Milk Quality and Prolactin Hormone Levels of Murrah Buffalo Fed with Local Forage and Urea Molasses Block at Kapau Village Agam Regency West Sumatra

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Abstract: Feeding is one of the main factors in the success of a Murrah buffalo farming business. Good quality feed will increase Murrah buffalo's productivity, including the quality of milk produced. Buffalo (*Bubalus bubalis*) milk has the advantage of 6-8% fat and 3-8% protein compared to 3-4% fat and protein content in cow's (*Bos taurus*) milk. This study aims to improve milk quality and prolactin hormone levels in Murrah buffaloes by providing local forage-based feed and urea molasses block. This research is an experimental study with a Latin Square Design (LSD), using four female Murrah buffaloes as the research sample with the following feeding: P1 = basal feed (10% of body weight); P2 = 30% sweet potato leaves + 30% cassava leaves + 40% P1 + urea molasses block; P3 = 40% sweet potato leaves + 40% cassava leaves + 20% P1 + urea molasses block; P4 = 50% sweet potato leaves + 50% cassava leaves + urea molasses block. The parameters measured in this study were protein, amino acids, fat, milk fatty acids, and Murrah buffalo Prolactin Hormone levels. The results obtained in the study in order are as follows: protein (2.37-3.83%); amino acids (2.54-8.45%w/w); fat (5.86-9.22%); prolactin (1.61-1.99ng/ml). The results showed that feeding 50% sweet potato leaves, 50% cassava leaves, and urea molasses block can improve milk quality and prolactin hormone levels in Murrah buffaloes.

Keywords: Milk quality, prolactin, murrah buffalo, local forage, urea molasses block.

INTRODUCTION

Buffalo (*Bubalus bubalis*) is one of the germplasm that can be developed to improve the genetic quality of buffalo in Indonesia because buffalo is a typical genetic source for improving the genetic quality of local livestock. According to research by Mihaiue M *et al*. [1] and Roza E *et al*. [2], buffalo milk has advantages in fat content ranging from 6-8% to 3-8% protein when compared to the fat and protein content of cow's (*Bos taurus*) milk at 3-4%. One buffalo that produces milk is the Murrah buffalo, a dairy buffalo widely farmed in Indonesia, especially the North Sumatra region, and is currently cultivated in West Sumatra.

In West Sumatra, the Murrah buffalo rearing system is still traditional, is a side business for the community, and the paradigm of people who still think that buffalo livestock development is complicated both in feeding management and production so that it needs to focus on improving the feeding system by utilizing local feed and increasing the production and quality of milk produced. Currently, the production and quality of milk remain the same, or there is no increase, which results in dairy cow milk dominating the market [3]. Therefore, the community needs to become more familiar with buffalo milk, which has quite good quality compared to cow's (*Bos taurus*) milk. To improve the quality of milk produced, of course, it is necessary to pay attention to feeding management in Murrah buffaloes where, so far, the feeding management carried out is still lacking, both in the amount of feed and the nutritional content, so that the non-fulfillment of the nutritional content of the feed results in a decrease in milk production and quality and can even result in reproductive disorders in Murrah buffaloes. Nutrient intake is a significant factor in improving milk quality to supply the energy required for milk secretion [3].

To overcome this problem, several local forages can be utilized, and minerals can be added to Murrah buffalo using the Urea Molasses Block. Local forages used are sweet potato leaves and cassava leaves. West Sumatra has great potential to provide these forages. Besides, West Sumatra has considerable agricultural land, especially in high-altitude areas, one of which is in the Bukit Tinggi and Agam areas, where this area is one of the largest producers of yam crackers in West Sumatra. According to [4], especially in Agam and Bukittinggi Regencies, the area of cassava farmland reached 502 Ha and 10 Ha, and the area of sweet potato farmland reached 617.6 Ha and 21 Ha. After harvesting, cassava and sweet potato leaves are usually piled up by farmers and rarely utilized. In addition to its availability, sweet potato and cassava leaves have a high enough nutritional content to be given to livestock.

