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Auteur : Le Bodo, Emelyne
Promoteur(s) : Hornick, Jean-Luc
Faculté : Faculté de Médecine Vétérinaire
Diplôme : Master en médecine vétérinaire
Année académique : 2019-2020
URI/URL : http://hdl.handle.net/2268.2/9700

Assessment of parasitic and productive parameters on sheep with a ration supplemented with leaves of Guazuma Ulmifolia in the Mexican tropics

Le Bodo Emelyne[1]; Martínez-Alfaro Juan Carlos[2]; Hernández Hernández Horacio[2]; Hornick Jean-Luc[1]

[1] Department of Veterinary Medical Sciences, Liège University

[2]Department of Veterinary Medical Sciences, Antonio Narro Autonomous Agrarian University

AIM OF THE WORK

The aim of this work is to assess the impact of ration supplementated with a local plant (*Guazuma Ulmifolia*) having a forage potential on gastrointestinal parasites, weight and body condition of sheep in the southern region of Mexico.

SUMMARY

Gastrointestinal parasites (Helminth type or other) infections represent a serious problem for the production of small ruminants that is currently aggravated by resistance to anthelmintic products and has induced a search for control alternatives, such as natural products. Polyphenol present in plants showed activity against *Haemonchus contortus.* The local Mexican plant *Guazuma ulmifolia* have been cited in ethnoveterinary studies and selected naturally by sheeps (Blackbelly and Pelibuey). Thus, the objective was to evaluate its activity against gastrointestinal parasites by supplementation of the ration with foliage. Twenty-two sheeps were randomly distributed in two groups: control group without foliage and test group with addition of foliage (30% of the dry matter of the total diet). For thirty days weight, body condition and gastrointestinal parasite load were assessed. Coprological analysis (MacMaster's cell count technique), and the Waldn-Brown scoring were the methods used. The statics analysis were made using the Compound Symetry technic. The results showed not a clear anthelmintic activities, as well as no significant impact on weight.

1. INTRODUCTION

Within recent years, Mexico experienced fast meat demand increase, mainly in the central region of the country. In response to this, sheep production developped owing to the hight profitability of this ruminant that is small size, prolific, easily adapting to different environments and thus taking advantage of the available resources of each region of the country (Partida, and all., 2013).

In southeastern Mexico, livestock is managed extensively, greatly promoted by government institutions. Thereby the vegetation has been strongly impacted and the original landscape modified, in which corn crop fields have been replaced by pastures (Nahed and all., 2013).

The use of tree and shrub foliage with forage potential in the feeding of ruminants has been used as an indirect alternative feed mainly in the time of forage shortage, which has aroused the interest of some researchers (Sosa and all., 2004; Pinto-Ruíz and all., 2014, Martínez-Alfaro and all., 2014; Martínez-Alfaro and all., 2015). Moreover it has been documented that trees dispersed in pastures or as a live fence perform multiple functions in production units (Nahed, and all., 2013).

In previous studies, surveys were made with producers in the region allowing the identification of the most locally used tree and shrub species with forage potential (Martínez-Alfaro et al., 2014; Martínez-Alfaro, et al., 2015), highlighting the social importance of *Guazuma ulmifolia* tree.

On this purpose studies on sheep ingestive behavior of some tropical trees with forage potential have been conducted. It has been conclude that both foliage of *Guazuma ulmifolia* (Sosa, and all., 2004; Martínez-Alfaro and all., 2014; Martínez-Alfaro and all., 2015), and fruits (Pinto-Ruíz, and all., 2014), have a higher preference rate in sheep and are highly valuable from a nutritional point of view.

Investigations on the plant showed various other medical qualities (Ricardo, and all., 2006) including gastrointestinal effects, but up to now, no information on the effects of *Guazuma Ul*. on gastrointestinal parasites. It has been shown that tannins have beneficial effects against helminths (Alonso-Díaz and all., 2007) and Guazuma contain tannins (Ricardo, and all., 2006). The objective of this study was to evaluate the effect of Guazuma Ulmifolia on gastrointestinal parasites through its tannin content and its nutritional value.

