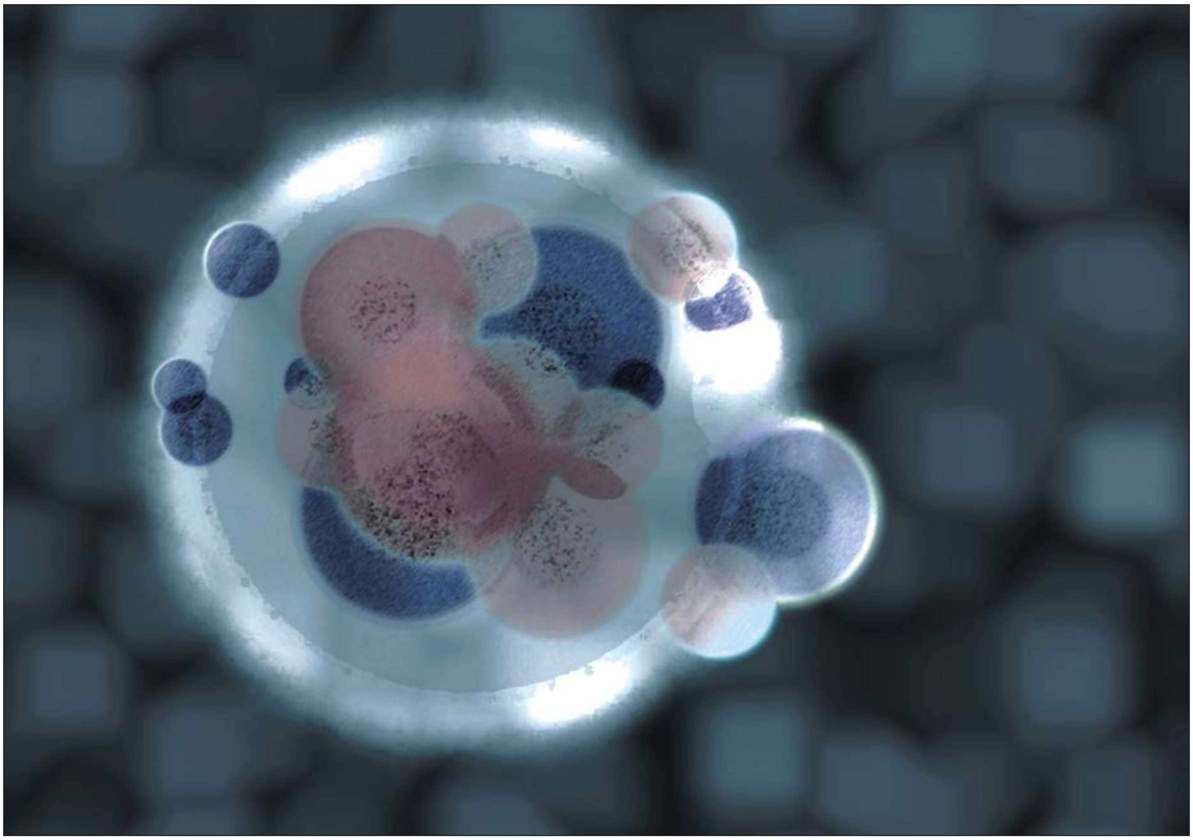

Journal of Biological Sciences

ISSN 1727-3048

Journal of Biological Sciences 6 (3): 604-609, 2006
ISSN 1727-3048

Morphometry, Carcass Yield and Traits of Mexican Creole Goat Kids Slaughtered and Packed in a Federal Inspection Plant

[1]M. Becerril-Herrera, [2]O. Guzmán-Pina, [3]M. Alonso-Spilsbury, [3]E.V. Dorsey-San Vicente, [4]C. Lemus-Flores, [5]S. Flores-Peinado, [3]R. Ramírez-Necoechea and [3]D. Mota-Rojas
[1]Eiah-Benemérita Universidad Autónoma de Puebla, San Juan Acateno, Mpio, Teziutlan, Puebla
[2]Inspector Oficial de Rastros TIF, SAGARPA, Saltillo Coahuila
[3]Departmento de Producción Agrícola y Animal, Universidad Autónoma Metropolitana-X, Calz, del Hueso 1100, Col Villa Quietud, Coyoacán, México DF 04960
[4]Facultad de Medicina Veterinaria y Zootecnia, Universidad Autónoma de Nayarit (UAN)
[5]Taller de Cárnicos, Facultad de Estudios Superiores de Cuautitlán, FES-C, UNAM

