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PRODUCTIVE INDICATORS OF MEVEZUG LAMBS FEED WITH WHOLE CORN GRAIN AND NATIVE GRASS HAY *(CHLORIS VIRGATA)*

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Abstrat: *The objective of this work was to determine the productive indicators of MEVEZUG breed lambs, 12 lambs of 22±3.04 kg of average live weight were randomly selected. The lambs to integrate in treatment 1(SP), feed consisted of grain corn, soy paste, native grass hay and mineral salts. In the treatment 2 (SPU), the feeding was similar to that of the SP, with the addition of urea, the variables were: dry matter ingestion (DMI), daily weight gain (DWG), feed conversion ratio (FCR) and yield in hot carcass (YHC), yield empty carcass (YEC), primary carcass cuts (PCC); the data were analyzed by ANOVA, comparison of means Duncan test with 5% probability (P< 0.05), according to the statistical package InfoStat. The DMI, DWG, FCR, YHC, YEC, cavitary fat in relation to live weight and PCC, had the following values: 1.038 kg, 0.271 kg, 3.831, 43.5%, 51.17%, 2.8% and 12.6 kg respectively and 1,058 kg, 0.247 kg, 4,284, 43.6%, 51.6%, 3.2% and 13.18 kg in SP and SPU respectively, these values were statistically similar with the exception of the FCR (P<0.0001). It is concluded that the studied indicators were similar in the two treatments, with the exception of the FCR.*

I. INTRODUCTION

In the intensive fattening of lambs, ground grains of corn, sorghum, barley, oats, wheat are used as the main source of energy, in percentages above 50% of the diet and the inclusion of oilseed pastes as a source of high protein nutritional value, these ingredients constitute the largest volume in the rations, the rest of the ingredients are represented by the source of forage, minerals and different food additives, in recent years studies have been carried out in order to reduce the intake of forage and increase the energy intake, through the incorporation of whole corn grain Gallo et al. [1], these authors report rations for fattening lambs composed only of de whole corn and as a protein source, an protein concentrate.

The diets for fattening lambs with the ingestion of whole corn grain offered at will, together with the protein and mineral ingredients, constitute more than 85% of the dry matter consumption and the rest corresponds to the forage source, Mireles et. al., [2], report an ingestion of sesame straw less than 10% without detriment to the daily weight gain in fattening lambs. Therefore, the present work aimed to determine the daily weight gain, feed conversion and carcass yield in lambs fed with whole grain of corn and native grass hay (*Chlorisvirgata*) offered at will.

II. MATERIALS AND METHODS

The present work was carried out in the sheep production unit (UPO), in the Faculty of Veterinary Medicine and Zootechnics. These place islocated in Carretera Nacional Altamirano-Iguala 3.5 km, in Cd. Altamirano, Guerrero. Geographic coordinates 18° 20' 30"North and 100° 39' 18" West in an altitudinal range of 240 masl. The climate is hot tropical dry with an average temperature of 29 ºC, with an annual rainfall of 1,000 millimeters [3, 4]

The experiment was carried out for 56 days, from August 6 to October 1, 2019, with a previous adaptation period of 10 days. The 12 lambs were of the MEVEZUG breed with which were randomly selected to integrate two treatments of six lambs in each one, Treatment 1 Soybean paste (SP) and Treatment 2 Soybean paste-urea (SPU).

The SP treatment feed consisted of grain corn, native grass hay and a mixture of mineral salts composed of 70% common salt for human consumption, 20% calidra(Nixtacal®)and 10% gypsum.

In the SPU, the feeding was similar to that of the soy treatment, with the addition of urea dissolved in water in the percentages shown in the following table 1.

Table 1. Percentage composition and nutritional content of the diet offered to MEVEZUG lambs in intensive fattening for voluntary consumption.

Ingredient	SP	SPU
Native grass hay	16.5	17.6
Wholecorn	55.1	58.1
Soy paste	26.4	21.7
Urea		0.5
Water		0.5
Minerales	2.0	1.6
Total	100	100
PC	18.9	18.4
EMMcal/kg	2.9	2.9
Ca	0.5	0.5
P	0.4	0.4

The native grass hay was obtained by cutting and drying in the sun for four days and later stored for its conservation and consumption. The white corn grain was obtained by purchasing in the local market in the quantity necessary for the entire experiment. In the soy treatment, the soy was mixed with mineral salts at 93% and 7% respectively. In the soy-urea treatment, soy, urea, water and mineral salts were mixed in the proportions 89.1%, 2.0%, 2.2% and 6.7% respectively.

