Provision of Multi-Nutrient Block for Local Goats: Effects on Physico-Chemical Properties of Goat Milk

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ABSTRACT

Farmers in Enrekang, South Sulawesi typically feed their goats with *Gliricidia maculuta* as a sole diet. This may cause a problem due to asynchrony of nutrient availability in the rumen, especially the availability of energy and protein, which could lead to poor milk yield in terms of quantity and quality. The purpose of this research was to study the effect of providing multi-nutrient block (MNB) on the physical and chemical characteristics of goat milk. Ten Ettawa crossbred goats on the 3rd-4th month of their lactating period were randomly divided into two groups (five goats/group). Each group was either fed on *Gliricidia maculata*/control (ration C, a ration typically used by Enrekang farmers for feeding their goats) or fed on C + MNB (CM). MNB was formulated from locally available feedstuff and was provided at the level of approximately 500 g/head/d. The results of the study showed that provision of MNB did not significantly (P>0.05) improve milk yield, i.e. 198 and 274 ml/d for C and CM, respectively. The treatment did not significantly (P>0.05) affect physical characteristics, i.e. pH and specific gravity of the milk. Similarly, provision of MNB did not significantly (P>0.05) alter chemical composition, i.e. total solids, crude protein, fat, carbohydrate, lactose, mineral, Ca, and P of the milk. In conclusion, there was no significant benefit on providing multi-nutrient block for goats consuming *Gliricidia maculuta* as a sole diet in terms of physical and chemical properties of the milk, but there was a tendency that provision of MNB may improve yield, crude protein and fat of goat milk.

Key Words: Multi-Nutrient Block, Protein of Goat Milk, Fat of Goat Milk, Total Solids of Goat Milk, Gliricidia maculata

INTRODUCTION

Milk is one of very important foods in the human diet. Milk serves as animal protein source, which is rich in nutritive components, such as protein, fat, carbohydrate, ash, calcium, and vitamins, as well as complete amino acid and fatty acid compositions. Similar to cow milk, the goat milk has been considered as a high quality food. Many factors have been reported to affect milk yield and milk compositions. Among others are breed (Ako, 2012), feeding (Andrade and Schmidely, 2006; Utari et al., 2012; Ramadhan et al., 2013); period of lactation (Bhosale et al., 2009; Strzakowska et al., 2009; Wibowo et al., 2013), management (Rangkuti, 2011; Ako, 2012), and environment (Mutamimah et al., 2013).

Management system is one factor that could affect the yield and the chemical properties of the milk. In Enrekang District, farmers usually feed their goats with *Gliricidia maculata,* a legume shrub, as the only diet for their animal. The farmers of Enrekang have been practicing this type of feeding management for a long time. Even though this feedstuff can be categorized as a good quality diet, which is characterized by its high digestibility and high crude protein content(Chadokar, 1982; Speedy and Pugliese, 1992; Toum et al., 2004; Winugroho and Widiawati, 2009; Islamiyati et al 2013), availability of energy and protein from this particular diet in the rumen is not synchronized due to high and very rapid protein degradation rate, which, in turn, could affect optimum rumen fermentation (Natsir, 2004).Winugroho and Widiastuti(2009) reported only 24-30% of protein of leucana and gliricidia can be utilized by the sheep, most of the protein is degraded in the rumen and lost through the urine. It is therefore important to provide some nutrients, especially energy source feedstuff, to balance the availability of protein of *Gliricidia maculata*. Synchronization of energy and protein availability in the rumen is an important factor optimizes rumen fermentation system (Andrade and Schmidely, 2006; Natsir, 2004, 2012).

Provision of multi-nutrient block (MNB), a feed supplement formulated from locally available feedstuff, is important to correct the nutrient problem for the goats in Enrekang.It is a good strategy for meeting all essential nutrients required by dairy goats for optimum milk production. The benefits of giving MNB to the goats can be seen not only from the aspect of meeting the nutrient requirements of the animal but also from the aspect of optimizing the utilization of agricultural by-products and agro-industry, which are abundantly available in the area. Syamsu *et al* (2003, 2006) reported that South Sulawesi has a high potential in agricultural by-product and agro-industry waste that can be utilized to support ruminant production, including goats. Therefore, this experiment was designed to study the impact of providing MNB on top of the basal diet (*Gliricidia maculata*) on the physical and chemical properties of goat milk in Enrekang District, South Sulawesi.

