Chemical Analysis and Palatability Test of Biscuit Fermented Sago Waste Enriched with Kelor Leaf (*Moringa oleifera*)

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**ABSTRACT**

Sago waste (SW) are produced from sago flour industries. The objective of this study was to investigate the effect of biscuit made from fermented sago waste enriched with kelor leaf on palatability of Dombos sheep. Biscuit was used as a supplementary feed. The study conducted from June to September 2017. Fermented sago biscuit was processed at Animal Production Laboratory of Sumatera Utara University. Palatability test was conducted at Mr. Sunardi Binjai's farm. Chemical analysis was analyzed at University of Diponegoro Nutrition Laboratory. The research design was complete randomized design (CRD) with 4 treatments and 3 replications, i.e P0 (Biscuit without fermented SW + Kelor leaf), P1 (Biscuit with 10% fermented SW + Kelor leaf), P2 (Biscuit with 20% fermented SW + Kelor leaf), P3 (Biscuit with 30% fermented SW + Kelor leaf). The study used 12 heads of Dombos sheep with the age about 6 months. Parameters were chemical analysis and palatability of biscuits consisted of fermented SW enriched with Kelor leaf. The results showed that biscuits with 30% fermented SW + Kelor leaf (P3) was the best biscuit, because the biscuit has the highest palatability which was 306.7g/head/hour when compared with other treatments.

**Key Words:** Biscuit, Fermented, Sago Pulp, Moringa Leaf

**INTRODUCTION**

The population of sheep on the island of Sumatra is relatively low, reaching only 509,178 heads, or about 6.39 percent of the total population of sheep in Indonesia (Ditjenmak 1997). Characteristics of Sumatera sheep indicated a smaller body size compared to Java sheep. In order to improve local sheep body size, livestock farmers in North Sumatera Province bought Dombos sheep from Wonesobo.

Feed is a very influential factor on productivity and is the largest production cost in the livestock business both fattening and breeding livestock. Problems facing in the livestock business are the quality and quantity of feeds, that have not been fulfilled the requirement of livestock nutrition caused by the high price of good quality feed. Forage availability is depend on the season. In most parts of Indonesia, during the rainy season, forage is easy to find, while in dry season forage is very difficult to find and low in quality.

The requirement of ruminants for feed is visible by its need for nutrition. The amount of daily nutrient required depends on the type of livestock, weight, age, physiological status (growth, adult, pregnancy, lactating), body condition (normal, sick) and the environment (temperature, humidity, relative air). Feed offered not just in the intention to overcome hunger or as a filler of the stomach only but must really useful for the necessities of life, forming new cells, replacing the damaged cells and for production.

Utilization of local resources optimally is one of the strategic steps in efforts to achieve the efficiency of livestock production business. Criteria that need attention in
relation to efficiency are the quantity and availability of feed ingredients. Agricultural industry produces biomass in the form of waste have high economic efficiency due to the availability of materials throughout the year. Sago waste (SW) is the by-product obtained from sago flour processing, where the amount is very abundant and until now has not been utilized. Aziz (2002) mentioned that nutrients content in SW were 3.36% crude fibre (CF), 67.4% neutral detergent fibre (NDF), 42.11% acid detergent fibre (ADF) and 3,738 kcal/kg gross energy (GE) and these nutrients content of SW was relatively comparable to grass.

Giting & Pase (2018) mentioned that due to the low nutrition content of SW, utilization of SW as animal feed needs to be processed before used. Fermentation is an alternative to biological processes that can increase nutrient content of feed ingredients. Giting & Pase (2018) found that by using *Ginta*, a bioactivator consisted of local microorganism, the CP of SW could be increased more than 2%. *Ginta* can produced by local livestock farmers. In addition, Mirwandono et al. (2018) found that local microorganisms could be used to ferment agricultural waste, which resulting an increasing in the CP content more than 2%.

Kelor is a tree that is commonly found in Indonesia as a hedge plant and has very wide benefits. According to Anwar et al. (2007) the taproot is white, enlarged like a radish. Propagation can be done either by generative (seed) or vegetative (stem cuttings) methods. Kelor usually are planted as boundaries or fences in the yard or lading in villages. Leaf and roots of kelor can be used as vegetables and as a traditional medicine. The leaf can be used as feed ingredients of sheep, goats, cattle, pigs, rabbits and are suitable for cultivated fish feed. Bark, leaf and roots have a very sharp and stinging smell, can also be used to stimulate or improve digestion. Various studies stated that the leaf of kelor contains vitamins A, B, calcium, iron and protein.

Kelor is easily to grow and can reach 7-11 meters of height. It can be cultivated in both tropics and subtropics in all soil types and is resistant to drought with a tolerance to drought for up to 6 months (Mendieta-Araica et al. 2013). Kelor has high biomass production, thus it can be used as alternative feed to solve the obstacles of feed availability throughout the year. Giting et al. (2018) mentioned Kelor as a multi purposes plant which helps to fertilize soil and conservation, because the germination process is about 85%, with also easy to propagate by stacking, useful for human consumption because it used to cook with traditional recipe and is palatable for livestock. Kelor has a complete amino acid content, with contains 18 amino acids consisting of 8 essential amino acids and 10 nonessential amino acids (Makkar & Becker 1996). The use of kelor flour as a source of protein has been widely applied. Kelor leaf flour can replace kapok seed meal as a feed supplement up to 20% for growin sheep (Murro et al. 2003).

