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EFFECT OF USING WHITE KABESAK LEAVES (*ACACIA LEUCOPHLOEA* ROXB) IN CONCENTRATE RATIONS ON CONSUMPTION, BLOOD UREA, AND GLUCOSE LEVELS, AND ECONOMIC VALUE IN LOCAL GOATS

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ABSTRACT
This study evaluated the effects of using white kabesak leaves (*Acacia leucophloea*) in concentrate rations in goats on consumption, urea, and blood glucose concentrations, and the economic value of rations measured through Income over Feed Cost (IOFC). A total of 25 male locals were used in the experiment with five different treatments, which involved varying the proportion of white kabesak leaves in the concentrate, Which is T0: 0%; T1: 10%; T2: 20%; T3: 30%, and T4: 40%. Results showed that the addition of white kabesak leaves significantly increased consumption and body weight gain of goats, but did not affect urea concentration, blood glucose, and IOFC. It was concluded that the use of white kabesak leaves in concentrate as a supplement increased the productivity of local goats as indicated by an increase in nutrient consumption, and IOFC values up to 20% usage level compared to the use of control feed.

KEYWORDS: Concentrate, consumption, economic value, local goats, white kabesak leaves.

INTRODUCTION
Feeding ruminants has always been a challenge that haunts livestock farming in dry areas. Livestock growth and production fluctuate with seasonal changes. Forages in pastures, especially natural grasses, cannot fulfill the needs of livestock during the dry season. Livestock generally cannot fulfill nutrient requirements for basic survival and production by relying solely on low-quality forage due to its low nutrient content.[1] The impact of low-quality basal feed on livestock is low productivity.[2] In several studies, it was found that the daily live weight gain (DLG) of local goats (Kacang goats) ranged from 30 g/d to 45 g/d when given natural grass as the sole feed.[3] In Indonesia, especially in the East, the lack of feed availability in terms of quality and quantity is a problem that ruminants face during the dry season.[4] Hozza et al.[5] also stated that this condition was also true. that goat production in tropical developing countries is based on extensive feeding management, characterized by browsing and grazing on low-quality natural pastures. The result is low productivity, with livestock generally undernourished due to inadequate nutrient supply for tissue metabolism.[3]

Various strategies are needed to overcome this condition. According to Gebregiorgis et al.[6] one of the efforts to overcome feed shortages, especially in small-scale farming systems, is the use of leguminous forage as a feed supplement in ruminant rations. Leguminous forages provide enough protein and energy for ruminants to produce.[7] Utilizing forage legumes that are endemically available in a region is a wise and economical course of action. Considering that about 70% of the input costs in livestock production systems are used for feed, optimal digestion, and metabolism are crucial for efficient and economical production systems. However, such increased utilization must not compromise the health and welfare of the livestock.[8] The feeding economy varies according to the cost of ingredients and is also influenced by animal intake and feed efficiency which will be converted per unit of body mass and the ability of livestock to convert dry matter intake into per unit of body weight gain.[9]

According to Traiyakun et al.[10] local forage protein sources derived from forage shrubs and trees can replace imported feed such as soybean meal as a protein supplement for increasing ruminant production such as goats. This has been proven by Isah et al.[11] that goats supplemented with leguminous shrubs helped improve

the utilization of low-quality forage during the dry season.

The white kabesak plant (Acacia leucophloea, Roxb.) Willd. Is a leguminous species that grows endemically on the island of Timor, East Nusa Tenggara Province, Indonesia, and is a mainstay feed for livestock during the dry season and can potentially replace leucaena in livestock rations.[12] The nutrient content of this forage is quite high, namely crude protein 16.20%, crude fiber 24.56%, Ether Extract 24.56%, total ash 8.22%, and BETN 49.03%.[13] The potential of white kabesak leaves will be useful if used in ruminant rations, especially as a component of concentrates given as a ration supplement. The use of white kabesak leaves in concentrates can have a positive effect on reducing the use of protein and energy from other concentrate components, which are traditionally used in goat rations so as to reduce ration costs without sacrificing production. This reduction in ration cost directly increases the economic value received due to lower input costs.

