{d}	18,83±0,14^{e}
Crude fat**	4,25±0,16^{c}	3,33±0,13^{a}	3,24±0,08^{a}	3,52±0,08^{b}	3,03±0,10^{a}
ADF**	10,62±0,43^{a}	12,10±0,12^{b}	12,35±0,12^{b}	12,67±0,13^{bc}	12,86±0,09^{c}
NDF**	12,25±0,10^{a}	14,06±0,10^{b}	14,37±0,15^{c}	14,87±0,11^{d}	15,02±0,04^{d}

Note: a,b,c,ddifferent superscripts indicate significant differences *= (P<0.05), **= (P<0.01). tn= not significant

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Variables measured

The variables observed during the study include:

a. Dry matter digestibility (KCBK)

b. Digestibility of Organic Material (KCBO)

c. Crude Protein Digestibility (KCPK)

Calculation of digestibility is done with a total collection of feces during the last week or week 5 of maintenance. The feces were dried using an oven at 60-70°C until completely dry. The dried feces were analyzed proximate, especially on dry matter, organic matter and crude protein contained in it, which was then calculated using the formula, as follows (Libra et al., 2014):

$$\text{KCBK (\%)} : \frac{\text{DM consumption} - \text{DM Feces}}{\text{DM consumption}} \text{x } 100\%$$

$$\text{KCBO (\%)} : \frac{\text{OM consumption} - \text{OM Feces}}{\text{OM consumption}} \text{x } 100\%$$

$$\text{KCPK (\%)} : \frac{\text{CP consumption} - \text{CP Feces}}{\text{CP consumption}} \text{x } 100\%$$

Data Analysis

The data of this study were processed using Randomized Group Design followed by Duncan's Multiple Range test or UJBD if there were significant effects and differences. The following is the mathematical model of the Randomized Group Design :

$Yij = \mu + \beta j + \varepsilon ij$; I = 1,2,…, p ; j=1,2,.., r

Description:

Yij: Observation value in the i-th treatment of the j-th replication

μ : General mean value

βj : Effect of i-th treatment

Σij : Experimental error (error) on treatment

i : 1, 2, 3, 4, 5

j : 1, 2, 3, 4

RESULTS AND DISCUSSION

Overview of the Research Location

The research site used in maintenance is located in Ngijo Village, Karang Ploso Subdistrict, Malang District, East Java. Geographically, Ngijo village is located at 7°20'-7°31' South latitude and 109°08'-110°10' East longitude, with an altitude of 525 m above sea level. The average temperature in the area based on BPS Malang Regency (2021) ranges from 18-30°C. The ideal temperature in rabbit rearing is 18°C with humidity ranging from 60-80%, where in these conditions rabbit feed consumption can increase due to not much energy expended by rabbits to adapt to the environment (Prianto et al., 2017). In line with the statement of Puspani et al. (2015) that a temperature of 15-20 ° C is the ideal temperature for rabbit livestock.

Environmental conditions can also affect rabbits' response to feed consumption and drinking water consumption. High temperatures can cause rabbits to experience heat stress, resulting in a decrease in the amount of feed consumed (Kovitvadhi et al., 2019). The importance of maintaining the temperature and humidity around the cage supported by good maintenance management can increase feed consumption and rabbit productivity (Llambiri et al., 2018). Rabbit carcass production and quality are influenced by breed, breed, body size, environmental conditions, age, slaughter weight, treatment before and after slaughter.

Digestibility of Dry Matter, Organic Matter and Crude Protein

Table 3. Effect of Treatment on KcBK, KcBO and KcPK

Parameters (%)	Mean±sd				
	P0	P1	P2	P3	P4
Digestibility Dry Matter (KcBK)*	44,65±8,3^{a}	67,33±1,0^{b}	60,28±1,6^{ab}	48,89±0,6^{a}	46,97±2,0^{a}
Digestibility Organic Matter (KcBO)*	42,98±8,5^{a}	66,57±1,0^{b}	59,17±1,7^{ab}	47,05±0,6^{a}	44,57±2,1^{a}
Digestibility Crude Protein (KcPK)*	45,18±8,2^{a}	66,39±1,0^{b}	58,79±1,7^{ab}	47,67±1,3^{a}	47,50±2,0^{a}