The fermentation process is done by adding a local starter, *Ginta* microorganisms that correspond to the substrate and the purpose of the fermentation process. The utilization of local microorganisms *Ginta* as a starter in the fermentation process is most suitable and in accordance with the purpose of fermentation to reduce the levels of crude fiber and at the same time can increase the levels of crude protein. Many studies of fermentation process have been done using local microorganism *Ginta*, primarily in efforts to decrease the fiber content of feed material and increase protein levels (Giting & Pase 2018).

The study objective was to investigate the effect of fermented biscuit SW enriched with kelor leaf on palatability of Dombok sheep. Dombok sheep has a quick growing process, thus need a good feed. From this research, it was expected to get the preferred biscuit for Dombok from material available in field.
MATERIAL AND METHOD

Fermented sago biscuit was processed at Animal Production Laboratory, University of North Sumatera, Palatability test was conducted at Mr. Sunardi Binjai's farm. Chemical analysis was conducted at The University of Diponegoro Nutrition Laboratory. The study conducted for 3 months from June to September 2017. Materials consisted of fermented sago pulp, rice bran, palm kernel cake, corn, moringa leaf, molasses, urea, minerals and Ginta (consisting of water, honey, yeast, dadih), 12 Dombos sheep with age of about 6 months.

Research methodology

The research design was complete randomized design (CRD) with 4 treatments and 3 replications. The treatment was as follows: P0: Biscuits without fermented SW, P1: Biscuits with 10% of fermented SW, P2: Biscuits with 20% of fermented SW, P3: Biscuits with 30% of fermented SW

Parameters measured were dry matter, crude protein and fat content as well as total digestible nutrients (TDN) of biscuits. In addition, palatability test of four types of biscuits was conducted by determine feed consumption level at 12 head of sheep. The palatability test was performed by giving biscuits from each treatment on three different group of sheep for one hour observation at 14.00-15.00 WIB. The palatability value of SW biscuits was obtained from the amount of biscuits (g) was consumed by sheep. Each biscuit weight was about 120 g.

RESULTS AND DISCUSSION

Characteristics of biscuits

Color and aroma are the characteristics of the feed and can be considered in the selection of feed. The color of feed biscuit produced varies between dark chocolate, chocolate and yellowish brown. The difference were due to differences in the use of palm kernel cake ingredients and fermented sago waste. The difference color of the feed biscuits was based on the sight and judgment of man, the sheep can not distinguish the color because the sheep are color blind Pond et al. (1995). The color of the yellowish brown P3 feed biscuit is compared with other treatments, while the feed biscuits on P0, P1, and P2 have more brown color. Different colour from each feed biscuit treatment is showed in Figure 1 and characteristics of each biscuit is showed in Table 1. The nutrient content of feed biscuits from 4 groups of treatment is presented in Table 2.

Table 1. Characteristics of fermented SW Biscuits

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Colour</th>
<th>Aroma</th>
<th>Density</th>
<th>Texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0</td>
<td>Dark Chocolate</td>
<td>Fragrant</td>
<td>Compact</td>
<td>Rough</td>
</tr>
<tr>
<td>P1</td>
<td>Chocolate</td>
<td>Fragrant</td>
<td>Compact</td>
<td>Rough</td>
</tr>
<tr>
<td>P2</td>
<td>Chocolate</td>
<td>Fragrant</td>
<td>Crumb</td>
<td>Rough</td>
</tr>
<tr>
<td>P3</td>
<td>Yellowish-Brown</td>
<td>Fragrant</td>
<td>Crumb</td>
<td>Rough</td>
</tr>
</tbody>
</table>

P0: Biscuits with no content of fermented SW; P1: Biscuits contained 10% fermented SW; P2: Biscuits with 20% content of fermented SW; P3: Biscuits with 30% content of fermented SW
Figure 1. Colour of fermented SW biscuit

Table 2. Composition of Nutrient of fermented SW Biscuits (%)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>WC</th>
<th>Ash</th>
<th>Crude fat</th>
<th>Crude fibre</th>
<th>Crude protein</th>
<th>TDN</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0</td>
<td>6.19</td>
<td>6.53</td>
<td>3.74</td>
<td>23.94</td>
<td>10.43</td>
<td>54.83</td>
</tr>
<tr>
<td>P1</td>
<td>6.74</td>
<td>6.74</td>
<td>5.21</td>
<td>35.98</td>
<td>11.52</td>
<td>68.16</td>
</tr>
<tr>
<td>P2</td>
<td>7.46</td>
<td>7.46</td>
<td>6.34</td>
<td>28.67</td>
<td>13.19</td>
<td>66.39</td>
</tr>
<tr>
<td>P3</td>
<td>8.29</td>
<td>8.29</td>
<td>6.90</td>
<td>23.30</td>
<td>14.27</td>
<td>61.71</td>
</tr>
</tbody>
</table>

The highest crude protein content of the sago biscuit (14.27%) was found in biscuit P3 and the lowest (10.43%) was found in P0, while the highest crude fiber content (35.98%) was found in P1 and the lowest (23.3%) was found in biscuit P3. It was due to the influence of protein and fiber composition contained in the raw material used to make biscuits of fermented SW.

