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Evaluation of the Characteristics of Goat Carcasses Slaughtered at the Korhogo Slaughterhouse (Ivory Coast)

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Abstract With the aim of improving goat production in the north of the country, a study was undertaken on the quality of the carcasses of goats admitted to the slaughterhouse in the town of Korhogo. During this study, which took place over two months, a total number of 736 goats (681 Djallonké goats and 55 Sahelian goats) was used to determine the characteristics of their carcasses. The results showed that the average live weight of Sahelian goats (22.30 ± 8.19 kg) was significantly higher ($P < 0.05$) than that of Djallonke goats (16.36 ± 5.83 kg). The average carcass weight of Sahelian goats (11.06 ± 4.03 kg) was significantly higher ($P < 0.05$) than that of Djallonke goats (7.87 ± 2.79 kg). Among Djallonke goats, females recorded an average carcass weight (9.14 ± 2.88 kg) significantly higher than that of males (6.35 ± 1.70 kg). The same observation was made among the Sahelians. The rate of category D goat carcasses was higher (49.45%). n the Djallonké breed, E conformation carcasses were more represented (45.24%). The lean and poorly covered fattening states were most represented with 45.65% and 35.33% respectively. Most of carcasses were red in color (more than 82.47%). Therefore, it appears from this work that the goat carcasses from the Korhogo slaughterhouse have good quality and that a study should be carried out over a long period in order to confirm these results.

Keywords: *quality, carcass, goats, breed, slaughterhouse, Korhogo*

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1. Introduction

West Africa, with 37.2% of the continental herd, is one of the main goat breeding areas with an important socio-economic role. These animals are raised in agroecological zones and in varied systems [1]. In Côte d'Ivoire, the production of small ruminants (sheep and goats) knew a strong increase of 54%, ranging from 15,495 tonnes carcass equivalent in 2014 to 23,789 tonnes carcass equivalent in 2019. Over the period from 2014 to 2019, the number of sheep/goats increased from 3,104,148 to 5,091,443 heads, an increase of 77% [2].

However, after breeding, very little attention is given to animals destined for slaughter. Indeed, those admitted to the slaughterhouse generally come from different ages, different physiological stages and different breeds, thereby leading to heterogeneity in the meat intended for consumption. Thus, in addition to being insufficient in terms of quantity, national production of goat meat lacks quality due to this heterogeneity. However, nowadays, quality has become a real challenge for producers and processors who must meet local and international requirements [3].

Unfortunately, this notion of "quality" is less perceived in the goat sector in Ivory Coast, especially in slaughterhouses where only health inspections are carried out diligently. Indeed, after inspection, all edible carcasses are treated in the same way despite their condition and origins. Indeed, after inspection, all carcasses intended for consumption are treated in the same way regardless of their condition (poor or good) and their origins. However, these should be grouped according to quality criteria to facilitate consumer choice. According to Lebret and Picard [4] meat quality includes multiple dimensions and expectations of industry players and consumers are convergent. However, certain actions such as activities carried out within the slaughterhouse can influence the quality of the meat. It is in this context that Lebret and Picard [4] affirm that the quality of carcasses remains a major criterion in animal production because it most often constitutes, with weight, the basis of payment for carcasses. However, the animals that reach the slaughterhouses are generally not of the same breed, of the same physiological stage, nor of the same age and come

from various farms with different practices. This leads to a heterogeneity of carcasses which, despite their differences in condition, are sold under the same brand. In view of this situation, it is appropriate to determine the quality of the carcasses of goats from the slaughterhouse in the City of Korhogo in order to know the level of production of livestock farms in the region. Conducting this study will allow breeders not only to review their production methods and to offer consumers quality products.

2. Material and Methods

2.1. Study Framework

This study took place at the Korhogo slaughterhouse. This slaughterhouse offers a slaughter area which only accommodates ruminants, including goats. It has a fence to reduce access to strangers and protect it from other domestic animals.

