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23

# MINERAL MINERAL CHARACTERISTICS OF BLOCK HERBS WITH THE ADDITION OF TURMERIC FLOUR AND MORINGA LEAF FLOUR

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***Abstract***

*This study was conducted to evaluate the chemical characteristics of herbal mineral Blok supplemented with turmeric flour and moringa leaf flour as a feed supplement for ruminants. The objective of this study was to determine the nutritional characteristics and palatability of herbal mineral Blok with different levels of moringa leaf flour addition. This study used a quantitative descriptive method by analyzing laboratory test results of several treatment samples, namely P0 (1% turmeric flour), P1 (1% turmeric flour + 1% moringa leaf flour), P2 (1% turmeric flour + 2% moringa leaf flour), and P3 (1% turmeric flour + 3% moringa leaf flour). The observed variables included crude protein, crude fat, moisture content, and palatability. The results showed that the addition of moringa leaf flour increased crude protein content from 4.638% in P0 to 5.918% in P3 and increased crude fat content from 5.275% to 6.737%. Moisture content showed relatively stable values among treatments, while palatability evaluation indicated that all treatments were accepted by livestock. The study concluded that the addition of moringa leaf flour up to 3% improved the nutritional characteristics of herbal mineral Blok without reducing feed acceptance.*
***Keywords****: herbal mineral Blok; moringa leaf flour; turmeric flour, Palatability*

***Abstrak***

Penelitian ini dilakukan untuk mengevaluasi karakteristik kimia mineral herbal blok dengan penambahan tepung kunyit dan tepung daun kelor sebagai pakan suplemen ternak ruminansia. Penelitian ini bertujuan untuk mengetahui karakteristik nutrisi dan tingkat palatabilitas mineral herbal blok dengan penambahan tepung daun kelor pada beberapa perlakuan. Metode yang digunakan adalah metode deskriptif kuantitatif melalui analisis hasil pengujian laboratorium terhadap sampel perlakuan, yaitu P0 (tepung kunyit 1%), P1 (tepung kunyit 1% + tepung daun kelor 1%), P2 (tepung kunyit 1% + tepung daun kelor 2%), dan P3 (tepung kunyit 1% + tepung daun kelor 3%). Parameter yang diamati meliputi protein kasar, lemak kasar, kadar air, dan palatabilitas. Hasil penelitian menunjukkan bahwa penambahan tepung daun kelor meningkatkan kadar protein kasar dari 4,638% pada P0 menjadi 5,918% pada P3 serta meningkatkan kadar lemak kasar dari 5,275% menjadi 6,737%. Kadar air menunjukkan nilai yang relatif stabil antar perlakuan, sedangkan hasil uji palatabilitas menunjukkan bahwa seluruh perlakuan masih dapat diterima oleh ternak. Berdasarkan hasil penelitian dapat disimpulkan bahwa penambahan tepung daun kelor hingga 3% mampu meningkatkan karakteristik nutrisi mineral herbal blok tanpa menurunkan tingkat penerimaan pakan oleh ternak.
**Kata Kunci**: mineral herbal blok, tepung daun kelor; tepung kunyit, Palatabilitas.

## I. INTRODUCTION

Ruminant farming has an important role in providing animal protein sources and supporting the community's economy, especially in livestock production center areas such as East Nusa Tenggara Province (NTT). Timor Island is one of the regions with a large cattle population and is one of the main contributors to the cattle population in NTT Province. The productivity of ruminant livestock in the region is still not optimal because it is influenced by various factors, especially the maintenance system and feed availability. Most livestock businesses still implement extensive maintenance systems that rely heavily on the availability of natural forage. Climatic conditions with a fairly long dry season, which lasts about eight to nine months every year, cause limitations in the number and quality of forage so that it has an impact on the decline in performance, body weight, and endurance of livestock.

Feed is one of the main factors that determine the success of ruminant livestock productivity. The availability of feed with good nutritional quality is needed to meet the needs of energy, protein, minerals, and support the activity of rumen microorganisms. In dry season conditions, the quality and quantity of forage decrease, so that the nutritional needs of livestock cannot be met optimally. One of the strategies that can be done to overcome this problem is through the provision of supplementary feed that is able to complement the nutritional deficiency in basic feed. One form of supplement feed that is widely developed is mineral herbal Block (MHB), which is a solid-form feed that contains a source of energy, minerals, and certain additives that are given to help meet the nutritional needs of livestock. Mineral Herbal Blocks have the potential as a supplement feed because they can provide nutrients needed by livestock and help improve feed utilization efficiency. Mineral blocks function to provide fast energy, non-protein nitrogen, and minerals that can support rumen microbial activity so that they play a role in improving the fermentation process of feed.