Abstract: The objective of the present study was to evaluate the morphometry and carcass traits of Creole goats sacrificed and packed in a Federal Inspection Plant (FIP). The study was carried out in a FIP abattoir during May and June 2004. Fifty Creole male goats, 40 to 50 days old were used, brought form nearby family farms. Goats were transported without stops and they were not fed, nor provided with water. Carcasses were graded and 11 indicators were measured: both hot and cold carcass yields, cold carcass temperature, viscera weight, morphometry and pH, among others. When comparing the hot carcass weight with and without viscera (5.03 vs. 4.55), the values measured indicated that viscera represented 20.22% of the animals weight. The difference observed between hot carcass and cold carcass weight was 4.55 vs. 4.28 kg, respectively. Positive correlations were determined (R = 0.96) between hind-limbs (R = 0.65) and forelimbs (R = 0.69), as well as the one registered of both limbs with the hind and fore canes´ perimeters. On the other hand, the abdominal and thoracic regions were highly correlated (R = 0.9). This is an indicator of the animal biotype, which shows that these animals are long linear with highly developed limbs. The pH mean of the hot carcass and the cold carcass was 6.06 and 5.97, respectively.

Key words: Goats, Mexican Creole goat kid, carcass, morphometry, abattoir

INTRODUCTION

Nutritional characteristics of goat livestock meat indicate that in the same cuts, goat meat has 50 to 65% less fat content than beef (with a similar proportion of protein), 42 to 59% less than lamb meat and approximately 25% less than veal (Addrizzo, 1994). Besides, the percentage of saturated fat in goat meat is 40% lower than poultry without skin, 85% lower than beef, 100% lower than pork and 90% lower than lamb (USDA, 1989).

Currently, there are several opinions on meat quality and they vary in each country and among different ethnic groups. For example, goat meat is not included in the diet of some communities, while in others it is preferred rather than beef and lamb. In India, for instance, meat from adult goats is highly appreciated, also in Italy, France and Latin America, where kid meat is considered a delicious dish (Dhanda *et al*., 1999b; Todaro *et al*., 2002). Meat is closely related to customs and preferences, for this reason it is not possible to use a universal standard for goat meat quality (Sheridan *et al*., 2003a, b).

In Mexico, kids are usually marketed at before weaning when they are 4 to 5 months old. This option includes direct trade in farms and goat meat supply for special celebrations or holidays; these factors influence the production and commercialization of quality products. Together with direct trade for ethnic groups there are other two potential trade niches for goat meat: 1) a diet proposal for customers who are under a low fat regimen, 2) for restaurants or meat stores that offer typical feed or gourmets cooked with goat meat. For marketing purposes goat meat is divided into two types: capretto, (obtained from suckling kids that produce carcasses weighing between 6 to 10 kg and their meat is pink) and chevon (old animals with carcasses that weigh 16 to 22 kg) (Dhanda *et al*., 1999b). However, to our knowledge there is not enough information published on the use of the genetic potential of different goat breeds to maximize meat production.

Corresponding Author: Daniel Mota Rojas, Departamento de Producción Agrícola y Animal, Universidad Autónoma Metropolitana-Xochimilco, México DF Tel/Fax (525) 55 5483 7535

Regarding economic profits, some studies show that meat production of kids slaughtered at 35 days is better than that from animals slaughtered at 25 days; nevertheless, information on meat quality is scarce (Todaro *et al*., 2002). Due to muscular development and organoleptic traits as the animals grow, quality characteristics decrease (Sheridan *et al*., 2003b). For this reason, in international markets and in countries that traditionally consume this kind of meat, animals are marketed when their live weight is not over than 12 kg.

