Morphostructural composition and meat quality in local goat kids from the northeastern region of Mexico

Composición morfoestructural y calidad de la carne en cabritos locales de la región noreste de México

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Abstract

Goat farming is an important activity in northern Mexico. In this sense, "cabrito" or kid goat is a typical regional dish with high economic and cultural value. However, information on the morphostructural composition and meat quality of these local specimens is scarce. Given this, the objective was to evaluate morphostructural characteristics, carcass and meat quality in local kids according to sex in the northeastern region of Mexico. For this purpose, 14 kids (7 males and 7 females) 57 days old were slaughtered. Morphostructural composition was evaluated with 22 zoomometric and phenotypic variables. Carcass characteristics were evaluated by considering different body structures, carcass yield and degree of fatness. Meat quality was determined by physicochemical characteristics, nutritional value and fatty acid profile. The sex effect was evaluated by t-test of independent means and Chi-square. Meat physicochemical characteristics, nutritional value and morphostructure of local kids were heterogeneous and showed no differences (P≥0.05) concerning sex. Carcass, kidneys, head, neck, rib and loin weights were higher in males than in females (P≤0.05). Fatty acids (FA) found in greater proportion were palmitic (C16:0), oleic (C18:1, n-9), stearic (C18:0), and myristic (C14:0). These FA comprised 80.85 % of the lipid profile of male meat and 76.83% of females. These results are the basis for future programs aimed to improve production systems. Differences found could shed light on future efforts on how to differentiate goat meat from this region of Mexico and enter new markets directly benefiting small producers.

Keywords
meat • carcass • nutritional quality • fatty acid profile

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Resumen

La caprinocultura es una actividad muy importante en el norte de México por la producción de leche y carne. En este sentido, el cabrito es un platillo típico de esta región con valor económico y cultural elevado, no obstante, la información que describe la composición morfoestructural y calidad de carne de estos ejemplares locales, ha sido poco documentada. Debido a lo anterior, el objetivo fue evaluar las características morfoestructurales, calidad de canal y carne en cabritos locales de acuerdo con el sexo (machos y hembras) en la región noreste de México, para esto se sacrificaron 14 cabritos (7 machos y 7 hembras) de 57 días de edad. Para evaluar la composición morfoestructural, se consideraron 22 variables zoométricas y fenotípicas. Las características de la canal se evaluaron considerando las distintas estructuras corporales, rendimiento en canal y grado de engrasamiento. Se determinó calidad de carne midiendo las características fisicoquímicas, valor nutricional y perfil de ácidos grasos. Se evaluó el efecto del sexo mediante una prueba de t de medias independientes y Chi cuadrada. La estructura morfoestructural de los cabritos locales es heterogénea, y no mostraron diferencias ($P \geq 0,05$) respecto del sexo. El peso de la canal, riñones, cabeza, cuello, costillar y lomo fueron mayores en machos que en hembras ($P \leq 0,05$). Las características fisicoquímicas y valor nutricional de la carne no mostraron diferencias entre sexos. Los ácidos grasos (AG) que se encontraron en mayor proporción fueron; palmítico (C16:0), oleico (C18:1, n-9), esteárico (C18:0), y mirístico (C14:0). Estos AG comprendieron el 80,85 % del perfil lipídico de la carne de los machos, mientras que en hembras representaron el 76,83 %. Estos resultados son la base para futuros programas de mejora del sistema productivo y donde las diferencias encontradas podrían arrojar luz sobre esfuerzos futuros, sobre cómo diferenciar la carne de cabrito en esta región de México e ingresar a nuevos mercados que beneficiarían directamente a los pequeños productores.

