



Effects of Supplementing Concentrates Varying in Ingredients on Blood Urea and Glucose Concentrations in Limousin Crossbred fed Cassava Leaf and Tuber Silage as Basal Diet

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Abstract. The cassava plant is considered a high-potential feed source for beef cattle due to its nutritional profile. Cassava leaves are characterized by high crude protein (CP) content, whereas cassava tubers serve as a valuable energy source. Using cassava leaf and tuber silage has been demonstrated to be an effective dietary strategy for beef cattle. This study aims to evaluate the effects of cassava leaf and tuber silage supplementation on blood urea concentration and blood glucose levels in Limousin crossbred. The in vivo experiment was conducted at the Sumber Sekar Field Laboratory using 20 Limousin crossbred cattle. The treatments consisted of varying inclusion levels of cassava leaf and tuber silage: 10% (P1), 15% (P2), 20% (P3), 25% (P4), and 30% (P5). Blood urea concentration and blood glucose levels were measured as response variables. The results showed that cassava leaf and tuber silage supplementation had a highly significant effect ($P < 0.01$) on blood urea concentration but did not significantly affect blood glucose levels ($P > 0.05$). It can be concluded that blood urea concentration and blood glucose levels in Limousin crossbred were within the upper threshold of normal ranges for ruminant livestock. Thus, blood glucose levels in this study can serve as a reliable indicator of the metabolic status and health of Limousin crossbred cattle supplemented with cassava leaf and tuber silage.

Keywords: Cassava Silage, Limousin Crossbred, Blood Urea Concentration, Blood Glucose Levels.

1 Introduction

The blood profile of cattle serves as a critical indicator of their metabolic status, health, and nutritional efficiency. Parameters such as blood urea and glucose levels provide valuable insights into protein and carbohydrate metabolism, which are directly influenced by dietary composition and feed quality. Blood urea levels reflect protein metabolism and the balance between protein intake and utilization, making it a reliable marker for assessing nitrogen efficiency and rumen microbial activity [1].

Similarly, blood glucose levels indicate the adequacy of energy supply from dietary carbohydrates and the hormonal regulation of metabolism.

In ruminants, dietary changes, especially in protein and carbohydrate sources, can significantly impact blood parameters. Cassava-based feed ingredients, such as cassava leaf and tuber silage, are increasingly explored as alternative feed resources due to their high nutritional potential and availability. Hay derived from cassava foliage in Thailand has been successfully utilized as a provider of ruminally undegraded protein and contains a significant amount of digestible nutrients [2]. However, the effects of these feed components on the blood profile, particularly urea and glucose levels, require further investigation to ensure their suitability for supporting optimal metabolic function and health in cattle.

This study focuses on evaluating the effects of varying levels of cassava leaf and tuber silage on the blood urea and glucose concentrations of Crossbred Limousin cattle. The findings aim to provide insights into how cassava-based silage influences metabolic indicators and contributes to the overall health and productivity of cattle.

2 Materials and Methods

2.1 Location

This research was conducted at the Nutrition and Animal Feed Laboratory, Faculty of Animal Science, Brawijaya University, Malang, to assess the quality of feed ingredients used during the study. In vivo trials using 20 crossbred Limousin cattle were carried out at the Sumber Sekar Field Laboratory in collaboration with the smallholder farmer (Kucur Mandiri).

2.2 Methods

This study aimed to evaluate the effects of cassava leaf and tuber silage levels on the blood profile of Crossbred Limousin cattle. The experiment was conducted following the principles of Harris [3] and consisted of three phases: [4] Preliminary Phase: Conducted over 7–10 days to ensure all cattle were healthy and acclimated to the experimental conditions. [5] Adaptation Phase: Conducted over 7–10 days, during which cattle were gradually introduced to the treatment diets. [6] Data Collection Phase. Blood Profile Analysis: Blood samples were collected over 3–4 days for the determination of glucose and urea concentrations.

The feed composition used in this study is detailed in the table below. Five dietary treatments (P1 to P5) were formulated with varying proportions of cassava tuber and leaf silage, while maintaining consistent levels of other feed ingredients across treatments.

Table 1. Experimental Feed Treatments.

Feed Ingredients	P1 (%)	P2 (%)	P3 (%)	P4 (%)	P5 (%)
Maize Stover	20	20	20	20	20
Cassava leaf and tuber silage	10	15	20	25	30
Palm Kernel Meal	20	20	20	20	20
Copra Meal	40	35	30	25	20
Coffee Pulp	10	10	10	10	10

Blood samples were collected via jugular venipuncture and analyzed for urea and glucose concentrations using standard spectrophotometric methods. Data on blood urea and glucose levels were statistically analyzed using ANOVA to evaluate the effects of dietary treatments.