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ISSN: 1927-5196 / E-ISSN: 1927-520X/25

Research by Nurulaisyah A *et al*. [5] reported that the protein and crude fiber content in cassava leaves were 16.72% and 19.06%, while Iqbal FC *et al*. [6] reported the protein and crude fiber content in sweet potato leaves as high as 12.93% and 29%. Local forage in the form of sweet potato and cassava leaves can be given in fresh form or processed first. Wirawati CU *et al*. [7] stated that giving cassava leaves can improve milk quality in cows(*Bos taurus*), buffaloes (*Bubalus bubalis*), and goats(*Capra hircus*). In addition, the provision of additional minerals in the form of urea molasses block as a supplement for livestock can help the formation of amino acids needed by ruminants and also help increase digestibility by stabilizing pH conditions in the rumen and increasing livestock palatability. This study aims to improve milk quality and prolactin hormone levels in Murrah buffaloes by providing local forage-based feed and urea molasses block.

MATERIAL AND METHODS

Ethical Approval

The implementation of this study refers to the ethics of research using experimental animals based on the government law of the Republic of Indonesia 18 of 2009 Article 66, which regulates the maintenance, treatment, and care of animals that are correctly cared for animals.

Experimental Site

This research was conducted at Murrah buffalo farm, Kapau Village, Agam Regency, West Sumatra Province, Indonesia. Kapau village is one of the villages in West Sumatra that cultivates Murrah buffaloes as milk-producing buffaloes. Kapau village is located at an altitude of 500-1000 meters above sea level, which has a fairly cool temperature with a temperature range of 21-25ºC; this temperature has very potential for raising Murrah buffalo [8]. Kapau Village is also the center of Murrah buffalo development in West Sumatra Province. It has 14.5 ha of agricultural/plantation land, on which the by-products, in the form of local forage (cassava leaves and sweet potato leaves), can be utilized as feed for Murrah buffalo. As with the tropics, it generally has dry and rainy seasons. The rainy season runs from September to February, and the dry season runs from March to August, while this research was conducted from June to September 2024.

Experimental Design

The material used was four female Murrah buffaloes aged 3-5 years from North Sumatra and kept in Kapau village, Agam Regency, with feed given basal forage (breeders), basal concentrate (livestock), sweet potato leaves, cassava leaves, and USB at different levels [9]. The research method used was an experimental method using a Latin Square Design (LSD), which consisted of 4 treatment groups and four replications. The treatments applied in this research are [9]:

P1= basal feed (field grass given as much as 10% of body weight) (control)

P2= 30% sweet potato leaves + 30% cassava leaves + 40% P1 + urea molasses block

P3= 40% sweet potato leaves + 40% cassava leaves + 20% P1 + urea molasses block

P4= 50% sweet potato leaves + 50% cassava leaves + urea molasses block

The nutrient and anti-nutrient contents of the feed are in Tables **1** and **2**.

Table 1: Nutrient Content of Forage Feeds

No	Sample	Crude protein (%)	Crude fat (%)	Crude Fiber (%)
1	Basal feed	8.70	3.82	19.71
2	Cassava leaf	23.45	9.15	22.30
3	Sweet potato leaves	24.92	2.55	25.06

Table 2: Anti-Nutrient Content of Feed

No	Sample	Average (%)	
		Flavonoids	Tannins
1	Cassava leaf	4.56	2.04
2	Sweet potato leaves	2.35	1.97

Parameters

Milk Protein and Fat

Milk quality testing (protein and fat) using the Lactoscan Milk Analyzer Biobase CN (Model: BKMA-MK). With the following stages of Lactoscan operation:

a) Press the LactoScan power button to the ON position.

b) Insert the analysis pipe into the prepared milk sample (5 ml milk/analysis).

c) Press the enter button and select the menu at the position of the milk to be tested.

d) Wait momentarily, and LactoScan will display the analysis results on the monitor screen.

Figure 1: Lactoscan Milk Analyzer Biobase CN (Model: BKMA-MK).

Milk Amino Acids

Amino acids are proteins broken down through metabolic processes into small molecules as essential ingredients for biosynthesis processes. Amino Acid Analyzer in milk (aspartic acid, threonine, serine, glutamate, glycine, alanine, valine, methionine, i-leucine, leucine, tyrosine, phenylalanine, histidine, lysine, arginine) using the IK.LP-04.7-LT-1.0 (HPLC) method.