Flavor, tenderness, aroma and juiciness affect the acceptability of goat meat; whereas pH and meat color have less organoleptic influence (Dhanda *et al*., 1999b). However, age has an important influence on meat palatability since meat from adult goats seems to be juicier. Studies on chemical composition indicate that regarding quality, goat meat is not inferior to lamb; however, the color of each meat is different, since goat meat is dark red (Dhanda *et al*., 1999a; Marichal *et al*., 2003; Todaro *et al*., 2002).

There are few studies available on kids' meat quality in Mexico, therefore standards to establish quality parameters have not been determined yet, because these vary in each country, between races, age, habits and regional customs. The objective of the present study was to evaluate the morphometry and carcass traits of Mexican Creole kids' carcasses, slaughtered and packed in a Federal Inspection Plant (FIP).

MATERIALS AND METHODS

Animals: The study was carried out in a FIP in the state of Coahuila, in Northern Mexico during May and June 2004. Fifty Creole male kids of approximately 45 days old were monitored, brought from family farms close to the slaughterhouse and with veterinary advice. Animals were transported in a pick-up during 30 min and at a distance not farther than 100 km. All vehicles had straw bedding according to the animal care regulations in Mexico (Official Mexican regulation NOM-024-ZOO-1995). Kids were transported without stops and were not fed, nor provided with water. Collection and transportation of kids was carried out between 6:00 and 8:00 AM.

Pre-slaughter handling: Rectal temperature was recorded with a Citizen® digital thermometer immediately after arrival to the slaughterhouse; animals were weighed individually with a Salter Brecknell® digital scale (with capacity for 25 kg) and were housed in a pen, where they remained between 4 to 6 h. During the rest period animals were provided with water *ad libitum* and kept under shade, in a space allowance of 0.6 square meters per animal.

After *ante mortem* inspection, animals were showered in order to remove away pollutants as powder, manure or another strange material that could contaminate the carcass; afterwards they were taken to the drain off room.

Slaughter performance: In the slaughter area dressing tasks took place, animals were immobilized inside a wooden box and were stunned using an electric discharge of 80 volts during 8 seconds. Thirty seconds after, they were cut in the jugular vein to bleed to death, this lasted between 3 to 5 min and the skin was manually removed. The esophagus was tided up to avoid meat contamination with gastric content and the epiglottis was extirpated; subsequently, the animals were taken to an area where viscera were removed and they were hung on the union of the tendon in the tarsus-metatarsal joint. At this point the animals' body weight (without blood or skin, but with viscera) was monitored.

The evisceration process was done by cutting the ventral midline, tiding up the anus to avoid meat contamination with manure and the peritoneum was removed (it is commonly used to cook a typical dish in Mexico called "*machitos*"). The lungs, heart and liver (without gallbladder) were removed and red viscera were separated from green viscera. Subsequently, the carcass trimming was performed; the penis, bladder, excesses of fat, remaining skin or hair were discarded. Carcasses were washed under pressure and a final trimming was carried out in order to eliminate physical pollutants as bone chips, blood and fat excess. Finally, hot carcass weight (with head) was registered, with a Salter Brecknell® digital scale with capacity for 10 kg, in order to obtain the carcass yield.

Carcass grading: Carcasses were graded according to the quantity of peri-renal fat (adipose capsule), as follows: First grade carcasses or of covered kidney: those with both kidneys totally covered with fat. Second grade carcasses: those with approximately 50% fat covering the kidneys. Commercial carcasses: those with less than 50% fat covering the kidneys.

Carcass chilling: Once the carcasses had been washed and graded, they were covered with plastic wrap and were taken to the chilling room and stored for 12 h at 0° to 4°C.

Packing: In the process room carcasses were dewed with lactic acid (2%) and were vacuum packed in special bags. Then they were deposited in a rack and were frozen at -20°C.

Carcass traits: After the cooling process, the following indicators were measured, in accordance with Rodríguez technique (2004).

