In vitro digestibility and rumen pH of diet comprised by different level of Indigofera zollingeriana and Pennisetum purpureum

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Abstract. The objective of this research was to evaluate the effects of different levels of Indigofera zollingeriana and Pennisetum purpureum cv. Mott on the in vitro digestibility and rumen pH. The treatments were T1=60% Pennisetum purpureum cv. Mott, T2 = 45% Pennisetum purpureum cv. Mott + 15% Indigofera zollingeriana, T3 = 30% Pennisetum purpureum cv. Mott + 30% Indigofera zollingeriana, T4 = 15% Pennisetum purpureum cv. Mott + 45% Indigofera zollingeriana, and T5 = 60% Indigofera zollingeriana. All the treatments supplied with rice bran 40%. The result showed that there are no significant difference on ruminal pH (P>0.05). The ruminal pH were in normal range that were 6.66-6.73. The increasing level of Indigofera zollingeriana to Pennisetum purpureum cv. Mott had no significant effect to dry matter and organic matter digestibility. The dry matter digestibility were around 60.56%-70.46% while the organic matter digestibility were around 60.01%-65.99%. This research indicated that the increasing level of Indigofera could decrease the digestibility. The treatment T4 (15% P. purpureum + 45% Indigofera zollingeriana) showed the highest digestibility values.

1 Introduction

The ruminants have significant role as protein food source. The feed are known to as one of determinants of the ruminant productivity. Most of farmers in Indonesia gave tropical or natural grasses that were not sufficient to meet the nutritional requirement for high producing performa. Tropical or natural grasses contain low crude protein (average 3.5%-7.8%) and high fraction fiber [1]. The ruminant feed comprised from forage and concentrate where have the problem in its preparation. The fluctuation of rainy and dry season, and land use change are the problem in forage shortage. The availability of concentrate feed are less stable caused the price is quite high. So that the effort need to be done in exploring the plant as source of forage feed.

The tree leguminous have a potential source as fodder, but have not get enough attention such as Indigofera zollingeriana. Indigofera zollingeriana can grow well and adaptable in low fertility land, responsive to fertilizer, and are easy maintainance [2]. Indigofera

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Indigofera zollingeriana has a great potency as good quality forage and can be a solution to overcome the problem of forage shortage [3]. Indigofera zollingeriana can be harvested on eight month age with the mean wet biomass production are about 2,595 kg/tree, with total production are about 52 ton/ha.

Indigofera zollingeriana has good nutrient quality for ruminant with crude protein around 17,00% and crude fiber 17,52% [4]. The leaf flour of Indigofera zollingeriana contained crude protein 27,89%, Ether extract (EE) 3,70% and crude fiber as much as 14,96% [5]. Nutrient content of Indigofera zollingeriana was almost the same with soyabean cake flour [6]. This good nutrient content made Indigofera zollingeriana as “green concentrate”.

Beside contained good nutrient quality, Abdullah and Suharlina [7] reported that Indigofera zollingeriana contained tannin 0,08±0,01%, saponin 0,41±0,02%, calcium 1,16±0,02% and phosphor 0,26±0,01%. Supplementation of rich tannin leguminous had a positive and negative effect, depend on its chemical structure, the concentration in the ration, and the species of livestock. The negative effect of tannin in feed can decreased the fiber digestibility and nitrogen nor production performance [8]. On the optimum concentration in the feed, tannin could increase protein digestibility and controlled parasites in gastrointestinal tract so that increased the production performance [9].

This research was conducted to evaluate the effects of different levels of Indigofera zollingeriana and Pennisetum purpureum cv. Mott on the in vitro digestibility and rumen pH.

2 Methods

2.1 Sampel preparation

This research was done in Dairy Nutrition Laboratorium Departement of Feed Technology and Nutrition Faculty of Animal Science Bogor University. The samples of Indigofera zollingeriana and Pennisetum purpureum cv. Mott were obtained from Commercial Zone of Animal Laboratory Departement Of Animal Science Faculty Of Agriculture University Bengkulu. Sample preparation was carried out directly in the field site by solar drying. The next step was to mill the material using 0.5 mm sieve grinder to obtain uniform size and surface area.

2.2 Researchal design and variables

The ruminal pH was measured using pH-meter. In vitro digestibility was evaluated according to Tilley & Terry method [10]. A completely randomized design was used to allocate five dietary treatments and four replicates in duplo so there were 40 experimental units. All the treatment were supplied with fine ricebrand as much as 40% respectively. All the treatment were : T1 : 60% Pennisetum purpureum cv. Mott, T2 : 45% Pennisetum purpureum cv. Mott + 15% Indigofera zollingeriana, T3 : 30% Pennisetum purpureum cv. Mott + 30% Indigofera zollingeriana, T4 : 15% Pennisetum purpureum cv. Mott + 45% Indigofera zollingeriana, and T5 : 60% Indigofera zollingeriana. Data were subjected to one-way analyses of variance [11] The composition of the treatment was in Table 1 and Table 2.
Table 1. Nutrient content of *Indigofera zolligeriana*, *Pennisetum purpureum* and ricebran.

