

Assessing The Effects of Velvet Bean (*Mucuna Pruriens*) Meal on Growth Performance of Weaned Pen Fattened Mashona Goats



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Abstract

A quantitative research was conducted where 48 goats were used in the experiment. Goats were fed on raw velvet bean meal, roasted velvet bean meal, 20%, 60% and 100% per diet. A completely randomized design (CRD) was used. The Mashona goats used were of the same age and they were from the same flock which made the initial weights to be almost the same. Four treatments were used each with three replications and each replication had four goats. Final weight for goats from all treatments were significantly different ($p < 0.001$). Feed intake for goats fed diet containing 60% roasted velvet bean was significantly different ($p = 0.004$) from all other treatments. Feed conversion ratio was highest from goats fed 100% raw velvet beans followed by those fed 20%, 100% and 60% roasted velvet bean meal respectively. The highest average weekly weight gains for the feeding experiment were 0.96 kg for raw VBM and 1.01kg for 20% meal, 1.03kg for 60% and 1.04kg for 100% of roasted VBM. Weekly body weight gain were highest from goats fed with 100 % VBM. High feed intake was realized from goats fed with 20% roasted velvet bean meal whilst low value was from goats fed with 60 % roasted velvet bean meal. Goats fed with 0%, 20% and 100% roasted velvet bean meal were not significantly different ($p > 0.05$). Goats fed with 100% roasted VBM had the highest daily weight gain of 0.136kg/d whilst control (goats fed raw VBM) recorded the lowest (0.130kg/d). Final weight was highest from goats fed with 100% VBM which recorded an average of 15.01 kg followed by goats fed with 20% VBM recording 14.94 kg on average. Goat farmers are recommended to use 60% VBM roasted to pen fatten goats to increase farm profitability.

Keywords: Assessing; *Mucuna pruriens*; Goat performance; Pen fattened

Introduction

Goats are probably the first domesticated animals in the world around 900-700BC (Husen et al. 2014). This long association between humans and small ruminants indicate the variety of uses and importance they can provide. These include but not limited to meat and milk production, can be liquidated in times of urgent need for cash to pay for tuition, medical and transport expenses (Murungweni et al. 2014; Byaruhanga et al. 2015). Locally, the population of goats is above 6 million of which 98% are owned by smallholder farmers (Sabine et al. 2007). Small ruminants are mostly kept in drier areas of natural farming region IV and V. Generally, the importance of small ruminants increases as the rainfall decreases [1]. This brief history and distribution of small ruminants reflects their importance as an agricultural component over large stock. Goat productivity however remains very low mainly due to high mortalities and poor management. Insufficient protein for ruminant animals during dry season is a

serious perennial problem in subtropical region and in Zimbabwe. It has become the major drawback to increased productivity and leads to sub optimal animal production (Kala, 2010). Goats have also become the symbol of injustice on the international trade relations due to low prices offered on the world market and as a result chevron producers have been greatly affected since the cost of supplementation has sky rocketed. The high cost and unavailability of plant protein sources and in particular velvet bean meal in stock feed manufacturing companies and on feed formulations has made research interest to primarily focus on inclusion of velvet bean meal (VBM) with maize meal (Kalidas et al. 2011). Farmers can add value to their goat enterprises by making cheaper supplementary diets. Goats can increase their population because economically, opportunity costs are low [2]. Therefore, the objective of this study was to assess the effects of feeding raw and roasted velvet bean meal on growth performance of weaned Mashona goats.

Methodology

Experimental site

The experiment was carried out in Mushayavanhu communal area in Gutu. The area is within latitude 19° 39' south and longitude 31°10' east. It lies under natural region V where rainfall is erratic thereby receiving 450mm to 600mm of rainfall annually. The rain season usually starts in November ending in March. Dry spells are experienced during the season.

Management of goats

Forty-eight weaned Mashona goats were used to monitor average daily, weekly, total weight gain (growth rate) and feed intake of roasted bean versus unroasted beans. The selected weaners were vaccinated against pulpy kidney at the rate of 1ml per goat subcutaneously. The weaners were dewormed against internal parasites using Albex at the rate of 1ml per 10kg body weight. Multi-vitamin was injected before the weaners were placed in the pens to reduce stress. Each treatment was allocated to all animals. Goats were weighed using a digital scale so as to record their initial body weight (induction weight). Dipping was also done using triatix acaricides and spraying was the method used. The trial was run for 72 days. Treatment diet was given at 7.30am every day for each goat, the first 30 days was for adaptation hence

no data was collected. During the 30 days of adoption, goats were also trained to feed in feed troughs so as to get rid of shy feeders. As from day 31, goats were weighed on weekly basis for 6 weeks, feed was given twice per day at 7.30 am and 12.30 pm. Clean water was readily available to goats throughout the experiment period.