Prolactin Hormone

Prolactin is an important hormone for initiating and maintaining lactation in some dairy-type livestock species. It is reported to have a strategic role in maximizing milk synthesis. A prolactin hormone assay using a Prolactin ELISA Kit.

Data Analysis

The data obtained were processed and analyzed using Analysis of Variant. If the treatment showed significantly different results ($p<0.05$), then the analysis continued with further tests using Duncan's Multiple Range Test. The data were analyzed using Minitab 14 and Origin Pro 8.5 applications.

RESULTS AND DISCUSSION

Milk Protein and Fat

The mean Protein and Milk Fat content of Murrah buffalo with local forage and USB mineral feeding can be seen in Table **3**.

Table 3: Milk Protein and Fat

Treatment	Milk Protein	Milk Fat
P1	2.37^{a}	5.86^{a}
P2	3.10^{a}	6.92^{b}
P3	3.20^{a}	7.27^{b}
P4	3.83^{b}	9.22^{c}

Note: Different superscripts in the same column indicate a significant effect ($P<0.05$).

The study's results obtained by giving local forage leaves and urea molasses block minerals to Murrah buffalo showed significant results in increasing their milk's protein and fat content. The higher the feeding of the P4 treatment, the higher the levels of protein and fat in Murrah buffalo milk, namely 3.83% and 9.22%. The high levels of protein and fat are due to the high feed content given to livestock (Table **1** and Figure **2**). The amino acid content also influences the high protein content obtained in cassava leaves, which is easily degraded by rumen microbes, namely 5.6% valine, 8.3% leucine, and 4.2 isoleucine [10] and cassava leaves are rich in soluble proteins [11]. Cassava leaves and sweet potato leaves are also a source of branched-chain amino acids, which are a source of carbon skeletons needed to stimulate the growth of cellulolytic bacteria. Ammonia cannot be used for rumen microbial protein synthesis without carbon skeletons. The increase in milk protein content is also due to the content of tannins (Table **2**) condensed in cassava and sweet potato leaves, which play a role in forming tannin-protein complexes and increasing protein bypass in the rumen [3], so that cassava leaves and sweet potato leaves as an additional protein source can increase milk protein composition.

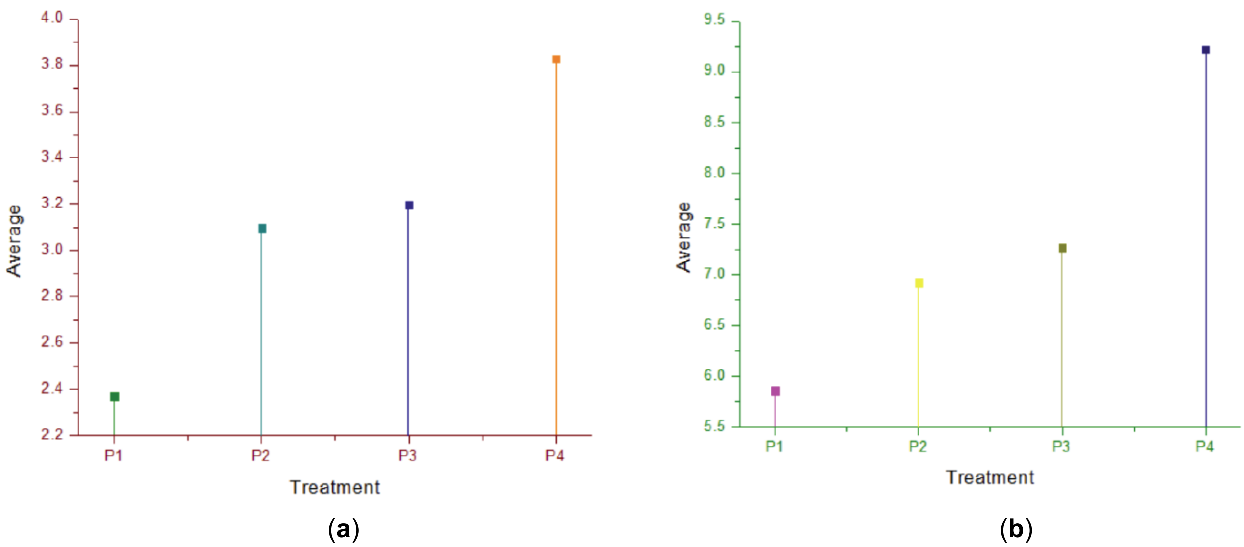

Figure 2: Milk Protein (**a**) and fat (**b**).