Cold carcass weight: After 12 h at refrigeration temperature, carcass weight (with head) was monitored using a Salter Brecknell® digital scale with capacity for 10 kg.

Carcass yield: Percentage relation between hot carcass weight and live weight at slaughter.

Real yield: Percentage relation between cold carcass weight and live weight at slaughter.

Carcass length: Distance (in centimeters) between the mid sections of the anterior border of the first rib to the ischiatic-pubian symphysis.

Thorax depth: Distance (in centimeters) from the inferior part of the breastbone to the mid dorsum.

Gaskin length: Distance (in centimeters) between the ischiatic tuberosity to the hock joints.

Loin-eye depth: It was determined on the *Longissimus dorsi* muscle at the level of the 10th and 11th rib, using a caliper (in millimeters).

Muscular pH: Forty five minutes after slaughtering, pH of the loin and leg muscles was measured, using a Hanna Instruments potentiometer (penetration pH electrode, HI 8314, pH meter membrane, 115V/60 Hz. Cod 1.1176).

Meat color: Meat was classified subjectively by coloration, according to Colomer *et al.* (1987) methodology; 3 color ranges were distinguished: 1 = pale, 2 = pink and 3 = red.

Loin length: Distance (in centimeters) of the *Longissimus dorsi* muscle.

Carcass temperature: *Longissimus dorsi* muscle temperature was determined 45 min after slaughtering, using an OMRON digital thermometer (Model 102, 1.5 V 0.1 mW).

Statistical analysis: An Univariate procedure was applied to all measured variables with the purpose of obtaining the descriptive statistics of such numeric variables. Correlation coefficients were also determined. SAS (2002) program was used in the analysis of the evaluated variables.

Table 1: Morphometry statistics of fifty goat Creole kids before slaughter

Statistics	CH	WH	TP	AP	AL	FLCP	HLCP
Media	48.86	46.62	51.90	54.06	57.66	7.19	7.74
Mode	48.00	43.00	52.00	56.00	54.00	7.00	8.00
Standard deviation	4.40	4.57	4.25	4.33	4.10	1.31	1.20
Minimum	43.00	41.00	42.00	43.00	52.00	5.00	6.00
Maximum	58.00	57.00	58.00	59.00	66.00	10.00	11.00
Variation coefficient	9.02	9.82	8.19	8.01	7.12	18.25	15.61

CH: Croup Height. WH: Withers Height. TP: Thorax Perimeter, AP: Abdominal Perimeter, AL: Animal Length, FLCP: Forelimb Cane Perimeter. HLCP: Hind-limb Cane Perimeter. All measurements are given in centimeters

RESULTS AND DISCUSSION

Since the slaughtered animals were Creole and did not have a defined genetic line, the following characteristics were observed: hind-limbs were higher than forelimbs and abdominal circumference wider than thoracic circumference. On the other hand, it is important to mention that these animals turned out to be longer than taller and they presented a considerable bone development that was reflected in the circumference of the hind and fore canes. The variation found in all measured variables was 7.12 to 18.52, which is considered as moderate (Table 1).

The productive performance and phenotypic traits of young goats destined for supply depend on many factors; for example, the animal's gender or genotype (Maiorano *et al.*, 2001; Hernández-Zepeda *et al.*, 2002). Kadimm *et al.* (2003) observed that gender affects: weight at birth (depending on the size of the parents), daily weight gain and time to reach slaughter weight. These findings agree with Dhanda *et al.* (1999a) who observed that Boer X Saanen and Saanen X Feral crossbreeds were heavier at birth and showed a higher daily weight gain than Feral X Feral and Saanen X Angora crossbreeds.

Body temperature was within the normal range, which indicates that transport was not a stress factor. The effect of the genetic line was reflected in the animals live weight and in its variation, although it is worth mentioning that weight was also within the established range for suckling kids' carcasses (Table 2). Dhanda *et al.* (2003a) report that physical characteristics of goat's growth such as weight depend among other factors on the breed.

