Evaluation of Leucaena Leaves (*Leucaena leucocephala* (Lam.) De Witt.) Supplementation in Feed on Digestibility in Lactation Period Ettawa Crossbred Goats

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Abstract. This study evaluated the effect of Leucaena leaves (*Leucaena leucocephala*) supplementation on the digestibility of Ettawa Crossbred goats. Twelve Ettawa Crossbred goats during the lactation period divided into six groups were allocated in a group randomized design with two treatments and six replicates (two goats per replicate). Treatments consisted of T1 in the form of 100% Leucaena leaves and T2 in the form of 50% Leucaena leaves and 50% concentrate. This study began with the preliminary stage, adaptation stage, data collection and analysis. Data from this study were tabulated using Microsoft Excel program, then analyzed using double T-test analysis with Randomized Group Design. The results showed that the Crude Fiber Digestibility value had a significantly different effect (P<0.05), Leucaena leaves high Crude Protein content can affect digestibility to be higher than T1 which is composed of 50% Leucaena leaves and 50% concentrate. ADF digestibility value showed no significant difference (P>0.05). NDF digestibility showed no significant difference (P>0.05). Hemicellulose digestibility showed no significant difference (P>0.05). The digestibility of organic matter showed no significant difference (P>0.05). Dry matter digestibility showed significantly different effects (P<0.05). The digestibility value of crude protein showed a significantly different effect (P<0.05). The results of the study can be concluded that Leucaena leaves supplementation can increase the feed digestibility value.

1. INTRODUCTION

The Ettawa Crossbred goat is one of the most popular goat breeds among farmers in Indonesia and is widely farmed for its milk and meat [1]. Ettawa Crossbred goats were originally the result of a cross between local and Ettawa goats from India [2]. The advantages of this goat have adapted well to the conditions and habitat of Indonesia so that many farmers choose this type of goat for cultivation. Dairy goat business in Indonesia is currently starting

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to increase. Farmers began to realize that dairy goats have high potential to be developed. In 2020 goat milk production in Indonesia reached 373,403 litres, in 2021 it increased by 7.97% to 403,174 liters [3]. This shows that PE dairy goats contribute to milk production to increase people's animal protein needs so that efforts need to be made to further increase milk production by improving the quality of feed nutrition for PE goats.

Feed is one of the factors that affect livestock productivity, where livestock productivity is a measure of success in the livestock business. Feed availability must be considered both in terms of quality, quantity, and continuity. Inadequate availability of forage both in quality and quantity is one of the obstacles in the development of livestock business. Forage in Indonesia consists of two types, namely grasses and legumes. One type of legume that is widespread in Indonesia is Leucaena leaves (Leucaena leucochepala). Leucaena has the potential to be used as animal feed because it has nutritional content that is quite supportive for feed. The content of Leucaena includes crude protein 31.1%, crude fat 5.6%, dry matter 94.8%, crude fiber 13.2%, ash 4.5% [4] The high protein content in Leucaena can be used as a supplement to improve feed quality in the hope of obtaining a balanced nutritional value and increasing production from the Ettawa Crossbred goat.

The quality of feed can be seen from the digestibility value of the feed, if the digestibility is low then the value of the benefits is also low, otherwise if the digestibility is high then the value of the benefits is also high [5]. Based on the description above, it is necessary to conduct research to find out how the digestibility of Ettawa Crossbred goats during lactation is given Leucaena leaves supplementation in feed.

2. Material and Method

2.1 Time and Location of Research

This research was conducted from September 2022 to March 2023. The in-vivo feeding experiment was conducted in the communal cage of Karya Mulya Farmer Group located in Sidomulyo Hamlet, Bangelan Village, Kromengan District, Malang Regency. Analysis of nutrient content in feedstuffs, feed residues and feces were conducted at the Animal Nutrition and Diet Laboratory, Faculty of Animal Husbandry, Brawijaya University.

2.2 Research Material

The livestock used in this study were female Ettawa Crossbred goats of lactation period originating from the Karya Mulya Farmer Group in Sidomulyo Hamlet, Bangelan Village, Kromengan District, Malang Regency with a total of twelve heads divided into six groups. Meanwhile, the feed ingredients used in this study were Leucaena leaves, and concentrates.

2.3 Research Method

The research method used in this study is an in-vivo feeding experiment using a randomized group design and T-test consisting of two treatments and six replicates. The treatment feed tested was Leucaena leaves supplementation. The treatments used in this study were as follows.

T1 = Leucaena leaves 100%
T2 = Leucaena leaves 50% + Concentrate 50%
2.4 Research Parameters

Variables observed are digestibility including dry matter digestibility, organic matter digestibility, crude protein digestibility, crude fiber digestibility, Acid Detergent Fiber digestibility, Neutral Detergent Fiber digestibility and hemicellulose digestibility.