From the results obtained, milk fat content also increased; this was influenced by cassava leaf feed and sweet potato leaves, which acted as a source of soluble carbohydrates and protein that escaped degradation. The feed carbohydrate is a precursor in the formation of glucose in the fermentation process by rumen microbes, whose final result is VFA, including acetic and butyric acids. Acetic and butyric acids are the essential ingredients of long-chain fat in milk; the higher the crude fiber content of the feed, the higher the acetic acid content in the rumen as a result of rumen microbial breakdown [12]. Acetic acid and butyric acid enter the blood circulation to the liver to be converted into fatty acids, which then enter the udder secretion cells for milk fat synthesis [13]. Giving urea molasses block minerals to livestock is a feed supplement to increase the digestibility of low-quality feed and overcome nutritional and mineral deficiencies in Murrah buffalo livestock. This is the opinion of Andita AS *et al*. [14], who state that providing the mineral urea molasses block increases the digestibility of animal feed and improves the quality of nutrients and animal appetite. Nista D *et al*. [15] Also added is urea molasses block or urea saka block, an additional supplement for ruminants that is rich in benefits and contains nutrients needed by livestock. Furthermore, giving urea molasses block can affect rapid fat gain, improve the condition of reproductive organs, reduce the risk of malnutrition, increase the urea molasses block of microorganisms in the rumen, and stabilize the rumen's pH so that the rumen's feed digestion system is more optimal so that it will potentially increase the quality of milk.According to the research results by Ace IS *et al*. [16], feeding urea molasses block to dairy cows (*Bos taurus*) can increase milk production by 1-1.5 liters/day/head while increasing milk fat by 0.1-0.2%.

Milk Amino Acids

The average Amino Acid content of Murrah buffalo milk with local forage and urea molasses blockmineral feeding can be seen in Table **4** and Figure **3**.

The results obtained by feeding local forage leaves and USB minerals to Murrah buffaloes, on average, showed an increase in the overall average amino acid content of Murrah buffalo milk. The higher the percentage of cassava leaves and cassava leaves (P4), the higher the average amino acids produced. It is known that amino acid levels are directly proportional to protein levels in milk; the higher the protein content, the higher the amino acids in milk [17]. Damayanthi E *et al*. [17] stated that about 95% of milk protein components are synthesized from amino acids, and the other 5% is absorbed from the blood. Amino acids in milk are formed by the body's process of protein breakdown. Milk contains essential and non-essential amino acids. Essential amino acids can be produced in the livestock body, while the body cannot produce non-essential amino acids, so they must be obtained from food. Damayanthi E *et al*. [17] reported that the essential amino acids in buffalo milk are Histidine, Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Threonine, and Valine. From the results obtained, the content of essential amino acids in Murrah buffalo milk increased along with the increasing percentage of cassava and sweet potato leaves (P4). The high essential amino acids obtained will benefit buffalo

Table 4: Milk Amino Acids

No	Amino Acids	Average (% w/w)			
		P1	P2	P3	P4
1	Aspartic Acid	0.48	0.21	0.53	0.68
2	Threonine	0.30	0.12	0.28	0.37
3	Serine	0.33	0.13	0.33	0.43
4	Glutamate	1.51	0.55	1.46	2.11
5	Glycine	0.11	0.05	0.12	0.16
6	Alanine	0.19	0.09	0.21	0.29
7	Valine	0.39	0.15	0.41	0.56
8	Methionine	0.14	0.06	0.16	0.23
9	I-leucine	0.36	0.15	0.36	0.50
10	Leucine	0.63	0.26	0.67	0.91
11	Tyrosine	0.28	0.10	0.28	0.38
12	Phenylalanine	0.30	0.12	0.30	0.41
13	Histidine	0.21	0.09	0.19	0.25
14	Lysine	0.52	0.22	0.52	0.69
15	Arginine	0.48	0.24	0.41	0.48
Total		6.23	2.54	6.23	8.45

calves and consumers who consume them because essential amino acids build muscle mass and strengthen the muscles.

