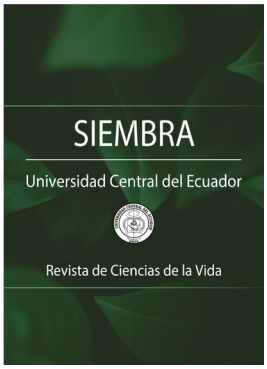
Carcasse performance in goats managed in open fields in southern Ecuador

Rendimiento a la canal en la cabra manejada a campo abierto en el Sur del Ecuador



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Abstract

More than 70% of Ecuador's goat population is found in the south of the country, where they are managed in open fields, with little technological application and support. The objective was to determine the performance of these animals at hot and cold carcasses and the degree of runoff. A total of 457 goats of different ages, genetic groups, and biotypes, slaughtered at the Municipal Slaughter Center of Zapotillo, were included in the study. Information on ante-mortem weights, and hot and cold carcasses was collected, and factors such as sex, age, breed group, and biotype were included in the analysis using an ANOVA with a randomized linear model. The results show a hot and cold carcass yield of 41.8± 2.6% and 41.1± 2.7% respectively, with no statistical difference in the factors analyzed. It is highlighted that carcass yield decreases minimally with increasing age; males present a slightly higher carcass yield (41.9%) compared to females (41.7%); regarding the breed, there were also slight differences with Chuscos Criollos, Mestizos and Anglo Nubian, presenting 41.8%, 42.1% and 41% of the hot carcass yield respectively; analyzing the biotype, presence and absence of horns, the yield was 41.8% and 41.9 % respectively. It is important to note that there was a minimal level of runoff in this population (1.23%). We conclude that these goats have a low carcass yield compared to other populations, possibly due to the type of management and feeding, where water scarcity predominates. It is worth noting the slight superiority of the Mestizo breed, which could be a good option for improving these variables.

Keywords: hot carcass, cold carcass, creole goat, degree of runoff.

Resumen

En el sur del Ecuador se encuentra más del 70% de la población de cabras del país, manejadas a campo abierto y con escasa aplicación y asistencia tecnológica. Conocer el rendimiento a la canal caliente y fría, y el grado de escurrimiento de estos animales, fue el objetivo de la investigación. 457 cabras de diferentes edades, sexo, grupos genéticos y biotipo, que se sacrificaron en el Centro de faenamiento Municipal del cantón Zapotillo, fueron consideradas en el estudio. La información de pesos *ante-morten*, canal caliente y fría fue recopilada y factores como sexo, edad, grupo

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racial y biotipo fueron considerados en el análisis mediante ANOVA, con un modelo lineal aleatorizado. Los resultados muestran un rendimiento a la canal caliente y fría de 41,8±2,6% y 41,1±2,7% respectivamente, no existiendo diferencia estadística en los factores analizados. Destacando que el rendimiento a la canal disminuye mínimamente conforme la edad aumenta; los machos presentan ligera superioridad (41,9%) en relación con las hembras (41,7%); en los grupos raciales los Chuscos criollos, Mestizos y Anglo Nubian, presentaron 41,8%, 42,1% y 41% de rendimiento a la canal caliente, respectivamente. Analizando el biotipo, presencia y ausencia de cuernos, el rendimiento fue de 41,8% y 41,9%; destacando en toda esta población su grado de escurrimiento mínimo (1,23%). Se concluye que, estas cabras presentan un rendimiento bajo en comparación con otras poblaciones, posiblemente por el tipo de manejo y alimentación que disponen, en donde predomina la escasez de agua. Hay que destacar la ligera superioridad del grupo de mestizas, demostrando ser una opción para mejorar estas variables.

Palabras clave: canal caliente, canal fría, cabra Chusca, grado de escurrimiento.

1. Introduction

In the south of Ecuador, bordering the northwestern part of Peru, lies the province of Loja. According to the Instituto Nacional de Estadísticas y Censos (INEC, 2022), this is where more than 70% of the country's goat population is found. These goats are raised in open fields within the seasonal ecosystem known as the dry forest, characterized by limited availability of water and pasture. In this environment, the primary food source available to goats consists of the native shrub and tree species (Aguirre-Riofrio et al., 2024).

According to de Gea (2005) and Sañudo et al. (2012), the goat carcass is characterized by its slender shape, flat ribcage, long legs, and a predominance of longitudinal over transversal measurements. It tends to be loosely compact, with lean meat that lacks marbling and has little subcutaneous fat. As Webb et al. (2005) point out, these are attributes that align with current nutritional demands of consumers.