<table>
<thead>
<tr>
<th>Materials (%)</th>
<th>Dry Matter (DM) (%)</th>
<th>Crude Protein (CP) (%)</th>
<th>Crude Fiber (CF) (%)</th>
<th>Ether Extract (EE) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Indigofera zolligeriana</em> [5]</td>
<td>90,88</td>
<td>27,00</td>
<td>17,52</td>
<td>1,36</td>
</tr>
<tr>
<td><em>Pennisetum purpureum</em> cv. Mott [12]</td>
<td>90,79</td>
<td>16,41</td>
<td>28,54</td>
<td>-</td>
</tr>
<tr>
<td><em>Ricebran</em> [13]</td>
<td>85,43</td>
<td>8,50</td>
<td>17,00</td>
<td>4,20</td>
</tr>
</tbody>
</table>

Table 2. Composition of treatment diet.

<table>
<thead>
<tr>
<th>Materials (%)</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
</tr>
<tr>
<td><em>Indigofera zolligeriana</em></td>
<td>-</td>
</tr>
<tr>
<td><em>Pennisetum purpureum</em> cv. Mott</td>
<td>60</td>
</tr>
<tr>
<td><em>Ricebran</em></td>
<td>40</td>
</tr>
<tr>
<td>Nutrient Composition*</td>
<td>100</td>
</tr>
<tr>
<td>Dry Matter (%)</td>
<td>44,32</td>
</tr>
<tr>
<td>Crude Protein (%)</td>
<td>14,94</td>
</tr>
<tr>
<td>Crude Fiber (%)</td>
<td>26,99</td>
</tr>
</tbody>
</table>

* Calculated from Table 1 and Table 2.

3 Result and discussion

3.1 Ruminal pH

The ruminal pH of each treatment were showed on Table 3.

Table 3. The effects of experimental treatments on ruminal pH, dry matter digestibility (DMD) and organic matter digestibility (OMD).

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pH</td>
</tr>
<tr>
<td>T1</td>
<td>6,68 ± 0,03</td>
</tr>
<tr>
<td>T2</td>
<td>6,71 ± 0,06</td>
</tr>
<tr>
<td>T3</td>
<td>6,73 ± 0,04</td>
</tr>
<tr>
<td>T4</td>
<td>6,66 ± 0,03</td>
</tr>
<tr>
<td>T5</td>
<td>6,68 ± 0,04</td>
</tr>
<tr>
<td>Probability</td>
<td>0,50</td>
</tr>
</tbody>
</table>

Notes: T1 = 60% *P. purpureum*, T2 = 45% *P. purpureum* + 15% *Indigofera zollingeriana*, T3 = 30% *P. purpureum* + 30% *Indigofera zollingeriana*, T4 = 15% *P. purpureum* + 45% *Indigofera zollingeriana*, T5 = 60% *Indigofera zollingeriana*. All the treatments supplied with ricebran as much as 40%. The treatments has no significant effect (P<0,05).
There is no a significant difference among treatments regarding ruminal pH (P>0.05). The increasing level of Indigofera zollingeriana to Pennisetum purpureum cv. Mott had no significant effect to ruminal pH in vitro (P>0.05). The ruminal pH in this research were in normal range 6.66-6.73. Ruminal pH is the first indicator of rumen functioning in relation to health disorders and to assist in decision-making for farm management [14]. Jonsson et al. [15] reported that pH rumen >5.8 were normal. Kamra [16] said that the condition for normal microbial rumen fermentation when rumen pH were 6-6.9.

3.2 Dry matter and organic digestibility

The digestibility of diet (dry matter and organic matter digestibility) are the primary determinant of the quality of feed. Dry matter (DMD) and organic matter digestibility (OMD) regarding to the level of Indigofera zollingeriana to Pennisetum purpureum cv. Mott presented on Table 3.

The increasing level of Indigofera zolligeriana to Pennisetum purpureum cv. Mott has no significant effect to in vitro dry matter and organic matter digestibility (P>0.05). The dry matter digestibility were around 60.56%-70.46% and organic matter were 60.01%-65.99%. According to Suparwi et al. [17] diet were classified good when their digestibility were minimally 60%. The digestibility were important to support the growth of rumen microbes and ruminant performs.

The dry matter digestibility in this research was slightly lower than Suharlina et al. [18] who reported that the dry matter digestibility of Indigofera zollingeriana were 68.21-73.15% and the organic matter digestibility were 65.33-70.64%. This condition was possibly because the quality of Indigofera zollingeriana used were different so that may affect its digestibility. Nutrient digestibility is determined by the composition of the fiber in the diet. The concentration of fiber were associated with several factors such as the interval of defoliation [19], soil fertility [20] and climate [21]. The dry matter and organic matter digestibility in this research were in normal range.

The result of this research indicated that the using of Indigofera could decrease the dry matter digestibility. The treatment T4 (15% P. purpureum + 45% Indigofera zollingeriana) showed the highest digestibility values. On the higher level of Indigofera zollingeriana that were on T5 (60% Indigofera), the digestibility values were decreased. The same pattern also happened on the organic matter digestibility. T4 treatment showed the highest organic matter digestibility and then decreased on T5 treatment. It seems that the concentration of secondary metabolite(tannin and saponins) in Indigofera increased on the higher level of Indigofera, and gave the negative effect to digestibility. Jayanegara et al. [22] said that the secondary compound in Indigofera (saponins and tannins) influenced the digestibility of nutrients by protecting the nutrient from rumen microbial degradation and fermentation. Suharlina et al. [23] reported that Indigofera zollingeriana contained secondary compound such as tannins and saponins which may affect the process of fermentation in the rumen. This substances at high concentration may negatively influence digestion processes in ruminants by acting as antinutritional factor.

4 Conclusion

It could be concluded that the Indigofera zollingeriana at 45% in ration showed the highest digestibility with the normal pH.
References