The supply of forage, corn in grain and mixtures were in quantities necessary to cover the requirements and including an amount so that there would be a daily rejection, because the consumption of these foods was voluntary, on average the quantities were, for lamb they were: 0.250 kg, 0.833 kg and 0.383 kg, respectively with the difference that in the soy-urea treatment, the amount of mixture was 0.350 kg, this due to the inclusion of non-protein nitrogen represented by urea.

2.1 Handling the lambs

In the work, 12 hair lambs, not castrated, with an average weight of 22 ± 4.04 kg were used. They were chosen completely at random in two groups, of 6 lambs each MEVEZUG breed group. Two corrals belonging to the FMVZ, 4 m long by 3 m wide, with a surface area of 2.0 m^2 per animal, with a cement floor and roofed with galvanized sheet, were used, they were conditioned with sheet feeders and water troughs.

The live weight record of the lambs was carried out at the beginning of the experimental period and subsequently every 14 days, by means of a digital scale with a 200 g scale.

2.2 Feeding

The native grass hay was provided through a forage feeder, where the animals extracted it for their ingestion, the corn grain was supplied in a feeder and in another similar the mixture of soy-mineral salts in the treatment of one and the other treatment, the mixture of soy, urea, water and mineral salts, each lamb had 15 cm of space in the feeder to consume the corn and the mixture.

The supply of forage, corn and mixture corresponding to the six lambs was weighed daily, the next day the rejection was weighed and by difference the daily consumption was determined and by dividing the quantity by the number of lambs per treatment, the corresponding for each animal.

At the end of the feeding period, the average consumption of native grass hay, grain corn and protein concentrate was determined, represented by the mixture of soy, mineral salts in treatment one and soy, urea, water and mineral salts in treatment two.

2.3 Determinación del YHC, YEC, and PCC

Three lambs were randomly chosen from each group for slaughter, after fasting for 12 hours for the determination of the YHC, YEC and PCC, the weight of the filled and empty gastrointestinal tract compartments, weight of perirenal fat, pericardial fat, mediastinal fat and abdominal fat.

The lambs were sacrificed according to the official Mexican standard NOM-033-ZOO-1995, at the Faculty of Veterinary Medicine and Zootechnics No. 1 of Ciudad Altamirano, by means of a previous desensitization and then slaughtering. The weight was recorded before slaughter and later the weight of the carcass, it was considered to this, as the lamb after bleeding without: the skin, the limbs sectioned at the height of the carpus and tarsus, the head which was sectioned in the occipitoatlantoid joint, thoracic and abdominal viscera. The carcass was weighed immediately. Carcass performance was determined by the following formula.

YHC% = (Weight of the hot carcass × 100)/Weight live before sacrifice

To determine the YHC variable, the weight of the entire gastrointestinal tract (GTI) was recorded and the content was subsequently extracted, in this way the following organs were weighed empty: rumen, reticulum, omasum, abomasum, small intestine (SI) and large intestine (LI), by difference between the weight of the full and empty organ, its content was determined. Subsequently, the contents of each organ were added and it was considered as the total weight of the contents of the organs of the GTI (TWCOGTI)

For the calculation of the YEC, it was carried out using the following formulas:

YEC= (weight of the carcass x 100) / Weight live before sacrifice - TWCOGTI

TWCOGTI = total weight of the contents of the organs of the GTI

Where:

T= Total; W= weight; C= contents; O= organs; G= gastro; T= Tract; G = and I = Intestinal

2.4 Primary carcass cuts (PCC)

There were 5 PCC and they were carried out according to local tradition, which included the following regions with the bones and the corresponding muscular covering: a neck (cervical vertebrae); two right and left arms (scapula, humerus, ulna and radius); 2 right and left ribs (ribs, middle of the sternum and abdominal muscles);

two right and left legs (femur, fibula and tibia); spine (dorsal, lumbar, sacral and coccygeal vertebrae). Subsequently, the primary sections were sectioned into small portions with the inclusion of muscle and bone; since the meat is destined for the elaboration of birria, broth or stew in different forms.

Once the small portions are cooked together in different shapes and styles according to the regional tradition, the final consumer is the one who selects the portion of their preference, that is, meat with or without the inclusion of a portion of a specific bone.

