Blood Glucose and Blood Urea Levels from Castrated, Non-Castrated Male, and Female Domestic Goats that were Fed Complete Feed

Paulus Klau Tahuk[1*] and Gerson F. Bira[2]

[1]*Animal Husbandry Study Program, Faculty of Agriculture, Universitas Timor, Kefamenanu-NTT*
[*]*Corresponding author. Email: paulklau@yahoo.co.id*

ABSTRACT
The productivity of local goats is strongly influenced by various factors including the nutritional content and availability of feed and internal factors (livestock) such as gender and management are also very decisive. Theoretically, differences in livestock sex and castration treatment can contribute to increasing the productivity of fattened goats. The contribution of complete feed and differences in sex and castration treatment can be seen from blood glucose and blood urea levels. This study aimed to determine blood glucose and blood urea levels of castrated, non-castrated male, and female domestic goats (*Carpa aegagrus hircus*) that were fed complete feed. The study used a completely randomized design using 15 domestic goats which were divided into 3 treatments, namely treatment T1: Castrated young male domestic goats group; T2: Non-castrated young male domestic goats group, and treatment T3: Young female domestic goats group. The three treatment groups were given a complete feed consisting of 30% corn straw + 20% *Gliricidia sepium* + 30% milled corn + 15% pollard bran + 5% rice bran and drinking water which was provided ad libitum. Blood was taken from the jugular vein at the end of the study-4 times per animal, namely 0 hours before being fed, 2 hours, 4 hours, and 6 hours after being fed complete feed. Data were analyzed using analysis of variance (ANOVA). The results showed that the treatment had no significant effect ($P>0.05$) on blood glucose levels at 0, 4, and 6 hours; while at 2 hours, it had a significant effect ($P<0.05$). Blood urea levels also had no significant effect ($P>0.05$) on samples taken at 0 hours before being fed and 2, 4, 6 hours after being fed. It is concluded that castrated male goats, non-castrated male goats, and female goats that were fed complete feed showed the same effect on blood glucose and blood urea levels produced.

Keywords: *Complete feed, Gender and castration, Domestic goats, Blood glucose, Blood urea*

1. INTRODUCTION

Increased productivity of goats needs to be done considering the important role of goats in people's lives, especially in dry-land areas such as East Nusa Tenggara. Goats have long been bred by farmers to meet human needs such as to provide animal protein, to be a source of income as well as to be used in matters of customs and religious events.

The process of breeding goats will show optimal production if it is supported by the availability of feed with complete nutritional content. One type of feed that can be given to goats is complete feed. Complete feed is forage and concentrate that is prepared and formulated in a complete and balanced manner which is given as the only source of feed except for water to meet the needs of livestock.

Provision of complete feed can be done by utilizing agricultural waste such as corn straw. Generally, after the seeds are taken, the corn straw is left alone until it rots and even burns when in fact, it can be used for ruminant fodder. The use of fibrous crop residues is an appropriate way to increase intake to increase feed utilization by livestock [1].

One of the characteristics of goats' eating habits is their selective nature. This trait is one of hindering

factors in goats breeding by farmers. The provision of feed in the form of complete feed is said to be able to minimize the selective nature of the goats [2].

Castration is one of the alternative management practices that can be implemented to ensure efficient livestock growth and feed conversion, to produce livestock with a docile temperament, as well as to make male livestock growth optimum without having to sacrifice their welfare [3, 4, 5]. In addition to castration, the utilization of nutrients derived from feed can be influenced by various factors such as gender. Gender classification (sex-class) has a significant effect on the carcass' weight, where the growth of male livestock is faster than the growth of females [6]. Thus, it is thought that there are differences in the utilization of feed energy by the body in the metabolic process. The food consumed will pass through the digestive tract and in this process, some of the energy will be wasted in the form of methane gas and energy in the faeces, and part of the energy is absorbed by the body and used in metabolic processes [7].