2. MATERIALS AND METHODS

2.1. Study area.

The study was carried out in the Sacrosanto Ranch, Municipality of Jiquipilas, Chiapas, located at 16 ° 34´20´´ LN and 93 ° 30´50´´ LW. It is located at an altitude of 610 meters above sea level.

2.2. Climate and vegetation.

According to the Kôppen Classification, modified by García (2004) the climate is Aw (w) (i): it is temperate subhumid C (W2) (W) with rains in summer, which corresponds to the study's period. The type of vegetation is tropical forest with tree species with potential forage of secondary succession such as *Guazuma ulmifolia, Bursera simaruba, Gliricidia sepium*, among others. It is important to mention that in this region (Central Region of Chiapas, Mexico) the presence of this tree species is quite important.

2.3. Animals.

Twenty-two Pelibuey sheep has been used. They were randomly allocated to two homogeneous groups in terms of physiological status (parasitology), age (between 1 and 2 years old) and nutritional status (weight, corporal score) (Table I.).

Table I. Group repartition of the studied animals according to the age, the BCS (Basic Corporal Score), and the coprological analyzes.

Parameters	Group		SEM	P>t
	Control	Test		
Age (year)	1,6	1,6	0,2	1
Weight (kg)	28,4	28,4	2,1	1
BCS (/5)	2,8	2,9	0,2	0,84
Trichostrongyle-type eggs (EPG)	202,3	277,3	115,4	0,68
Eimeria spp. oocysts (OPG)	429,5	493,2	140,9	0,74
Strongyloides spp. larvated eggs (EPG)	93,2	131,8	61,7	0,68

Control group: feed with only hay of Cynodon ml. Test group: feed with foliage of Guazuma ul. and hay of Cynodon ml. EPG : egg per gram. OPG : oocysts per gram. SEM : standard error of mean.

2.4. Experimental design.

The animals were fed with hay of *Cynodon mlenfuensis*, mineral salts and water ad libitum. The test group was provided with 70% of the nutritional requirements based on dry matter, in addition it will be provided with 30% fresh foliage of *Guazuma ulmifolia*. The control group will only be provided Estrella de Africa (*Cynodon mlenfuensis*). The nutritional requirements were calculated based on the fact that sheeps needed 3% of their weight on DM per day and assuming that *Cynodon mlenfuensis* as hay would be around 95% of DM and *Guazuma ulmifolia* would be around 50% of DM. For each group two meals per day were given. The animals were under treatment during 30 days. The body condition (using the Waldn-Brown scoring) and the weight have been measured 3 times (on day 0, 19 and 29), and individual coproscopic analyzes has been done each 5 days. Moreover the refusal of feed has been measured each day: *Guazuma ulmifolia* individually for each meal, and *Cynodon mlenfuensis* per group once a day.

2.5. Laboratory Analysis.

In order to detect and evaluate the gastrointestinal parasites charge the MacMaster's cell count technique (Thienpont D. and al., 1995) was used. Excrement were collected on the morning, conserved in a cool place with ice. Randomised coprological analysis were made during the day.

The Chemical composition analyses of the feed samples were carried according to the procedures of AOAC (2000). Crude Protein (CP) was determined by the Kjeldahl method (N x 6,25); and crude fiber (CF) by the method of Weende (method no. 978.10). The dry matter content was determined from a test sample of 5g maintained at a temperature of 105 °C for 24h (AFNOR, 1982).

The crude ash was determined from a test sample of 1g carbonized in a oven at 550°C during X hours ?

The Fractions of Detergent Neutral Fiber (FND) were determined according to the technique proposed by Van Soest, et al. (1991).

The determination of tannins, were made using the MCP method for the total tannins (Mercurio and al., 2007), and by the heating in acid method for the condensed tannins.

Finally, atomic absorption spectrometry was used to assay minerals, calcium (Ca), phosphorus (Ph), Potassium (K), sodium (Na), Magnesium (Mg).

Cours : phosphore par colorimétrie et autres minéraux par spectrométrie de flamme

Trace element: Cu, Fe, Mn, Zn ? Atomic absorption spectrometry also?

2.6. Statistical analysis

For the repartition of animals in groups the test student t was applied.