Note: a,b,c,ddifferent superscripts indicate significant differences *= (P<0.05), **= (P<0.01). tn= not significant

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The content of the feed designed in this study is in accordance with the minimum and maximum guidelines listed in tables 1 and 2, so it has been able to meet the daily nutritional needs of rabbits. The importance of measuring the digestibility value is done to determine the amount of nutrients absorbed by the body of livestock in the planning channel. Tahuk and Bira (2022) state that digestibility is obtained by calculating the amount of feed consumed with digested feed, the calculation is calculated in percent. The effect of treatment P0: basal feed, P1: basal feed + 5% sludge, P2: basal feed + 10% sludge, P3: basal feed + 15% sludge and P4: basal feed + 20% sludge on the digestibility of dry matter, organic matter and crude protein can be seen in table 3. Based on the data listed in the table, there are significant differences between treatments on dry matter digestibility (KcBK), organic matter digestibility (KcBO) and crude protein digestibility (KcPK) ($P<0.05$). The data shown indicate that as the percentage of sludge added to the ration increases, it negatively affects the level of digestibility produced. The highest dry matter digestibility occurred in rabbits treated with 5% sludge (P1) while the lowest was in the control treatment or without the addition of sludge (P0). The higher the digestibility value in livestock shows that the absorption of nutrients contained in the feed is getting better too. Waly et al (2021) added that better absorption of nutrients has a positive effect on the level of digestibility. Digestibility is closely related to feed consumption, where livestock that have a higher consumption rate may hoard more protein as a form of growth response that is useful for carcass formation (Pratiwi et al., 2017).

Different rations affect the digestibility of organic matter produced. This is evidenced in the data listed in table 3. The highest digestibility of organic matter based on the data processed occurred in rabbits fed P1 which amounted to 66.57% and then successively in P2: 59,17%, P3 : 47,05%, P4 : 44, 57 and the lowest at P0: 42,98%. Increased digestibility of organic matter can be caused by the ability to absorb good nutrients in feed and low toxicity so as to increase productivity (Abdel-Wareth et al., 2019). Kitilit (2018) stated that the difference in the level of digestibility is influenced by the content of nutrients contained in the ration. There is a relationship between the two due to the inhibition of the digestive process by various chemical reactions that may occur. The low digestibility value means that fewer nutrients are absorbed in the livestock's body so that the nutrients in the feed only pass and are not fully utilized. High digestibility identifies that the nutrient content in the feed is getting better too.High digestibility identifies that the nutrient content in the feed is getting better too. the higher the digestibility of feed has a positive effect on carcass quality and rabbit productivity (Akpensuen et al., 2019). This means that the highest digestibility in this study can be used as a reference for selecting the nutrient content in the ration to be given to livestock.

The average decrease in crude protein digestibility between treatments ranged from 3-4%. The highest crude protein digestibility was found in P1 at 66.39% while the lowest was in P0 at 45.18%. The high digestibility of crude protein is in line with the protein content in the ration. Feed that has a high protein content can mean that the feed has better quality. In accordance with the statement of Purwin (2019) which states that the proximate content contained in the feed affects the digestibility value of rabbit feed. The better nutritional content will cause rabbits to have better digestibility. In contrast to the crude fiber content in the ration, the higher the crude fiber content causes a decrease in livestock digestibility. The decrease is influenced by the thicker cell walls in the forage and has a high resistance to the degradation of fiber-digesting microorganisms (Wijayanti et al., 2012). The need to pay attention to the quantity and type of fiber used in the ration can be the main point whether the fiber is easy or difficult to digest due to high lignin (Lebas, 2013).

CONCLUSION

The addition of sludge in the ration of New Zealand White rabbits with different percentages produces a significant effect between treatments on the digestibility of dry matter, organic matter and crude protein. The higher the digestibility value, the better the feed quality. The highest dry matter digestibility is found in P1, which is the addition of sludge by 5%. Based on these results, it can be concluded that the addition of 5% sludge in rabbit feed can increase the digestibility value of feed.

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