When comparing hot carcass weight with viscera and carcass weight without viscera (5.03 vs. 4.55), the figures measured indicated that viscera represented 20.22% of the animal's weight. The difference observed between hot carcass weight and cold carcass weight (4.55 vs. 4.28 kg), is a consequence of water loss due to maturation or chilling. Yields are indicators of the percentage of profit obtained in an animal and the real yield is more reliable than the slaughter yield (59.27 vs. 62.93), since in the latter, run off losses during chilling are considered.

Table 2: Descriptive statistics of carcass performance in fifty goat Creole kids

Statistics	RT (°C)	LWS (kg)	CWV (kg)	HCW (kg)	CCW (kg)	CY (%)	RY (%)	CC
Media	38.89	7.30	5.03	4.55	4.28	62.93	59.27	1.86
Mode	39.00	7.00	4.98	3.69	3.40	52.71	52.00	2.00
SD	0.33	1.54	1.45	1.00	0.97	8.58	10.70	0.72
Minimum	38.50	5.00	3.84	3.10	2.82	44.71	41.71	1.00
Maximum	39.50	11.00	9.47	6.91	6.50	82.00	77.40	3.00
Variation coefficient	0.87	21.12	24.11	22.13	22.89	13.64	18.05	39.17

RT: Rectal Temperature. LWS: Live Weight at Slaughter. CWV: Carcass Weight with Viscera. HCW: Hot Carcass Weight. CCW: Cold Carcass Weight. CY: Carcass Yield. RY: Real Yield. CC: Carcass Classification

Table 3: Means and standard deviation of the means of the carcass performance in fifty Creole goat kids

Statistics	CL	TD	GL	GR	LED	LL
Media	41.00	13.28	25.80	21.04	2.61	38.84
Mode	42.00	13.00	26.00	21.00	2.50	42.00
SD	2.68	1.06	1.97	1.80	0.48	4.71
Minimum	34.00	11.00	22.00	17.00	2.10	21.00
Maximum	50.00	17.00	33.00	26.00	5.20	51.00
CV	6.53	7.98	7.67	8.58	18.74	12.14

CL: Carcass Length. TD: Thorax Depth. GL: Gaskin Length. GR: Gaskin Roundness. LED: Loin-eye Depth. LL: Loin Length. All measurements are given in centimeters

Table 4: Viscera and skin weights of fifty Creole goat kids

Statistics	RVW	GVW	GVWNC	SW
Media	0.55	1.33	0.16	1.32
Mode	0.51	1.36	0.15	1.40
SD	0.11	0.26	0.03	0.18
Minimum	0.24	0.97	0.10	1.00
Maximum	0.76	2.28	0.29	1.66
CV	20.48	19.69	24.50	13.70

RVW: Red Viscera Weight. GVW: Green Viscera Weight (with contents). GVWNC: Green Viscera Weight (with no contents). SW: Skin Weight. Weights are given in kilograms

Table 5: Meat quality results from fifty Creole goat kids

Statistics	pH HC	pH CF	Meat color	CT (°C)
Media	6.06	5.97	1.96	8.78
Mode	5.90	5.60	2.00	8.00
SD	0.37	0.34	0.69	0.78
Minimum	5.36	5.30	1.00	8.00
Maximum	6.89	6.70	3.00	10.00
CVariation	0.05	5.76	35.64	8.99

pH HC: pH of the Hot Carcass. pH CC: pH of the Cold Carcass. CT: Carcass Temperature

Table 6: Correlation coefficient analysis of the morphometry

	CH	WH	TP	AP	AL	FLPC	HLCP
AG	1						
AC	0.96	1					
TP	0.22	0.23	1				
AP	0.14	0.18	0.9	1			
AL	0.8	0.81	0.18	0.17	1		
FLPC	0.69	0.65	0.24	0.13	0.53	1	
HLCP	0.65	0.62	0.11	0.01	0.52	0.92	1

CH: Crop Height. WH: Withers Height. TP: Thorax Perimeter, AP: Abdominal Perimeter, AL: Animal Length, FLCP: Forelimb Cane Perimeter. HLCP: Hind-limb Cane Perimeter

Another genotype effect is shown in the carcass traits; Kadim *et al.* (2003) found differences in the head, skin, paws, rumen-reticulum, liver, heart and kidney weights, depending on the breed. Also, fat deposition and carcass conformation were affected. Nevertheless, data does not agree with Dhanda *et al.* (1999c, 2003b) who demonstrated that genotype does not affect carcass conformation; they determined similar contribution percentages in primary cuts between breeds, results that agree with the present investigation, therefore in spite of the use of different crossbreeds the variation in the results was not considerable.