Energy and protein are needed by livestock to perform maximum production. Blood glucose and blood urea are parameters that can describe the adequacy of feed, especially energy and protein consumption [8]. Most of the energy needed by ruminant animals is obtained from carbohydrates [9]. Meanwhile, protein can determine the high and low levels of blood urea. The high concentration of NH_3 (ammonia) in the rumen and low energy consumption by livestock also depend on the availability of energy [8] because it affects energy and protein utilization for rumen microbes-which lead to nutrient absorption so that it is sufficient to determine peripheral blood circulation.

Rumen microbes will utilize NH_3 for body formation which will then be absorbed through the rumen wall and blood circulation-and enter the liver-where it will be converted into urea [10]. The need for energy can be obtained from carbohydrates, fats, and proteins which can be provided by complete feeds. Referring to the concept of thought that has been explained, it is necessary to conduct a study to determine the extent of the effects of gender differences and castration treatment on blood glucose and blood urea levels of goats that are fed complete feed.

2. MATERIALS AND METHODS

Research time, place and design

The study took place in the experimental cage at Universitas Timor from May-August 2021, while the blood analysis was carried out in the Bio Reproductive and Livestock Health Laboratory, Faculty of Animal Husbandry, Universitas Nusa Cendana. This study used a completely randomized design (CRD) with 15 growth-age domestic goats (goats) (5-6 months) which were divided into 3 groups, and each treatment consisted of 5 goats:

T1: Castrated young male domestic goats group

T2: Non-castrated young male domestic goats group

T3: Young female domestic goats group

The three treatment groups were given a complete feed consisting of 30% corn straw + 20% *Gliricidia sepium* + 30% milled corn + 15% pollard bran + 5% rice bran and drinking water was provided *ad libitum.*

Research procedures

Complete feed production procedure

The steps in making a complete feed procedure are: fresh corn straw and *Gliricidia sepium* leaves which were collected from the surrounding area dried in the sun to reduce the moisture content. Next, the two feed ingredients were ground with a milling machine on a sieve diameter of 10 mm. Concentrated feed ingredients in the form of corn were also collected from the market and the local community, milled using a milling machine on a 5 mm sieve diameter. The three feed ingredients that have been milled were then mixed evenly with rice bran and pollard bran as well as mineral premix according to the formulation that has been prepared which includes: corn straw 30% + *Gliricidia sepium* 20% + milled corn 30% + pollard bran 15% + rice bran 5%. The ration mixture was then ready to be given to livestock.

Blood drawing procedure

Blood samples were taken through the jugular vein-as much as 5 ml, using a multi drawing needle (suction needle) which was placed in the tube holder and injected in the jugular vein, then followed by a vacuum tube containing the anticoagulant EDTA (*Ethylene Diamine Tetraacetic Acid*). Blood sampling was carried out at the end of the study period and taken at 0 hours before being fed complete feed; then at 2 hours, 4 hours, and 6 hours after being fed complete feed for each animal. Blood samples were taken to the laboratory and centrifuged at 3,000 rpm for 10 minutes; blood serum was taken for analysis of blood serum urea and blood glucose.

Variables and variable measurement procedures

Table 1. Nutritional Content of Complete Feed Ingredients

Nutritional Content	Feed ingredients				
	Corn straw*	*Gliricidia sepium**	Milled Corn*	Pollard bran*	Rice bran*
DM (%)	86.740	88.580	88.423	87.611	90.010
OM (%)	77.866	78.649	87.126	82.854	75.964
CP (%)	4.274	25.487	9.161	18.957	8.220
CF (%)	31.630	16.900	2.478	8.780	18.279
EE (%)	0.626	3.090	3.080	4.560	8.752
CHO (%)	72.966	50.072	74.885	59.337	58.992
NFE (%)	41.336	33.172	72.407	50.557	40.713
TDN (%)	42.913**	73.13***	90.504**	80.45**	75.69**
GE:-(MJ/kg.DM)	13,873	15,894	16,226	16,416	15,154
-(Kcal/kg.DM)	3,303.03	3,784.31	3,863.36	3,908.49	3,615.19
EM (Kcal/kg.DM)	1,996.82	2,672.32	3,691.04	3,784.31	2,815.46