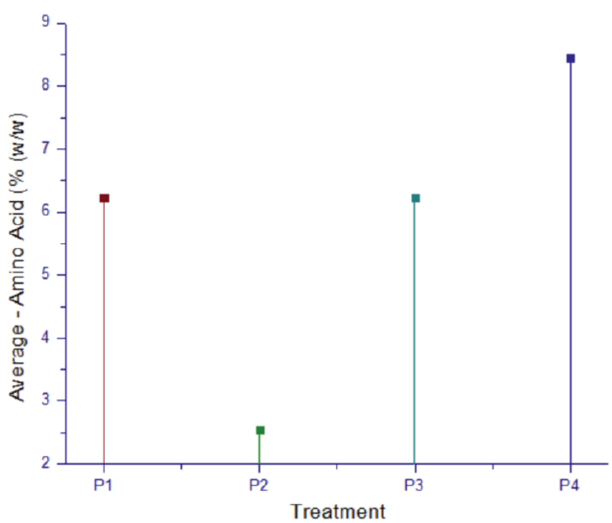

Figure 3: Milk Amino Acids.

Prolactin Hormone

The mean prolactin hormone levels of Murrah buffaloes fed with local forage and USB minerals can be seen in Table **5**.

In the table above, it can be seen that feeding local forage (cassava leaves and sweet potato leaves) and urea molasses blocks did not have a significant effect (P>0.05) on prolactin hormone levels. This can be interpreted as the feed still meeting the needs of the Murrah buffalo's body in synthesizing the hormone prolactin. This is the opinion of Sugiatno S [18], who stated that the feed given to livestock is helpful for everyday living needs or activities, including the hormone synthesis process in the livestock's body. Meanwhile, Leduc A *et al*. [19], Fruscalso V *et al*. [20], and Cremilleux M *et al*. [21] argue that insufficient feed given to lactating livestock can have an impact on decreasing prolactin hormone levels, which results in reduced milk production.

Table 5: Prolactin Hormone

Treatment	Rataan (ng/ml)
P1	1.770
P2	1.771
P3	1.773
P4	1.758

The average prolactin hormone levels in this study were similar to those obtained by Bell H [22] after giving birth; prolactin hormone levels were 1.7 - 2.3ng/ml. This may be due to the breed or type of buffalo (Murrah buffalo), species (*Bubalus bubalis*), and rearing system. Prolactin hormone is important in mammary gland physiology, especially in female cows (*Bos taurus*). Prolactin hormone also promotes the growth of alveoli glands, the main component of milk production. Prolactin hormone also stimulates mammary alveolar epithelial cells to synthesize milk components, including lactose (milk carbohydrate), casein (milk protein), and lipids. According to Chalabi MA *et al*. [23], any deficiency in prolactin secretion will result in clinically significant pathological processes. Prolactin hormone levels are essential for normal lactation ability. If the levels are too low, the mother cannot produce milk normally [23]. According to the research results, Murrah buffaloes continued to produce milk until the end of the lactation period.

CONCLUSIONS

The study revealed that feeding based on cassava leaves (50%), sweet potato leaves (50%), and urea molasses blocks can improve milk quality and increase prolactin hormone levels in Murrah buffaloes. The results of this study can be used as feed ingredients for Murrah buffaloes to increase their productivity.

ACKNOWLEDGMENTS

Thank you to LPPM Universitas Andalas through Direktorat Riset Teknologi dan Pengabdian Kepada Masyarakat, Direktorat Jenderal Pendidikan Tinggi Riset dan Teknologi, Kementerian Pendidikan, Kebudayaan, Riset dan Teknologi Republik Indonesia with contract No. 106/UN16.19/PT.01.03/PL/2024.

CONFLICT OF INTEREST

The authors have declared no conflict of interest.

AUTHORS' CONTRIBUTIONS

All authors contributed equally to the manuscript.

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Received on 04-02-2025 Accepted on 14-06-2025 Published on 07-07-2025

https://doi.org/10.6000/1927-520X.2025.14.10