Regarding carcass grading, results showed that the average was very near to the commercial range with a value of 2; this variation can be consequence of the age, weight, genetics and nutrition of the animals, since not all of them came from the same production unit. In general, the variation coefficients observed in all variables were from low (0.87) to moderate (39.17).

The carcass length was 41 cm, with a very low variation. The thorax depth is an indicator of the growth grade of the ribs length, that given the weight and age of the monitored kids, it was limited (13.28 cm). A notable development of the hind-limbs (length 25.8 cm and roundness 21.04 cm), as well as of the loin (length 38.84 cm and depth 2.61 cm), as considered profitable for marketing matters; since the most appreciated primary cuts (ham and loins) involve these anatomical regions (Table 3).

Red viscera represented 7.54% of the live weight, whereas green viscera, 2.19% of the animal's weight. It is worth mentioning that the percentage of the stomach and intestinal content was 15.75% of the live weight. In all the variables already mentioned the variation was 13.70 to 24.50. The percentages of carcass, skin, blood and limbs (classified as others), red viscera, green viscera, intestinal and stomach contents were 58, 18, 7, 2 and 15%, respectively (Table 4).

Marichal *et al.* (2003) evaluated the carcasses and meat quality in three different kid slaughtering weights, when comparing our results with this study the following similarities were found: for the variable carcass yield, a lower figure was reported compared to the results obtained in the present investigation (50.34% vs. 59.27%), this is a consequence of the differences observed between slaughter weight and hot carcass weight (2.93 vs. 1.48). On the other hand, the mentioned authors stated

Table 7: Correlation coefficient analysis between weights, carcass yield and carcass performance

	LWS	HCW	CC	CCW	CY	RY	C	CT	pH HC	pH CC
LWS	1									
HCW	0.83	1								
CC	-0.17	-0.14	1							
CCW	0.76	0.94	-0.15	1						
CY	-0.26	0.29	0.08	0.35	1					
RY	-0.2	0.29	0.02	0.38	0.91	1				
C	-0.15	-0.15	0.02	-0.11	0.01	-0.07	1			
CT	-0.06	-0.12	-0.01	-0.18	-0.09	-0.09	-0.16	1		
pH HC	-0.28	0.004	0.14	-0.01	0.05	0.07	-0.25	-0.03	1	
pH CC	-0.02	-0.08	0.09	-0.13	-0.09	-0.17	0.004	0.08	0.67	1

LWS: Live Weight at Slaughter. HCW: Hot Carcass Weight. CC: Carcass Classification CCW: Cold Carcass Weight. CY: Carcass Yield. RY: Real Yield. C: Color. CT: Carcass Temperature. pH HC: pH of the Hot Carcass. pH CC: pH of the Cold Carcass

Table 8: Correlation analysis between different carcass variables

	CL	TD	GL	GR	LED	LL
CL	1					
TD	0.4	1				
GL	0.4	0.38	1			
GR	0.19	0.24	0.38	1		
LED	0.44	0.43	0.61	0.24	1	
LL	0.24	0.47	0.19	0.02	0.26	1

CL: Carcass Length. TD: Thorax Depth. GL: Gaskin Length. GR: Gaskin Roundness. LED: Loin-eye Depth. LL: Loin Length

that empty green viscera in kids of 6 kg live weight, occupy an approximate percentage of 14.02; in the present study we obtained value was 2.19%, which is explained when comparing the percentage of intestinal content of both investigations (5.20 vs. 15.75%, respectively). With regard to red viscera, the same authors reported 7.6%, which is similar to the figure obtained in the results (7.54%).