It is worth highlighting that the predominant genotype in these goat herds is the local Creole type, known as the "Chusca Lojana" goat. According to the morphometric description provided by Aguirre et al. (2021), this is an elipometric, long-lined, short and lean animal, with a productive tendency more toward milk than meat. This leads to the need to determine whether the productive carcass yield of these animals, and their quality in terms of drip loss or weight loss due to the airing process, fall within the values reported in the literature for Creole goats, which range from 42 to 51% (Mellado, 1997). This is especially important considering that factors such as age and slaughter weight (de Gea, 2005), genetics, sex, type of feed, management system (Acevedo Cárdenas et al., 2024; Guerrero et al., 2016), and even the time of year (Mellado, 1997), influence these parameters.

2. Materials and Methods

The present study was conducted at the municipal slaughter center in the city of Zapotillo, located in southern Ecuador (4°23′11''S 80°14′37''W), involving a total of 457 goats slaughtered over an eight-week period during August and September 2023.

The animals arrived at the municipal center 24 hours before slaughter for a fasting period, sanitary inspection, and registration, which included weighing the animals prior to slaughter (live weight, LW), and after slaughter once the animals had been skinned (hot carcass weight, HCW). Subsequently, the carcasses were placed in a cold room at 8°C for 24 hours for maturation and drip loss, after which they were weighed again (cold carcass weight, CCW).

All weighing procedures were carried out by the same person using a clock-type hanging scale with a capacity of 100 kg, CAMRY® brand (accuracy level: 0.1 kg). The hot carcass yield [HCY] was calculated using Equation [1], the cold carcass yield [CCY] with Equation [2], and drip loss [DL] was determined using Equation [3].

$$HCY = {}^{HCW}/_{LW} * 100 \quad [1]$$

$$CCY = {}^{CCW}/_{LW} * 100 \quad [2]$$

$$DL = {}^{HCW - CCW}/_{HCW} * 100 \quad [3]$$

Age determination was carried out through dentition inspection, based on the dental chronometry table described by Aguirre-Riofrío and Jiménez-Capa (2023). Regarding the categorization of animals by racial group, the identification of Creole goats—predominantly found in this area—was based on the morphometric and phaneroptic characteristics described by Aguirre et al. (2021). All collected information was analyzed using descriptive statistics. The data were grouped according to the analyzed factors (sex, age, racial group, biotype), and an ANOVA was performed to determine statistical differences ($p < 0.05$).

3. Results

In the present study, most of the slaughtered population were males (66%); the most common slaughter age ranged between 3 and 12 months (84%), with a very small proportion of animals over 2 years of age (13.4%) (Table 1). It is also noteworthy that 70% of this population consisted of Creole goats, and 23% were crossbreeds, where Creole goats had been crossed with breeds such as Nubian, Saanen, or Boer. Additionally, 7% of the slaughtered goats were Anglo-Nubian.

Table 1. Hot and cold carcass performance in goats in extensive production system, considering factors such as sex, age, genotype, and biotype.

Proportion (%)		Live Weight (kg)	Hot Carcass Yield [HCY] (%)	Cold Carcass Yield [CCY]	p value*	
					HCY	CCY
100	**General**	19.4±9.6	41.8±2.6	41.1±2.7		
	CV %	49.3	6.3	6.5		
	Sexo				0.531	0.79
66	Male	16±5.4	41.9±2.6	41.1±2.6		
34	Female	26±12.2	41.7±2.7	41.2±2.8		
	Age (months)				0.199	0.717
84	3 <12	16.2±4.8	41.9±2.7	41.2±2.7		
2.6	>12 <24	27.5±3.1	41.4±2	41±2.2		
4.4	24 - 42	30.6±5.2	41±2.8	40.7±3.4		
9	>42 - 96	42.1±10.8	41.3±1.8	41±1.7		
	Genotype				0.148	0.129
70	Creole	20±9.6	41.8±2.6	41.1±2.7		
23	Crossbred	16.7±6.8	42.1±2.6	41.5±2.7		
7	Anglo-Nubian	19.1±8.9	41±2.3	40.2±2.2		
	Biotype				0.741	0.791
26	Hornless	18.7±9.3	41.9±2.9	41.2±3		
74	With horns	19.6±9.7	41.8±2.5	41.1±2.6		

* $p > 0.05$: no statistical significance.

The hot and cold carcass yield in this population of goats raised in open pasture in the dry forest ecosystem of southern Ecuador was 41.8 ± 2.6% and 41.1 ± 2.7%, respectively. These are homogeneous yields, as shown by the coefficient of variation (CV), which does not exceed 6.5%. Likewise, the carcass of these animals is solid and compact, as evidenced by the degree of drip loss or water loss (the difference between hot and cold carcass), which is 1.23% (Table 2).

