Palatability test of fermented cassava waste biscuit; enriched with kelor leaf (*Moringa oliefera*) on dombos sheep

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Abstract. In order to improve performance of sheep, livestockers in North Sumatera introduced Dombos. However, Dombos maintenance requires better nutrition intake. As commercial feed is expensive, it needs an effort to create uncommercial feed. Cassava waste (CW) is available in North Sumatra Province because cassava industry is significant. CW could be used as cattle feed, sheep feed. However the low nutrient content in CW caused it to improve its quality. This research was conducted with the objective was to find a better Dombos feed by utilizing CW fermentation enriched with local legume; Kelor leaf (KL). This research was a part of a project of a series of research which was initiated by research of chemical composition of CW fermented by local microorganism, Ginta. This research had been conducted from June to September 2017. The design was complete randomized design (RAL) with 4 treatments and 3 replications. The treatments were a combination between various concentrations of fermented CW and KL, i.e P0 (Biscuit 0% fermented CW + KL), P1 (Biscuit 10% fermented CW + KL), P2 (Biscuit 20% fermented CW + KL), P3 (Biscuit 30% fermented CW + KL). Based on the previous result of chemical composition and followed by palatability tests, it could be concluded that treatment of CW enriched with Kelor leaf biscuit which contains 30% of fermented CW showed the most favorable palatability compared to others.

1. Introduction

One of the main obstacles in meat industry of medium livestock at the moment in Indonesia is limited sheep species in this case sheep for meat purpose. The Indonesian government introduced Texel sheep from the Netherlands which is developed in Wonosobo and known as Dombos or Wonosobo sheep. Dombos has a higher cutting weight than local sheep and has been well adapted with climates in Indonesia. Therefore, farmers in North Sumatra try to develop Dombos. Dombos have a higher body weight than the local sheep, average birth weight of 5.5 kg for males and 4.5 kg for females, respectively. The weaning weight of Dombos was 18-20 kg in males and 16-18 kg in female at 3-4 months of age [3]

The problem of availability of feed, as well as its quality is also needs to be a concern in the field of animal production. This is due to the unavailability in both quality and quantity feed. Therefore, alternative feed ingredients are sought. In its development, numerous studies have been done to find the right alternative for use as ruminant feed that have good nutritional content, especially those containing protein, considering that high protein content in feed is correlated with high prices.
On livestock feed, conventional sources of protein were very expensive, for example fish meal and also inadequate. This is why, efforts to find nonconventional sources are of much concern, for example through protein from plants. Kelor (*Moringa oleifera*) is a plant that is now widely used by farmers. Kelor which is an endemic plants in North Sumatra, has adapted with North Sumatra climate for decades. [6] has developed Kelor in Samosir Island. Kelor is called a multi purposes plant because in addition to conservation, Kelor also as a protective plant on coffee plantation, a source of nutrients for humans because it is very nutritious as well as for sheep feeds. Kelor has a high level of forage production. Biomass production capability reaches 4.2-8.3 tons dry matter/ha/year. Leaf protein content ranged from 19.3 to 26.4% [8].

Feed for livestock, must also contain with carbohydrates. Therefore, materials such as CW become an option because it is available in large quantities and cheap. Province of North Sumatra was rated as the second biggest cassava producer in Sumatra together with Lampung [2]. Cassava production was 1,619,405 tons which mostly processed into tapioca starch thus produced abundant CW because for every ton of cassava were produced 114 kg of waste. However the protein content of CW is low therefore one way to improve it by fermentation. [5] suggested that in order to improve protein content in feed, breeders must do fermentation by using local microorganisms, such as Ginta. Fermentation with Ginta can be done by breeder and Crude Protein at the beginning of fermentation was 3.25 and after 6 days of fermentation CP turned in 5.58. CW that was fermented in 2 months remained in fresh condition and was favored by sheep.

This research tried to investigate a better Dombos feed that was CW biscuit. The feed material used CW which previously was fermentated by Ginta and than enriched with KL. In this research, the focus was to find out chemical composition and favourable palatability of CW biscuit.

2. Materials and Methods

The research was conducted at the Livestock Production Laboratory of the Faculty of Agriculture, Universitas Sumatra Utara, Medan. Chemical analyzes were conducted at the Nutrition and Animal Feed Laboratory, Faculty of Agriculture Universitas Sumatra Utara and palatability test on Dombos was conducted at Mr. Sunardi’s farm in Binjai. This study lasted for 4 months from August to November 2017.

Biscuits consisted of fermented CW, rice bran, palm kernel cake, corn, Kelor leaf, molasses, urea, minerals and Ginta (consisting of water, tempe yeast and tape, dadih curd, sugar, honey, molasses), Dombos 12 heads .

