Response of goat fed ammoniated local feed and urea palm sugar block

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Abstract. Forages, such as corn straw and *B. mutica* grass as a single feed of livestock, only meet the basic needs of livestock. Low quality forage results in inadequate mineral requirements in the body of livestock, causing mineral deficiency. Therefore, it is necessary to afford an additional feed or supplements as a complement. Local feed in the form of *B. mutica* and corn straw are forages available throughout the year in large enough quantities; however, they have several limitations such as low nutritional and biological value. Through ammoniating technology, it is expected that these forages can improve their quality. Urea Palm Sugar Block (UPSB) is a modified feed mixture, consisting of several feed ingredients such as palm sugar, urea, rice bran, oil cake, minerals and salt, which are processed and pressed into blocks. Palm sugar is used in animal feed as a Readily Available Carbohydrate (RAC), functioning as a carbon skeleton, while urea serves as a source of non-protein nitrogen (NPN) for rumen microbial protein synthesis. The purpose of this research is to study the response of goats fed ammoniated local feed and UPSB. The data obtained were analyzed using a Completely Randomized Design (CRD) with 4 treatments and 8 replications. The parameters observed were the consumption of dry matter intake, daily weight gain and blood metabolic status. The results show that the R3 treatment provided an optimal response of goat fed by ammoniated local feed and UPSB.

Keywords: *B. mutica*, corn straw, ammoniating, UPSB, goat

1. Introduction
Animal husbandry development is an integral and inseparable part of agricultural and national development. Therefore, the development of livestock must increase farmer’s income, open employment opportunities through increasing population and livestock production to meet domestic and export needs, and increase community nutrition through providing animal protein sources without ignoring natural resources and environment. From the evaluation results of the implementation of livestock development, there are obstacles in increasing the population of livestock production. One of them is the reduced availability of land for livestock, due to changes in the structure of land functions from agricultural land to food crops plantations and settlements.

Goat is one of the livestock commodities that have high population in Indonesia. Demand for goats is quite high because besides its utilization for daily consumption, it’s also needed for sacrificial worship.

Meat is the main product of raising livestock. Availability of good forage in quality and quantity is one of many factors affecting meat quality. The quality of tropical forage is characterized by high levels of crude fiber and low crude protein. Business development through superior forage planting is
limited by the increasingly limited land, while feed has the largest contribution from the production costs of livestock business.

To improve the quality of forage, especially to increase crude protein, feed digestibility and palatability, ammoniating technology is carried out.

Utilization and optimization of the potential forage and agricultural industrial waste as local resources, is a strategic step that must be taken to reduce the dependence of forage imports. Corn straw as crop residues could be a potential source of feed, although the quality is low. Therefore treatment is needed to improve its quality through an ammoniating technology. Ammoniating is a way to improve feed quality by providing urea as non-protein nitrogen, while molasses is a by-product of agro-industry in the process of making sugar which is useful as an energy source needed by livestock. However, because molasses as the main raw material for making a molasses-urea block is only limited to certain regions, modification is needed by replacing it with locally available raw materials.

UPSB is intended to supplement the food substances obtained by the body, so that there is a balanced composition for optimal production. Palm sugar is the result of processing sap that is tapped from palm trees. Palm sugar in UPSB is an easily digestible carbohydrate for goats that acts as an energy source and carbon skeleton in microbial cell protein synthesis. Giving UPSB is expected to increase the number of microbial populations in the rumen, enhancing feed digestibility and in turn increasing goat productivity.

The purpose of this research is to study the response of goats fed ammoniated local feed and UPSB.

Local feeds - Brachiaria mutica and corn straw are forage available throughout the year in large quantities, but they have several limitations such as low nutritional and biological value. Through ammoniating technology, it is expected that these forages can improve their quality and palatability.

The addition of UPSB as forage supplement can improve the nutritional value of feed. The addition of palm sugar will stimulate microbiological activity in the rumen to ferment fibrous feed more efficiently, so that livestock production can be maintained or even increased and livestock business can be profitable. This study is expected to obtain the right goat feed formulation by utilizing ammoniated local feed and UPSB.