Table 2. Weight loss (percentage) due to runoff in the carcass after the airing process, considering the various factors analyzed.

	Hot carcass weight (kg)	Cold or aired carcass weight (kg)	Loss due to airing or drip loss (%)	CV (%)
General	8.08	7.97	1.23	6.38
Sex				
Male	6.69	6.58	1.5	6.30
Female	10.80	10.68	0.1	6.56
Age (months)				
3 <12	6.78	6.67	1.47	6.53
>12 <24	11.43	11.32	0.9	5.11
24 - 42	12.54	12.44	0.8	7.63
>42 - 96	17.41	17.30	0.6	4.29
Genotype				
Creole	8.38	8.27	1.2	6.40
Crossbred	7.00	6.89	1.43	6.39
Anglo-Nubian	7.81	7.69	1.3	5.51
Biotype				
Hornless	7.80	7.70	1.3	7.0
With horn	8.18	8.07	1.2	6.16

When analyzing the yields considering the evaluated factors, no statistically significant differences were found in any of them; however, there were small mathematical differences. Regarding sex, in HCY, males (41.9%) showed a slight advantage compared to females (41.7%), but also experienced greater drip loss (1.5% ♂ and 0.1% ♀).

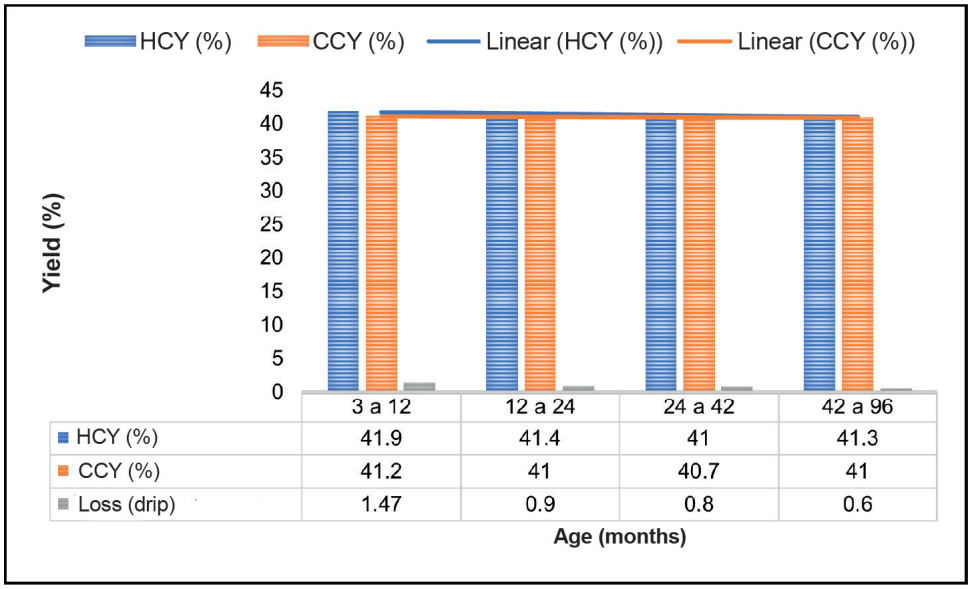

Figure 1. Trends in hot carcass (HCY) and cold carcass (CCY) performance, considering slaughter age.

In both hot and cold carcass yields, across the different slaughter ages of the animals, a slight decreasing linear trend in yields can be observed as age increases (Figure 1). Additionally, drip loss also shows a negative correlation, with older animals having a more solid carcass and less weight loss during the maturation process.

When analyzing the genetic factor, it was evident that the highest yields came from crossbred genotypes

(42.1% HCY and 41.5% CCY), followed by Creole goats (41.8% HCY and 41.1% CCY), and lastly, Anglo-Nubian goats (41% HCY and 40.2% CCY). However, in terms of carcass weight loss due to drip loss, the best performance was shown by the Creole goats (1.2%), followed by the Anglo-Nubians (1.3%), and finally, the crossbreds with 1.43% (Table 2).

In this study, the goats were also grouped by biotype: presence or absence of horns. It was found that hot and cold carcass yields were similar in both biotypes, with a slightly lower weight loss due to airing in horned goats (1.2%) compared to the *mucas* or hornless ones (1.3%).

