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Potential for Using *Leucaena leucocephala* or *Manihot esculenta* Leaves for Supplementing Feeding of Goats in West Cameroon

Research Article

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ABSTRACT

The study of the potntial for using *Leucaena leucocephala* or *Manihot esculenta* for supplementing feeding of West African dwarf goats were carried out from November 2003 to January 2004 in the Experimental Farm of the University of Dschang. Twenty four West African dwarf goats, were divided in three groups of eight animals, each one 12 months old with average weight of 13.1±4.4 kg, were used in this study. The animals of the supplemented group received 500 g of *Leucaena leucocephala* (group 2) or 500 g of *Manihot esculenta* (group 3) per animal per day, whereas those of the control group (group 1) did not receive any supplement. The animals were weighed every 14 days for the evaluation of growth. The body condition score (BCS) was taken at the beginning and at the end of the study. A sample of 100 g of *Leucaena leucocephala* or *Manihot esculenta* leaves was taken for the chemical composition analysis. The supplements had a high percentage of crude proteins (26.1% DM and 28.1% DM respectively for *Leucaena leucocephala* and *Manihot esculenta* leaves) and organic matter (91.3% DM and 92.8% DM respectively for *Leucaena leucocephala* and *Manihot esculenta* leaves). The ash content was 8.7 and 7.3% DM for *Leucaena leucocephala* and *Manihot esculenta* leaves, respectively. At the end of the study, the average BCS (3.9±0.1 and 3.7±0.1 for animals of group 2 and group 3) and average weight (AW) of the supplemented goats (15.5±3.7 kg and 15.4±3.3 kg for animals of group 2 and group 3) was significantly higher ($P<0.05$) than that of the control group (BCS: 2.9±0.1; AW: 13.5±5.1 kg). The total weight gain was 0.7, 2.4 and 2.2 kg corresponding to a daily average weight gain of 8.3, 30.4 and 27.6 g/d respectively for the animals of group 1, 2 and 3. The *Leucaena leucocephala* or *Manihot esculenta* leaves significantly improved the growth of the West African dwarf goats in West Cameroon.

KEY WORDS growth, *Leucaena leucocephala*, *Manihot esculenta*, supplement, West African dwarf goats.

INTRODUCTION

Ruminants form a major component of domesticated livestock in Africa, especially in the Central African region. The climate in this region is characterized by a relatively short dry season that alternates with a much longer rainy season. Ruminants in the region are mainly grazed and/or browsed on available natural pastures. The quantity and quality of fodder available from natural pasture has seasonal fluctuation (Pamo *et al.* 2006; Pamo *et al.* 2007). During the rainy season, pasture plants grow rapidly and, although their nutritive value may be high at the start of the rainy season, they mature rapidly with a resulting decline in nutritive quality (Lhoste *et al.* 1993). The situation is worsened because available pasture land is rapidly decreasing due to the increasing human population and increasing demand for crop land (Oteino *et al.* 1992). Consequently, ruminants must remain tethered during the rainy season, feeding on

household wastes and/or on very limited pockets of grass growing by road sides. This management system is very common in the highly populated rural areas of western Cameroon where density ranges from 400 to 1000 persons/km^2 (Pamo *et al.* 2006).

During the dry season, there is an acute shortage of feed and available forages are of very poor nutritive quality (i.e. low in crude protein (CP) and high in crude fiber), which results in low voluntary intake by ruminants and low digestibility. Low pasture quality and limited availability of water is reflected in low production and reproductive performance, as well as slow growth in ruminants especially when grazing is the main feed (Oteino *et al.* 1992; Pamo *et al.* 2001; Pamo *et al.* 2006; Pamo *et al.* 2007). Undernourished animals are susceptible to diseases and parasites and, in extreme cases, lose body weight and may die (Palmer and Tatang, 1996; Merkel *et al.* 1999). Therefore, adequate nutrition is essential to exploit the genetic potential of the animals (Chesworth, 1996; Lhoste *et al.* 1993).