The research method was complete randomized design (RAL) with 4 treatments and 3 replications. The treatments were as follows:
- **P0**: Biscuits 0% fermented CW + Kelor Leaf
- **P1**: Biscuits 10% fermented CW + Kelor Leaf
- **P2**: Biscuits 20% fermented CW + Kelor Leaf
- **P3**: Biscuits 30% fermented CW + Kelor Leaf

Physiology of biscuits were presented in Figure 1.

![Figure 1](image-url) Biscuits without or with fermented CW + Kelor leaves
2.1 Parameter of Research

Research parameters were consisted of Chemical composition and Palatability. Chemical composition were consisted of Dry Material, Crude Fiber, Crude Protein and TDN.

2.2 Palatability Test of Biscuit

Examination of palatability of four treatments of biscuit was done by looking at feed consumption level on Dombos which amounted to 12 heads. The palatability test was performed by giving biscuits each treatment on three different sheep for one hour observation that was at 14.00-15.00 WIB. The value of palatability of CW biscuit was obtained from how many biscuits (g) were consumed by sheep.

2.3 Data analysis

The data were analyzed by using variance analysis (ANOVA), when the treatment was significantly different (P≤0,05) or very real (P≤0,01) followed by the appropriate real difference test.

3. Results and Discussion

Table 1. Chemical composition of CW biscuit which enriched with Kelor leaf

| Treatments | Dry Matter (g) | Crude Fat (g) | Crude Protein (g) | Total Digestible Nutrients (g) |
|------------|----------------|---------------|-------------------|-------------------------------|
| P0         | 93.81±0.21     | 3.74±0.34     | 9.14±0.08         | 74.21±0.17                   |
| P1         | 93.26±0.25     | 4.21±0.47     | 10.19±0.05        | 80.18±0.39                   |
| P2         | 92.54±0.31     | 4.34±0.31     | 11.71±0.26        | 83.56±0.43                   |
| P3         | 91.71±0.61     | 4.90±0.18     | 12.67±0.21        | 85.87±0.60                   |

Description: The numbers followed by different superscript letters on the same line (a, b, c, d) show significantly different.

3.1 Dry Matter

The result of variance analysis showed that biscuits of CW with various concentrations enriched with Kelor leaf had no significant effect on dry matter of biscuit. The amount of dry matter ingredients that can be consumed by medium ruminants is about 3-3.8 % of body weight [14]. The consumption of dry matter ingredients depends on the nutrient content and from the feed ingredients. Feed which is a combination of concentrate and forage, will affect the consumption of dry matter.

3.2 Crude Fat

The result of variance analysis showed that biscuits of fermented CW enriched with Kelor leaf significantly affected crude biscuit fat (P<0.05). The results of Duncan’s further test showed that the crude fat of biscuit P0 was significantly different when compared with the P1 biscuit and P2 biscuit while P1 and P2 differed significantly with P3. P1, P2 and P3 use fermented CW. Therefore, there was an increased in fat content in CW.

Ginta contains a variety of microorganisms and the dominant is lactic acid bacteria (BAL). BAL has the activation of lipase enzyme which works on starch of CW resulting in increased fat. There was an increasing fat on fermented cassava waste from 0.68 to 2.62 by using Ginta [7].

BAL leads to eco-friendly processing and BAL also has a fermentable capability on many of the agricultural and agro-industrial by-products [12]. This is because BAL has an outcome to improve the quality of the environment. Materials previously discharged into the environment such as agricultural waste are generally able to be transformed by BAL into useful materials for animal feed.
BAL becomes attractive candidates in fermentation biotechnology to produce a value added product with multiple applications.

3.3. Crude Protein
The result of variance analysis showed that biscuits of fermented CW enriched with Kelor leaf significantly affected crude protein biscuit (P < 0.05). The results of Duncan's further test showed that the crude protein was significantly different, i.e. the P0 biscuit was significantly different when compared with the biscuits P1, P2, P3. Likewise P1 and P2 differ significantly with P3 (P < 0.05).

As a feed, P3 biscuits had high protein content, which was 12.67% different with P0 biscuit (without fermented CW) which has the lowest crude protein content (10.43%). According to [12] the digestibility of the crude protein depends on the protein content in the ration. Rations that have low protein content, generally have a low digestibility and vice versa. The high level of protein digestion depends on the protein content of feed ingredients and the amount of protein that enters the digestive tract.

The different crude protein content of biscuits was also influenced by the work of microorganisms in the fermentation process. BAL in addition to donating protein in the form of amino acids, also donate enzymes. [4] mentioned that fermentation was how to produce enzymatic-pools, which were proteins and fatty acids. Even so, there was also a difference from the fermentation work and this depends on the most suitable microorganisms with substrate, nutrient content of substrates and the treatment [11]. However, any kind of microorganisms have their own specific good, for example L. plantarum which could be acted as probiotic. L. plantarum was one of the most dominant bacteria in dadih curd [13]. L. plantarum can improve livestock health. [9] found that by using local microorganisms, crude protein could be improve more than 2%.