The hypothesis built from this research is that there is an increase in consumption and economic value of the ration as well as the content of urea and blood glucose of local goats given white kabesak leaves showing a positive effect. Based on this review, the purpose of this study is to evaluate the inclusion of white kabesak leaves in the ration on consumption, urea content, and blood glucose as well as the economic value of the ration of local goats.

MATERIAL AND METHODS

Research location

The research was conducted from March to May 2015 in the goat barn of Balai Besar Pelatihan Peternakan, Badan Penyuluhan dan Pengembangan Sumberdaya Manusia, Kementerian Pertanian, NoElbaki, Kupang-NTT. Analysis of feed samples was conducted at the Animal Nutrition and Food Laboratory, Faculty of Animal Husbandry, Brawijaya University, and blood glucose and urea analyses were conducted at the Health Laboratory Unit, East Nusa Tenggara Provincial Health Office.

Livestock Management

The animals used in this experiment were 25 male local goats aged 1-1.5 years with initial body weight (BW) ranging from 10.7-30.6 kg with an average of 16.71±5.003 kg. Goats were obtained from areas around the study site. Livestock were grouped into 5 herds and randomly assigned to 25 individual pen units. The goats were dewormed (Nemasol brand) orally during the preliminary period. The pens used were stage pens that were partitioned into individual pens, with floorboards spaced apart to remove feces. Each cage measures 120 cm x 75 cm x 70 cm and is equipped with a feeder and drinking water. Before the experiment, the cages were cleaned with soap and water and then disinfected using Neoantisep brand disinfectant and left for 5 days.

Ration Treatment

The concentrate feeds used were: Soyabean meal, coconut meal, corn meal, and rice bran while white kabesak leaves were collected from the area around Kupang City, East Nusa Tenggara Province. The white kabesak plant is endemic to the island of Timor, East Nusa Tenggara province, Indonesia. White kabesak leaves are dried by aerating and then ground into flour, then mixed with other concentrate feed based on the percentage in each treatment. The ration was prepared with a ratio of 60% natural grass and 40% concentrate (in DM) with a CP content of 11.5-12.5%. White kabesak leaves contain crude protein of 14.72%, crude fiber of 30.40%, total tannin of 0.97%, condensed tannin of 0.49%, total phenol of 3.52%, and NDF and ADF contents of 46.88% and 34.89%.

The ration was prepared with a ratio of 60% natural grass (NG) and 40% concentrate. The percentage of white kabesak leaves in concentrate according to the treatment was,

T0 = 60% natural grass: 40% Concentrate (without white kabesak leaves)
T1 = 60% natural grass: 30% Concentrate + 10% white kabesak leaves
T2 = 60% natural grass: 20% Concentrate + 20% white kabesak leaves
T3 = 60% natural grass: 10% Concentrate + 30% white kabesak leaves
T4 = 60% natural grass: 40% White kabesak leaves (without concentrate)

The composition of feed ingredients in each treatment is listed in Table 1. The nutrient content of each treatment is listed in Table 2.

Table 1: Composition of Concentrate Ingredients Containing White Kabesak Leaf.

Feed Ingredients (%)	Treatments				
	T0	T1	T2	T3	T4
Soybean Meal	12.5	10.0	7.5	5.0	0.0
Coconut meal	20.0	15.0	12.5	10.0	0.0
Rice Bran	37.5	25.0	17.5	5.0	0.0
Fine Corn	30.0	25.0	12.5	5.0	0.0
White Kabesak Leaf	0.0	25.0	50.0	75.0	100.0
	100	100	100	100	100

Table 2: Nutrient Content of Feed Treatment.

Nutrient Content (%)	Treatments				
	T0	T1	T2	T3	T4
Dry Matter	88.97	89.89	89.84	89.88	90.06
Organic Matter	87.89	87.86	88.19	88.47	88.50
Crude Protein	12.14	12.13	12.25	12.38	11.72
Crude Fiber	27.90	28.32	28.64	31.21	34.54

Variables measured

Response variables measured included ration consumption, urea and blood glucose concentrations and

the economic value of the ration.