In West Cameroon, where goat meat is preferred over cattle and sheep, goats are raised in extensive systems where they eat a diet composed of tree-leaves and shrubs that are available year round, albeit with a low to medium nutritional quality. Hence, their performance is generally low and variable. It appears that the main limiting factors of this vegetation are its low level of crude protein (CP) and high level of crude fiber, although its high level of phenolic compounds (Kayouli and Buldgen, 2001) can be a problem as they form complexes with proteins rendering them unavailable to rumen micro-organisms. In many studies, it was concluded that goats fed browse require a CP supplement. The multipurpose leguminous trees like *Leucaena leucocephala*, *Calliandra calothyrsus* and *Gliricidia sepium* have excellent potentials for growth in the African region (Jones, 1994; Pamo *et al.* 2003). Their leaves are very good source of nitrogen (Topps, 1992; Jones, 1994; Pamo *et al.* 2001; Pamo *et al.* 2004) and can therefore be used as feed supplements for ruminants. However, little information is available in the literature regarding the effects on the growth performance of West African dwarf goat during dry season when these two browses are used as feed supplements. Therefore, the present work was designed to study the potential for using *Leucaena leucocephala* or *Manihot esculenta* leaves for supplementing feeding of goats in West Cameroon.

MATERIALS AND METHODS

Study area

The study was carried out at the Animal Experimental Farm of Dschang University during the months of November 2003 to March 2004. The area falls within the Soudano-Guinean zone (latitude 5º26'N, longitude 10º26'E). The annual temperature varies between 16 and 27 ºC while the relative humidity is 40-97%. There are two main seasons: the rainy season (April to October) and the dry season (November to March). The altitude is at 1400 m above sea level while the mean annual rainfall is about 2000 mm (Pamo *et al*. 2002).

Animals

Twenty four West African dwarf goats (WADG) aged between 12-14 months and weighing about 13.1±4.4 kg were used for this experiment. These goats were born at the Animal Experimental Farm of Dschang University. They were housed in pens (8 goats/pen) and dewormed using Ivermectine 1%. After two weeks of adaptation, the animals were divided in three equal groups based on the weight; the first group (8 goats) was control, the second group (8 goats) was the supplemented with *Leucaena leucocephala* and the third group with *Manihot esculenta*.

Housing and feeding

Three pens in a building on stilts built plank served as shelter for animals. The leaves of *Leucaena leucocephala* and *Manihot esculenta* used in this study were collected from experimental plots of the Animal Experimental Farm of Dschang. The goats were fed *Trypsacum laxum ad libitum* and allowed to graze daily on mixed pasture comprising *Brachiaria ruziziensis* and *Pennisetum purpureum* between 9 am and 5 pm. The diet of the second and third group was respectively supplemented with fresh leaves of *Leucaena leucocephala* or with *Manihot esculenta*, respectively. Each animal of the supplemented groups received 500 g of *Leucaena leucocephala* or *Manihot esculenta* in the evening after grazing in the pasture during the 84 days of study. The first group received no feed supplementation thus serving as the control.

Data collection

Representative samples of leaves of *Leucaena leucocephala* and *Manihot esculenta* were collected monthly for chemical analysis. Standard methods as described in AOAC (1990) were used for determination of dry matter (DM, method no. 930.15), organic matter and ash (method no. 924.05). Crude protein (CP, method no. 984.13) was assayed by the Kjeldahl method, modified by using a solution of boric acid (40 g/L) to receive free ammonia during distillation; a solution of 2 g/L of bromocresol green and 1 g/L of methyl red in ethanol as indicator and a standard acid solution (1N HCl) for titration.

The weight of the goats was recorded every 14 days (at eight o'clock) during 84 days using an electronic balance. The body condition scores (BCS) were measured at the beginning and at the end of the study on the animals of the

control and those supplemented with *Leucaena leucocephala* and *Manihot esculenta*.