2.5 Data Analysis

The data from this study were tabulated using the Microsoft Excel program, then analyzed using double T-test analysis with a randomized group design.

3. RESULT AND DISCUSSION

The results of the digestibility analysis on Ettawa Crossbred goats of lactation period given Leucaena leaves supplementation in feed are presented in Table 1.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Digestibility</th>
<th>DMD</th>
<th>OMD</th>
<th>CPD</th>
<th>CFD</th>
<th>NDFD</th>
<th>ADFD</th>
<th>Hemiselulose Digestibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>62.57±5.87</td>
<td>63.93±5.57</td>
<td>70.61±4.07</td>
<td>52.24±7.73</td>
<td>43.18±9.368</td>
<td>24.83±6.29</td>
<td>81.29±4.83</td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>58.43±0.06</td>
<td>61.74±4.79</td>
<td>64.37±3.52</td>
<td>44.21±5.42</td>
<td>51.48±7.293</td>
<td>37.82±10.19</td>
<td>78.80±5.35</td>
<td></td>
</tr>
</tbody>
</table>

3.1 Dry Matter Digestibility

Dry matter digestibility in ruminants shows the high amount of food substances that have been digested by digestive enzymes and microbes in the rumen [6]. Digestibility that has a high value reflects the amount of contribution of certain nutrients to livestock, while feed that has low digestibility indicates that the feed is less able to supply nutrients for basic life and for livestock production purposes [7].

The average results of the calculation of dry matter digestibility in each treatment can be seen in Table 1. Digestibility is the physical and chemical changes that occur in feed ingredients in the digestive tract. Feed breakdown in the digestive tract is caused by microbes in the rumen so that its chemical properties change fermentatively into other compounds that are different from its nutrient origin and its physical properties change into smaller particles [7].

Based on the results of the study, it shows that the treatment gives a significant difference (P <0.05) on the value of dry matter digestibility, meaning that the provision of Leucaena in Ettawa Crossbred dairy goats affects the value of dry matter digestibility. The digestibility value of dry matter in this study was lower than the digestibility of organic matter. This is because organic matter has no ash content, while dry matter still contains ash [8]. T1 treatment showed a value of 62.57 ± 5.87. This value has a higher value compared to the digestibility value in the T2 treatment of 58.43 ± 0.06. This can be suspected because in this study using different feed and ratios in the T1 and T2 treatments so that it can affect the value of dry matter digestibility, this is supported by the opinion of [9] which states that different DMD values in each forage feed can be influenced by the type of forage feed and different nutrient content.

3.2 Organic Matter Digestibility

The digestibility of organic matter is closely related to the digestibility of dry matter, because some dry matter is organic matter consisting of crude protein, crude fat, crude fiber and
Nitrogen Free Extract (NFE). Digestibility of organic matter shows the amount of nutrients, fat, carbohydrates, and protein that can be digested by livestock [10].

Based on the results showed that the treatment gave a significant difference (P < 0.05) to the digestibility of organic matter, meaning that the provision of Leucaena as feed or as additional feed to Ettawa Crossbred dairy goats in the lactation period gave effect to the digestibility of organic matter. The digestibility value of organic matter tends to be higher than the digestibility value of dry matter. The digestibility value of organic matter is higher than the digestibility value of dry matter, this is because the dry matter still contains ash, while the organic matter does not contain ash, so the material without ash content is relatively easier to digest. Ash content slows or inhibits the digestibility of dry matter. Increased digestibility of organic matter is due to increased digestibility of dry matter [8]. Based on table 1. The average value of treatment T1 is higher than that of treatment T2. This is thought to be due to the use of different feed ratios. [7] states that feed digestibility is influenced by the chemical composition of feed, and the fibrous feed fraction has a major effect on digestibility.

### 3.3 Crude Protein Digestibility

The results of the study on crude protein digestibility of PE goats were significantly different (P <0.05), which means that the provision of Leucaena in PE dairy goats gives an effect on crude protein digestibility. Statistical results can be seen in Table 5. The highest average crude protein digestibility in the T1 treatment was 70.61 ± 4.07 and in the T2 treatment the crude protein digestibility value was 64.37 ± 3.52. It is suspected that the T1 treatment consisting of 100% Leucaena which makes it a high protein source feed makes digestibility higher.

According to [11] The high digestibility of protein can be influenced by differences in nutrient content (protein or organic matter), protein type (protein structure and solubility), nutrient interactions, especially carbohydrates in some feed in the rumen. Protein has two types of characteristics, namely soluble and insoluble proteins. Leucaena is one of the sources of insoluble protein so that it has a great opportunity to enter the post- rumen gastrointestinal tract, causing the protein to be enzymatically digested and absorbed efficiently [12]. The high protein digestibility in Leucaena can also be influenced by the lower crude fiber content compared to the crude fiber content in the 50% Leucaena and 50% concentrate feed.