2.2. Material

The biological material consisted of the different breeds of goats sent to the Korhogo slaughterhouse. A total of 736 goats were taken into account during the 2 months of the study (from March 10 to May 15, 2023). The technical material used consisted of sheets relating to information relating to breed, age, sex, physiological stage, weight and body condition notes. On the other hand, it is made up of a Generic brand scale with a capacity of 150 kg and an accuracy of 0.5 kg, and 2 ropes (one to contain the animal and the other to suspend the scale). The biological material consisted of the different breeds of goats sent to the Korhogo slaughterhouse. A total of 736 goats were taken into account during the 2 months of the study (from March 10 to May 15, 2023).

As for the technical material used, it is composed on the one hand of sheets relating to information relating to breed, age, sex, physiological stage, weight and body condition notes. On the other hand, it is made up of a Generic brand scale with a capacity of 150 kg and an accuracy of 0.5 kg, and 2 ropes (one to contain the animal and the other to suspend the scale)

2.3. Methods

2.3.1. Parameters Estimation

To estimate the live weight of goats, a webbing restraint system was created. Thus, the animals were placed in this restraint system and weighed individually using a scale. After the ante-mortem inspection, the animals were transferred to the waiting park. The slaughter began at 7 a.m. and ended at 3 p.m. During slaughter, the animals were sent one by one to the bleeding site and contained using ropes before being bled. The covering was immediately completed. After the inspection, the hot carcasses were weighed using the scale and the carcass yield was determined. The determination of the category and the conformation of the carcass was determined according to Regulation (EC) No. 1249/2008 of the European Commission. The state of fattening was determined according to a 5-level grid from the European Commission [5]. The criterion corresponds to the quantity of fat visible outside and inside the carcass. The coloring of the carcass was determined according to Moëvi [6]. Thus, the color criterion is classified according to a 4-level grid. The color of each carcass was therefore determined according to this grid.

2.3.2. Statistical Analyze

After collecting the data, the percentages and standard deviations were calculated with Microsoft Excel 2016 software. Statistica 7.1 software. was used for further statistical analyses. Thus, after checking the normality and homogeneity of variances, the Mann Withney U test was used at the significance level of 0.05 to determine probable differences.

3. Results and Discussion

3.1. Results

3.1.1. Average Live Weight of Goats

Females of the Djallonke breed recorded an average live weight of 19.29 ± 5.86 kg which was significantly higher than that of males (12.83 ± 3.28 kg). Within the Sahelian race, the same observation was made. Males recorded a mean weight (18.69 ± 4.68 kg) significantly lower ($P < 0.05$) than that of females (29.72 ± 8.96 kg). The average live weight of Sahelian goats (22.30 ± 8.19 kg) was significantly higher ($P < 0.05$) than that of Djallonke goats (16.36 ± 5.83 kg) (Figure 1).

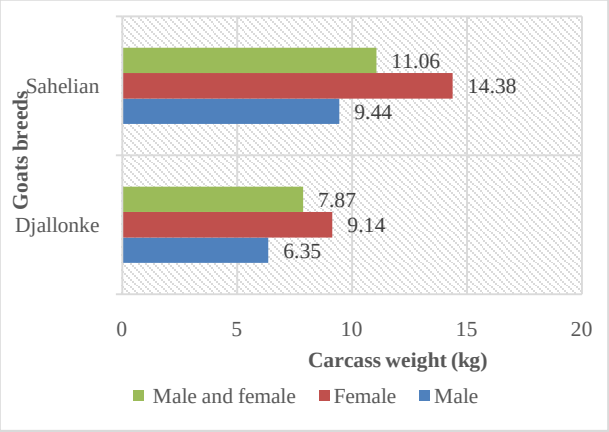

Figure 1. Average live weight of goats

3.1.2. Average Carcass Weight

The average carcass weight of Sahelian goats (11.06 ± 4.03 kg) was significantly higher ($P < 0.05$) than that of Djallonke goats (7.87 ± 2.79 kg) with average carcass weight. Among Sahelian goats, females recorded an average carcass weight of 14.38 ± 4.50 kg compared to 9.44 ± 2.56 kg for males. The same observation was made among the Djallonke with respectively 9.14 ± 2.88 kg for females and 6.35 ± 1.70 kg for males. A significant difference ($P < 0.05$) was observed (Figure 2).

