Journal of Animal and Veterinary Advances 6 (1): 39-41, 2007

Intake and Digestibility of Tree Fodders by White Tailed Deer (*Odocoileus virginianus yucatanensis*)

E. Lopéz-Cobá, C.A. Sandoval-Castro and R.C. Montes-Pérez
Faculty of Veterinary Medicine and Animal Science, University of Yucatan, México
Km 15.5 Carretera Xmatkuil, Apdo. 4-116 Itzimná, Mérida, Yucatán, 97100, México

Abstract: Intake and preference of white tailed deer (Odocoileus virginianus yucatanensis) towards four forage trees was assessed via cafeteria and intake trials. Four deer males (43±1.6 kg LW) and four tree fodders *Brosimun alicastrum, Leucaena leucocephala, Bursera simaruba* and *Guazuma ulmifolia* were used. *B. alicastrum* was the most preferred tree (p<0.0001) followed by *L. leucocephala*, *G.ulmifolia* and *B. simaruba* which were eaten in similar amounts. Digestibility was 60 and 61% for *G. ulmifolia* and *B. alicastrum* and 80 and 81% for *B. simaruba* and *L. leucocephala.* Short term preference of tree fodders was associated with their lignin content (p<0.05). It was concluded that white tailed deer tree fodder preference seems to be associated to fibrous material content and not with tannins. *Brosimun alicastrum* had the highest intake and DDM intake of the four forages evaluated.

Key words: White tailed deer, intake, digestibility, forage tree

INTRODUCTION

White tailed deer is distributed along America. In Yucatán, México, the sub specie *O. virginianus yucatanenses* has been hunted for food, leather and ritual purposes in prehispanic times (Mandujano and Rico Gray, 1991). The yucatecan native white tailed deer (*Odocoileus virginianus yucatanensis*) has been considered an endangered sub specie due to severe hunting practices, a situation that has made necessary to design alternatives for its conservation.

The establishment of white tailed deer farms (governmentally approved) has been encouraged in México in recent years in order to alleviate the pressure upon its numbers in the wild. However, most of the incipient farms are been set without adequate knowledge of deer biology. As feeding practices, most farmers will use some grains or grain concentrate feed. As forage source, either grass or *B. alicastrum* is used (Loría-Mendez *et al.* 2006) resembling cattle management. Thus, in order to establish proper management practices is necessary to gather information on all aspect of deer biology including forage preference, intake and digestibility. Knowing forage intake and digestibility will also allow the farmers to further incorporate forages into feeding practices and/or manage the habitat to favor those species with highest intake and/or digestibility. Thus, the objective of the present research was to assess preference, dry matter intake and digestibility of four forage trees by captive white tailed deer.

MATERIALS AND METHODS

Four deer males with an average live weight of 43±1.6 kg (16.8±0.62 kg $LW^{0.75}$) were used. Four tree fodders were evaluated; *Brosimun alicastrum, Leucaena leucocephala, Bursera simaruba, Guazuma ulmifolia*. Each fodder was evaluated separately during two weeks. Forage was offered *ad libitum* and intake measured every day. Animals were observed during the day in order to take fecal ground samples associated with the each animal. Digestibility was hence estimated using the Acid Insoluble Ash technique (Owens and Hanson, 1991). This was an observational study and no statistical analysis was performed on the results. In addition, deer were used in a two stage cafeteria trial to assess forage tree preference as DMI in a 4-h period (Sandoval-Castro *et al.* 2005).

Stage 1: Fresh tree fodder was offered separately on plastic containers. A 4×4 latin square design was used, where columns=position of the tree fodder in the pen, row=day of measurement and treatments=the four tree fodders under evaluation (*B. alicastrum, L. leucocephala, B. simaruba, G. ulmifolia*). Forage was offered for a 4-h period and intake measured by difference. Allocation of tree fodder within the pen (in the container) was changed every day to avoid the animal associate position with any particular forage.

Corresponding Author: C.A. Sandoval-Castro, Faculty of Veterinary Medicine and Animal Science, University of Yucatan, México. Km 15.5 Carretera Xmatkuil, Apdo. 4-116 Itzimná, Mérida, Yucatán, 97100, México.

Table 1: Chemical composition of fodder trees (% DM, except DM)

	DM	CP	Lignin	ADF	NDF	TP	CT
B. alicastrum	56.60	16.44	5.55	27.28	45.32	1.28	0.84
B. simaruba	44.00	12.64	12.18	26.73	44.84	2.54	28.72
L. leucocephala	45.40	24.63	10.23	19.34	43.95	1.68	2.09
G. ulmifolia	70.60	12.09	11.78	31.77	50.8	1.16	4.59

Stage 2: In order to know if the deers will increase its intake of forages with previous low intakes, the most preferred feed was eliminated during stage 2 and the remaining forages tested on a similar design in a 3×3 latin square design. The trial was repeated twice.