Table 5 includes kid meat quality indicators. pH values are within the normal range allowed for pork and beef (5.8-6.2). Hot carcass pH (45 min post slaughter) turned out to be a more reliable indicator of meat quality, since its variation was null. On the other hand, chilled carcasses′pH showed more variation due to the proportional relationship between temperature and the degree of action of the enzymes that transform muscle to meat. For the variable color, a value of 1.96 was obtained, which is commonly desired since in the particular case of kid meat, ranges between 2 and 3 are expected as a rule. In the case of carcass temperature an average of 8.78°C was registered after 12 h at chilling temperature.

Meat color can affect pH, since a higher final pH will be expected if the meat is dark red (Kadim *et al.*, 2003); Dhanda *et al.* (1999b) showed that the final pH was in a range between 5.6 to 5.8 for the capretto and chevon groups, with minimum differences between breeds, these are below to what was found in the present study (6.06). Ibebunjo (1994) in an experiment with British Saanen adult goats, demonstrated that variation in pH is due to the activity of the muscular enzymes (myosine adenine triphosphatase) and its inhibitors; besides the variation in temperature, the author found a pH between 4.30 to 4.56, due possibly to the pre-incubation of enzymes and the slaughter method used, where sodium pentobarbital was given in euthanasic dose, possibly affecting the pH in the muscles involved in this experiment.

On the other hand, Kannan *et al.* (2003) showed that final pH (24 h) in young and old goats is insignificantly influenced by pre-slaughter stress, obtaining a very similar pH under either conditions, stressing or not (5.8 vs. 5.8 old and 6.2 vs. 6.0 young, respectively). Young animals were more affected by pre-slaughter stress; similar findings to the previous results from Kadim *et al.* (2003) and Dhanda (1999b).

It is important to emphasize the relationship found between hind-limbs and forelimbs, as well as the one registered in both limbs together with the hind and fore canes perimeters. On the other hand, the abdominal and thoracic regions were highly correlated (Table 6). It is an indicator of the animal's biotype, which shows that these animals are long linear with highly developed limbs.

The most significant observed correlations correspond to live weight at slaughter and hot carcass and cold carcass weights; between the latter, a high correlation was observed. Hot carcass pH was negatively correlated to carcass temperature and color (Table 7).

The correlation grade between these variables was minimum, except for the length of the leg with the loin eye depth (Table 8).

Morphometry traits of Northern Mexican Creole kids (of an average of 7.3 kg.) could be established. Regarding morphometry, the measured values varied a lot because there was a great genetic diversity in the animals that arrived the FIP; however, results in this study are within what could be considered as "optimum figures" because the more developed anatomical regions corresponded to the most appreciated primary cuts.

The variations in the carcasses yields could have been affected by several factors: age, weight, genetics and nutrition of the animals, since not all of them came from the same production unit as already mentioned.

With regard to quality indicators, hot carcass pH was the most reliable figure due to its null variation and cold carcass pH values remained within the values of quality allowed for beef and pork. As for color, the obtained value was very close to the one expected for this type of carcasses.

Temperature after 12 h of chilling was within the range allowed for the maturation of the muscle in meat. There were different types of peri-renal fat coverage; however, there was no significant correlation with the morphometric measurements observed in the animals.

Due to the lack of enough information available it is necessary to carry out more research on the topic, especially regarding to the standardization of goat carcasses.

REFERENCES

Addrizzo, J.R., 1994. Use of goat milk and goat meat as therapeutic aids in cardiovascular diseases. http://goat.clemson.edu/edu/NC%20Handbook/helth.htm.

Colomer, R.F., F.P. Morand and H.A. Kirton, 1987. Standard methods and procedures for goat carcass evaluation, jointing and tissue separation. Livestock Production Sci., 17:149-159.

Dhanda, J.S., D.G. Taylor, J.E. McCosker and P.J. Murray, 1999a. The influence of goat genotype on the production of capretto and chevon carcasses. 1. Growth and carcasses characteristics. Meat Sci., 52: 355-361.