The previous modality is totally different to the cuts of the carcass in the American or French style that includes the following: neck (neck), shoulder (shoulder), rib (rib), loin (loin), sirloin (sirloin), leg (leg)), breast (chest), flank (flank), foreshank (front shaft) and hindshank (rear shaft), Kansas State University [5].

2.5 Variables studied

The variables were: voluntary consumption of whole corn and soybeans, native grass, initial weight, final weight, total weight gain, daily weight gain, hot yield carcass, empty yield carcass y primary cuts.

Statistical analysis

The data recorded for the variables studied were subjected to an analysis of variance and the means were measured with the Duncan test, according to the InfoStat statistical package Balzariniet. al. [6].

III. Results and Discussion

3.1. Consumption of food and dry matter

In table 2, it is observed that the voluntary consumption of soybean paste was 40 g, which represented 15.32% more in the SP treatment, compared to the SPU, this resulted in a higher ingestion of corn grain in this treatment, with a value of 35 g that meant 5.9% more, this was possibly due to the addition of urea that reduced the consumption of soybean paste. However, the dry matter intake was statistically similar and in a range that coincides with the recommendations of the NRC, 2007 [7].

Table 2. Voluntary food consumption and diet kg^{-day} dry basis of MEVEZUG lamb in intensive fattening with soybean paste and soybean paste plus urea

Ingrediente	SP	SPU	P
Hay *Chlorisvirgata*Sw	0.151	0.154	0.6369
Wholecorn	0.594^{b}	629^{a}	0.0477
Soybean paste	0.301^{a}	0.261^{b}	<0.0001
Urea	-	0.008	-
Water	-	0.011	-
Mineral salts	0.031^{a}	0.027^{b}	<0.0001
DM kg	1.038	1.058	0.3954

DM = dry matter, means in the same row with different literals are statistically different (P<0.05).

3.2. Composition and percentage nutritional content of the diet

In table 3, it is observed that the percentage voluntary consumption of hay was 5.2% less than that offered in the two treatments, which was compensated, possibly with a higher intake of whole corn grain. However, the ingestion of the nutrients PC, EMMcal, Ca and P were similar in SP and SPU, highlights the percentage value of the voluntary consumption of PC of 17%, in the same way the voluntary ingestion of forage of 14.52%, values coinciding with the recommendation of 16.9 and 15% respectively from the NRC, 1985[8].

Table 4. Initial weight, final weight, TWG and DWG in kg and FCR of MEVEZUG lambs fed with soybean paste and soybean paste plus urea in intensive fattening

Indicador	SP	SPU	P
Initial weight	17.167	16.667	0.7668
Final weight	32.333	30.500	0.4173
TWG	15.167	13.833	0.0948
DWG	0.271	0.247	0.0948

Table 3. Composition and percentage nutritional content in DM of PC, Ca, P and EMMcal of the diet offered and consumed of MEVEZUG lambs in intensive fattening with soybean paste and soybean paste plus urea

Ingredient	SP		SPU		Consumed
	Offered	Consumed	Offered	Consumed	P
Hay *Chlorisvirgata*Sw	19.68	14.59	19.94	14.52	0.8570
Wolecorn	52.61	57.71[b]	53.06	58.31[a]	0.0009
Soybean paste	25.10	25.67[a]	22.64	23.09[b]	<0.0001
Urea	-	-	0.8	0.67	
Water	-	-	1.4	1.34	
Mineral salts	2.8	2.7[a]	2.4	2.4[b]	<0.0001
PC%	16.80	17.2	17.90	17.9	
EMMcal/kg DM	2.9	2.9	2.8	2.90	
Ca%	0.55	0.52	0.49	0.47	
P%	0.24	0.23	0.23	0.22	

DM= dry matter, PC = crude protein, Ca = calcium, P = phosphorus.

The values of the final weight indicator and DWG in the two treatments were statistically similar, with only a greater difference of 1.833 kg, which represents 5.7% and 0.024 kg equal to 8.8% of final live weight and DWG respectively in SP when compared with SPU, as shown in table 4. This could possibly be attributed to the fact that in the first treatment there were three lambs that presented 0.018 kg, more compared to three lambs that in the second treatment obtained higher DWG.

This, can also be justified because when providing corn in grain, it is necessary to establish a way to include urea in the ration without being mixed with the other ingredients of the ration and one of the ways is to mix it with the soybean paste and minerals, with the consequent presence of the urease typical of soybean paste, which causes the formation of ammonia, which would represent a loss of nitrogen.