Feed samples were taken for dry matter, crude protein (AOAC., 1980), neutral- and acid detergent fibre(Van Soest *et al*; 1991) total polyphenols and condensed tannins (Price and Butler, 1977; Price *et al.*, 1978).

RESULTS

Chemical composition of forages: Chemical composition of fodder trees is presented in Table 1. *B. alicastrum* had the lowest lignin content, *L. leucocephala* the highest protein content and *B. simaruba* de highest tannin content.

Dry matter intake and digestibility: Dry matter intake, digestibility and Digestible DM intake are presented in Table 2. To our knowledge this is the first report of *in vivo* digestibility in *Odocoileus virginianus yucatanensis* for *B. simaruba*, *L. leucocephala* and *G. ulmifolia.* When forages were offered as single feed, DMI ranged from 154 and 166 g kg^{-1} $LW^{0.75}$ for *B. simaruba* and *L. leucocephala,* to 224 and 265 g kg^{-1} $LW^{0.75}$ for *G. ulmifolia* and *B. alicastrum* respectively. While digestibility was 60 and 61% for *G. ulmifolia* and *B. alicastrum* and 80 and 81% for *B. simaruba* and *L. leucocephala*. Highest intake was obtained with *B. alicastrum*, although it was not associated with the highest digestibility.

Preference: During stage 1, *B. alicastrum* was the most preferred tree ($p<0.0001$) followed by *L. leucocephala*, *G.ulmifolia* and *B. simaruba* which were eaten in similar amounts. When *B. alicastrum* was removed from the test the intake of the remaining trees increased but none was significantly preferred ($p>0.05$) amongst them (Table 3). Short term preference of tree fodders was associated with their lignin content. The relationship for white tailed deer was described by the following equation:

$$\text{Intake (g DM Kg}^{-1}\text{ LW}^{0.75}) = -3.6486\ (\%\ \text{lignin}) + 51.95$$

Table 2: Dry Matter Intake (DMI), DM Digestibility (DMD) digestible DM intake and digestibility of tree fodder by white tailed deer (mean±s.e.).

	B. simaruba	*G. ulmifolia*	*L. leucocephala*	*B. alicastrum*
DMI g DM kg^{-1} $LW^{0.75}$	154.2±19.96	224.3±33.56	166.3±32.36	265.3±17.48
g DM kg^{-1} LW	35.9	52.2	38.7	61.7
DMD (%)	80	60	81	61
DDM intake	123±16.0	134.6±20.1	134.7±26.2	161±10.7

DISCUSSION

Chemical composition of forages was within the range commonly reported in the area and elsewhere (Sandoval-Castro *et al.*, 2005; Solorio Sanchez, *et al.*, 2001). Crude protein content was always above critical level (7%) for optimal rumen function (Van Soest, 1994). therefore no limitation to DMI was expected from forage CP content.

Although it is though that intake might be influenced by forage digestibility, it has been shown previously with sheep (Khazaal *et al.*, 1993; Mendoza Nazar and Sandoval Castro, 2003). that they are not necessarily related (Table 2). Similar to previous report with cattle(Sandoval-Castro *et al.*, 2005). short term preference of tree fodders was associated with their lignin content (Table 1 and 3), suggesting an inherent ability of ruminants which while eating are able to detect forage characteristics and discriminate those feeds which are more difficult to digest and/or with a lower content of potential digestible material, thus optimizing DDM intake (Table 2). Similarly, Berteaux *et al.* (1998) and Silva-Villalobos *et al.* (1999) found that white tailed deer selected forage trees with high digestible energy content in order to be able to meet the requirements of growth (fawns) or antler development (adults). Ruminants grazing/browsing in a biodiverse environment have to quickly decide which forages are worth to harvest in order to optimize intake rate while reducing predation risk. Trade-off between quality and quantity of available herbage may lead to herbivores to select diets of intermediate quality in order to maximize their overall rate of nutrient assimilation (Duncan and Gordon, 1999). If decision is to be fast, it has to be independent of post-ingestive effects, thus animal will have to rely more likely on oral stimulus and result of the present study support the theory that ruminants are detecting forage

Table 3: White tailed deer forage tree intake (g DM Kg^{-1} $LW^{0.75}$) on a two stage cafeteria trial

	B. simaruba	*G. ulmifolia*	*L. leucocephala*	*B. alicastrum*	SEM	p
1st stage	7.86 b	8.42 b	11.66 b	28.65 a	2.310	0.0001
2nd stage	14.41 a	9.46 a	13.52 a	---------	2.061	0.242

"hardiness" or "resistance to comminution" which would be an indirect indicator of the feed fibre content and its potential digestible material.