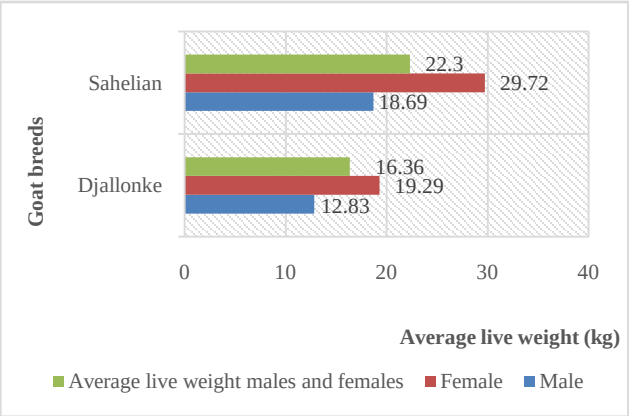

Figure 2. Average carcass weight of goats

3.1.3. Carcass Yield

The carcass yield of Sahelian goats (49.66 ± 3.24%) was significantly higher (P < 0.002) than that of Djallonke (48.30 ± 4.55%). Sahelian males had a carcass yield (50.32 ± 3.46%) which is not significantly higher than that of Djallonke (49.53 ± 3.66%). The same observation was made among females, with respectively 47.29 ± 4.96% for Djallonke and 48.31 ± 2.29% for Sahelians. Among the Djallonke, males have a carcass yield (49.53 ± 3.66%), significantly higher (P < 0.05) than females 47.29 ± 4.96%. The same observation was made among the Sahelians with respectively 48.31 ± 2.29% for females and 50.32 ± 3.46% for males (Figure 3).

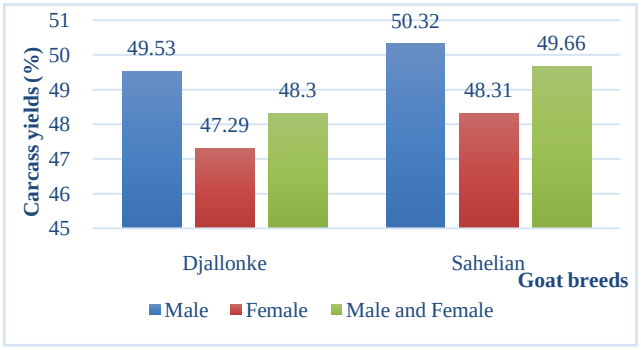

Figure 3. Goat carcass yields

3.1.4. Carcass Categories

The carcasses of goats (Table 1) having already given birth (category D) were the most numerous (49.45%). Djallonke females represented 47.28% and Sahelian females were 2.17%. After category D carcasses, those of category A (carcasses of young uncastrated goats less than 2 years old) were the most numerous (32.2%) with 29.48% and 2.72% respectively for Djallonké and Sahelians. Carcasses of castrated goats (categories C) represented 14.13% (12.23% for Djallonke and 1.9% for Sahelians). Those of other female animals had a rate of 3.53% (3.26% for the Djallonke and 0.27% for the Sahelians). Finally, category B carcasses (carcasses of other non-castrated animals) were in the minority. They represented 0.68% of the total population (with 0.41% and 0.27% respectively among Sahelian and Djallonke goats).