The mean DWG of the SP treatment of 0.271 kg was very close to the 0.275 kg reported by Gallo et al. [1], who fed lambs with grain corn and a protein concentrate, this could possibly be due to the diet of the authors mentioned only consisted of these two ingredients, the authors do not report the source of forage.

In relation to the FCR (Table 4) of 3.831 and 4.284 (P<0.0001), in the SP and SPU treatments respectively the above may be due to the fact that in the first treatment there was higher DWG and lower dry matter consumption with 0.024 kg and 0.020 kg respectively, when compared to SPU.

In	FCR	3.831^{b}	4.284^{a}	<0.0001

SP= soybean paste, SPU=soybean paste plus urea, TWG = total weight gain, DWG = daily weight gain, FCR= feed conversion ratio, means in the same row with different literals are statistically different (P<0.05).

studies conducted by the authors Delgado and Soto [9], with MEVEZUG lambs and Dorper x Criollo crosses report DWG of 0.233 kg and 0.226 kg, respectively, quantities lower than 0.038 kg, an amount that represented 14% less in MEVEZUG, and 16.6% in crosses . These same authors report a lower FCR with 4.8 and 4.6 amounts higher than those obtained in the present work with 0.969 FCR, this is possibly due to the fact that the corn was ground and the passage of this food remained less time in the gastro-intestinal tract, as mentioned by McDonald et. al. [10] and Camps and González [11], coupled with the fact that the forage source was corn silage in the work of the aforementioned authors.

Mendoza and Trujillo [12], in MEVEZUG lambs fed ad libitum with: whole grain corn, as the main energy source and native grass hay (*Chlorisvirgata*Sw), report a DWG of 0.213 kg, a quantity less than 0.058 kg which represented a 26.7% less and a lower FCR of 5.6 higher quantity in 1.769, this was possibly a consequence of the offer of soybean paste and separated mineral salts, which caused a lower consumption of forage of 0.110 kg and a higher consumption of soybean paste of 0.390 kg and only 0.010 kg of mineral salts; against 0.151 kg, 0.301 kg and 0.031 kg, respectively, figures that were obtained in the present study, as observed in table 2.

Trabiet. al. [13], in a work with Hu breed lambs, fed with diets of 30% forage, 40.6% ground corn grain, 15.6% wheat bran and 3% mineral ingredients report a DWG of 0.245 kg , a lower quantity in 0.026 kg that represented 9.59% less DWG compared to that obtained in the present work and a FCR of 5.98 higher quantity in 2,149, this can be attributed to the greater quantity of forage in the ration represented by the straw of oats in 23% and 7% of alfalfa hay that add 30% of forage and to the lower amount of CP in the ration with 13.8% compared to what was consumed by the lambs in the present work with 14.59% and 17.2% respectively as it is observed in table 3.

In relation to the DWG Mireles et. al. [2], reported 0.258 kg, 0.245 and 0.269 in MEVEZUG, MEVEZUG non-colored and cross Dorper x Criollo lambs fed with sesame straw, whole corn grain, soybean paste and mineral salts, amounts close to those that are observed in table 4 with 0.271 and 0.249 kg this can be attributed to the similarity of the diets provided in the present work.

3.4. Carcass characteristics

In table 5, it is observed that the YHC, YEC, TWCOGTI / LW% and fat / LW% were obtained 43.5% and 51.4%, 15.2% and 3.0% average respectively in SP and SPU, without statistically significant difference as observed In table 5, this can be attributed to the fact that the significant difference in the intake of corn grain and soybean meal (tables 2 and 3) had no effect on these indicators, coupled with the fact that the total intake of DM, CP and EMMcal were quantitatively similar as can be seen in table 3. Gallo et. al.[1] reported a YHC of 47.31% in lambs fed with grain corn and a protein concentrate in Dorper x Santa Inés breed lambs, but close to that of lambs fed a diet with ground corn with 45.17%, This last value is close to that of the present work, the higher figure is probably related to having provided a protein concentrate without reporting its composition and the second value for having provided ground corn.

The YHC was much higher than that reported by Mireles et. al. [14], with 40% in lambs grazing native grasslands and supplemented with 30% of the DM requirements of *Acasiacochliacantha* pods, this can be attributed to the different feeding system used in these studies. However, Souza et. al. [15] report a YHC of 46.30% in lambs fed canola at 0%, 8% and 16% in the ration and the sacrifice was with a previous fast of 18 hours, this fasting time was possibly reflected in higher YHC, given that the content of the intestinal tract decreased by prolonged fasting, compared to the 12 hours of fasting in the present work.