Palabras clave
carne • canal • calidad nutricional • perfil de ácidos grasos

Introduction

In Mexico, goat production is focused on meat and milk. During 2022, carcass meat production achieved 77,000 tons, and 160 million liters of milk (32). The predominant production system is extensive, with animals known as "local", with an undefined phenotype derived from mating different breeds such as Alpina, Saanen, Nubia, and Toggenburg (31). Besides feeding suckling kids, the produced milk is used for cheese, cajeta (a milk candy-type), and typical regional candies. Kids are slaughtered and consumed at approximately 30 days old. Their meat is soft and tender, low-fat, pearly white and juicy. As a traditional Mexican dish, particularly in the north of Mexico, it is consumed on special events and can be cooked in various presentations like "al pastor" (shawarma), fried, or roasted. It is also considered a gourmet dish reaching high prices in restaurants (32).

Similar dishes are prepared in other countries such as Spain, where this meat should meet certain characteristics (9), India, China, Pakistan, Nigeria, Bangladesh, and Iran, where goat production is important (13). However, in Mexico, particularly in the northeast, information on body structure, carcass quality, and nutritional properties of kid meat is scarce. Nevertheless, breeds such as Payoya, Gokcead, Maltese, Majorera, Blanca celtiberica, Negra serrana and Moncaica, have been extensively documented (6).

In this context, generating local information on kid meat produced in this region of Mexico is important given that it supplies almost all the consumed kid meat in the northern states of Mexico. Regional goat raising relies on the environmentally best-adapted breeds. In this sense, particular production strategies can set particular qualities, where denominations of origin can trigger added value (26). The aforementioned is particularly important for small-scale, and highly social and economically marginalized producers (31, 35). Therefore, our objective was to evaluate morphostructural traits, carcass and meat quality, and fatty acid profile considering sex in local kids from the northeastern region of Mexico.

Material and methods

Animal management and study protocol was approved by the Bioethics Committee of the Facultad de Medicina Veterinaria y Zootecnia – Universidad Autónoma de Tamaulipas in the pronouncement CBBA_01_2023.

Place of study

This experiment was conducted in a commercial production unit, located in ejido Ignacio Zaragoza, Viesca, Coahuila, Mexico, within the region known as Comarca Lagunera. The climate is desert, semi-warm with cool winters (BWhw), mean annual rainfall of 240 mm, with average temperature of 25°C, ranging from -1°C in winter to 44°C in summer.

Animals and feeding

Before the experiment, during the summer, a herd of 150 local empty goats mated naturally during grazing and in housing pens.

Fourteen 57-day-old kids (7 males and 7 females) weighing 7.7 kg (live weight; LW) were housed with their mothers from birth in individual 2 x 3 m pens provided with shade, drinkers and *ad libitum* mineral salts.

Goat feeding was based on grazing from 8:00 a.m. to 1:00 p.m., and from 4:00 p.m. to 8:00 p.m., keeping the goats penned during the hottest hours of the day, and taking advantage of this space of time for kid suckling. Table 1 shows plant nutritional value during grazing.

Table 1. Average chemical composition of the main plant species consumed by local goats in northeastern Mexico.

Tabla 1. Composición química promedio de las principales especies de plantas consumidas por caprinos locales en el noreste de México.

Species	Nutritional Content (Dry basis; g kg DM)					
	DM	CP	ADF	NDF	ME	NEl
Cynodon dactilon	95.3	5.9	36.9	61.4	1.7	1.5
Amaranthus palmeri	93.8	14.4	25.9	33.7	2.1	1.3
Setaria macrostachia	94.0	13.2	37.4	61.4	1.7	1.1
Solanum eleagnifolium	93.7	22.1	32.6	37.7	2.5	1.3
Spharalcea angustifolia	94.1	11.9	39.1	51.4	2.0	1.2
Enneapogon desvauxii	94.8	5.3	44.3	71.0	1.5	0.8
Cucumis melo (Vegetative part)	90.7	13.8	33.8	34.1	2.2	1.4
Cucumis melo (Fruit)	92.9	10.5	30.9	35.7	2.2	1.1

DM= dry matter; CP= crude protein; ADF= acid detergent fiber; NDF= neutral detergent fiber; ME= metabolizable energy; NEl= net energy for lactation.