For the analysis of the impact of the linear variables (time, group and the interaction between time and group) the Compound Symetry technic has been used.

2.7. Ethical mention?

3. RESULTS

3.1. Chemical composition of *Cynodon mlenfuensis* and *Guazuma Ulmifolia*.

Table II. Chemical composition of Guazuma ul. (foliage) and Cynodon ml. (hay) used in the study.

Nutriment (% DM basis)	***Guazuma Foliage***				Estrella (Cynodon)
	Average	SD	Average	SD	
Dry matter	38,7	0,8	83,0	0,9	
Crude ash	10,7	1,3	10,5	2,7	
Crude protein	15,4	2,3	6,9	2,3	
Crude fiber	22,9	2,4	34,5	4,6	
FND	62,7	3,8	68,5	8,2	
Calcium	1,90	0,5	0,4	0,1	
Phosphorus	0,31	0,0	0,2	0,1	
Potassium	1,86	0,2	1,5	0,1	
Sodium	0,01	0,0	0,1	0,1	
Magnesium	0,44	0,1	0,2	0,1	
Copper	0,003	0,002	0,001	0,0004	
Iron	0,009	0,002	0,037	0,0272	
Manganese	0,005	0,001	0,008	0,0008	
Zinc	0,003	0,001	0,003	0,0005	

SD : standard deviation.

Table III. Energetic values of Guazuma ul. (foliage) and Cynodon ml. (hay) used in the study.

	Guazuma ul.		Cynodon ml.	
	Average	SD	Average	SD
KVEM	0,83	0,01	0,68	0,02

SD : standard deviation.

Table IV. Tannin analyses of Guazuma Ul. used in the study.

Total tannins		Condensed tannins	
Average	SD	Average	SD
7,36 (mg EEC/gr seché)	0.42	9,76 (mg EC/gr seché)	0.34
3,06 (mg EEC/gr)		4,06 (mg EC/gr)	
0,79 % DM		1,05 % DM	

EEC : equivalent epicatéchine. EC :equivalent cyanidine

3.2. Time effect over the BCS, weight, parasitic charge.

Table V. Statistical analysis of the impact of time over the weight, the BCS, the coprological analyzes.

Parameters	Time (days)									SEM	Pr>F
	0	5	10	15	19	20	25	29	30		
Weight (kg)	28,4				28,7			27,5		1,35	**0,0334**
BCS (/5)	2,8				2,6			2,6		0,12	**0,0038**
Trichostrongyle-type eggs (EPG)	290,9	325,0	345,5	440,9		697,7	1231,8		1456,8	277,07	**<.0001**
Eimeria spp. oocysts (OPG)	443,2	434,1	493,2	227,3		268,2	347,7		205,7	93,06	**0,0191**
Strongyloides spp. larvated eggs EPG	112,5	152,3	102,3	56,8		81,8	231,8		150,0	52,24	**0,0096**

SEM : standard error of mean. EPG : egg per gram. OPG : oocyst per gram.