1. Dry matter consumption

Consumption of dry matter was determined by subtracting the amount of feed given from the amount of residual feed. The natural grass that was fed was weighed and the uneaten residue was weighed the following day. Grasses were given and the rest were sampled (100 g) to be analyzed for dry matter content using the method established by AOAC.[14] Consumption measurements were made using the following formula,

DMI (g/kg $BW^{0.75}$/day) = {feed (g) x (%DM)} - {feed residue (g) x (%DM)} / metabolic BW

2. Blood glucose and urea

Blood samples were collected from the jugular vein before the goats were fed at the end of the growing period. Blood samples were centrifuged at 4000 rpm for 20 minutes. A portion of the separated serum was used for enzyme activity determination, while the remaining portion was stored frozen at -20°C until biochemical analysis. Commercial kits were used for colorimetric biochemical determination. For blood collection, 10 mL of blood was collected using a vacutainer tube for blood plasma containing anticoagulant (EDTA). Blood samples were centrifuged and plasma was poured into tubes. Blood samples were analyzed using ABX micros 60 Hematology Analyser Specification.

3. Income Over Feed Cost (IOFC)

Income over feed cost is the amount of cost obtained from reducing the selling cost of goats with feed costs incurred and illustrates the economic value of rations to livestock. IOFC value is measured in IDR per goat per day referring to the equation of Bailey et al.[15]: IOFC =PLW x ADG-DFC

Where : IOFC: income over feed cost

PLW: farm-gate price of live weight of goat (IDR/kg)

ADG: average daily gain

DFC: daily feed cost (IDR/kg)

Assuming: price per kg of grass IDR 1000, soybean meal IDR 6000/kg, coconut meal IDR 4000/kg, rice bran IDR 3000/kg, finely ground corn IDR 4500/kg, white kabesak leaves IDR 2750/kg and live weight price of goats IDR 50000/kg.

Statistical Analysis

The research data were processed and statistically analyzed using ANOVA according to the Randomised Group Design. Treatment means that showed a significant effect were tested using Duncan's Multiple Range Test (DMRT) using the General Linear Procedure (GLM) Statistical Analysis System.[16]

The mathematical model used is as follows:

$$Yij = \mu + \alpha i + \beta j + €ij$$

Description:

Yij = Observation result

μ = Generalised mean value

αi = Effect of feed treatment

βj = Effect of jth group

€ij = Experimental error i-th treatment, j-th group

i = 1,2,3,4,5

j = 1,2,3,4,5

RESULT AND DISCUSSION

The average ration consumption of feed from the experimental goats is presented in Table 3.

Table 3: Average Nutrient Consumption (g/kg $BW^{0.75}$/day) of Goats Receiving White Kabesak Leaves in Concentrate as a Supplement.

Variables measured	Treatments				
	T0	T1	T2	T3	T4
Nutrient consumption, g/kg, $BW^{0.75}$/day:	49.96±16.56^{b}	38.67±6.98^{ab}	38.37±6.06^{ab}	32.10±5.92^{a}	30.61±4.22^{a}
DMI Concentrate	18.81±0.93	13.76±1.53	8.78±1.07	4.74±0.24	0
DMI White kabesak leaves	0	4.74±0.53	9.08±1.10	14.75±0.72	19.04±1.53
Total DMI	68.77±17.14^{b}	57.17±5.04^{ab}	56.22±4.52^{a}	51.60±6.22^{a}	49.65±5.40^{a}
DMI NG: DMI Concentrate	2.66:1	2.09:1	2.15:1	1.65:1	1.61:1
DMI (% BW)	3.91	3.02	2.79	2.98	2.68

Notes: (a,b,c) mean values with different superscripts in the same row indicate significantly different (P < 0.05).
BW: Body weight; DMI: Dry matter intake; NG: Native grass.