Glucose Concentrations. The glucose concentration is measured using a glucose oxidase/oxidase method, which involves enzymatic reactions to form a colored complex quantifiable via spectrophotometry. Initially, glucose is oxidized by glucose oxidase to gluconate and hydrogen peroxide. The generated hydrogen peroxide reacts with phenol and 4-aminoantipyrine in the presence of peroxidase to form quinoneimine, a colored compound. The absorbance of this compound is measured at 500 nm. The procedure uses ready-to-use reagents and standards, with samples being serum or plasma collected using anticoagulants like heparin or EDTA. Results are calculated relative to a standard, ensuring accuracy through quality control and calibration with biochemistry control serums [7].

Blood Urea. The measurement of urea concentration is performed using the urease-salicylate colorimetric method. Urea in the sample is hydrolyzed by urease to produce ammonia and carbon dioxide. The released ammonia reacts with sodium salicylate and sodium hypochlorite to form indophenol, a colored compound. This color intensity is proportional to the urea concentration and is measured at 600 nm using a spectrophotometer. The method employs ready-to-use and pre-mixed reagents to ensure accuracy and convenience. Serum, plasma, or urine can be used as samples, with specific handling protocols to maintain stability. Calibration is conducted with provided standards, and quality control is ensured through biochemistry control serums. Results are interpreted against established reference ranges, with necessary precautions for potential interferences, including hemolysis and elevated ammonia levels [5].

3 Result and Discussion

The inclusion of cassava leaf and tuber silage had a highly significant effect ($P < 0.01$) on blood urea concentration. However, it did not have a significant effect on blood glucose levels ($P > 0.05$).

Table 2. Blood Fluid Profile.

Parameters	Treatments				
	P1	P2	P3	P4	P5
Glukosa (mg/dl)	73.25 ± 3.78	79.75 ± 6.70	77.25 ± 6.19	68.50 ± 6.19	69.50 ± 1.73
BUN (mg/dl)**	12.35 ± 0.87 ^b	12.08 ± 0.88 ^b	9.00 ± 0.71 ^a	8.55 ± 0.77 ^a	7.73 ± 0.65 ^a

The addition of cassava leaf and tuber silage levels did not have a significant effect on the blood glucose levels of Crossbred Limousin cattle. The highest blood glucose level was observed in treatment P2, at 79.75 mg/dL. Blood glucose levels originate from the digestion of dietary carbohydrates consumed by livestock [8]. The blood glucose levels in this study were lower compared to the findings [9].

The elevated blood glucose levels in Crossbred Limousin cattle in this study were influenced by several factors, including the amount of dietary carbohydrates and the release of insulin hormone. According to Anggorodi [4], the normal blood glucose levels in ruminants range from 30–70 mg/dL. The data from this study (Table 2) show that the blood glucose levels in Crossbred Limousin cattle were at the upper limit of the normal range for ruminants. Thus, the blood glucose levels observed in this study can serve as an indicator of the metabolic condition and health status of Crossbred Limousin cattle fed cassava leaf and tuber silage.

In this study, the blood urea levels of Crossbred Limousin cattle fed cassava leaf and tuber silage are presented in Table 2. Blood urea levels decreased as the inclusion level of cassava leaf and tuber silage increased. The highest blood urea level was observed in treatment P1, at 12.35 mg/dL, which may be attributed to the crude protein (CP) content in P1 at 16.80% and a CP intake of 1.11 kg/head/day. Conversely, the lowest blood urea level was recorded in treatment P5, at 7.73 mg/dL, likely due to lower dietary protein intake, which corresponds to reduced blood urea levels in Crossbred Limousin cattle.

The average normal range of blood urea nitrogen in cattle is 8–25 mg/dL [10]. The blood urea level in treatment P5 was below this standard range. According to Fal-lahnezhad et al. [6], urea is the final product of protein metabolism in ruminants, circulating in the bloodstream. Prawirokusumo [1] stated that blood urea levels can serve as an indicator of the cattle's ability to digest the protein in their feed and the utilization of ammonia by rumen microbes. Blood urea nitrogen is also an essential parameter for assessing the nutritional status and health of cattle.

4 Conclusion

The results showed that cassava leaf and tuber silage supplementation had a highly significant effect ($P < 0.01$) on blood urea concentration but did not significantly affect blood glucose levels ($P > 0.05$). It can be concluded that blood urea concentration and blood glucose levels in Limousin crossbred were within the upper threshold of normal ranges for ruminant livestock. Thus, blood glucose levels in this study can serve as a reliable indicator of the metabolic status and health of Limousin crossbred cattle supplemented with cassava leaf and tuber silage.

Disclosure of Interests. The authors have no competing interests to declare that are relevant to the content of this article.

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