4. Discussion

The HCY, also known as slaughter or dressing percentage, in this population of extensively managed goats in southern Ecuador was low (41.8 ± 2.6%) when compared to the range of 46% to 57% reported by Chagra Dib et al. (2021) for the goat species. It is worth noting, as stated by Mellado (1997), that the carcass yield in Creole goats ranges between 42% and 50.8%, which aligns with the yields obtained in the present study.

Regarding sex, Guzmán et al. (2008) and de Gea (2005) indicate that there is no difference in carcass yield between sexes in young and lightweight animals, with male kids showing a slight advantage over females—an outcome also observed in this study. These authors also note that sex influences yield when older animals are considered; however, this could not be verified in the present work because most of the slaughtered males were processed at a young age (3 to 12 months) and had a body weight of 16 ± 5.4 kg. It is also worth highlighting, in terms of carcass quality, the observation made by Mourad et al. (2001) that females show better quality than males. Considering carcass drip loss during the chilling phase as a quality parameter, it can be stated that the carcass of females in this population shows minimal weight loss (0.1%) compared to that of males (1.5%).

Regarding slaughter age, de Gea (2005) states that carcass yield in goats increases as age and slaughter weight increase, but once the growth curve reaches its peak (adult weight) and no further weight gain occurs, the yield decreases—making continued rearing beyond that point inadvisable. This assertion was not corroborated in the present study; in fact, carcass yields decreased linearly with increasing age and weight, although not significantly. Notably, greater age was associated with lower drip loss. At this point, it is worth adding the findings of Aguirre-Riofrío and Jiménez-Capa (2023), who report that Creole goats in this region reach their growth peak at 48 months, with males reaching 65.8 kg and females 43.4 kg. All this information will support informed technical decisions regarding the most appropriate slaughter age for these goats, both for commercial purposes and carcass quality.

When analyzing the genetic factor, Chagra Dib et al. (2021) mention high inbreeding within herds, uncontrolled crossbreeding, and the lack of improved genetic material as limitations to goat production, resulting in low weights and yields. These factors explain the yields observed in this predominantly Creole population, which is raised in open pasture under a free reproductive management system with no specific breeding objectives or selection criteria. In this regard, Ding et al. (2010) state that introducing imported bucks in crossbreeding programs could improve carcass yield and meat quality parameters—an assertion confirmed in this study, where the best yields were obtained in the crossbred genotype.

According to de Gea (2005), Chagra Dib et al. (2021), and López Chasin (2023), the factors that directly influence carcass yield and quality are the type of feeding and the management system. These authors report higher yields in their studies, but under some form of overfeeding and/or confinement. In this context, the low yields of these extensively managed goats can be understood or justified, as they must walk long distances daily in search of food, relying primarily on shrubs and trees as their natural forage resource (Aguirre-Riofrío et al., 2024).

5. Conclusions

The goat population in southern Ecuador, which inhabits the seasonal dry forest ecosystem—where water and food availability are limiting factors—shows low carcass yields compared to other goat populations. However, it is worth highlighting the solid and compact nature of its carcass, with minimal drip loss. According to the study, crossbreeding, along with alternative feed sources and the training and technical support provided to goat farmers, are key options for improving these productive and quality-related variables.

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Contributor roles

- Edgar Lenin Aguirre-Riofrío: conceptualization, data curation, methodology, project administration, supervision, writing – review and editing.
- Nathaly Salazar-Jimenez: investigation, resources, writing – original draft.
- Ramiro Armijos-Cabrera: formal analysis.

Ethical Considerations

The authors declare that, due to the nature of the study—data collection from commercially slaughtered animals—approval from an Animal Research Ethics Committee was not required.

Ethical implications

The authors declare that they have no affiliation with any organization with a direct or indirect financial interest that could have appeared to influence the work reported.

References

Acevedo Cárdenas, R. C., Durán Osorio, D. S., Trujillo Navarro, Y. Y., & Vargas Bayona, J. E. (2024). Contenido de ácidos grasos en la carne de cabra santandereana según la edad al sacrificio. *@limentech, Ciencia y Tecnología Alimentaria*, *22*(1), 42-59. https://doi.org/10.24054/limentech.v22i1.2862

Aguirre, E. L., Quezada, M., Maza, T., Albito, O., Armijos, D. R., Flores, A., & Camacho, O. (2021). Descripción morfométrica y faneroptica de la cabra "Chusca lojana" del bosque seco del Sur del Ecuador. *Archivos de Zootecnia*, *70*(270), 172-176. https://doi.org/10.21071/az.v70i270.5469