Laurerano and Díaz [16], in report an YHC and YEC of 46.26% and 55% respectively in MEVEZUG and Dorper x Criollo lambs fed intensively with whole grain of corn and sesame straw as a source of forage, the figures are higher compared to those of the present work, this was possibly caused by the amount of forage ingested in the diet with 8% in the work of these authors, compared with 14.5% in this study as indicated in table 3.

Regarding the TWCOGTI / LW% ratio, Laureano and Díaz [16] in 2013 determined 15.8%, an amount that is 3.8% higher than that determined in the present work, this may have influenced a higher YHC with 46.26% and in YEC of 55%, reported by these authors in comparison with 43.5% and 51% in the present work, as shown in table 5.

Mireles et. al. [17], reported a higher content of the gastro-intestinal tract of 22.23% in relation to live weight, an amount 7% higher than that determined in the present work as expressed in table 5, this may be as a consequence of the system, different from feeding, in grazing in the mentioned authors and intensive in the present work.

In table 5, it is observed that the percentage of fat in relation to live weight was on average 3% (P> 0.4967), which indicates that the difference in ingestion of corn grain and soybean paste between the two treatments did not influenced this indicator, however these figures were higher than those reported by Laureano and Díaz [16], who report values of 1.8%, 1.5% in MEVEZUG lambs in intensive fattening with consumption of 8% of sesame straw, percentage lower than that consumed by the lambs in the present work, which could influence higher production of acetic acid in ruminal fermentation, which led to higher cavity fat deposition McDonal et. al. [10].

3.5. Primary cuts of the carcass

In Table 6, it is observed that the total percentage of primary cuts of the carcass in relation to live weight before slaughter of the lambs in SP and SPU were statistically similar, which indicates that the statistical difference in the FCR did not influence the the weight of the primary cuts. The authors Laureano and Díaz [16], reported similar results of the primary cuts, however when comparing the neck weight between MEVEZUG and Dorper x Criollo lambs they were (P<0.0395) with 1,643 kg and 1,287 kg, respectively, this possibly is a characteristic of the MEVEZUG breed, that it has a heavier neck.

Table 5. Live weight, weight HC, YHC, YEC, TWCOGTI, TWCOGTI/LW % total cavity fat and Fat/LW % of MEVEZUG lambs fed with soybean meal and soybean meal plus urea in intensive fattening

Indicador	SP	SPU	P
Live weight kg	28.33	30.00	0.5473
Weight HC kg	12.33	13.07	0.5732
YHC%	43.50	43.56	0.9311
YEC%	51.17	51.60	0.5971
TWCOGTI kg	4.20	4.67	0.3549
TWCOGTI/PV%	14.9	15.5	0.6142
Fat* total kg	0.81	0.951	0.3880
Fat/LW%	2.8	3.2	0.4967

HC= hot carcass, YHC= yield hot carcass, YEC= yield empty carcass, TWCOGTI= total weight content organ gastro tract intestinal, LW = live weight, *mediastinal, abdominal, pericardial and perirenal fat.

Table 6. Primary cuts of the MEVEZUG lamb carcass fed with soybean paste and soybean paste plus urea in intensive fattening

Primary cuts	SP kg	% PC/LW	SPU	% PC/LW	P kg	P %
Arms	2.76	9.7	2.79	9.3	0.8904	0.6827
Legs	3.13	11.1	3.22	10.7	0.8266	0.7860
Ribs	2.99	10.6	3.10	10.3	0.7777	0.8328
Neck	1.14	4.0	1.21	4	0.5511	>0.999
Backbone	2.59	9.1	2.86	9.5	0.4972	0.7500
*Head	1.36	4.8	1.21	4	0.2889	0.1668

SP= soybean paste, SPU= soybean paste plus urea, PC= primary cuts LW= live weight, *does not correspond to the carcasses.

IV. Conclusions

The indicators of DMI, DWG, YHC, YEC, the percentage of cavitary fat in relation to live weight and the percentage of the weight of the primary cuts were similar in the SP and SPU treatments, however there was a

better FCR in the first treatment in in relation to the second, so it is suggested not to mix the urea diluted in water with the soybean paste and mineral salts.

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