DM= materia seca; CP= proteína cruda; ADF= fibra detergente ácido; NDF= fibra detergente neutro; ME= energía metabolizable; NEl= energía neta para la lactancia.

Transportation and slaughtering of goat kids

Kids were slaughtered at weaning (57 days of age). Twelve hours before slaughter, they were separated from their mothers and transported to the Municipal slaughterhouse in Matamoros, Coahuila, where they were slaughtered following the Official Mexican Standard NOM-033-SAG/ZOO-2014.

Zoometric and morphostructural measurements

Before slaughter, zoometric traits were measured: live weight (LW), face width (FW), skull length (SL), ear length (EL), ear width (EW), neck width (NW), neck length (NL), height at withers (HW), chest circumference (CC), barrel circumference (BC), flank depth (FD), lumbosacral height (ASL), leg length (LL), cane perimeter (CP). Morphostructural traits recorded included skin pigmentation (SP), hoof pigmentation (HP), mucous membrane pigmentation (MP), presence of wattles, beard, and horns (1=present, 2=absent) (8, 12, 14).

Carcass yield

Before slaughter, the PV was recorded. Subsequently, carcass productive components were sectioned and removed (head without skin, skin, legs, lungs and trachea, liver, heart, rumen, intestine and testicles -in males-). Yield was calculated by dividing cold carcass weight (24 hours postmortem at 4°C) by the initial live weight, expressed as a percentage (4).

Nutritional value

From each kid, 200 g of *Longissimus dorsi* muscle meat were grounded to homogenize and determine protein, fat, collagen, and moisture content with a FoodScan™ Meat Analyzer.

Physicochemical characteristics of meat

To measure meat physicochemical characteristics, the *Longissimus Dorsi* muscle was removed with a transverse cut between the 12th and 14th rib, 24 hours *postmortem* (4).

pH

The pH was measured 24 h *post mortem* from a cut of the *Longissimus dorsi* muscle at the 12th rib, inserting the electrode of a portable potentiometer (HANNA® instruments, HI99163, Singapore), previously calibrated with pH 4.00 and 7.00 buffer solutions.

Color

Color was measured at three different points on the surface of the *Longissimus dorsi* muscle 24 h *post mortem*, using the Hunter method. A colorimeter (Minolta, Mod CR-400/410, Tokyo, Japan) determined L* (lightness), a* (red-green) and b* (yellow-blue) (11).

Drip loss

Drip loss was determined after Wang *et al.* (2016) with modifications. Approximately 30 g of the *Longissimus dorsi* muscle meat sample were weighed and placed in Styrofoam cups hanging from a thread without touching the walls of the cup. Subsequently, they were stored at 4°C and weighed 24 h later. Drip loss was expressed as the percentage of weight loss to initial weight (8).

Water retention capacity (WRC)

The WRC was analyzed following Guerrero *et al.* (2002), with modifications. Five g of finely minced meat of the *Longissimus dorsi* muscle, 24 h *postmortem*, were weighed and homogenized with 8 ml of sodium chloride for 1 minute using a glass rod. Subsequently, it was left to rest for 30 minutes in an ice bath. The extract was centrifuged for 25 minutes at 35,000 r.p.m. The supernatant was drained and the volume was measured in a graduated cylinder. The amount of ml of solution retained in 100 g of meat was reported.

Cooking yield

Cooking yield was determined after Liu *et al.* (2012) with modifications. From each meat sample, 50 g of the *Longissimus dorsi* muscle, 24 h *postmortem* were weighed using an analytical scale and placed in Ziploc-type bags. They were then placed in a water bath at 90°C for 15 minutes. Meat internal temperature was measured with a stem thermometer. Subsequently, they were left to rest at room temperature for 30 minutes. After this time, they were re-weighed. Cooking yield was obtained by considering initial *vs.* final weight differences, expressed as percentages.