Table 1. Categories of goat carcasses

Carcass categories	Djallonke breed	Sahelian breed	Total
A	29,48 %	2,72 %	32,2 %
B	0,27 %	0,41 %	0,68 %
C	12,23 %	1,9 %	14,13 %
D	47,28 %	2,17 %	49,45 %
E	3,26 %	0,27 %	3,53 %

A: Jeunes mâles non castrés, **B:** Mâles non castrés, **C:** Mâles castrés, **D:** Femelles ayant vêlé, **E:** Autres types de femelles

3.1.5. Carcass Conformation

Table 2, below, provides information on the conformation state of goat carcasses. The E conformation carcasses were more represented among the Djallonke (45.24%) than among the Sahelians (2.17%). Among Djallonké females, E conformation carcasses were more numerous (24.59%) than those from males (20.65%). As for Sahelian goats, the carcasses of females with excellent conformation (E) represented 0.68% of the carcasses compared to 1.49% for those of males. The R conformation carcasses and O conformation carcasses were only represented in the Djallonke breed. However, no carcass had the P conformation.

Table 2. Conformation of goat carcasses

Conformations		Djallonke breed		Sahelian breed	
S	Male	17.93 %	33.29 %	3.4 %	4.76 %
	Female	15.36 %		1.36 %	
E	Male	20.65 %	45.24 %	1.49 %	2.17 %
	Female	24.59 %		0.68 %	
U	Male	3.26 %	13.04 %	0.13 %	0.54 %
	Female	9.78 %		0.41 %	
R	Male	0.14 %	0.68 %	0	0
	Female	0.54 %		0	
O	Male	0	0.27 %	0	0
	Female	0.27 %		0	
P	Male	0	0	0	0
	Female	0		0	

S: Supérieure, **E:** Excellente, **U:** Très bonne, **R:** Bonne, **O:** Assez-bonne, **P:** Médiocre

3.1.6. Fattening state of the carcass

Table 3. State of fattening of goat carcasses

Fattening state		Djallonke breed		Sahelian breeed	
Lean (%)	Male	30,57	45,65	1,77	2,18
	Female	15,06		0,41	
Little coverage (%)	Male	10,33	35,33	2,99	4,21
	Female	25		1,22	
Covered (%)	Male	1,09	10,47	4,21	1,09
	Female	9,38		0,82	
Fat (%)	Male	0	1,22	0	0
	Female	1,22		0	
Very fat (%)	Male	0	0	0	0
	Female	0		0	

Table 3 shows the distribution of carcass fattening states of goats at the Korhogo slaughterhouse. Among the

Djallonke, lean and little coverage fattening states were the most represented with 45.65% and 35.33% respectively. In this same breed, more male carcasses had a lean fattening state (30.57%) while female carcasses mostly had a slightly lean fattening state (25%). Among the Sahelians, the highest carcass rate (4.21%) had a little covered fattening state.

3.1.7. Carcass Coloring

The red coloring of the carcasses was the most dominant. Among the Djallonke, this coloring (82.47%) was more represented than in the carcasses of the Sahelians (7.21%). In Djallonke females, red carcasses had a percentage of 44.43% compared to 38.04% in male carcasses. At the Sahelian breed level, red carcasses were estimated at 2.45% for females and 4.76% for males. The coloring of the carcasses is illustrated in Table 4.

Table 4. Coloring of goat carcasses

Carcass coloring		Djallonke breed		Sahelian breeed	
Red (%)	Male	38,04	82,47	4,76	7,21
	Female	44,43		,27	
Pink (%)	Male	3,94	10,05	0,27	0,27
	Female	3,94		0	