Statistical analysis

The general linear procedure (GLM) of SPSS 19.0 was used to analyse data on body weight gain of goat and BCS. The Duncan multiple range test was used to compare means of treatments (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Chemical composition and ingestion rate of *Leucaena leucocephala* and *Manihot esculenta*

The chemical composition and ingestion rate of the leaves of *Leucaena leucocephala* and *Manihot esculenta* used in this experiment is presented in Table 1. The levels of DM, OM and total ash were similar. However, CP in the leaves of *Manihot esculenta* was higher than CP in the leaves of *Leucaena leucocephala*. On the 0.5 kg of supplements offered to each animal every day, they consumed 0.43 kg of *Leucaena leucocephala* and 0.40 kg of *Manihot esculenta* leaves, corresponding to an ingestion rate of 86 and 80%, respectively. However there were no significant differences between the ingestion of *Leucaena leucocephala* and *Manihot esculenta*.

Table 1 Chemical composition and ingestion rate of *Leucaena leucocephala* and *Manihot esculenta*

	Composition chimique	
	L. leucocephala	*M. esculenta*
Dry matter (DM)	97.5	96.3
Organic matter (OM)	91.3	92.7
Ash	8.7	7.3
Crude protein (CP)	26.1	28.1
Quantity offer (kg/animal/j)	0.5	0.5
Ingestion (kg/j)	0.4±0.5	0.4±0.5
Ingestion rate (%)	86	80

Effect of *Leucaena leucocephala* and *Manihot esculenta* on live weight gain and body condition scores

The weight change of animals with supplementation showed that the weight of animals have increased with time (Figure 1). From the 28th to 84th days, the weight of the animals in the supplemented groups was significantly ($P<0.05$) higher than that of the control group. On the other hand, from the beginning until the end (84 days) there were no significant differences observed between the weights of animals in the control and supplemented groups. The logarithmic adjustments of weight gave very interesting results as shown by the coefficient of determination (Figure 1). These coefficients of determination (R^2) indicated that a good proportion of weight variation of animals can be explained by the regression curve.

Table 2 presents the initial weights, final weights, total gains, average daily weight gains and body condition score (BCS) of animals in the control and supplemented groups. From table 2 it is clear that the weight and BCS of animals in the control group were not significantly different to that of the animals in supplemented groups at the beginning of the study. At the end of the study, the weight and BCS of the supplemented animals was significantly ($P<0.05$) higher than that of animals in the control group. Supplementation with *Leucaena leucocephala* and *Manihot esculenta* leaves yielded total gains of 2.4 and 2.2 kg, respectively, which corresponded to a daily weight gain of 30.4 and 27.6 g/d over the experimental period (84 days). On the other hand, animals in the control group achieved a total gain of 0.7 kg, corresponding to a daily weight gain of 8.3 g/d. Finally the supplementation with *Leucaena leucocephala* and *Manihot esculenta* has achieved an increase weight of about 72.8 and 70.1%.

Table 2 Growth performance of control and supplemented group*

	Groups		
	Control	*L. leucocephala*	*M. esculenta*
Initial weight (kg)	12.9±4.7^a	13.2±4.6^a	13.2±4.0^a
Final weight (kg)	13.5±5.1^a	15.6±3.7^b	15.39±3.3^b
Total gain (kg)	0.7	2.4	2.2
ADWG (g/d)	8.3^a	30.4^b	27.6^b
Gain over the control (%)	-	72.8	70.1
Initial BCS	2.8±0.2^a	2.8±0.1^a	2.9±0.1^a
Final BCS	2.9±0.1^a	3.9±0.1^b	3.7±0.1^b

*The means in the same row that have at least one common letter, do not have significant difference ($P>0.05$).
ADWG: Average daily weight gain.

The organic matter (91.7%) and crude protein (28.1%) content of the leaves of *M. esculenta* is higher than the result obtained by Sokerya and Preston (2003), which were 17.0% organic matter and 20.4% crude protein. This difference is due not only to environmental and geographical conditions that differ from one study area to another, but also due to the time of harvest of plants and their vegetative stage.