Similarly to previous reports (Silva-Villalobos *et al*., 1999) intake and preference was not influenced by the forage content of polyphenols and tannins. Austin *et al*., (1989) found a protein in the saliva of *Odocoileus hemionus* (present in *Odocoileus* spp.) which binds to tannins and minimize their effects, effectively allowing them to ingest tanniniferous plants and explaining their lack of effect of preference and intake.

CONCLUSION

White tailed deer tree fodder preference seems to be associated to fibrous material content and not with tannins. *Brosimun alicastrum* had the highest intake and DDM intake of the four forages evaluated.

REFERENCES

AOAC., 1980. Official methods of analysis. (13th Edn.), Washington, DC.

Austin, J.P., L. Suchar, C. Robbins and A. Hagerman, 1989. Tannin binding proteins in saliva of deer and their absence in saliva of sheep and cattle. J. Chem. Ecol., 15: 1335-1347.

Berteuax, D., M. Crête, J. Huot, J. Maltais and J. Ouellet, 1998. Food choice by white-tailed deer in relation to protein and energy content of the diet: A field experiment. Oecologia. 115: 84-92.

Duncan, A.J. and I.J. Gordon, 1999. Habitat selection according to the ability of animals to eat, digest and detoxify foods. Proc. Nutr. Soc., 58: 799-805.

Khazaal, K., M.T. Dentinho, J.M. Ribeiro and E.R. Orskov, 1993. A comparison of gas production during incubation with rumen contents in vitro and nylon bag degradability as predictors of the apparent digestibility in vivo and the voluntary intake of hay. Anim. Prod., 57: 105-112.

Loría-Mendez, M.M., C.A. Sandoval-Castro and H. Mendoza-Castillo, 2006. Evaluation of feeding management in three white tailed deer breeding places (Odocoileus virginianus yucatanensis) in Yucatan Mexico. Trends in Applied Sci. Res., 1: 105-112.

Mandujano, S. and V. Rico Gray, 1991. Hunting, use and knowledge of the biology of the white tailed deer (Odocoileus virginianus Hays) by the Maya of central Yucatan, Mexico. J. Ethnobiol., 11: 175-183.

Mendoza Nazar, P. and C. Sandoval Castro, 2003. *In vitro* gas production and nylon bab rumen degradation as predictors of the in vivo apparent digestibility and voluntary intake of tropical hays fed to sheep. J. Appl. Anim. Res., 23: 103-116.

Owens, N. and F. Hanson, 1991. External and internal markers for appraising site and extent of digestión in ruminants. J. Dairy Sci., 75: 2605-2617.

Price, M.L. and L.G. Butler, 1977. Rapid visual estimation and spectrophotometric determination of tannin content of sorghum grain. J. Agric Food Chem., 25: 1268-1273.

Price, M.L., S. Van Scoyoc and L.G. Butler, 1978. A critical evaluation of the vanillin reaction assay for tannin in sorghum grain J. Agric. Food Chem., 26: 1214-1218.

Sandoval-Castro, C.A., H.L. Lizarraga-Sanchez and F.J. Solorio-Sanchez, 2005. Assesment of tree fodder preference by cattle using chemical composition, in vitro gas production and in situ degradability. Anim. Feed Sci. Tech., 123-124: 277-289.

Silva-Villalobos, G., S. Mandujano, G. Arceo, S. Gallina and L. Pérez-Jiménez, 1999. Nutritional characteristics of plants consumed by the white-tailed deer in a tropical forest of Mexico. Vida Silvestre Neotropical, 8: 38-42.

Solorio Sanchez, J.F. and B. Solorio Sanchez, 2001. Integrating fodder trees into animal production systems in the tropics. Trop. Subtrop. Agroecosys. 1: 1-11.

Van Soest, P.J., J.B. Robertson and B.A. Lewis., 1991. Methods for dietary fiber, neutral detergent fiber and non-starch polysaccharides in relation. Anim. Nutr. J. Dairy Sci., pp: 74-3583.

Van Soest, J., 1994. Nutritional ecology of the ruminants. (2nd Ed.), Cornell University Press. Ithaca and London. pp: 463 .