Experimental design

A quantitative research was conducted where 48 goats were used in the experiment. Goats were fed on raw velvet bean meal, roasted velvet bean meal, 20%, 60% and 100% per diet. A completely randomized design (CRD) was used. The goats were of the same age and they were from the same flock which made the initial weights to be almost the same. Four treatments were used each with three replications and each replication had four goats. A total of four large pens were used with three compartments enclosed in each large pen.

Experimental diet

The composition of the experimental diet used is indicated in (Table 1). The diet was formulated using roasted velvet bean replacing raw velvet bean at different percentages which were 20%, 60% and 100% and raw diet being a control. The roasted velvet bean meal was included at 0, 200, 600 and 1000g/kg of feed given to fattened goats (Table 2).

Table 1: Chemical composition of velvet beans used in the diet.

M .Pruriens	DM(g/kg)	Fatty Acids (%)	ASH (%)	C.P (%)	C.F (%)	Either Extracts (%)
	92.88	12.49	3.6	22.36	7.23	14.52

Table 2: Experimental diet used in the experiment.

Roasted Velvet Bean Meal				
Ingredients (g/kg)	0%	20%	60%	100%
Raw velvet bean	1000	800	400	0

Experimental ethics

Goat housing which was used on the experiment was cleaned once per week using disinfectants to avoid pathogens, external parasites and flies. The goats' houses were under shed and it was well ventilated and proper goat spacing of 1m² per goat was maintained, clean drinking water for the goats was made available all the time.

Data analysis

Data collected was analyzed using IBM SPSS version 25 and means which were different were identified using least significant difference (LSD) at 5%.

Results

Chemical composition of *Mucuna pruriens* on dry matter basis

The results show that velvet bean used in the diet contains

high crude protein of 22.36 %, low fiber content of 7.23 % and 12.49% fatty acids after roasting. High crude protein indicate high digestibility of velvet bean meal used and may correlate well to growth. It also contains high dry matter (92.88g/kg) as compared to other forages like grass. Ash content was also low (3.6%) and high ether extract (14.52%) as shown in (Table 1).

Performance of goats fed *M. pruriens* over a period of six weeks

Initial weight of goats was significantly different ($p < 0.05$) for all treatments. Final weight of goats from all treatments was significantly different with $p < 0.05$. Results show that there was a significant increase ($p < 0.05$) in daily gain between treatments with goats fed with raw velvet bean gaining 0.13kg/day followed by 0.133kg for goats fed with diet containing 20% roasted velvet bean meal, 0.135kg and 0.136kg for those fed 60% and 100% diets respectively. Daily gain of goats fed with raw velvet bean was significantly different ($p < 0.05$) from all other treatments. Results

show that an increase in feed containing roasted velvet bean increases weight gain of goats. Findings also indicate that there were no significant differences ($p < 0.05$) between weight gains of goats fed with 60% and 100% roasted velvet bean (Table 3). Feed intake per day was highest on goats fed with 20% roasted velvet bean whilst 60% roasted velvet bean scored the least. Feed

intake of goats fed with diet containing 60% roasted velvet bean was significantly different ($p = 0.004$) when compared to other treatments. High feed conversion ratio was realized from goats fed with 100% raw velvet beans followed by those fed with 20%, 100% and 60% roasted velvet bean meal respectively.

Table 3: Growth performance of the goats during the 6 weeks of experiment.

	Roasted Velvet Bean Meal, % in Diet				SEM	P
	0	20	60	100		
Initial wt, kg	9.3 ^c	9.36 ^d	9.15 ^a	9.28 ^b	0.04423	<0.001
Final wt, kg	14.74 ^a	14.94 ^c	14.81 ^b	15.01 ^d	0.03422	<0.001
Daily gain, kg	0.13 ^a	0.133 ^{ab}	0.135 ^b	0.136 ^b	0.000866	0.036
Feed intake, kg/d	0.465 ^b	0.468 ^b	0.458 ^a	0.464 ^b	0.001377	0.004
Feed conversion	3.58	3.52	3.39	3.41		

*Same superscripts in same row denotes no significant differences between treatments at $p = 0.05$.