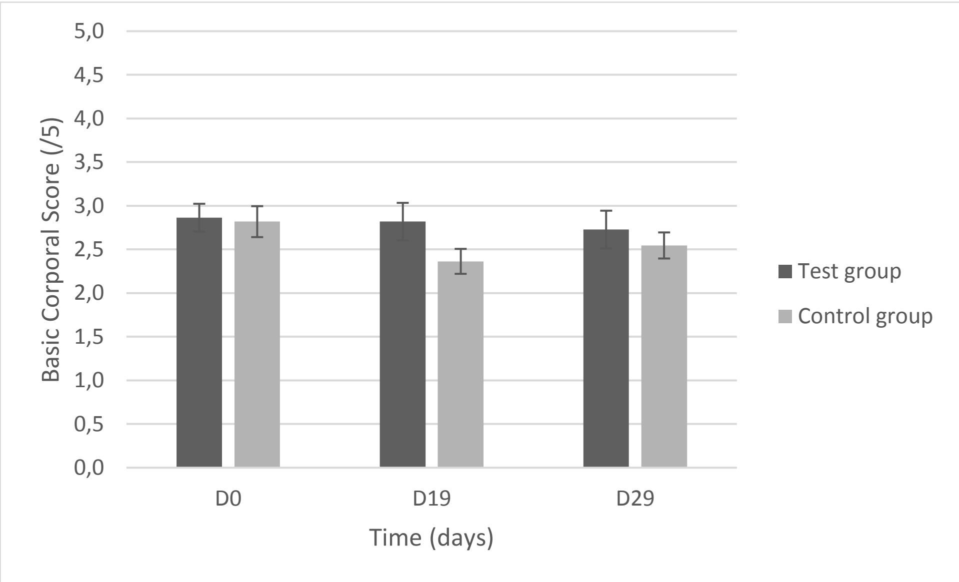

Figure 1. Average basic corporal score of the experiments groups (with foliage of Guazuma ul. and hay of Cynodon ml. for the test group and with only hay of Cynodon ml. for the control group) in the time.

Regarding the BCS there is significant effects of the time and the evolution of the two group over the time (Pr>F, $p < 0.05$). The BCS on the day 29 showed a diminution compared to the day 0 and 29. Moreover there is a difference between the control and the test group: the control group presented lower values than the test group on the day 29.

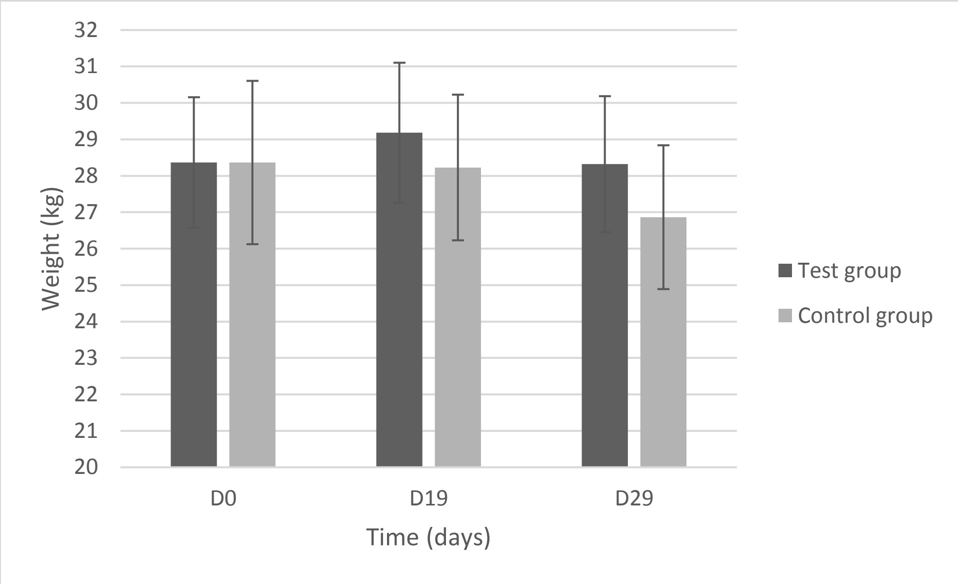

Figure 2. Average weight of the experiments groups (with foliage of Guazuma ul. and hay of Cynodon ml. for the test group and with only hay of Cynodon ml. for the control group) in the time.

Significant effect of the time over the weight (Pr>F, $p < 0.05$), but none of the group nor the group weight over the time. *Effet linéaire entre les deux groupes : le poids du contrôle diminue par rapport à celui du groupe testé ?*