The development of MHB is currently being directed by the addition of herbal ingredients that have bioactive functions, one of which is turmeric (*Curcuma Longa*). Turmeric contains active compounds such as curcuminoids, flavonoids, and essential oils that have antioxidant and anti-inflammatory activities so that they have the potential to support the health of the digestive tract and increase the palatability of livestock. The use of turmeric in the formulation of Mineral Herbal Blocks still has limitations because of the relatively low protein and energy content so that its contribution to increasing the nutritional value of feed has not been maximized. Turmeric-based MHB plays a greater role in improving the health and acceptance aspects of livestock than improving production performance.

The administration of MHB containing turmeric had a good acceptance rate by livestock, but it did not show a significant effect on feed consumption and feed conversion compared to controls. This shows that herbal MHB formulations still need development with the addition of ingredients that are able to increase nutritional value, especially protein content. One of the local ingredients that has the potential to be used to improve the nutritional quality of the mineral blocks of herbs is moringa leaf flour (*Moringa oleifera*). Moringa leaves are known to have a high nutritional content, especially crude protein, minerals, vitamins, and antioxidant compounds that can support the nutritional needs of livestock. The study found that moringa leaf flour has a crude protein content of 24.14%, so it has the potential to be used as a source of protein in animal feed. Moringa leaf flour contains proteins, vitamins, and minerals that are able to support growth and increase the efficiency of using rations in livestock.

Based on these conditions, there is a gap between the expected conditions (*das sollen*) and the conditions that occur in the field (*das sein*). Ideally, Mineral Herbal Blocks are expected to not only function as a source of minerals and herbal ingredients to improve the health of livestock, but also be able to provide additional nutrients, especially protein, to support the productivity of ruminant livestock. Herbal MHB formulations such as turmeric still have limitations in increasing nutrient content, so innovation is needed through the addition of local feed ingredients that have higher nutritional value. The novelty *(state of the art*) in this research lies in the development of a formulation of Mineral Herbal Blocks based on turmeric flour with the addition of moringa leaf flour as a natural source of protein. In contrast to previous studies that evaluated the function of turmeric herbs on palatability and livestock health, this study combines herbal ingredients and vegetable protein sources to produce supplement feed that has better chemical characteristics while maintaining its herbal potential. The use of moringa leaf flour in MHB formulations is expected to improve nutritional quality and become an alternative to the use of local ingredients in supporting ruminant livestock productivity. Based on this description, this study aims to develop a formulation of Turmeric Flour-based Herbal Mineral Blocks with the addition of moringa leaf flour and evaluate its chemical characteristics and palatability as an alternative supplement feed in cattle. The results of this study are expected to provide scientific information on the use of herbal ingredients and local ingredients with high nutritional value in the development of supplementary feed that supports the improvement of nutritional quality and productivity of ruminant livestock

## II. THEORETICAL STUDIES

### 2.1 Mineral Herbal Blocks (MHB)

Mineral Herbal Blocks (MHB) are solid-form supplement feeds that are used as nutritional complements in ruminant livestock. MHB is formulated from a mixture of essential minerals such as calcium (Ca), phosphorus (P), zinc (Zn), and selenium (Se) which play a role in supporting metabolism, bone growth, and improving the immune system of livestock. MHB also contains urea as a non-protein nitrogen source that is utilized by rumen microorganisms for microbial protein synthesis. Molasses and bran serve as a source of energy while also increasing palatability, while binders keep the shape of the blocks stable. The advantage of MHB is that it is used slowly in consumption through licking, so it can help control nutrient intake and increase the efficiency of feed utilization in livestock.

### 2.2 Utilization of Herbal Ingredients in Feed

The development of MHB is currently directed at the addition of herbal ingredients to improve the biological function of feed. Turmeric (*Curcuma Longa*) which contains curcumin, flavonoids, and essential oils. These compounds have antioxidant, anti-inflammatory, and antimicrobial activities that play a role in maintaining the health of the digestive tract and increasing feed efficiency. Moringa leaves (*Moringa oleifera*) also have the potential to be a feed ingredient because they have a high crude protein content (±20–30%) and are rich in vitamins and minerals. The content of flavonoids and polyphenols in moringa also functions as antioxidants that can improve the health and performance of livestock. The combination of these two ingredients in MHB formulation is expected to provide a synergistic effect, namely improving the quality of nutrition as well as improving the health of the digestive system of livestock.

### 2.3 Previous Research

Several studies show that the use of herbal ingredients in supplement feed is able to improve livestock performance. The use of turmeric in MHB acts as an antioxidant that improves digestive health and nutrient utilization efficiency in cows. The addition of turmeric flour up to 1% can increase body weight and feed efficiency, although it does not have a significant effect on feed consumption. Moringa leaves have a high protein content so they have the potential to be an alternative source of protein in animal feed. The administration of moringa leaves can increase the palatability of feed even though it does not have a real effect on consumption. The addition of moringa leaf flour at the level of 5% is able to increase the efficiency of rations and increase the body weight of livestock. Another study stated that the

administration of moringa leaf flour as much as 30 grams per head per day provides an effective dose in improving the sperm quality of thin-tailed sheep.