### 3.4 Crude Fiber Digestibility

Based on the results of the study, it shows that the treatment gives a significantly different effect (P < 0.05), which means that the provision of Leucaena in PE dairy goats affects the value of crude fiber digestibility. The data in Table 1 shows that the highest value of crude fiber digestibility is in the T1 treatment of 52.24 ± 7.730 and T2 of 44.21 ± 5.42.

According to [13] the digested protein in the ration will pass through the Krebs cycle and will increase the supply of digestible energy in the feed, so that it will increase the growth of fiber-digesting bacteria. In addition, Leucaena leaves, which are one of the forage sources of protein, can also help increase the digestibility of crude fiber in feed rations. The increase in crude fiber digestibility will always go hand in hand with the increase in protein content in the ration. In accordance with the statement [13], which states that the value of crude fiber digestibility is basically obtained from the fiber content that can be digested by ruminants with a value of 50-90%. While for the CFD value in T2 with a feed composition consisting of 50% Leucaena + 50% concentrate has a lower value than T1, it is influenced by the addition of concentrates to the feed so that the protein content in the feed becomes lower and can affect the digestibility of CF in the feed.
3.5 Neutral Detergent Fiber Digestibility

Digestibility of acids detergent fiber (ADF) is an accumulation of digestibility values that contain cellulose, hemicellulose, and lignin [14]. Based on the results of the ADF digestibility study in T2 with a ration composition of 50% Leucaena leaves + 50% Concentrate with a digestibility value of 37.82 ± 10.192% higher than the T1 treatment of 24.83 ± 6.297% which has a feed composition of 100% Leucaena.

This higher ADF value is thought to be due to the different feed composition in the P2 treatment, which contains Leucaena and also concentrate, which is one of the feed ingredients that can improve ration quality. Melati et al., (2016) [15] stated that ADF is highly correlated with the quality of feed rations. ADF digestibility can increase if the quality of the feed provided is of good quality. On the other hand, if the quality of feed given to livestock is of poor quality, it will reduce ADF digestibility in livestock. The Leucaena stems given in treatment P1 have a smaller amount due to the reduction in the proportion of Leucaena given. This can also reduce lignin levels in animal feed so that it can increase ADF digestibility. This also agrees with the statement of Hambakodu et al., (2020) [14] which says ADF digestibility in the rumen will be increasingly disturbed if high lignin levels are often found in feed, especially the stems.

3.6 Acid Detergent Fiber Digestibility

Neutral detergent fiber (NDF) digestibility is a description of NDF fiber nutrients that are digested by microbes in the rumen [16]. The digestibility value of NDF in this study showed that there was no effect (P > 0.05) on the digestibility value of NDF. The digestibility value in the T1 treatment was 43.18 ± 9.368 and T2 was 51.48 ± 7.293.

NDF digestibility is influenced by the lignin and cellulose content of the forage. The level of digestibility in feed can be used to measure indicators of feed quality. High cellulose content and low lignin will increase digestibility in the rumen [17]. High lignin content of feed will reduce feed digestibility in the rumen. Low crude fiber content leads to higher digestibility values [18].

3.7 Hemicellulose Digestibility

Hemicellulose digestibility is the digestibility value of reducing the percentage of NDF digestibility with ADF digestibility. Analysis of variance showed that the treatment of Leucaena leaves was not significantly different (P > 0.05). Table 1 shows that feed from treatment T1 with a hemicellulose digestibility value of 81.29 ± 4.836% has a higher value than the digestibility of T2 feed which has a value of 78.80 ± 5.359%.

Different hemicellulose digestibility is influenced by different NDF and ADF levels [14]. NDF and ADF levels in Leucaena feed are higher than those in 50% Leucaena and 50% concentrate feed, so the hemicellulose digestibility is also higher. Another factor is also influenced by the lignin content of the feed which is quite low, thus supporting digestibility in the rumen effectively. Lignin in plant cell walls binds cellulose and hemicellulose. High lignin levels will cause low digestibility, while low lignin levels cause high digestibility. The presence of lignin and anti-nutritional compounds in feed will be an obstacle for rumen microbes to digest feed [19]. Lignin in plant cell walls is a limiting factor for the digestibility process of ruminants because if the concentration of lignin is high, it will protect plant cell wall material from rumen microbial degradation [20]. Lignin present in feed causes low degradation or fermentation value of feed in the rumen, because crude fiber in the form of cellulose and hemicellulose binds to lignin and will be difficult to break down by digestive enzymes [21].
4. CONCLUSION

Based on the results of the study, it can be concluded that Leucaena is one of the forage legumes that has the potential to be used as animal feed. However, it would be nice if the use of Leucaena which has advantages in protein content as feed is added with concentrates to balance the nutrients in animal feed.

REFERENCES

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