MATERIALS AND METHODS

Treatment Diet and Experimental Design

Ten dairy goats in the 3rd-4th monthof lactation period, with an average body weight of approximately 40 kg,were randomly assigned into two groups (five goats/group). Each group was either fed on *Gliricidia maculata/*control diet = C (diet typically used by the local farmers in Enrekang)or fed on control feed + multi-nutrient block (CM). Multi-nutrient block (MNB) used in this study was sourced from locally available feedstuff and prepared in the Laboratory of Feed Industry, Faculty of Animal Science, Hasanuddin University. MNB was formulated to contain crude protein content around 20%. *Gliricidia maculata*was offered *ad libitum* while MNB was provided at the level of 500 g/head/d. The composition of MNB is presented in Table 1, while chemical composition of *Gliricidia maculata* and MNB is presented in Table 2. Throughout the study, each animal had free access to drinking water.

Table 1. Feedstuff composition of multi nutrient block

Ingredients	**Composition (%)**
Molasses	40
Urea	2.5
Rice brand	20
Copra meal	15
Corn ears	10
Fish meal	5.5
Mineral	2
Salt	1
Cement	4
Total	100

Sampling

All animals were fed on the experimental diet for one month before taking samples. Daily feed intake was measured for five consecutive days. Feed samples (*Gliricidia maculata* and MNB) were subjected to laboratory analysis during the sampling period. Feed consumption was calculated by substracting the amount of feed offered from the orts. Similarly, milk production was measured for five consecutive days during the sampling period. Each animal was milked once a day in the morning.

Individual milk sample was placed in a marked container and put in an ice box before this was brought to Makassar for laboratory analysis.

Table 2. Chemical composition of feedstuff used in the experiment*

Nutrients (g/kg DM)	***Gliricidia maculata***	**MNB**
Dry matter	224.2	830.5
Crude protein	208.6	196.3
Ether extract	49.4	42.4
Crud fibre	195.9	63.4
Nitrogen free extract	446.6	541.6
Minerals	99.5	156.3
Neutral Detergent Fiber	346.1	249.6
Acid Detergent Fiber	186.1	144.0
Hemicelluloses	155.5	105.6
Cellulose	129.0	96.8
Lignin	48.3	38.0

MNB = Multi-nutrient block
*The Feed Chemical Laboratory , Faculty of Animal Science, Hasanuddin University, 2014.

Chemical Analysis

Chemical composition of diet (*Gliricidia maculata* and MNB) was determined for dry matter, organic matter, crude protein, crude fibre, ether extract, nitrogen-free extract, and mineral (AOAC, 2000). The diets were also analyzed for fibre composition: neutral detergent fiber (NDF), acid detergent fiber (ADF) and lignin (Goering and Van Soest, 1970). With regard to physical properties, the milk was analyzed for pH and specific gravity, while chemical composition of the goat milk was determined for total solids, crude protein, fat, carbohydrates, lactose, ash, calcium, and phosphorus (AOAC, 2000).

Parameters and Data Analysis

Parameters measured inthis experimentincluded milk yield; physical properties of the milk, i.e. pH and specific gravity; and chemical properties of the milk, i.e. total solids, protein, fat, carbohydrate, lactose, mineral, calcium, and phosphor. All data were analysed using t-test for two means with assumption of unequal variances for both groups (Sudjana, 2005).

RESULTS AND DISCUSSION

The goats were in good condition throughout the study. As feed intake has been recognized as one factor affecting milk yield and milk composition, the rate of nutrient intake was measured in addition to milk properties parameters. Nutrient intake depends on several factors, i.e. type of diets, nutrient concentration and palatability. Dry matter intake of dairy goats in this study was 1,578 and 1,753 g/d for C and CM, respectively, or around 3.9% and 4.4% of BW. In this study, the average feed intake, when it was expressed in relation to their body weight, was still in the normal range for feed consumption of goats, namely, between 2% and4% of BW (Ako, 2012). High palatability of the diet is probabaly one reason why the intake is quitehigh (Parakkasi, 1999; Natsir, 2012). Intake for some other nutrients, i.e. crude protein, neutral detergent fibreand acid detergent fibre was 329, 539and 294 g/d for ration C and 361, 563, and 310 g/d for CM, respectively. Analysis of variances indicated no significant difference in nutrient intakes for both groups. Even though that there was no significant difference in feed intake between both groups, there was a tendency that the goats consuming ration CM had more nutrient intakes. This is can be understood as the provision of MNB increased the total intake for the whole ration compared with the feed intake of the goats consuming only *Gliricidia maculata* (ration C).Positive associative effect could be observed in this experiment in which provision of energy sources on protein feedstuff source increases the total intake of the ration (Natsir, 2004).