2. Materials and methods
2.1 Procedures, Tools and Materials
This research was conducted in Paniki I village, Manado city, for 3 months. The livestock used consisting of 32 local male goats aged 12 months old and weighing around 18-20 kg. The cage used was an individual cage with a size of 1x0.7x0.5m, which was equipped with a special dining area for UPSB placement. The forages used were B.mutica grass and corn straw. The materials used to make UPSB can be seen in Table 2. UPSB was constantly given as much as 300gram / head / day and drinking water was given on an ad libitum basis.

The treatment rations given were regulated as follows:
R0 = Control (B.mutica grass)
R1 = Concentrate 1% of body weight + ammoniated corn straw (50%) + B.mutica grass (50%) + 300 gram UPSB
R2 = 1% Concentrate of body weight + ammoniated corn straw (100%) + 300gram UPSB
R3 = 1% concentrate of body weight + ammoniated B. mutica grass (100%) + 300 gram UPSB

| Nutrients   | Corn straw (%) |
|-------------|----------------|
| Dry matter  | 78.0           |
| Crude protein| 7.54           |
| Crude fiber | 36.70          |
| Fat         | 1.74           |
| Ash         | 14.00          |

Table 1. Contents of nutrients in corn straw
Calcium 0.67
Phosphor 0.21
Gross Energy 4063.1 (cal/kg)

Laboratory of Faculty of Animal Science, Sam Ratulangi University (2017)

Table 2. Urea Palm Sugar Block (UPSB) composition

| Ingredients | Percentage (%) |
|-------------|----------------|
| Palm sugar  | 50             |
| Urea        | 4              |
| Rice bran   | 26             |
| Coconut cake| 9              |
| Salt        | 2              |
| Mineral     | 9              |
| Total       | 100            |

Table 3. Composition of Goat’s concentrates

| Ingredients     | Percentage (%) |
|-----------------|----------------|
| Bran            | 70             |
| Coconut cake    | 20             |
| Fish flour      | 9              |
| Bone meal       | 0.5            |
| Minerals        | 0.5            |
| Total           | 100            |

2.2 UPSB Manufacturing process
UPSB is easily made using inexpensive feed ingredients, easily obtained by optimizing the use of available local ingredients. The followings are the steps of the UPSB process:

a. Firstly, prepare the ingredients according to the needs you want to make:
b. Weigh each ingredient according to the composition

c. Material in the form of solid / dry is mixed starting from a small amount, then added to a larger amount of material while stirring until it is even.
d. After that the liquid ingredients are added little by little while stirring, so that no lumps are formed
e. The dough is printed by printing equipment until it is solid.
f. After printing, it is dried under the sun for 24 hours
g. To maintain its quality, it needs to be packaged with transparent plastic.
h. Finally, the packaging is stored in a clean and free of mold location with a smooth air circulation

2.3 Measurement and Analysis
The observed parameters were dry matter intake, daily weight gain and blood metabolic status. Dry matter from feed was determined according to the AOAC (2000) method. Dry Matter Intake (DMI) was calculated by multiplying consumption of fresh feed by dry matter’s percentage.

2.4 Body Weight Measurement
Weigh measurement was carried out every 2 weeks. Daily weight gain data were obtained from the weight of the weighing results at the last study period minus the initial weight data of the period are divided by the number of study days.

2.5 Metabolic profile of blood
The metabolic profile of blood measured was serum mineral levels of calcium, magnesium, potassium, sodium and chloride. Blood sampling was carried out by withdrawing 2 cc of blood through jugular vein. Then mineral analysis was performed. Chemicals used to measure mineral content in blood samples were carried out with reagent kits, and mineral content readings were carried out by using a spectrometer.
2.6 Data analysis
Data were presented in tabular form using a completely randomized design (CRD) with 4 treatments and 8 replications. The obtained data were then analyzed using covariance analysis. If between treatments there was a significant or highly significant difference, it would proceed with Duncan’s multiple range test following the Steel and Torrie’s procedure (1991).