Fatty acid (FA) profile

Fat purification was carried out through FA methylation. We proceeded to oven-dehydrate 30 g of the *Longissimus dorsi* muscle at 60°C. Subsequently, meat samples were purified (15) and methylated according to Jenkins (2010) modified by Granados-Rivera *et al.* (2017). Once the FA methyl esters were obtained, they were determined in a Hewlett Packard 6890 chromatograph with an automatic injector equipped with a silica capillary column (100 m x 0.25 mm x 0.20 µm thickness, Sp-2560, Supelco). FA identification was done by comparing retention times of each peak obtained from the chromatogram against a standard of 37 FA methyl ester components, and a specific standard for cis-9, trans-11 and trans-10, cis-12 isomers (Nu-Check).

Statistical analysis

Significant differences among quantitative zoometric traits, nutritional value, carcass and meat quality, and fatty acid profile between male and female goat kids were determined by a t-student test for independent means with the SAS version 9.3 program. Given morphostructural variables are frequencies, a Chi-square (χ^2) test was used to assess independence concerning sex.

Results

Zoometric, morphostructural, and carcass measurements

Morphostructure of local kids was heterogeneous, and no differences (P≥0.05) were found between sexes (table 2).

Table 2. Absolute (AF) and relative (RF) frequencies for morphostructural traits in local goat kids.

Tabla 2. Frecuencias absolutas (FA) y relativas (FR) para las características morfoestructurales en cabritos locales.

Skin pigmentation		**Male**	**Female**	**Mucous membrane pigmentation**		**Male**	**Female**
Present	AF (n)	3	3	Present	AF (n)	7	6
	RF (%)	21.43	21.43		RF (%)	50.0	42.86
Absent	AF (n)	4	4	Absent	AF (n)	0	1
	RF (%)	28.57	28.57		RF (%)	0	7.14
		χ^2	1.0000			χ^2	0.2994
Hoof pigmentation		**Male**	**Female**	**Presence of wattles**		**Male**	**Female**
Present	AF (n)	5	4	Present	AF (n)	1	2
	RF (%)	28.57	35.71		RF (%)	7.14	14.29
Absent	AF (n)	2	3	Absent	AF (n)	6	5
	RF (%)	21.43	14.29		RF (%)	42.86	35.71
		χ^2	0.5770			χ^2	0.5148
Presence of horns		**Male**	**Female**	**Presence of beard**		**Male**	**Female**
Present	AF (n)	4	5	Present	AF (n)	0	0
	RF (%)	28.57	35.71		RF (%)	0	0
Absent	AF (n)	3	2	Absent	AF (n)	7	7
	RF (%)	21.43	14.29		RF (%)	50.0	50.0
		χ^2	0.5770				

Table 3. Live weight and zoometric measurements of local goat kids.
Table 3. Peso vivo y medidas zoométricas de cabritos locales.

Variable (cm)	Male	Female	SEM	*P value*
Live weight (kg)	8.23	7.29	0.3298	0.0001
Face width	6.07	5.71	0.3141	0.2842
Skull length	8.57	8.21	0.5487	0.5287
Ear length	9.42	10.07	0.1279	0.5836
Ear width	4.85	4.50	0.3891	0.3798
Neck width	17.35	17.28	1.1628	0.9522
Neck length	14.58	14.78	0.7214	0.9423
Height at withers	34.61	34.57	1.3087	0.9522
Chest circumference	32.08	30.37	0.855	0.0688
Barrel circumference	32.92	31.21	1.4487	0.2634
Flank depth	11.35	11.78	0.5933	0.4842
Lumbosacral height	35.51	34.92	1.3863	0.9600
Leg length	14.42	14.07	0.4862	0.4809
Calf perimeter	6.14	6.07	0.7641	0.7787

SEM: Mean standard error.
SEM: error estándar de la media.

Regarding yield components and carcass traits, weights of cold carcass, kidneys, head, neck, ribs, and loin were higher in males than females (P≤0.05), showing significant differences between sexes. Other carcass components did not show differences between sexes (table 4).