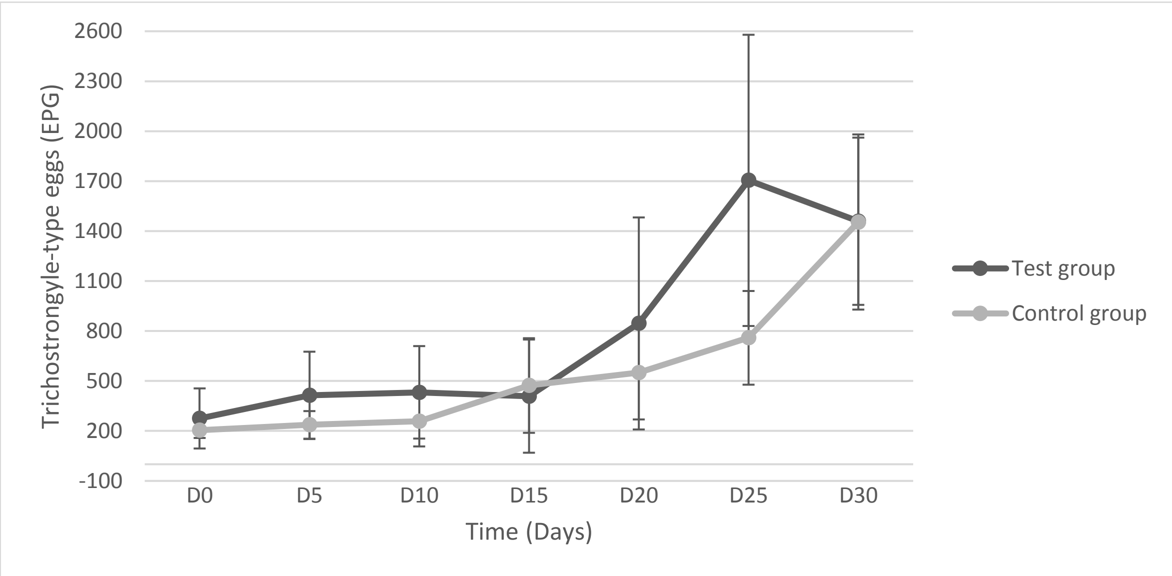

Figure 3. Parasitic load of Trichostrongyle-type eggs according to the studied groups (with foliage of Guazuma ul. and hay of Cynodon ml. for the test group and with only hay of Cynodon ml. for the control group) in the time.

Regarding the trichostrongyle-type parasites the coprology has showed no significant difference between the test group and the control group, idem for the evolution of the two group over the time. However there is a significant effect of the time (Pr>F, $p < 0.05$) : the average trichostrongyle-type eggs in the last two analysis showed an augmentation compared to the analysis of the first half of the study.

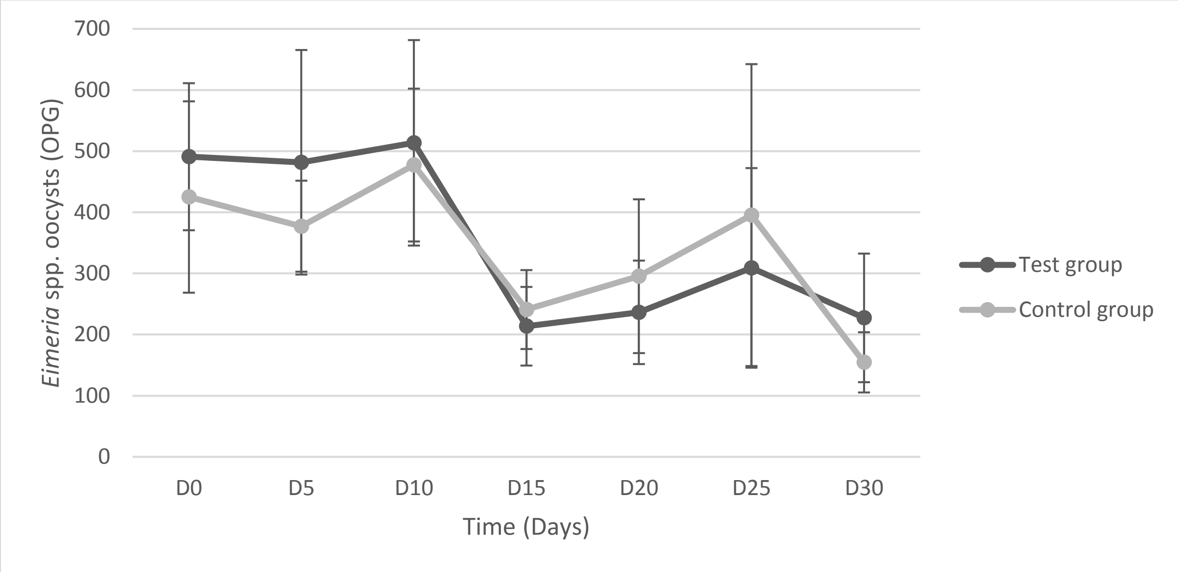

Figure 4. Parasitic load of Eimeria spp. oocysts according to the studied groups (with foliage of Guazuma ul. and hay of Cynodon ml. for the test group and with only hay of Cynodon ml. for the control group) in the time.