Table 3. Nutrient intakesof each treatment diet

Parameters	**Ration C**	**Ration CM**
	-------------------------------g/d	-----------------------------------
Dry matter	1,578	1,753
Crude protein	329	361
NDF	539	563
ADF	294	310

Ration C = *Gliricidia maculata*
Ration CM = *Gliricidia maculata*+ Multi-Nutrient Block

With regard to milk production, statistical analysis indicated that there was no significant difference (P>0.05) of milk yield for both treatments, namely 198 ml/d and 274 ml/d for C and CM, respectively. Many factors contribute to the milk yield, such as breed, feeding, period of lactation, environment, and management system (Andrade and Schmidely, 2006; Bhosale et al., 2009; Ako, 2012; Utari et al., 2012; Wibowo et al., 2013; Mutamimah et al., 2013).However, the main reason for low milk yield is due to the period of lactation. In this study, most of the goats used were already entering the third or fourth month of their lactation period. Period of lactation is an important factor determining the milk yield, higher in the early lactation and continuously decreasing to the end of location period (Ako, 2012). Even though statistical analysis indicated that milk yield for both groups was similar, there was a tendency that provision of multi- nutrient block increased milk yield. This is might be related to nutrient intakes, in which the goats consuming ration CM tended to consume more nutrient than that of the control group, ration C (Table 3). High variances of the data might be another factor that contributed to the failure of statistics in determining the difference between both groups.

Table 4. Milk yield, milk physical properties, and milk chemical propertiesfor both treatments

Ccriteria	**Ration C**	**Ration CM**
Milk yield (ml/d)	198	274
Physical properties:		
pH	6.6	6.5
Specific Gravity	1.04	1.04
Chemical properties:		
Total solids (%)	12.77	12.88
Crude protein (%)	3.48	3.81
Fat (%)	3.92	4.62
Carbohydrates (%)	3.67	4.02
Lactose (%)	2.76	3.03
Mineral (%)	0.86	0.85
Calcium (%)	0.16	0.15
Phosphor (%)	0.10	0.10

Ration C = *Gliricidia maculate;* Ration CM = *Gliricidia maculata*+ Multi-Nutrient Block

In terms of milk quality (physical and chemical properties), provision of multi-nutrient block on top of the basal diet did not significantly (P>0.05) alter the physical and chemical composition of the milk (Table 4). The milk pH and milk specific gravity of both treatmentswere not different. Similarly, chemical milk components, i.e. crude protein, fat, carbohydrates, lactose, mineral, calcium and phosphorus of both treatmentswere similar. Numerically, however, there was a tendency that crude protein content and fat content of milk obtained from goats given multi-nutrient supplement increased. This is might be related to higher nutrient intakes (crude protein and fibre intakes) of goats in this group.

Tendency of increasing milk protein content of goats receiving MNB is due to an increase of crude protein intake. Moreover, provision of MNB in the ration CM may improve synchrony of energy and protein availability in the rumen that leads to optimum microbial protein synthesis (Andrade and Schmidely, 2006; Natsir 2007), which, in turn, increased microbial protein supply for the host animal (Natsir, 2007). This was supported by the percentage of blood urea plasma (data not shown) of the animal. The concentration of blood urea plasma of goats consuming CM was lower than that of goats consuming ration C, meaning that availability of N from protein degradation of *Gliricidia maculata* in the rumen can be coupled by the availability of energy from the MNB.The results of this study is consistent with the results reported by Sukarini (2006) and Utari *et al* (2012), who stated that addition of protein source feedstuff could increase total solids non-fat and protein of the milk. Even though, milk protein content in this study was lower than that reported by Mutmainnah et al, 2013, who stated that milk protein content of Sapera goat was between 4.45-4.60%. However, in general, protein level of milk reported in this study is still inside the range of protein content reported by Jennes (1980) who reviewed all studies regarding the chemical properties of goat milk published between 1968 and 1979.As what happened with milk protein, there was a tendency that percentage of fat in the milk of goats consuming CM was higher. Increased level of milk fat is related to higher consumption of NDF and ADF. Animals consuming high fiber diet will produce more acetic acid during fermentation of the diet in the rumen. Acetic acid is the precursor for fat synthesis (Ace and Wahyuningsih, 2010; Ramadhan et al., 2013).

CONCLUSION

Provision of multi-nutrient block (MNB) on top of the basal diet (G*liricidia maculata*) did not significantly alter physical and chemical properties of the milk of the local goats. There is a tendency, however, that provision of supplements may improve the crude protein and fat content of the local goat milk.

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