Table 4. Yield components of the carcass in local goat kids.
Tabla 4. Componentes de rendimiento de la canal en cabritos locales.

Variable (kg)	Male	Female	SEM	*P value*
Head	0.52	0.47	0.0192	0.0313
Skin	1.02	0.85	0.0905	0.0872
Blood	0.25	0.26	0.0497	0.7788
Hooves	0.33	0.30	0.0233	0.1674
Rumen	0.18	0.15	0.0212	0.1644
Intestine	0.27	0.23	0.0358	0.2539
Heart	0.04	0.04	0.0149	0.2577
Kidneys	0.05	0.03	0.0142	0.0285
Liver	0.16	0.14	0.0126	0.1389
Cold carcass weight	5.20	4.22	1.0222	0.0121
Omental fat	0.05	0.05	0.0136	0.6091
Mesenteric fat	0.06	0.05	0.0126	0.6095
Perinephric fat	0.11	0.07	0.0322	0.2075
Ribs	1.49	1.24	0.1025	0.0296
Legs	0.84	0.75	0.0911	0.3072
Loin	0.55	0.42	0.1013	0.0024

SEM: Mean standard error.
SEM: error estándar de la media.

Nutritional value and meat physicochemical characteristics

Meat nutritional value of male and female kids showed no differences (P≥0.05) (table 5).

Table 5. Nutritional value and meat quality of local goat kids.
Tabla 5. Valor nutricional y calidad de la carne de cabritos locales.

Variable (%)	Male	Female	SEM	*P value*
Dry matter	24.34	25.51	0.6118	0.0923
Moisture	75.65	74.48	0.6118	0.0923
Protein	21.58	22.23	0.3177	0.0648
Fat	2.49	2.18	0.2882	0.1948
Collagen	1.25	1.17	0.0983	0.4597
pH	5.99	6.15	0.2733	0.5627
Drip loss %	2.28	3.66	0.9086	0.0689
Cooking yield %	69.65	65.51	3.8076	0.2987
Water retention capacity (mL/100 g)	38.02	26.34	6.9588	0.1224
L*	48.61	48.17	1.5912	0.7835
a*	17.46	16.99	0.9604	0.6324
b*	10.06	10.18	0.8332	0.8919

L*: lightness index; a* red to green index; b*: yellow to blue index; SEM: Mean standard error.

L*: índice de luminosidad; a*índice de rojo a verde; b*: índice de amarillo a azul; SEM: error estándar de la media.

Fatty acid profile

The FAs found in greater quantity in meat were palmitic (C16:0), oleic (C18:1, n-9), stearic (C18:0), and myristic (C14:0). These, in total, represented an average of 80.85% of the FA that make up male meat and 76.83% of female meat (table 6, page XXX).

Meat concentration of caproic, lauric, myristic, and oleic acids showed differences (P≥0.05) regarding sex, being higher in male meat.

The concentration of saturated FA was significantly higher in males compared to females with values of 56.45% and 46.72%, respectively, while the amount of monounsaturated (40.53 %) and polyunsaturated (9.28 %) FA was higher females compared to males (P<0.05).

Discussion

Zoometric, morphostructural and carcass measurements

Morphostructural characteristics were heterogeneous, without defined traits in terms of sex. In this regard, Maldonado-Jáquez *et al.* (2023) report that, in local kids from northern Mexico, the dominant phenotype corresponds to animals without wattles or beards. This coincides with our study since no animal presented wattles (total frequency of 78.57%), or beard. Furthermore, these same authors mention that local kids present pigmented mucous membranes and horns. In this study, 85.71% of the animals presented pigmented mucous membranes and 94.28% presented horns, reaffirming this information. These results can be attributed to local animals of this region being a cross between different breeds, with varying phenotypic traits.