3. Discussion
3.1 Effect of Treatment on Dry Matter Intake (DMI)

| Mean variable            | Treatments |
|--------------------------|------------|
| Dry matter consumption   | R0         | R1         | R2         | R3         |
| (gr/head/day)            | 350.20c    | 425.50b    | 430.25b    | 470.90a    |

Superscript with different letters in the same line shows very significant different (P < 0.01)

The mean DMI in this study ranges from 350.20 - 470.90 gram / head / day. The results of analysis of variance showed the feeding of ammoniated local feed and UPSB in goat ration had a very significant effect (P <0.01) on DMI. Post-hoc analysis showed the R3 treatment was significantly higher (P <0.01) than the other treatments (R0, R1 and R2). While R2 treatment was not significantly different (P> 0.05) from R1 treatment. R1 treatment was significantly higher (P <0.01) than the treatment R0. The highest DMI was found in R3 treatment.

According to Aurora (1995), feed consumption is influenced in part by the rate of feed digestion and feed quality. The high crude fiber in the feed is a limiting factor for digestion duration, so that it will affect the rate of digestion and ultimately reduce feed consumption. Farizal (2008) states that molasses-urea block as feed supplementation can affect the nutritional value of feed, which will stimulate microbes in the rumen to ferment high-fiber feed efficiently. Wibisono (2005) examines that giving UPSB can increase the dry matter and protein consumption and weight gain in cattle. This is due to the presence of palm sugar which functions as a stimulant to increase appetite, so instinctively cattle will increase the consumption of dry ingredients. According to Nurhayu et al. (2010), by adding molasses-urea block as supplement, it could improve the nutritional value of feed by adding carbohydrates and stimulating microbiological activity in the rumen to ferment high-fiber feed more efficiently so that production can be maintained both in quality and quantity.

The role of urea as feed supplementation includes increased dry matter digestibility, increased protein content, increased dry matter intake, increased milk production and increased body weight (Yanuartono et al., 2017). Puastuti (2010) suggests that the use of urea in the feed either through the process of ammoniating or as a supplement can increase the digestibility of dry matter or increase its protein content.

4. Effect of Treatment on Daily Weight Gain

| Mean variable            | Treatments |
|--------------------------|------------|
| Daily weight gain        | R0         | R1         | R2         | R3         |
| (gram/head/day)          | 50.66c     | 97.20b     | 98.50b     | 110.40a    |

Superscript with different letters in the same line shows very significant different (P < 0.01)
The mean daily weight gain in this study ranges from 50.66 - 110.40 gram / head / day. The results of analysis of variance showed the feeding of ammoniated local feed and UPSB in goat rations had a very significant effect (P <0.01) on daily weight gain.

Post-hoc analysis showed the R3 treatment was significantly higher (P <0.01) than the other treatments (R0, R1 and R2). While the R2 treatment was not significantly different (P> 0.05) from the R1 treatment. The R1 treatment was significantly higher (P <0.01) than the treatment R0. The highest daily weight gain was in the R3 treatment. The R3 treatment produced the highest daily weight gain, because it is the most efficient in converting the consumed ration into body weight.

Weight gain is a reflection of the quality of feed provided. The amount of animal growth is a manifestation of the utilization of feed by the body which is very dependent on the quality of feed (Agustina, 2013). Rostini et al. (2014) states that daily weight gain is the ability of livestock to convert nutrients contained in feed into meat.

The treatment with UPSB (R1, R2 and R3) produced daily weight gain higher than treatment without UPSB (R0). This is in line with the opinion of Ella et al. (2004), which states that UPSB creates an optimal microbial growth environment conditions in the rumen and there are also proteins that can be directly absorbed by the body so that it responds well to weight gain. The observation of Zurriyati (2017) shows that there is a higher body weight gain (8 - 12%) in goats with additional molasses-urea blocks feeding compared to controls.