Effects of raw and roasted velvet beans on feed intake

Results show that feed intake increased from week 1 to week 6 for all treatments and were significantly different ($p = 0.004$). Average weekly feed intake was varied among treatments with significant difference ($p < 0.05$) on average feed intake recorded weekly, they were as follows; feed intake was high in the 20% VBM diet at week 1 and 6. Feed was given daily basing on 5%

body weight on each goat, and the amount of feed was gradually increased in relation to weight gain (5% of body weight), the significance difference was ($p < 0.05$) observed in feed consumed in different weeks of the trial. Goats fed with raw velvet bean meal showed reduced feed intake as compared to other trials. Raw velvet bean meal contains anti-nutritional factors which reduce palatability of the VBM and reduce nutrient digestibility (Table 4).

Table 4: Feed intake (kg) by goats during a six-week experiment period.

Treatments	Time in Weeks					
	1	2	3	4	5	6
Control (Raw)	3.26 ^a	6.51 ^a	9.77 ^{ab}	13.02 ^{ab}	16.28 ^{ab}	19.53 ^b
VBM20	3.28 ^a	6.55 ^{ab}	9.83 ^b	13.10 ^b	16.38 ^b	19.67 ^c
VBM60	3.21 ^a	6.41 ^a	9.62 ^a	12.82 ^a	16.03 ^a	19.24 ^a
VBM100	3.25 ^a	6.50 ^a	9.74 ^{ab}	12.99 ^{ab}	16.24 ^{ab}	19.49 ^b

*Same superscripts in same column denotes no significant differences between treatments at $p = 0.05$.

Effects of raw and roasted velvet beans on growth rate

Table 5: Average weekly weight (kg) for goats in different groups.

Treatments	Time in Weeks					
	1	2	3	4	5	6
Control (Raw)	10.14 ^b	11.02 ^b	11.92 ^b	12.84 ^b	13.78 ^a	14.74 ^a
VBM20	10.19 ^{bc}	11.08 ^{bc}	11.99 ^c	12.95 ^d	13.93 ^b	14.94 ^c
VBM60	9.95 ^a	10.85 ^a	11.78 ^a	12.77 ^a	13.78 ^a	14.81 ^b
VBM100	10.14 ^b	11.03 ^b	11.94 ^b	12.9 ^{bc}	13.97 ^c	15.01 ^d

*Same superscripts in same column denotes no significance differences between treatments at $p = 0.05$.

Growth rate of the goats which were fed using roasted velvet bean meal was very high as compared to the goats which were fed raw velvet bean meal. The goats which were fed on roasted

velvet bean meal were showing greater changes in weight gain, their final weight gain was as follows; raw velvet bean meal had 14.74kg, 20% diet had 14.94kg, 60% diet had 14.81kg and lastly

100% diet had 15.01kg. Feed conversion ratio of goats was high in raw velvet bean meal which recorded the highest rate of 3.58 whilst the lowest was observed in the 100% diet (3.41). Growth rate showed a significant change $p < 0.05$ among the 4 dietary treatments, the weight gains for the whole trial were 14.74 kg control, 14.94kg for 20%, 14.81kg for 60% and 15.01kg for 100% VBM diet (Figure 1). Results on (Figure 2) show that there were significant differences ($p < 0.05$) in weekly body weight gain from week 4 to week 6. Weight gain for goats which were fed with 100% VBM decreased in week 6. Goats fed with 60% VBM showed a rapid increase in weekly body weight gain as shown in Figure . Goats fed with raw VBM had the lowest weekly weight gain as from week 2 onwards. Weekly weight for goats fed with 100% VBM and 60% VBM were not significantly ($p > 0.05$) different at week 6 (Table 5).