Regarding the *Eimeria* spp. oocysts (OPG) load the coprology has showed no significant difference between the test group and the control group, idem for the evolution of the two group over the time. However there is a significant effect of the time (Pr>F, $p < 0.05$) : the proportion of trichostrongyle-type eggs increased on the second part of the experiment.

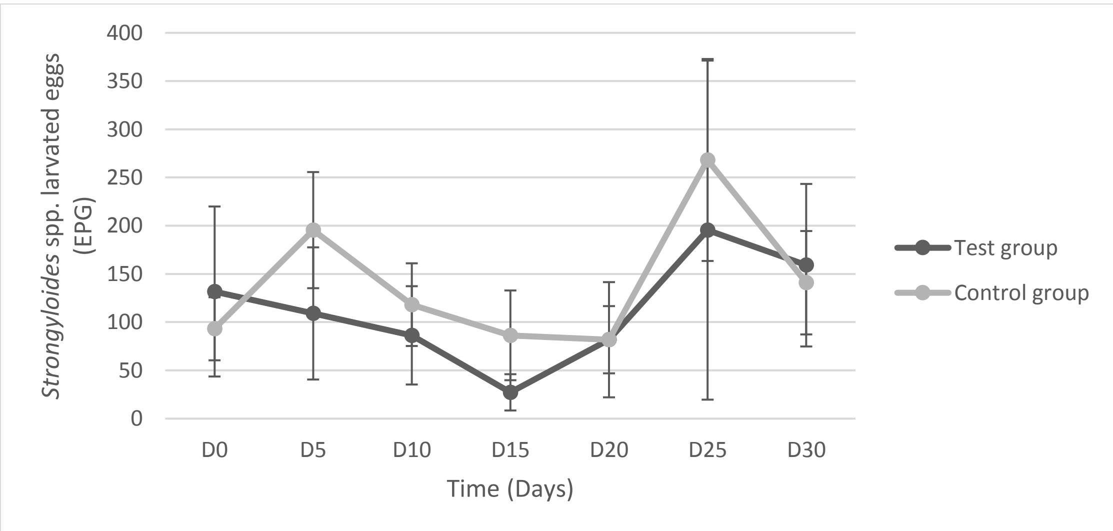

Figure 5. Parasitic load of Strongyloides spp. larvated eggs according to the experiments groups (with foliage of Guazuma ul. and hay of Cynodon ml. for the test group and with only hay of Cynodon ml. for the control group) in the time.

3.3. Group effect over the BCS, weight, and parasitic load.

Table 7. Statistical analysis of the group impact over the weight, the BCS, the parasitic loads.

Parameters	Group		SEM	Pr>F
	Control	Test		
Weight (kg)	28,6	27,8	1,88	0,7800
BCS (/5)	2,6	2,7	0,15	0,4390
Trichostrongyle-type eggs (EPG)	562,3	805,8	281,57	0,5477
Eimeria spp. oocysts (OPG)	338,0	353,3	93,91	0,9097
Strongyloides spp. larvated eggs (EPG)	140,6	113,0	59,52	0,7464

SEM : standard error of mean. EPG : eggs per gram. OPG : oocysts per gram.

No significant difference has been highlighted between the control group and the test group (with Guazuma) for all the parameters recorded.

4. DISCUSSION

Discuter la composition bromatologique et la valeur alimentaire (énergie, protéine)

Discuter l'effet sur le score corporel

The scoring used in this experiment is objective, but no significative difference was revealed.

Discuter l'effet sur les parasites (compte tenu de la valeur alimentaire et donc l'effet sur la croissance, et la présence de composés potentiellement antihelmintiques).

5. CONCLUSIONS

6. BIBLIOGRAPHY