This improvement was advisable as local microorganisms which process as bioactivator could be made by local livestockers easily and in the long time application, local microorganisms could improve livestock performance as it was a probiotic itself. Now in Indonesia, application of probiotic on livestock is advisable in order to minimize application of antibiotic.

The addition of Kelor leaf meal increased the protein content in biscuits. Kelor has a high level of forage production. Biomass production capability reaches 4.2-8.3 tons dry matter / ha. Leaf protein content ranged from 19.3 to 26.4% so that Kelor can be used as a source of new feed, especially for ruminant livestock. Kelor has a complete amino acid content, i.e. 18 amino acids consisting of 8 essential amino acids and 10 non-essential amino acids [8]. Kelor is preferred by medium ruminants.

3.4. Total Digestible Nutrients (TDN)
The result of variance analysis showed that biscuits of fermented CW enriched with Kelor leaf significantly affected the Total Digestible Nutrients (TDN) biscuit (P < 0.05). Further Duncan test results showed that Total Digestible Nutrients (TDN) biscuit P0 was significantly different when compared to P1 biscuit. Biscuits P2 and P3 showed no significant differences between treatments but were significantly different when compared with treatment P0 and P1. High TDN was influenced by several factors including feed quality in the form of PK and TDN balancing or energy [1]. TDN and protein greatly affected the productivity and palatability of livestock.

3.5. Palatability of Biscuits
The result of palatability test of biscuit fermented CW can be seen in Table 2
Table 2. Palatability of fermented CW waste biscuits enriched with Kelor leave

| Treatment | Repetition | Mean     |
|-----------|------------|----------|
| P0        | 1          | 06.10    |
|           | 2          | 07.25    |
|           | 3          | 07.50    |
|           |            | 06.95±0.74<sup>a</sup> |
| P1        | 1          | 06.04    |
|           | 2          | 06.15    |
|           | 3          | 06.51    |
|           |            | 06.23±0.25<sup>a</sup> |
| P2        | 1          | 05.35    |
|           | 2          | 05.55    |
|           | 3          | 05.20    |
|           |            | 05.37±0.17<sup>b</sup> |
| P3        | 1          | 04.50    |
|           | 2          | 04.15    |
|           | 3          | 04.35    |
|           |            | 04.33±0.17<sup>c</sup> |

Palatability of fermented CW waste biscuits enriched with Kelor leaves (60 minutes/head/g biscuit)

| Treatment | Repetition | Mean     |
|-----------|------------|----------|
| P0        | 1          | 139.7    |
|           | 2          | 126.8    |
|           | 3          | 121.5    |
|           |            | 129.3±9.4<sup>a</sup> |
| P1        | 1          | 227.3    |
|           | 2          | 216.6    |
|           | 3          | 203.4    |
|           |            | 215.8±11.9<sup>a</sup> |
| P2        | 1          | 226.1    |
|           | 2          | 218.9    |
|           | 3          | 231.7    |
|           |            | 225.6±6.4<sup>b</sup> |
| P3        | 1          | 296.7    |
|           | 2          | 316.5    |
|           | 3          | 305.2    |
|           |            | 306.1±9.9<sup>c</sup> |

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

1 biscuit weight 150 g

The result of palatability test showed a significant difference (P <0.05) on fermented CW biscuit treatment. Table 2 showed that treatment P3 had a higher palatability (4.33 minutes on 1 biscuit) when compared with other treatments (P <0.05). Further Duncan test results showed that P0 and P1 were significantly different when compared with P2 and P3. P0, P1 and P2 were significantly different from P3. On observation in the 60th minute, the consistency of Dombos likes on biscuit was still, the most preferred was P3 biscuits and Dombos spend as much as 306 g of biscuit. Based on the results of the research by [10] on the test of physical properties and palatability of corn waste biscuit as substitution of fiber source for sheep, the result of palatability showed consumption was 55.00 g/head/6 hours.

At the time of the study, Dombos showed the behavior of smelling the biscuit first. Next Dombos began to eat Kelor biscuits by choosing the crumb then took away with the help of the tongue. Dombos was more passionate and chewed biscuits faster at the same time picked the crumb which was the preferred part. Also in eating, include destroyed the biscuits first or broke the biscuits with the help of lips and teeth. Biscuit could be eaten by Dombos in the form of whole-feed biscuits because of its round shape according to the morphology of the lamb’s mouth making it was easier for the sheep to eat it. P3 was the fastest-running biscuit which proved as the most preferred.

The high palatability in P3 was due to the composition of the most common of fermented CW and fermented CW biscuit had a more fragrant aroma because it contained more fermentation material. P3 also has a crude texture and crumble density than P0, P1 and P2.
4. Conclusions

Based on the results of chemical analysis and palatability of biscuits of fermented CW enriched with kelor leaf it can be concluded that P3 biscuit containing 3% fermented CW enriched with kelor leaf was the best biscuit, because the biscuit had the highest palatability when compared with other treatments. Every 1 biscuit weighing 150 g, Dombos spent in 4.33 minutes consuming.

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