Aguirre-Riofrio, E. L., Ullaguari-Ramirez, V. T., Alvarado-Jaramillo, V., Aguirre-Mendoza, Z., & Viñan-Díaz, H. (2024). Shrubby and arboreal species diet preferences of creole goat in extensive husbandry during dry season at different altitude levels of dry forest in southern Ecuador. *Livestock Research for Rural Development*. *36*(3), 30. http://www.lrrd.org/lrrd36/3/3630edga.html

Aguirre-Riofrío, E. L., & Jiménez-Capa, S. (2023). Estudio de la cronometría dentaria y su relación con el peso vivo en la cabra criolla Chusca lojana manejada extensivamente en el bosque seco del sur del Ecuador. In J. Cayambe, X. Coronado, y F. Rivas (eds.), *Ciencia, Innovación y Tecnología* (pp. 379-392). Centro de Publicaciones PUCE. https://www.pucesi.edu.ec/webs2/libros-docentes/2023/libro-ciencia-innovacion-tecnologia.pdf

Chagra Dib, E. P., Leguiza, H. D., Fernández Madero, J., Vera, T., Tolaba, M., & Rivera, H. (2021). Características y rendimiento de la canal de caponcitos caprinos anglo nNubian engordados a corral con la utilización de dos fuentes de proteína. *Ciencia Veterinaria*, (*Edición Especial*). http://dx.doi.org/10.19137/cienvet2021esp01-02

de Gea, G. (2005). Características de la canal y de la carne en cabritos tipo criollo. En *El ganado caprino en la Argentina* (pp. 113-133). Universidad Nacional de Río Cuarto. https://www.produccion-animal.com.ar/produccion_caprina/ganado_caprino_en_argentina/capitulo4.pdf

Ding, W., Kou, L., Cao, B., & Wei, Y. (2010). Meat quality parameters of descendants by grading hybridization of Boer goat and Guanzhong Dairy goat. *Meat Science*, *84*(3), 323-328. https://doi.org/10.1016/j.meatsci.2009.04.015

Guerrero, A., Lemes, J. S., Campo, M. M., Olleta, J. L., Muela, E., Resconi, V. C., Guerra, V. M., Assis-Macedo, F., & Sañudo, C. (2016). Características de la canal y de la carne en la raza caprina Bermeya. Comparación con el Ternasco de Aragón y lechales de la raza Murciano-Granadina. *Informacion Tecnica Economica Agraria*, *112*(3), 271-285. https://doi.org/10.12706/itea.2016.017

Guzmán, J. L., Delgado-Pertiñez, M., Zarazaga, L. A., Celi, I., Flores, A., Puerta, R., Acosta, J. M., & Argüello, A. (2008). Efecto del sexo sobre la calidad de la canal y la carne de cabritos lechales de raza Blanca Andaluza en sistema de explotación convencional. En *XXXIII Jornadas Científicas y XII Internacionales de la Sociedad Española de Ovinotecnia y Caprinotecnia* (pp. 452-456). Almería. https://www.cabidigitallibrary.org/doi/pdf/10.5555/20163297857

Instituto Nacional de Estadísticas y Censos [INEC]. (2022). *Encuesta de Superficie y Producción Agropecuaria Continua 2021*. Número de cabezas de ganado al día de la entrevista, según especies por región y provincia. https://www.ecuadorencifras.gob.ec/encuesta-de-produccion-agropecuaria-continua/

López Chasin, J. K. (2023). *Características de la canal y organometría de cabras criollas con la suplementación de balanceado y bloque nutricional, zona norte de la provincia de Santa Elena*. Universidad Universidad Estatal Península de Santa Elena. https://repositorio.upse.edu.ec/handle/46000/9746

Mellado, M. (1997). La cabra criolla en América Latina. *Veterinaria México*, *28*(4), 333-343. https://www.medigraphic.com/cgi-bin/new/resumen.cgi?IDARTICULO=21065

Mourad, M., Gbanamou, G., & Balde, I. B. (2001). Carcass characteristics of West African dwarf goats under extensive system. *Small Ruminant Research*, *42*(1), 81-85. https://doi.org/10.1016/S0921-4488(01)00211-5

Sañudo, C., Campo, M. M., Muela, E., Olleta, J. L., Delfa, R., Jiménez-Badillo, R., Alcalde, M. J., Horcada, A., Oliveira, I., & Cilla, I. (2012). Carcass characteristics and instrumental meat quality of suckling kids and lambs. *Spanish Journal of Agricultural Research*, *10*(3), 690-700. https://doi.org/10.5424/sjar/2012103-670-11

Webb, E. C., Casey, N. H., & Simela, L. (2005). Goat meat quality. *Small Ruminant Research*, *60*(1-2), 153-166. https://doi.org/10.1016/j.smallrumres.2005.06.009