On the other hand, sex had a significant effect on animal weight, where males were heavier than females. This same result is reported by Maldonado-Jáquez *et al.* (2023) for 30-day-old kids, where males weighed an average of 800 g more than females. This effect is explained by goat growth curves (2), showing shorter growth phases in males (ending up to 4 months before) than females. Moreover, the growth hormone has a marked effect on the early development of males, when the highest growth rates are observed between 20 and 60 days old (27, 29).

Regarding body measurements, our results differ from the reported by Maldonado-Jáquez *et al.* (2023), who indicated differences in neck length and width, body length, chest circumference, and leg length, probably given by age differences. While

Maldonado-Jáquez *et al.* (2023) considered 1 to 30 days, our research measured at 57 days old. Age significantly influences live weight and body conformation (3).

Cold carcass was heavier in males than in females, as found by Todaro *et al.* (2004) who reported differences in carcass weight with respect to sex with values of 5.7 kg and 5.3 in males and females of the Nebrodi breed, respectively, at 47 days old. However, Bonvillani *et al.* (2010) indicated no differences concerning sex, with average weights of 5.34 and 5.48 kg for females and males respectively in local kids from Córdoba, Argentina, at 60 to 90 days old. This could be due to age heterogeneity rather than sex. However, the breed effect could also influence carcass weight of males and females.

Differences in rib and loin weights between males and females can be attributed to males having a higher live weight at 56 days old, and consequently, a higher carcass weight reflected in a higher weight in these structures. This sex difference may assist decisions considering males being directed to the sale of cuts (30), for wholesale sale and/or in restaurants, reaching high prices. This relies on the fact that a single piece is equivalent to 50% of the price paid to the producer for a whole live goat (5). Females not meeting breeding characteristics can be commercialized as meat.

Table 6. Fatty acid profile (g/100 g^{-1} of fat) in local goat kids' meat.
Tabla 6. Perfil de ácidos grasos (g/100 g^{-1} de grasa) en carne de cabritos locales.

Fatty acid	Common name	Male	Female	SEM	*P-value*
C4:0	Butyric	0.761	1.309	0.4719	0.2675
C6:0	Caproic	0.511	0.187	0.0588	0.0005
C12:0	Lauric	1.632	0.842	0.1539	0.0003
C14:0	Myristic	9.841	6.920	0.9025	0.0071
C14:1	Myristoleic	0.339	0.511	0.0848	0.0658
C15:0	Pentadecanoic	0.826	0.570	0.1414	0.0958
C16:0	Palmitic	30.55	25.690	2.7086	0.0990
C16:1 *cis-9*	Palmitoleic	2.797	3.333	0.6165	0.4048
C17:0	Heptadecanoic	1.198	0.956	0.1728	0.1864
C17:1*cis-10*	Cis-10-Heptadecenoic	0.797	1.222	0.1971	0.0519
C18:0	Stearic	10.686	9.663	1.6219	0.5400
C18:1 *cis-9*	Elaidic	0.527	0.849	0.2435	0.2184
C18:1, n-9	Oleic	29.780	34.56	1.1955	0.0017
C18:2	Linoleic	3.697	5.353	1.1752	0.1843
C18:3 n-9,12,15	Linolenic	0.525	0.756	0.1613	0.1772
C18:2 cis-9, *trans-11*	CLA	0.283	0.305	0.0299	0.4821
C20:1 *cis-9*	Gondoic	0.048	0.044	0.0046	0.3771
C20:3 n-6	Dihomo-γ-linolenic acid	0.1130	0.149	0.0438	0.4172
C20:3 n-3	Cis 11,14,17 Eicosatrienoic	1.663	2.49	0.7037	0.2692
C22:0	Behenic acid	0.431	0.584	0.2197	0.5001
C22:6 n-3	Docosahexaenoic acid (DHA)	0.174	0.225	0.0653	0.4503
SFA		56.45	46.72	1.7464	<.0001
MUFA		34.29	40.53	1.1829	<.0001
PUFA		6.45	9.28	1.1008	<.0001
Undetermined		2.80	3.45		

[ab] Different letters in the same row show statistical differences (P ≤ 0.05); SEM: Mean standard error; SFA= saturated fatty acids, MUFA= monounsaturated fatty acids; PUFA= polyunsaturated fatty acids.

