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Short communication

Nutrient digestibility and metabolizable energy content of *Mucuna pruriens* beans fed to growing Pelibuey lambs

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ABSTRACT

The nutrient digestibility, nitrogen balance and *in vivo* metabolizable energy supply of *Mucuna pruriens* beans fed to growing Pelibuey lambs were investigated. Eight Pelibuey sheep housed in metabolic crates were fed increasing levels of raw *M. pruriens* beans. Treatments according to Mucuna inclusion level (g/kg dry matter) were: 0 (control), 100 (Mucuna100), 200 (Mucuna200) and 300 (Mucuna300) g/kg dry matter. The control diet consisted of sorghum grain, soybean meal, *Cynodon nlemfluensis* grass hay and calcium carbonate. Dry matter (DM), N and gross energy (GE) intakes were similar (P>0.05) across treatments. Increasing *M. pruriens* beans in the diet resulted in a linear increase (P<0.005) in DM, N and GE apparent digestibility from 0.64, 0.57 and 0.64 to 0.73, 0.69 and 0.72 from 0 to 300 g Mucuna/kg DM respectively. There was no effect of inclusion level of *M. pruriens* bean on N retention (P>0.05), but GE retention coefficient increased (P<0.01) from 0.55 to 0.63 from diets of 0 to 300 g Mucuna/kg DM respectively. Nitrogen balance was positive and similar across all treatments (P>0.05). The DM, N and GE apparent digestibility coefficients of *M. pruriens* beans obtained using multiple regression equations were 0.89, 0.82 and 0.87 respectively. *In vivo* digestible (DE) and metabolizable energy (ME) content of Mucuna bean were estimated as 14.1 and 12.6 MJ/kg DM respectively. It was concluded that raw *M. pruriens* beans ME value compares favorably with ME values of conventional feed resources. This is the first *in vivo* estimation of the ME value of Mucuna bean for ruminants.

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1. Introduction

Mucuna pruriens foliage, whole pods and beans are used in many tropical countries as protein and energy supplements for small ruminants fed low quality roughage diets, especially during the dry season, when animals have lower performance due to reduced availability and quality of pastures (Castillo-Caamal et al., 2003; Matenga et al., 2003). Hence, there is a renewed interest to evaluate the feed potential of *M. pruriens* for ruminants (Castillo-Caamal et al., 2003; Matenga et al., 2003; Chikagwa-Malunga et al., 2009a,b,c,d). Unlike the situation in monogastric animals, feeding Mucuna to small ruminants

Abbreviations: ADF, acid detergent fiber; DE, digestible energy; CP, crude protein; DM, dry matter; GE, gross energy; LW, live weight; ME, metabolizable energy; MP, metabolizable protein; aNDF, neutral detergent fiber; NF, nitrogen in feces; NI, nitrogen intake; NR, nitrogen retention; NU, nitrogen in urine; OM, organic matter.

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Table 1
Chemical composition of diets and *M. pruriens* beans (g/kg DM).[a]

Mucuna inclusion level (g/kg DM)[b]					
Item	0	100	200	300	*M. pruriens* bean
DM	883.5	881	883.3	884.3	890.6
CP	131.1	142	155	163.7	245.1
aNDF	346.6	331.9	389.1	345.1	244.8
ADF	181.6	181	172.4	171.8	100.2
Lignin	35.7	34.3	32.3	30.3	–
Ash	39.3	38.9	38.5	38.8	40.7
GE	17.2	17.6	17.1	17.3	18.7

DM, dry matter; CP, crude protein; aNDF, neutral detergent fiber; ADF, acid detergent fiber; GE, gross energy.
[a] Except DM expressed in g/kg fresh weight and GE in MJ/kg dry matter. Control diet, 574.1, 320.8, 97.2 and 7.9 g/kg DM of sorghum grain, *C. nlemfuensis* hay, soybean meal and $CaCO_3$ respectively.
[b] Inclusion level indicates the amount of the control diet which was replaced with Mucuna beans (g/kg DM).

in large amounts has not caused detrimental effects (Pérez-Hernández et al., 2003; Castillo-Caamal et al., 2003; Mendoza-Castillo et al., 2003).

The *M. pruriens* bean has a high content of crude protein and is highly digestible by ruminants (Ayala-Burgos et al., 2003; Sandoval Castro et al., 2003). However, *in vivo* studies evaluating its nutrient digestibility or nitrogen retention in ruminants are scarce (Chay-Canul et al., 2009; Chikagwa-Malunga et al., 2009d). Previous studies have suggested a high metabolizable energy (ME) value for ruminants (from 11.9 to 13.9 MJ/kg DM) (Burgos et al., 2002; Sandoval Castro et al., 2003). However, these ME estimations were based on *in vitro* digestibility values and currently there is no *in vivo* estimation of the ME of Mucuna beans ME which can be incorporated into feeding systems. Hence this experiment was undertaken to evaluate the Mucuna beans. Mucuna pods were recently evaluated in a separate experiment (Loyra et al., unpublished). The objectives of this study were (i) to determine apparent digestibility of Mucuna beans (dry matter (DM), N, and gross energy (GE)), (ii) to estimate N and GE retention coefficients when the *M. pruriens* bean was incorporated in a diet and (iii) to estimate *in vivo* Mucuna bean ME value in diets for growing Pelibuey lambs.

2. Materials and methods

The experiment was conducted at the Faculty of Veterinary Medicine and Animal Science (University of Yucatán), located in the central region of the state of Yucatán, Mexico (21°15′N lat., 83°32′ long.). The region has an annual average rainfall of 953 mm. Annual average temperature and humidity of 26.5 °C and 72% respectively.

2.1. Animals

Eight Pelibuey male lambs (23.72 ± 1.44 kg live weight) *ca.* 7 months old, were housed in individual metabolic cages made from steel and plastic flooring. Crates were designed with a plastic mesh which diverted feces while allowing urine to filter into separate containers, thus allowing a complete separation and recovery of feces and urine. Lambs were treated against internal parasites (oral doses of albendazole 7.5 mg/kg live weight (LW)) a month before the start of the trial.

2.2. Feeds and feeding

M. pruriens was grown and harvested by local farmers in Yucatán, Mexico. Pods were manually shelled to obtain the beans. *Cynodon nlemfuensis* was harvested at 4 weeks of re-growth and then sun dried at the dairy unit of the Univ. of Yucatán, Mexico. *M. pruriens* raw bean and *C. nlemfuensis* hay were ground separately through a 3 mm screen. In addition, sorghum grain, soybean meal and $CaCO_3$ were obtained from a commercial company of the region and incorporated into the diets.

There were four diets. The control diet contained 574.1, 320.8, 97.2 and 7.9 g/kg DM of sorghum grain, *C. nlemfluensis* hay, soybean meal and mineral premix (containing mainly $CaCO_3$) respectively. The experimental diets consisted of replacement of the control diet with ground *M. pruriens* beans in the following proportions 0 (control diet); 100, 200 and 300 g/kg DM. Levels were selected to allow the estimation of energy value of Mucuna beans using the methodology of Schneider and Flatt (1975) and taking into account feasible feed formulation inclusion levels. The chemical composition of the *M. pruriens* beans and experimental diets is shown in Table 1. Lambs were fed *ad libitum* once daily at 9:00 h, when all feed was offered. To ensure *ad libitum* intake the DM intake from the previous day measured and from this value an additional 20% feed was offered at feeding time. Water was freely available. Diets were well mixed to avoid selection.

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