Dhanda, J.S., D.G. Taylor, J.E. McCosker and P.J. Murray, 1999b. The influence of goat genotype on the production of capretto and chevon carcasses. 2. Meat quality. Meat Sci., 52: 363-367.

Dhanda, J.S., D.G. Taylor, J.E. McCosker and P.J. Murray, 1999c. The influence of goat genotype on the production of capretto and chevon carcasses. 3. Dissected carcass composition. Meat Sci., 52: 369-374.

Dhanda, J.S., D.G. Taylor and P.J. Murray, 2003a. Part 1. Growth, carcass and meat quality parameters of male goats: Effects of genotype and liveweight at slaughter. Small Ruminant Res., 50: 57-66.

Dhanda, J.S., D.G. Taylor and P.J. Murray, 2003b. Part 2. Carcass composition and fatty acid profiles of adipose tissue of male goats: Effects of genotype and liveweight at slaughter. Small Ruminant Res., 50: 67-74.

Hernández-Zepeda, J.S., F.J. Franco, M. Herrera, E. Rodero, A.C. Sierra, A.y. Bañuelos and J.V. Delgado, 2002. Estudio de los recursos genéticos de México: Características morfológicas y morfo-estructurales de los caprinos nativos de Puebla. Archivos de Zootecnia, 51: 53-64.

Ibebunjo, C., 1994. Morphologic and morphometric characteristics of limb muscles of the goat. Small Ruminant Res., 13: 277-286.

Kadim, I.T., D.S. Mahgoub, R.S. Al-Ajmi, N.M. Al-Maqbaly and A.R. Al-Saqri, 2003. An evaluation of the growth, carcass and meta quality characteristics of Omán goat breeds. Meat Sci., 66: 203-210.

Kannan, G., B. Koaukou, T.H. Terrill and S. Gelaye, 2003. Endocrine, blood metabolite and meat quality changes in goat as influenced by short term, preslaughter stress. J. Anim. Sci., 81: 1499-1507.

Maiorano, G., G. Filetti, S.M. Gambacorta, A. Bellitti and G. Oriani, 2001. Growth, salughter and intra muscular collagen characteristics in Garganica kids. Small Ruminant Res., 39: 289-294.

Marichal, A., N. Castro, J. Capote, M.J. Zamorano and A. Argüello, 2003. Effects of live weight at slaughter (6, 10 and 15 kg) on kid carcass and meat quality. Livestock Production Sci., 83: 247-256.

NOM-024-Z00, 1995. Norma Oficial Mexicana NOM-024-ZOO-1995, Especificaciones y características zoosanitarias para el transporte de animales, sus productos y subproductos, productos químicos, farmacéuticos, biológicos y alimenticios para uso en animales o consumo por éstos. Diario Oficial de la Federación, 10: 16-95.

Rodriguez, C.J.G., 2004. Evaluaciones para calidad de la canal. Memoria *Curso Elaboración de Productos Cárnicos de Cerdo.* Universidad Autónoma de Nayarit, Universidad Autónoma Metropolitana Unidad Xochimilco, Benemérita Universidad Autónoma de Puebla; Compostela, Nayarit, México, pp: 64-68.

SAS Institute, Inc. Versión 8.12. Cary, North Carolina, USA, 2002.

Sheridan, R., L.C. Hoffman and A.V. Ferreira, 2003a. Meat quality of Boer goat kids and mutton merino lambs 1. Commercial yields and chemical composition. Anim. Sci., 76: 63-71.

Sheridan, R., L.C. Hoffman and A.V. Ferreira, 2003b. Meat quality of Boer goat kids and mutton merino lambs 1. Sensory meat evaluation. Anim. Sci., 76: 73-79.

Todaro, M., A. Corrao, C.M.A. Barone, R. Schinelli, M. Occidente and P. Giaconne, 2002. The influence of age at slaughter and litter size on some quality traits of kid meat. Small Ruminant Res., 44: 75-80.

USDA, 1989. Official United States Standars for Grades of Carcass Beef. Usda, Agricultural Marketing Service,washington, DC, USA.