The results of statistical calculations showed that the dry matter consumption of rations of research goats showed a significant treatment effect (P <0.05). The overall average DM consumption was 56.68±1.42 g/kg $BW^{0.75}$/day or 3.08% of the goat's BW. Devendra and Burns[17] stated that the DM consumption of local tropical goats ranged from 1.8-3.8% of body weight or equivalent to 40.5-127.3 g/kg $BW^{0.75}$ while NRC[18] stated that goat dry matter consumption was 2-3.8% of body weight. This means that the average consumption of feed DM in this study is within the recommended range. Overall, the use of white kabesak leaves in this study was above the consumption level recommended by Kearl[19] which is 50-55 g/kg $BW^{0.75}$ except in treatment T4 which was below this level. Increasing the level of white kabesak leaves in concentrate feed resulted in a decrease in total feed DM consumption. This is due to the influence of secondary compounds contained in white kabesak leaves although in small amounts. According to Ngwa et al.[20] and Sandoval-Castro et

al.[21] phenolic compounds, alkaloids, tannins, and aromatic compounds are known to reduce palatability regardless of the nutritional value of the feed. Livestock selection of feed depends on palatability, and tannins usually reduce palatability which results in reduced grazing vigor.[22] In this study, white kabesak leaves had a total tannin content of 0.97% and condensed tannin (CT) of 0.49%, which is low. The average consumption of total tannins and condensed tannins of goats is as follows:

- T0: 0 g/kg DM
- T1: 0.20±0.03 g/kg DM (condensed tannins) and 0.41±0.06 g/kg DM (total tannins)
- T2: 0.41±0.06 g/kg DM (condensed tannins) and 0.81±0.12 g/kg DM (total tannins)
- T3: 0.61±0.09 g/kg DM (condensed tannins) and 1.21±0.18 g/kg DM (total tannins)
- T4: 0.82±0.13 g/kg DM (condensed tannin) and 1.62±0.25 g/kg DM (total tannin)

Blood Urea and Glucose Concentration

Blood urea and glucose concentrations of goats fed white kabesak leaves in concentrate are shown in Table 4.

Table 4: Blood Urea and Glucose Concentrations of Goats Fed White Kabesak Leaves in Concentrate.

Variables measured	Treatments				
	T0	T1	T2	T3	T4
Blood urea concentration (mg/dL)	37.8±6.10	30.6±6.11	39.2±9.4	38.8±10.45	38.2±8.76
Blood glucose concentration (mg/dL)	72.0±3.81	74.0±7.94	75.6±2.97	78.8±4,97	79.0±12.19

Statistical test results showed that the treatment of using white kabesak leaves in concentrate feed did not significantly (P>0.05) affect the concentration of urea or blood glucose of the research goats. This indicates that the concentrations of these two blood components due to the use of white kabesak leaves did not differ between treatments and were in normal conditions. Blood urea and glucose levels can be used as indicators of goat energy status.[23] Even blood biochemical and hematological variables can be used to monitor and/or evaluate the health, nutritional, and physiological status of ruminants.[24][25]

Blood urea concentrations of the study goats ranged from 30.6 mg/dL to 39.2 mg/dL (10.92-13.99 mmol/L). There was a tendency for blood urea to increase with increasing levels of white kabesak leaves in the diet and T2 showed higher values than the other treatments. The blood urea concentration in this study was higher than the normal range for goats proposed by Lloyd [26] which is 11.2-27.7 mg/dL. Mousa[27] also found that in sheep fed 40% acacia saligna leaves (30.78 mg/dL) blood urea concentration was not different from those fed 20% (35.50 mg/dL) and 0% (31.51 mg/dL). The range of blood metabolites in this study was above the normal range. The recommended blood plasma urea range for goats by Mehrez[28] is 2.5-6.5 mmol/L, and Uguru[29] obtained blood plasma urea values in Red Sokoto goats fed diets containing acacia pods of 3.70-5.08 mmol/L.

The blood glucose concentration of goats in this study ranged from 72.0-79.0 mg/dL (3.99-4.38 mmol/L). This is slightly higher than the normal level for goats suggested by Kaneko[30] of 50-75 mg/dL (2.78-4.16 mmol/L). Glucose is used for cell maintenance, as an acetate precursor in fat synthesis of lactating animals, and fat synthesis in the liver and adipose tissue.

Continuous provision of glucose is important as the main source of energy for the nervous system and erythrocytes.[31] The blood glucose concentration of goats in this study increased linearly according to the level of use of white kabesak leaves. The use of blood glucose in livestock under normal conditions according to Weekes,[32] between 20 and 30 percent of the total glucose produced will be oxidized by the ruminal brain. Above 10% will be converted into glycogen by the liver while about 30% will be deposited as fat. The rest is used as an energy source by the tendons. The blood glucose concentration of goats in this study was higher than that obtained by Mousa[27] in sheep that received *acacia saligna* leaves 0% (51.08 mg/dL), 20% (41.75 mg/dL) and 40% (49.76 mg/dL). The difference is thought to be due to different types of livestock and types of feed, especially acacia leaves.