Rapid weight gain observed with the animals of the supplemented groups (2.4 kg and 2.2 kg respectively for batches supplemented with leaves of *L. leucocephala* and *M. esculenta*) compared with the control, were much lower than values obtained by Nguyen *et al.* (2003) which were 6.5 and 6.3 kg respectively for *M. esculenta* and *L. leucocephala*. The same observation was made regarding the average daily gain (ADG) obtained in this study which was 27.6 and 30.4 g/d respectively for animal supplemented with leaves of *M. esculenta* and *L. leucocephala* compared with values of 42.8 and 41.7 g/d obtained by Nguyen *et al.* (2003). This difference observed with the weight gain could be explained by the composition of the basic diet of the ani-

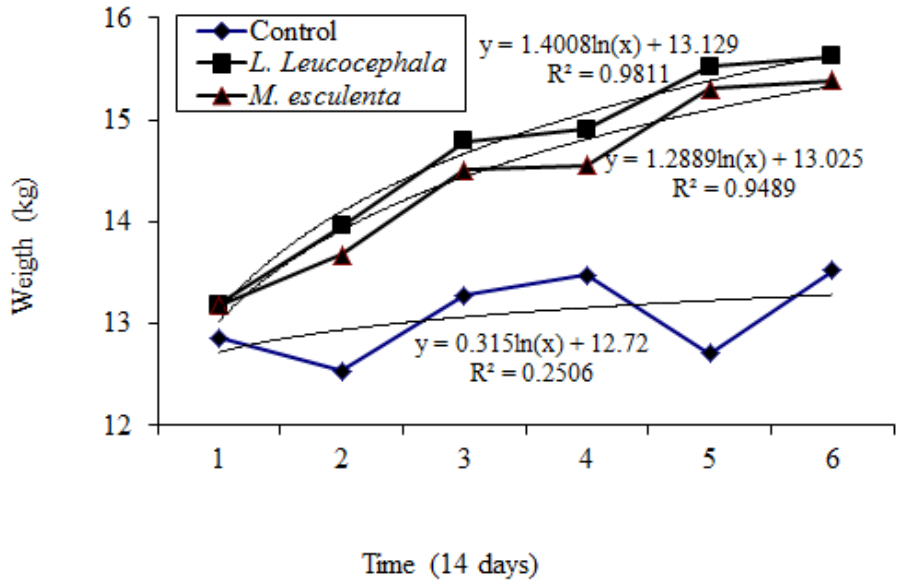

Figure 1: Evaluation of the average weight of goats as a function of time and supplement

mals. In fact, our basic diet consisted mainly of herbs found in our pasture while in the trial of Nguyen *et al*. (2003), the basic diet consisted of rice flour (10 g/kg), a block-urea molasses 5 g/kg of body weight and hay dried grass (*Brachiaria ruziziensis* and *Pannicum maximum*). These differences are also due to the amount of supplement intake, which in our study was on average 400 g and 430 g, respectively, for the goats supplemented with leaves of *M. esculenta* and *L. leucocephala*, while the ingesting obtained by Nguyen *et al.* (2003) were of 1385 g and 1087 g, respectively, for the leaves of *M. esculenta* and *L. leucocephala*. Despite differences observed in the weight gain and average daily weight gain, the improvement of the growth performance of goats supplemented with leaves of *L. leucocephala* and *M. esculenta* agree with the results obtained by Pamo *et al.* (2001), Sokerya and Rodriguez (2001) and Sokerya and Preston (2003).

CONCLUSION

Feed supplementation with *Leucaena leucocephala* and *Manihot esculenta* leaves resulted to an increase in the performance of West African dwarf goat. The goats supplemented with leaves of *Leucaena leucocephala* and *Manihot esculenta* gained respectively 72.8 and 70.1% more weight than those of control group during this period (dry season). The average daily weight gain of control, group 2 and 3 was respectively 8.3, 30.4 and 27.6 g/j.

Therefore, there will be a marked improvement in the growth performance when the grazing diet of West African dwarf goat is supplemented with leaves of *Leucaena leucocephala* and *Manihot esculenta* especially during the dry season.

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