2.4 Research Gap and Novelty (*Novelty*)

Although there have been many studies on turmeric and moringa leaves as feed ingredients, studies that integrate the two ingredients in the formulation of Mineral Herbal Blocks are still limited. In addition, studies on the influence of these combinations on feed chemical characteristics such as crude protein, crude fat, and water content are still not widely reported. Therefore, this study focuses on the development of MHB based on local ingredients (turmeric and moringa leaves) to evaluate its chemical characteristics and potential as a supplement feed for ruminant livestock.

## III. RESEARCH METHODS

This research was carried out at the SVD Halikelen Livestock Agriculture Unit, Naekasa Village, West Tasifeto District, Belu Regency, in April-May 2026. The study used a quantitative descriptive method to evaluate the chemical characteristics and palatability level of Mineral Herbal Blocks (MHB) added to moringa leaf flour at different levels. The treatment used consisted of P0 (turmeric flour 1%), P1 (turmeric flour 1% + moringa leaf flour 1%), P2 (turmeric flour 1% + moringa leaf flour 2%), and P3 (turmeric flour 1% + moringa leaf flour 3%). The materials used include molasses, salt, bran, mineral mix, white cement, turmeric flour, corn flour, and moringa leaf flour, while the equipment used includes scales, blenders, measuring cups, wood mixers, thread ropes, and tarpaulins. The manufacture of MHB is carried out by mixing ingredients according to the formulation, namely molasses 250 g, salt 40 g, bran 300 g, mineral mix 50 g, white cement 50 g, turmeric flour 10 g, corn flour 300 g, and moringa leaf flour according to the treatment (10 g, 20 g, and 30 g). All dry ingredients are mixed until homogeneous, then molasses is added that has been diluted with a little water, stirred evenly, molded, compacted, and dried in the sun for 3–7 days until hardened. The research data was obtained through laboratory analysis of crude protein, crude fat, and moisture content, as well as observation of the palatability of ruminant livestock against MHB. The data obtained were analyzed descriptively by comparing the results of each treatment to illustrate the effect of the addition of moringa leaf flour on the chemical characteristics and the level of MHB acceptance by livestock.

## IV. RESEARCH RESULTS

| Kode Sampel | PK (% BK) | LK (% BK) | KA (% BK) |
|---|---|---|---|
| **P0** | **4,638** | **5,275** | **5,618** |
| **P1** | **5,433** | **5,523** | **5,597** |
| **P2** | **5,668** | **5,841** | **5,528** |
| **P3** | **5,918** | **6,737** | **5,568** |

Chemical Test Results of Herbal Mineral Blocks
Source : UNDANA Feed Chemistry Laboratory (2026)
Ket. PK: Protein Country, LK: Lemak Country, KA: Air Cost

Based on the results of the proxy analysis, the addition of moringa leaf flour to the mineral block showed a tendency to increase crude protein levels from P0 to P3 treatment. The crude protein value increased from 4.638% in the control treatment (P0) to 5.918% in the treatment with the addition of 3% moringa leaf flour (P3). The increase shows that moringa leaf flour acts as an additional protein source in the formulation of the herbal mineral block. The higher the use of moringa leaf flour, the greater the contribution of protein to the final product. This is related to the characteristics of moringa leaves which have a high enough protein content so that it has the potential to be used as an additional feed ingredient for ruminant livestock. Moringa leaves are one of the ingredients of plant feed that has a high protein content and is able to improve the quality of feed nutrition. Moringa leaves contain proteins that range from 20–30% based on dry ingredients, so the addition of moringa leaf flour in the mineral herbal block can increase the protein content and improve the nutritional value of the product. The increase in protein in this study also showed that moringa leaves play a greater role as a source of nutrients than turmeric flour used in formulations, Turmeric functions more as a source of bioactive compounds such as curcuminoids.

1. In the crude fat parameters, the results of the analysis showed an increase along with the increase in moringa leaf flour. The crude fat content increased from 5.275% in the P0 treatment to 6.737% in the P3 treatment. The P2 treatment had a fat content of 5.841%, while P1 was 5.523%. The increase suggests that moringa leaf flour contributes to the increase in crude fat content in the mineral block herb because moringa leaves also have natural lipid content. The fat content of moringa leaves is reported to range from 4.03–9.51% in dry ingredients, and moringa leaf flour has a fat content of about 6.11%. Increased levels of moringa leaf flour in MHB formulations may lead to increased fat content in the final product. The fat content in feed has a function as a source of energy for livestock and helps the absorption of fat-soluble vitamins such as vitamins A, D, E, and K.