3.2. Discussion

The results of this study showed that Djallonke goats have a significantly lower average carcass weight (7.87 ± 2.79 kg) ($P < 0.05$) than that of Sahelian goats (11.06 ± 4.03 kg). This difference could be explained by the formats of these two races. Indeed, the Djallonké breed is a small breed with short legs (around 45 cm at the withers and an average weight of 17 kg) compared to Sahelian goats which are large. Among Sahelian goats, females recorded an average carcass weight of 14.38 ± 4.50 kg compared to 9.44 ± 2.56 kg for males. The same observation was made in the Djallonké breed where the average carcass weights were 9.14 ± 2.88 kg and 6.35 ± 1.70 kg respectively for females and males. This difference could be explained by the slaughter pressure that males experience. Indeed in the Poro region, due to cultural practices, males are more used during initiation activities. This leads to a scarcity of adult goats, especially males, on farms and stockyards to supply the slaughterhouse, thus leading to the slaughter of animals less than a year old. Also the weight difference could be linked to sex as indicated by Mbeurnodji [7]. who reported a difference in carcass weight depending on sex, as indicated by our work. In fact, the latter recorded in the Sahelian breed an average carcass weight of 8.41±1.11 kg in goats and 5.4±0.41kg in goats. Our results recorded in the Djallonke goat are similar to those of Tamini et al [8] who reported an average carcass weight (8 kg) in this breed.

He carcass yield of Sahelian goats (49.66 ± 3.24%) was significantly higher ($P < 0.002$) than that of Djallonke (48.30%). Only our carcass yields obtained with the Sahelian breed are close to those of Mbeurnodji [8]. The results provided by the latter on the Sahelian breed show that males have a carcass yield of 55.56 ± 4.56% and that of females is 45.67 ± 3.93%. Djenontin et al [9]. obtained a carcass yield which varies from 52.59 to 60.28 among the Djallonke. This difference in yield could be explained by the duration of breeding, the diet, as well as the age of the animals at slaughter.

Category D goat carcasses are the most numerous (49.45%) followed by those of category A (32.2%). This could be explained by the lack of goats of slaughter age on farms. This leads breeders to sell young males and even females after a single birth. Some authors such as Ngona et al [10], Nana et al [11] and Kouamo et al [12] obtained similar results with more category D carcasses. Indeed, these authors recorded rates of 44%, 49% and 59.3% of category D carcasses respectively. The lean fattening state predominated among Djallonke goats (45.65%), thus illustrating the good quality of this meat. Indeed, according to Lebret and Picard [4], the quality of carcasses is determined by their proportion of lean meat relative to fatty and bone tissue. This quality of the carcasses could be due to the breeding system practiced by the breeders. In fact, the animals are generally raised free-range or on natural ranges. Furthermore, these results could be linked to the season. Indeed, the data collection being carried out between March and May, the long dry season in the north of the country, the goats lacked food resources. Therefore, they undoubtedly used body reserves which strongly impacted the quality of the carcass. E conformation carcasses were more represented among the Djallonke (45.24%) while among the Sahelians it was S conformation carcasses (4.76%). Among all goats, lean and sparse fattening conditions were the most represented. These results are different from those of [13] observed more carcasses (69 to 73%) whose fattening state was fatty. Also Normand and Ferrand [14] recorded R (51%) and O (46%) conformations during their work. According to Couvreur [15], several factors can influence the conformation and fattening state of the carcass such as the selection of breeding stock, breeding conditions including diet and animal welfare.

The coloring of the majority of carcasses was red (87%). The dominance of this color could be explained by the fact that breeders essentially feed the animals on natural forage. The influence of eating behavior has been reported by Soro et al [16]. Indeed, these authors noted that grasscutter fed with a pellet designed with 70% green fodder and 30% food supplement recorded a darker red color than those fed with 70% bulk green fodder and benefiting from 30%. supplement served in bulk. Also this coloring could be linked to age. According to Perdriel [17] the myoglobin content (protein responsible for muscle coloring) increases significantly with age.

4. Conclusion

This study carried out within the Korhogo slaughterhouse indirectly noted the state of production of goat farms in the area. The goats had an average carcass weight of 7.87 ± 2.79 kg. The majority of carcasses (49.45%) belonged to category D (therefore already given birth) and had a poor fattening state (45.65%). However, they had an E conformation (45.24%). These results reveal an anarchic exploitation of the region's goat potential, most of which are slaughtered males less than one year old or single-parous females. However, collecting data over a year

will allow us to better understand the extent of the situation.

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