Note: *Analysis Results of Feed Chemistry Laboratory, Faculty of Animal Husbandry, Undana (2021); **According to the equation [11]; NFE: extract material without nitrogen, TDN: Total digestible nutrients.**** [12]

Table 2. Use of forage and concentrate (%) in the study (basic of DM)

Feed type	Usage proportion	Forage and concentrate ratio
Fresh corn straw	30	50 : 50
Gliricidia sepium	20	
Yellow corn	30	
Pollard bran	15	
Rice bran	5	
Total	100	

Table 3. The composition of the study feed (basic of DM)

Feed Ingredients	Proportion of feed ingredients	Nutritional Content of feed ingredients making ration			Nutritional Content of the composed ration	
		DM (%)	CP (%)	TDN (%)	CP ration (%)	TDN ration (%)
Fresh corn straw	30	86	9	58	2.6	17.4
Gliricidia sepium leaves	20	86	26	78	5.2	15.6
Milled corn	30	89	10	80	3.1	24.0
Pollard bran	15	90	7	51	0.3	2.5
Rice bran	5	85	16	74	2.4	11.1
Total	100				13.7	70.6

The variables measured in the study were blood glucose levels and blood urea levels which were measured using a spectrophotometer. Tubes were prepared according to the number of samples and filled with 5 ml glucose reagent and 1 tube filled with standard reagents. As much as 0.02 ml of blood plasma samples were added into a tube containing glucose reagent then left for 20 minutes. Enter the standard reagent into the spectrophotometer which has been connected to the monitor screen and the absorbance of the standard solution would be read at a wavelength of 546 nm. The same thing was also done on samples that had been left for 20 minutes—the absorbance of the standard solution was read at the same wavelength. Calculation of blood glucose levels was done with the formula: (Abs. Sample/Abs. Standard) X 100 Mg/dl.

Tubes were prepared according to the number of samples and filled with 5 ml urea reagent and 1 tube

filled with standard reagents. Furthermore, 0.02 ml of blood plasma samples were added to the tube containing the reagents and left for 20 minutes. Standard reagents were entered into a spectrophotometer that has been connected to a monitor screen. The absorbance of the standard solution was read at a wavelength of 546 nm. The same was done on samples that had been left for 20 minutes then the absorbance of the standard solution would be at the same wavelength. Calculation of blood urea levels was done with the formula: (Abs. Sample/Abs. Standard) X 50 Mg/dl.

Data analysis

The data obtained were analyzed according to the analysis of variance (ANOVA) and continued with Duncan's multiple distance testing [13]. The Analysis Tool used was SPSS version 21.

3. RESULTS AND DISCUSSION

Blood Glucose

Blood glucose contained in the blood reflects the energy sources available in the body [14], and is often referred to as blood sugar levels. Results of this study (Table 2) showed that all the subject groups, castrated young male domestic goats (T1), non-castrated young male domestic goats (T2) and young female domestic goats group (T3) had no significant effect on blood glucose levels at blood sampling 0 hours before feed consumption, and at 4 and 6 hours after feed consumption ($P>0.05$). At 2 hours of blood sampling after being fed, the blood glucose level had a significant effect ($P<0.05$)-where the T2 treatment results in higher blood glucose levels than the T1 and T3.

The difference in blood glucose levels at 2 hours showed that after 2 hours of feed consumption, feed digestibility began to increase, which increased blood glucose, where the peak was at 4 hours after feed consumption (Table 4). When digestibility of feed in the rumen is maximal, it has an impact on increasing the content of rumen VFA which is a glucose precursor. Livestock in the T2 treatment was thought to have a higher VFA content so that the blood glucose produced was also higher than the other 2 treatments.

Although non-castrated male goats showed higher blood glucose at 2 hours after feed consumption, gender and castration differences were thought to have no significant effect on blood glucose. High and low blood glucose is more influenced by the type of feed consumed and its quality as explained [15].