Quality of biscuit nutrition

The result of variance analysis showed that biscuits of fermented SW enriched with kelor leaf with various concentrations significantly affected the dry matter content of biscuit (P<0.05). Composition of nutrient biscuit of fermented SW was showed in Table 3.
**Tabel 3.** Nutrient Composition of Biscuit Fermented SW (%)  

<table>
<thead>
<tr>
<th>Treatment</th>
<th>DM</th>
<th>Crude fat</th>
<th>Crude protein</th>
<th>TDN</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0</td>
<td>93.81±0.32&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.74±0.93&lt;sup&gt;a&lt;/sup&gt;</td>
<td>10.43±0.35&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.73±3.35&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>P1</td>
<td>93.26±0.23&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>5.21±0.45&lt;sup&gt;b&lt;/sup&gt;</td>
<td>11.52±0.33&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.21±7.64&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>P2</td>
<td>92.54±0.37&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>6.34±0.32&lt;sup&gt;c&lt;/sup&gt;</td>
<td>13.19±0.14&lt;sup&gt;c&lt;/sup&gt;</td>
<td>6.34±1.72&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>P3</td>
<td>91.71±0.78&lt;sup&gt;c&lt;/sup&gt;</td>
<td>6.90±0.25&lt;sup&gt;c&lt;/sup&gt;</td>
<td>14.27±0.09&lt;sup&gt;d&lt;/sup&gt;</td>
<td>6.90±4.64&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

The numbers followed by different superscript letters on the same line (a, b, c, d) show significantly different (P<0.05)

**Crude fat**

Fat is a non-polar ester compound that was insoluble in water (Kusnandar *et al.* 2010). Fat can improve the physical structure such as development, softness, texture and aroma (Manley 2000). The result of variance analysis showed that biscuits of fermented SW enriched with kelor leaf with various concentrations significantly affected ether extract of biscuit (P<0.05). Further Duncan test results showed that the crude fat of P0 biscuit was significantly different.

**Crude protein**

The result of variance analysis showed that biscuits of fermented SW enriched with kelor leaf with various concentrations had significant effect on crude protein (P <0.05). Protein in the ration increased due to increasing protein of fermented SW. P3 contained the highest fermented SW.

**Total digestible nutrients (TDN)**

The result of variance analysis showed that biscuits of fermented SW enriched with moringa leaf with various concentrations, significantly affected the Total Digestible Nutrients (TDN) biscuit (P<0.05). Further Duncan test results showed that TDN content of biscuit P0 was significantly different when compared with P1 biscuit. Biscuits P2 and P3 showed no significant differences between treatments but were significantly different when compared with P0 and P1 treatments.

**Palatability of biscuits**

The result of palatability test assay showed a significant difference (P<0.05) among the biscuit treatment. The study results showed that treatment P3 had higher palatability (306.7±7.3 g/head/hour) when compared with other treatments (P<0.05). The high standard deviation value in each treatment was thought to be caused by the short time of palatability test (one hour). The result of palatability test was showed on Figure 2.
Figure 2. Palatability test of CW Biscuits on Dombos

Further Duncan test results show that P1 and P2 were significantly different when compared with P0 and P3. Between P0 and P3, there was a differed significant, however between P1 and P2 did not show any significant difference (Table 4).

Table 4. Palatability of biscuit sago waste (g/head/hour)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Replications</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>P0</td>
<td>96.4</td>
<td>115.9</td>
</tr>
<tr>
<td>P1</td>
<td>204.6</td>
<td>217.3</td>
</tr>
<tr>
<td>P2</td>
<td>224.6</td>
<td>233.7</td>
</tr>
<tr>
<td>P3</td>
<td>300.0</td>
<td>305.7</td>
</tr>
</tbody>
</table>

Different lowercase superscripts on the same line show significantly different (P<0.05)

CONCLUSION

Based on the results of characterization test, chemical analysis, and palatability of biscuits of fermented SW enriched with kelor leaf, it can be concluded that P3 biscuits containing kelor leaf + 30% fermented SW was the best biscuit, due to the highest palatability compared with other biscuit treatments.

REFERENCES


DISCUSSION

Question

*what is Dombos? Is that right that kelor leaves were fermented?*

Answer

*Dombos is a sheep breed in Binjai Farm. Binjai farm is a very large farm and we found Dombos sheep in this farm; No, kelor leaves were not fermented.*