5. Effect of Treatment on Blood Metabolic Status

Table 6. Effect of treatment on blood metabolic status

| Mean Variables | R0       | R1       | R2       | R3       |
|----------------|----------|----------|----------|----------|
| Ca (mg/dL)     | 5.94c    | 9.57b    | 9.97b    | 14.05a   |
| Mg (mg/dL)     | 0.86c    | 2.44b    | 2.69b    | 5.02a    |
| Na (mmol/L)    | 120c     | 135b     | 138b     | 160a     |
| K (mmol/L)     | 2.8c     | 4.0b     | 4.5b     | 5.7a     |
| Cl (mmol/L)    | 100c     | 110b     | 113b     | 125a     |

Superscript with different letters in the same line shows very significant different (P < 0.01)

The mean serum calcium in this study ranges from 5.94 - 14.05 mg / dL. The results of analysis of variance showed the feeding of ammoniated local feed and UPSB in goat ration had a very significant effect (P <0.01) on serum calcium.

Post-hoc analysis showed the R3 treatment was significantly higher (P <0.01) than other treatments (R0, R1 and R2). While the R2 treatment was not significantly different (P> 0.05) from the R1 treatment. The R1 treatment was significantly higher (P <0.01) than the R0 treatment. The highest serum calcium was in R3 treatment. The normal range of goat serum calcium levels is 9-12 mg/dL (Church, 1979).

The mean serum magnesium in this study ranges from 0.86 to 5.02 mg / dL. The results of analysis of variance showed the feeding of ammoniated local feed and UPSB in goat rations had a very significant effect (P <0.01) on serum magnesium.

Post-hoc analysis showed the R3 treatment was significantly higher (P <0.01) than the other treatments (R0, R1 and R2). While the R2 treatment was not significantly different (P> 0.05) from R1 treatment. The R1 treatment was significantly (P <0.01) higher than the R0 treatment. The highest serum magnesium was found in the R3 treatment. The normal range of serum magnesium in goat is 1.8 - 3.0 mg / dL (Church, 1979). According to Robinson et al. (1989), magnesium deficiency results in decreased appetite so that overall nutrient intake decreases.

The feeding of ammoniated local feed and UPSB in goat rations resulted in a very significant effect (P <0.01) on serum sodium, potassium and chloride levels. Aurora (1995) argues that minerals
for ruminants, besides being used to meet their own needs are also used to support and supply rumen microbial needs.\(^2\) If there is a deficiency of one mineral then the microbial fermentation activity does not take place optimally; consequently it will have an impact on decreasing livestock productivity.

Post-hoc analysis showed the R3 treatment was significantly higher (P <0.01) than the other treatments (R0, R1 and R2). While the R2 treatment was not significantly different (P> 0.05) from than R1 treatment. The R1 treatment was significantly higher (P <0.01) than the R0 treatment. The highest level of serum sodium, potassium and chloride level was found in the R3 treatment.

Normal goat serum potassium is 3.8 - 5.2 mmol / L (Anderson and Rings, 2009).\(^14\) Potassium is essentially needed by rumen microorganisms, and lower potassium concentrations in forage will reduce feed intake in ruminants (Velladurai et al., 2016).\(^15\)

Normal serum sodium in goat blood is 137 - 148 mmol / L (Anderson and Rings, 2009).\(^14\) While the normal serum chloride is 90-110 mmol / L (Clark, 2001).\(^16\) Sodium and chloride have a close ionic relationship, so they are called salt compounds or sodium chloride – NaCl (Holum, 1998).\(^17\) Low NaCl intake in long term basis could affect livestock health conditions such as decreased appetite and body weight (Berger, 1987).\(^18\)

According to Sriagtula (2008), the role of minerals is very important in all aspects of the livestock's metabolism.\(^19\) Deficiency or excess of one mineral will disrupt metabolism, which is manifested in livestock productivity. This is one cause of the low body weight gain of goats.

6. Conclusion

From the results of this study, it can be concluded that the R3 treatment gave the best results compared with R0, R1 and R2 treatments, in terms of dry matter intake, daily weight gain and blood metabolic status.

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