Economic value of the ration

Data on body weight and daily weight gain of goats and the economic value of the ration, which is described in the income over feed cost (IOFC) value, are listed in Table 5.

Table 5: Average Body Weight, Daily Weight Gain, and Income Over Feed Cost (IOFC).

Variables Measured	Treatments				
	T0	T1	T2	T3	T4
Initial body weight (kg)	15.78±3.42	17.1±6.58	18.24±7.32	15.54±2.99	16.90±5.17
Final body weight (kg)	19.43±3.62	20.70±6.73	21.98±7.53	19.05±3.10	20.07±5.49
Average Daily Gain (ADG) (kg)	3.65	3.60	3.74	3.51	3.17
Metabolic BW (g/kg $BW^{0.75}$)	8.57	8.99	9.41	8.46	8.86
Body weight gain per day (g/e/h)	$65.24±4.57^{bc}$	$64.31±4.84^{bc}$	$66.74±6,27^{c}$	$62.69±5.54^{b}$	56.67±6.64
Feed cost, IDR/day	1102.21	971.225	936.7	786.86	728.66

Live weight price, IDR/kg	3262	3216	3337	3134	2833
IOFC (IDR)	2159.79	2244.775	2400.3	2347.14	2104.34

Notes: (a,b,c) mean values with different superscripts in the same row indicate significantly different (P < 0.05).

The economic value of feed to produce ADG of research goats can be predicted from the feed conversion value, but through the calculation of IOFC, it can be known how much the actual cost must be incurred by subtracting the cost of feed from the sale value of goats per live weight prevailing in the market. The results showed that IOFC values were not different (P>0.05) among treatments. The use of white kabesak leaves in concentrate produces the same IOFC value as the control feed. This indicates that white kabesak leaves can be used as a concentrate in improving goat growth.

The amount of feed consumption and the resulting ADG can be used as indicators in analyzing the value of profit obtained based on the feed costs incurred. According to Khaskheli et al.[9] the economy of feeding varies according to the cost of materials and is also influenced by livestock intake and feed efficiency which will be converted per unit of body mass and the ability of livestock to convert dry matter intake into per unit of body weight gain.

The calculation results showed the IOFC value of goats that received concentrate with 20% white kabesak leaves (T2) resulted in a profit of IDR 2400.30. The results of this study are much higher than those reported by Simanihuruk et al.[33] who gave sago waste silage as goat basal feed with an IOFC value of IDR 111.398-130.923. The quality of feed in this study is still higher to produce goat performance that has high economic value. According to Bach[34], feed efficiency is a reflection of nutritional quality, reproductive performance, health, and management.

The average IOFC value in this study increased with increasing levels of white kabesak leaves use until treatment T3, while in treatment T4 the IOFC was lower than T0 (control). This shows that with the use of white kabesak leaves, the cost incurred for feed is lower with increasing live weight so the selling value of goats increases. Based on the IOFC value obtained, the goats that received the T2 treatment were still higher than the other treatments so they were considered more economical. This indication is supported not only by other response variables in vivo research but also in vitro research, where the fermentation product produced is higher in the treatment of 20% white kabesak leaves in concentrate. From the results of this study, it can be said that the use of white kabesak leaves (*Acacia leucophloea*) in goat rations can have a positive impact on IOFC, which is a measure of economic efficiency in livestock production. However, while improving production efficiency remains a key goal of all livestock enterprises, feed costs and livestock performance need to be assessed independently of market prices to provide benefits not only for producers but also for livestock welfare and the environment.[8]

CONCLUSION

The use of white kabesak leaves in concentrate as a supplement increased the productivity of local goats indicated by increased nutrient consumption, and IOFC values up to the level of 20% use compared to the use of control feed.

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DECLARATION OF COMPETING INTEREST

The authors declare that there is no conflict of interest.

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