Blood glucose levels are influenced by the feed consumed after undergoing the mastication process and then enters the rumen where the breakdown of carbohydrates, fats and proteins occurs [16]. In this study, the nutritional content available in goat concentrate was high with a crude protein of 16.139% so that it could support the fermentation process carried out in the rumen by microbes into VFA and simple sugars [17].

Blood glucose kinetics (Table 4) shows that before being fed (0 hours) blood glucose levels were high but after being fed (2 hours) blood glucose levels decreased again then increased again at 4 hours and decreased again at 6 hours after being fed. There are several factors that affect the increase or decrease in blood glucose levels, including the stimulation of the release of the insulin hormones [18] so that it will accelerate the entry of glucose into the liver and muscles and converted it into glycogen [19]. Besides, energy consumption will also affect blood glucose levels [8]. Relatively the same blood glucose levels at 0, 4 and 6 hours of sampling because of the similarity of the control mechanism by the insulin and glucagon hormones which regulate the balance of blood glucose so that it results in the same blood glucose level. Blood

Table 4. Mean of Blood Glucose and Blood Urea Levels of Domestic Goats Seen from the Difference in Gender and Castration Treatment

Observation Variable	Pick Up Time	Treatment			Mean
		T1	T2	T3	
Blood Glucose (mg/dl)	0 Hours	74.56±10.49	79.52±9.77	71.56±4.28	75.21
	2 hours	69.90±4.96^{b}	78.83±2.03^{a}	69.43±2.78^{b}	72.72
	4 Hours	83.41±3.62	87.65±5.01	85.23±3.50	85.43
	6 Hours	68.24±9.80	71.93±8.42	65.37±3.91	68.51
	Mean	74.03	79.48	72.90	
Blood Urea (mg/dl)	0 Hours	39.76±2.80	38.98±2.86	40.64±2.35	39.80
	2 Hours	39.33±1.73	40,17±0.92	39.78±2.00	39.76
	4 Hours	42.09±0.67	43.62±1.62	42.29±1.37	42.67
	6 Hours	37.71±2.82	38.92±6.28	37.42±6.33	38.02
	Mean	39.72	40.42	40.03	

Data is presented in ±SD; T1 = Castrated Male Goats, T2 = Non-Castrated Male Goats, T3 = Female Goats. ^{ns}=Not significant

glucose levels in this study were normal, which ranged from 30-70 mg/dl for ruminants [20].

Blood Urea

The results of the study (Table 2) showed that the treatment of T1 (castrated young male domestic goats), T2 (young male domestic goats) and T3 (young female domestic goats) had no significant effect (P>0.05) on blood urea levels. This gives an understanding that castrated male domestic goats, non-castrated male domestic goats and female domestic goats have no effect on blood urea levels as it is more influenced by feed. The content of urea in the blood is influenced by the protein content of the feed [21]. The higher the protein feed, the higher the blood urea level.

Blood urea levels in this study were quite high. Blood urea level of PE goats (mg/dl) at 0, 4 and 8 hours of sampling was 28.972; 31.066 and 33.304 [22]. This is due to the type of feed and the nutritional content available in it. Crude protein content in the complete feed only ranged from 12-12.41% [22] while in this study the crude protein content of the complete feed was 16.139%.

Livestock that receives high protein feed intake, most of the protein will undergo fermentation in the rumen and have an impact on blood urea levels [23]. However, the blood urea levels that resulted in this study were still considered normal. The average blood urea range for ruminants is 26.6-56.7 mg/dl [24].

4. CONCLUSION

It was concluded that castrated young male domestic goats, non-castrated young male domestic goats, and young female domestic goats groups that were given complete feed could increase blood glucose and blood urea levels which were not much different (significant).

AUTHORS' CONTRIBUTIONS

P.K. Tahuk designed research, statistical analysis and drafted manuscripts. G.F. Bira assisted in the research process and data collection. All author makes a significant contribution to the research and has read and approved the final manuscript.

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