2. Based on the 2017 Indonesian National Standard (SNI), the maximum limit of crude fat content in feed ingredients is around 7%. The highest crude fat value in this study was found in the P3 treatment, which was 6.737%, so it is still within the safe limit of use as an additional feed for ruminant livestock. This shows that the use of moringa leaf flour up to the level of 3% is able to increase the nutritional value of the mineral blocks without causing an excessive increase in fat.
3. The results of the moisture content analysis showed that the water content value was relatively stable in all treatments. The moisture content ranges from 5.528–5.618%, with the highest value at P0 at 5.618% and the lowest value at P2 at 5.528%. These conditions show that the addition of moringa leaf flour does not provide a major change to the mineral content of the block herbs. This is suspected because all treatments undergo the same manufacturing and drying process so that the processing factor is more dominant in determining the moisture content of the final product. The addition of moringa leaf flour to processed products is able to increase protein and fat content, while the moisture content is more influenced by the processing process such as the drying time and the condition of the ingredients. These results support this study that the increased use of moringa leaf flour in the mineral block herb leads to an increase in crude protein and crude fat content, while the moisture content remains relatively stable. Overall, the addition of moringa leaf flour to the block of herbal minerals from P0 to P3 treatment has a tendency to improve nutritional quality, especially in the content of crude protein and crude fat. The increase occurs because moringa leaves have a fairly high nutritional content and are able to contribute to the chemical composition of the final product. The moisture content does not undergo a major change because it is more influenced by the process of making, molding, and drying the mineral herbal blocks.

Results of Livestock Palatability Test

| No. | Treatment | Cow Response (Likes and Dislikes) | Explanation | Interprestasi | Number of Livestock |
|---|---|---|---|---|---|
| P0. | Po: Mineral block herbs without the addition of moringa leaf flour | Mineral Herbal Blocks with herbal ingredients in the form of turmeric plus the aroma of molasses can be liked by livestock. | The cattle approach MHB, lick it several times, then bite and consume part of the block | Liked | 16 Fish |
| P1. | P1: Mineral Herbal Blocks + 1% Moringa Leaf Flour | The addition of a little moringa leaf flour makes livestock more interested in licking MBH. | Cattle are faster to approach MHB, licking and biting the blocks repeatedly until most of them are consumed. | Liked | 16 Fish |
| P2. | P2: Mineral Herbal Block + Moringa Leaf Flour 2% | The addition of moringa leaf flour increases the taste of livestock until MBH is completely licked | Immediate livestock approach MHB after administration, actively lick and bite until the block is consumed | Very Liked | 16 Fish |

| | | | | | |
|---|---|---|---|---|---|
| P3. | The addition of moringa leaf flour increases the taste of livestock until MBH is completely licked | The addition of moringa leaf flour gives a distinctive aroma but is still liked and licked by livestock | Cattle show an interest in MHB, licking and biting the blocks until they are finished even though the aroma of moringa leaves is stronger than other treatments | Highly liked | 16 Fish |

Source: Processed Researcher (2026)

The results of the observations show that all Mineral Herbal Blocks (MHB) treatments can is well received by livestock. In the P0 treatment, the cattle show a response by approaching, licking, and biting the block before consuming it. In P1 and P2 treatments, the herd response was more active, characterized by cattle immediately approaching MHB, licking, and biting the block repeatedly until most or all of the blocks were consumed. Meanwhile, in the P3 treatment, livestock still showed a good acceptance rate even though the aroma of moringa leaves was stronger due to the increased level of moringa leaf flour. The licking, biting, and depleting behavior of blocks showed that the addition of moringa leaf meal up to the level of 3% did not decrease the palatability of MHB and was still acceptable to livestock. The addition of moringa leaves in ruminant feed does not reduce the consumption or acceptance of livestock because it has aroma characteristics and nutritional content that are still acceptable. The level of mineral palatability of the block herbs is also supported by the use of molasses in the formulation, because the sweet taste and distinctive aroma of molasses are able to increase the attractiveness of feed so that livestock consumption becomes better.

## V.CONCLUSION

The addition of moringa leaf flour to the formulation of Mineral Herbal Blocks (MHB) up to the level of 3% improves the nutritional quality of the product, which is shown by the increased levels of crude protein and crude fat compared to treatment without the addition of moringa leaf flour (P0). Meanwhile, the moisture content was relatively stable throughout the treatment. The results of palatability observations showed that the entire treatment was still well tolerated by the livestock, which was characterized by licking, biting, and consuming the given Mineral Herbal Blocks. Thus, the addition of moringa leaf flour up to 30 g in the formulation of Mineral Herbal Blocks has the potential to be used as a local feed ingredient to improve the nutritional quality of feed without reducing the level of acceptance by livestock

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