[ab] Letras diferentes en la misma fila presentan diferencias estadísticas (P ≤ 0,05); SEM: error estándar de la media; SFA= ácidos grasos saturados, MUFA= ácidos grasos monoinsaturados; PUFA= ácidos grasos poliinsaturados.

Nutritional value of meat

Sex does not influence meat nutritional value. Other authors concluded that in Nebrodi breed kids, sex did not change the protein, fat, and ash contents of meat (34). Protein content of local kid meat from northeastern Mexico is higher than the 20.79% and 19.72%

reported by Horcada *et al.* (2012), as well as the 2.37% fat reported by Kawęcka *et al.* (2022). Fat percentage in kid meat is low compared to other species, probably because of age, since fat formed in early stages is mesenteric, while intramuscular fat is formed during adulthood (20).

Physicochemical characteristics of meat

Sex does not influence meat pH at 24 hours *post mortem*. Values found are close to those reported in Payoya kids at 30 days old (19). However, others report higher pH (23). Regardless, our values are over the recommendations for normal meat considering species for meat production (1). This effect could be due to kids being only fed with milk and muscle glycogen before slaughter is not abundant given goat restless behavior (20) rather than chronic stress before slaughter, a condition that has been documented to cause high pH values in meat (1).

Drip loss, water retention capacity, cooking yield, and color were not modified by sex, as already observed (33, 34). This may be explained by absent differences in pH since low or high final pH will determine the amount of water lost during handling, as well as pale or dark colors. The lightness index and yellow index values obtained in this study are within the reported ranks (10, 19, 34). Conversely, the values obtained for the a* parameter are higher than other reports (33, 34), probably given by factors like breed and age at the time of slaughter.

Fatty acid profile

Fatty acids found in greater quantity are within the reported ranges. Regardless of breed or feeding systems, FAs are palmitic acid (C16:0) with minimum values from 17.32 g/100 g (34) to 25.0 g/100 g (20); stearic acid (C18:0) with values from 7.87 g/100 g (21) to 19.71 g/100 g (7); and oleic acid (C18:1, n-9) with values from 25.38 g/100 g (34) to 51.08 g/100 g (21). The fact that these fatty acids predominate in meat of young and adult animals can be explained by ruminant animals with endogenous synthesis in the adipocyte from acetate, obtained during ruminal fermentation. This determines palmitic acid as the main final product, later elongated into stearic acid or desaturated to oleic acid. Long-chain fatty acids are easily synthesized in adipose tissue (17, 28).

While other studies found no differences regarding fatty acid content concerning sex in Nebrodi and Criollo Cordobes breeds (10, 34), our study found the opposite effect with a greater amount of saturated fatty acids; caproic, lauric, and myristic in male meat. While females have a higher amount of oleic unsaturated fatty acid due to the above, males showed a higher amount of saturated fatty acids and a lower amount of monounsaturated and polyunsaturated fatty acids. These differences could be due to breed or diet, since, even though kids are milk-fed, the lipid profile of the mother's milk will be largely determined by her diet (25).

Conclusions

Based on the results, we conclude that kid morphometric characteristics are heterogeneous in females and males in northeastern Mexico. Sex did not affect carcass characteristics, nutritional value, and physicochemical traits of meat. However, sex tended to modify FA profile, favoring a higher concentration of caproic (C6:0), lauric (C12:0), myristic (C14:0), and oleic (C18:1, n-9) acids in males.

This constitutes a pioneer study on morphostructure, carcass, and meat quality characterization of local goat kids from northeastern Mexico and will lay the foundations for future programs to improve the production system. The differences found could shed light on future efforts to differentiate kid meat from this region of Mexico oriented to new markets that would directly benefit small producers.

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