Discussion

Effect of feeding goats with roasted velvet bean on feed intake and growth rate

Feeding goats with roasted velvet bean meal was seen to increase daily weight gain of goats and final weight. Final weight of goats fed with different percentages of roasted velvet bean meal were significantly different. This might have been caused by reduced effects of antinutritional factors by roasting the beans thereby increasing digestibility. Results concur with findings by Jayaweera et al. (2010) who reported that heating velvet bean destroys antinutritional factors such as tannins, L-dopa and many others hence increasing feed intake, daily gain and final weight of animals. Goats fed raw velvet bean alone had lowest final weight and daily gain. These results corroborates to those by Tuleun et al. (2008) who reported that animals fed with raw velvet beans recorded poor weight gains due to presence of appetite depressants or antinutritional factors which reduces digestibility and affect protein digestion. Goats that were fed on raw velvet bean meal were increasing weight at a low rate as compared to the goats that were fed with roasted *Mucuna pruriens*. The feed intake of the goats which were fed with raw mucuna was increasing at a low rate in contrast with roasted (VBM). Feed intake was high in roasted VBM because some anti-palatability factors such as L. Dopa, tannins and phytic acid were removed. These results also concur with results by Gurumoothi et al. (2013) who reported that animals fed roasted velvet bean meal had high feed intake and high growth rates. This was also affirmed by Kaanuka (2012) who reported that palatability increases feed intake thereby contributing to high growth rate.

Effects of roasted velvet bean meal on weekly weight gain and feed conversion ratio

Weekly body weight gain showed significant change ($p < 0.05$) among the four different treatments. The highest average weekly weight gain of 1.04kg was recorded on 100% roasted (VBM). Findings concurs with results by Tuleun et al. (2008) who reported that roasting velvet bean is very successful in increasing growth

in ruminant animal and monogastric animals. Weekly weight gain was decreasing for goats fed with 100% VBM at week six, this might have been caused by acidosis caused by legumes. This is common in animals which are fed with legumes especially those with no or reduced levels of antinutritional factors. Results are in line to those by Taiwo et al. (2006) who reported that legumes like velvet bean have high crude protein which increases weight gain in animals if they are fed with them. Legumes are more palatable and have high digestibility compared to grasses and any other forages used as goat feeds. This is also supported by [2] who reported significant increase in weight gains on ruminants fed with roasted velvet bean meal. High weight gains recorded by goats fed with velvet bean meal had significant effects on feed conversion ratios. The results agrees with findings by [2] who reported that feeding animals with velvet bean meal such as goats showed high feed conversion ratios, which transform to high weight gain and feed conversion ratios. In this experiment feed conversion ratios were higher than those obtained by [3-21].

Conclusion

Goats fed diet containing 20% roasted velvet bean meal scored the highest feed intake whilst 60 % roasted velvet bean meal scored the least. Goats fed with 100% roasted VBM had the highest daily weight gain of 0.136kg/d and control had the lowest (0.130kg/d). Goats fed with 100% VBM recorded the highest (15.01kg) final weight on average followed by goats fed with 20% VBM which scored 14.94kg on average. These results were dependent on initial weight of goats used. Goats which were assigned to VB60 treatments had the lowest initial mean weight which was significantly different from all other treatments but its daily weight was high.

Recommendation

In this study *Mucuna pruriens* was used to feed Mashona weaners, more studies should be done to identify the effects of legumes when used to feed different breeds of goats.

- a) Researchers recommend farmers to use 60% VBM roasted to pen fatten goats because results were not significantly different from goats fed with 100% VBM on daily weight gain.
- b) The researchers recommend that the feeding experiment should be repeated on a larger scale.
- c) The researchers highly recommend *Mucuna pruriens* that it can be safely used by feed manufactures.
- d) This experiment should be repeated using different breeds of goats to see its efficiency.
- e) The researchers recommend roasting as a method of removing antinutritional factors in velvet bean because the process is very effective and easy to carry even by smallholder farmers.

f) Roasted velvet bean meal is a rich protein supplement which is cost effective. Roasted (VBM) will reduce overdependence in commercial feeds and will help the goat enterprise to expand in small holder farmers in developing countries like Zimbabwe.

References

1. Yakubu A, Salako AE, Imumorin IG, Ige AO, Akinyemi MO (2010) Discriminatory analysis of morphometric differentiation in the West African and Dwarf Sokoto goats. *South African Journal of Animal Science* 40: 381-387.
2. Murungweni EC, Mabuku O, Manyawu GJ (2004) *Mucuna*, Lablab and Paprika Calyx as substitutes for commercial protein sources used in dairy and pen-fattening diets by smallholder farmers of Zimbabwe in Whitebread.
3. Vadivel, Vand Pugalenth M (2010) Evaluation of growth performance of broiler birds fed with dietcontaining different levels of effectively processed velvet bean seeds collected from South India. *Livestock Science* 127(1): 76-83.
4. Tuleun CD, Igyem SY, Adenkola AY (2008) The feeding value of toasted mucuna seed meal diets for growing Japanese quail (*Coturnix coturnix japonica*). *Int J Poult Sci* 8(11): 1042-1046.
5. Aboh AB, Olaafa M, Dossou-Gbété GSO, Dossa AD, Djagoun N (2002) Voluntary ingestion and apparent digestibility of a ration based on *Mucuna pruriens* var. utilis seeds flour completed with forage on rabbits. *Tropiculture* 20(4): 165-169.
6. Ani AO (2008) The feeding value of processed velvet bean (*Mucuna pruriens*) for pullets chicks. *Journal of Tropical Agriculture, Food, Environment and Extension* 7(2): 149-155.
7. Eilittä M, Carsky RJ (2003) Efforts to improve the potential of *Mucuna* as a food and feed crop: background to the workshop. *Trop Subtrop Agroecosyst* 1: 47-55.
8. Emenalom OO, Udedibie ABI (2005) Evaluation of different heat processing methods on the nutritive value of *Mucuna pruriens* (Velvet bean) seed meals for broilers. *Int J Poult Sci* 4(8): 543-548.
9. Emenalom OO, Udedibie ABI, Esonu BO Etuk EB (2005) Evaluation of processed velvet bean (*Mucuna pruriens*) as a feed ingredient in starter diets for broiler chickens. *Japan J Poult Sci* 42(4): 301-307.
10. Emenalom OO, Udedibie ABI, Esonu BO, Etuk EB (2006) Cooking in local alkaline solution as a method for improving the nutritive value of velvet bean (*Mucuna pruriens*) for broiler. The role of biotechnology in animal agriculture to address poverty in Africa: opportunities and challenges. *Proc. 4thAll Africa Conf on Animal Agriculture, Arusha, Tanzania, 20-24 Sept. 2005*, pp. 239-245.
11. Emenalom OO, Udedibie ABI, Esonu BO, Etuk EB Emenike HI (2004) Evaluation of unprocessed and cracked, soaked and cooked velvet beans (*Mucuna pruriens*) as feed ingredients for pigs. *Livest Res Rural Dev* 16: 33.
12. FAO STAT (2013) The Food and Agricultural Organizations Database.
13. Gurumoorthi P, Janardhanan K, Myhrman VR (2003) Effect of differential processing methods on L-Dopa and protein quality in velvet bean, an underutilized pulse. *LWT Food Sci Technol* 1 : 588-596.
14. Murungweni C, van Wijk MT, Andersson JA, Smaling EMA, Giller KE (2011) Application of Fuzzy Cognitive Mapping in Livelihood Vulnerability Analysis. *Ecology and Society* 16(4): 8.
15. Ngambi JW, Alabi OJ, Norris D (2013) Role of goats in food security, poverty alleviation and prosperity with special reference to Sub-Saharan Africa: a review. *Indian J Anim Res* 47: 1-9.
16. Ngambu S, Muchenje V, Marume U (2012) The effect of Acacia karroo supplementation and thermal preparation on meat sensory characteristics of the indigenous Xhosa lop-eared goat Ruminant Res 60: 179-186.
17. Ngambu S, Muchenje V, Marume U (2012) The effect of Acacia karroo supplementation and thermal preparation on meat sensory characteristics of the indigenous Xhosa lop-eared goat genotype. *Afr J Biotechnol* 11(65): 12878-12884.
18. Ngambu S, V Muchenje, U Marume (2013) Effect of Acacia karroo supplementation on growth, ultimate pH, colour and cooking losses of meat from indigenous Xhosa Lop-eared goats. *Asian- Australas J Anim Sci* 26: 128-133.
19. Vadivel V, Janardhanan K (2000) Nutritional and anti-nutritional composition of velvet bean: an underutilized food legume in South India. *International Journal of Food Science and Nutrition* 51: 279-287.
20. Vadivel V, Pugalenth M (2008) Removal of anti-nutritional substances and improvement in the Protein digestibility of velvet bean (*Mucuna pruriens*) Seed during processing. *Journal of West Africa contributing to sustainable agriculture* 2(4): 331-339.
21. Yakubu A, Salako AE, Imumorin, IG (2011) Comparative multivariate analysis of biometric traits of West African Dwarf and Red Sokoto goats. *Tropical Animal Health* 43: 561-566.



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