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Effects of raising area and pasture type on carcass and meat characteristics of barbarine lambs

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Abstract. The aim of this study was to characterize the lamb meat of the mountainous areas of the Northwest "Djebel" of Tunisia. Lambs of Djebel group (D) were reared in a region characterized by mountainous terrain and soil unsuitable for crops, lambs grazed natural forests with dominance of woody species. While in the region of Bou-Rebiaa (BR) and Oueslatia (O), grazing pasture is based on herbaceous and lambs were supplemented with concentrate and hay. At the age of 6 months, lambs (12 from Djebel; 12 from Bou-Rebiaa and 11 lambs from Oueslatia area) were slaughtered. Lambs' slaughter body weight (SBW) was affected by the pasture type (25.8, 26.8 and 22.6 kg for Djebel, Bou-Rebiaa and Oueslatia region, respectively). Also, higher carcass weight and higher dressing percentage were recorded for lambs from Djebel and Bou-Rebiaa. Similarly, the skin, head and feet weights were higher for these groups; these organs are strongly correlated to the SBW which was higher for Djebel and Bou-Rebiaa regions. Similarly, higher ultimate pH and lower meat lightness (L*) were recorded for lambs from Djebel area. In conclusion, lambs grazing natural forests in the mountainous area presented similar carcass weight and SBW to those supplemented with hay and concentrate. Investigations on meat composition and eating quality are needed to characterize Djebel meat.

Keywords. Pasture type – Mountainous area – Lambs – Carcass characteristics – Meat quality.

Effets de la zone d'élevage et du type de pâturage sur les caractéristiques de la carcasse et la qualité de la viande des agneaux

Résumé. *Le but de cette étude était de caractériser la viande d'agneau des régions montagneuses du "Djebel" du nord-ouest de la Tunisie. Les agneaux du groupe Djebel (D) ont été élevés dans une région caractérisée par un terrain montagneux et un sol impropre aux cultures, des agneaux ont pâturé dans les forêts naturelles avec une prédominance d'espèces ligneuses. Alors que dans la région de Bou-Rebiaa (BR) et Oueslatia (O), les pâturages sont à base d'herbacées et que les agneaux ont été complétés avec du concentré et du foin. À l'âge de 6 mois, des agneaux (12 de Djebel, 12 de Bou-Rebiaa et 11 agneaux de la région d'Oueslatia) ont été abattus. Le type de pâturage influait sur le poids d'abattage des agneaux (25,8, 26,8 et 22,6 kg pour les régions de Djebel, Bou-Rebiaa et Oueslatia, respectivement). En outre, un poids de carcasse et un rendement commercial supérieurs ont été enregistrés pour les agneaux de Djebel et de Bou-Rebiaa. De même, les poids de la peau, de la tête et des pattes étaient plus élevés pour ces groupes; ces organes sont fortement corrélés au poids vif à l'abattage qui était plus élevé pour les régions de Djebel et Bou-Rebiaa. De même, un pH ultime plus élevé et une légèreté de la viande (L *) plus faible ont été enregistrés pour les agneaux de la région de Djebel. En conclusion, les agneaux élevés dans les forêts naturelles de la région montagneuse présentaient un poids en carcasse et un poids vif à l'abattage similaires à ceux recevant du foin et du concentré. Des études sur la composition de la viande et la qualité de l'alimentation sont nécessaires pour caractériser la viande de Djebel.*

Mots-clés. *Type de pâturage – Zone montagneuse – Agneaux – Carcasse – Viande.*

I – Introduction

Meat quality is becoming an essential concept of food policies. Thus, the development of systems for identifying and certifying the quality and origin of products, important criteria for consumers' choices, is nowadays needed. The producer may sort to employ production systems that provide acceptable carcass and meat quality (Warren *et al.,* 2008) and maintain healthy products for consumers. In Tunisia, during religious ceremonies, specific lamb types "Djebel" are distinguished by specific meat taste that consumers look for and appreciate. The aim of this study was to characterize the lamb meat of the mountainous areas of the Northwest "Djebel" of Tunisia in comparison to common meat.

II – Material and methods

Lambs of Djebel group (D) were reared in a region characterized by mountainous terrain and soils unsuitable for crops; lambs grazed natural forests with dominance of woody species. While in the region of Bou-Rebiaa (BR) and Oueslatia (O), grazing is based on herbaceous pastures and lambs were supplemented with concentrate and hay. The difference between the three sites was based on the distance to the sea. The experimental site D (36° 58′ 31″ North, 9° 04′ 51″ East) is 37 km away from the sea. The second site (BR, 36° 36′ 30″ North, 10° 10′ 18″ East) is 46 km from the sea. The third site (O, 35° 50′ North, 9° 35′ East) is 151 km from the sea. Lambs, lambs (12 from Djebel; 12 from Bou-Rebiaa and 11 lambs from Oueslatia area) were slaughtered at the age of 6 months.

All lambs were slaughtered in the abattoir of the INRAT. Before slaughtering, lambs were fasted for 12 h with free access to water. Animals were weighed just before slaughter (slaughter body weight, SBW). The head, skin, feet, full and empty digestive tract, red organs (heart, liver, lung and trachea), internal fats (omental and mesenteric) and the hot carcasses (HCW) were weighed using an electronic scale (Société Douik Balance, Sousse, Tunisia). The carcasses were stored at 4°C for 24 h. Then, cold carcasses were weighed (cold carcass weight, CCW). The dressing percentage was calculated as: DP=100 × CCW/SBW. The left half-carcasses were cut into six joints; all joints were dissected. Samples of *longissimus dorsi* (LD) muscle were taken for meat quality analysis.

The initial and ultimate pH was measured using a penetrating electrode connected to a portable pH-meter (HI 99163; Hanna Instruments, Romania) after calibration with two buffers (7.01 and 4.01). To determine the water cooking loss (WCL), meat samples were weighed (initial weight, Wi) and held in plastic bags and then immersed in a water-bath at 75°C and heated for 30 min until the internal temperature reached 75°C, which was monitored with thermocouple. Then, the bags were cooled under running tap water and blotted dry with paper towels. The cooked meat was weighed again (final weight, Wf). The WCL was calculated as 100 × (Wi –Wf)/Wi.

A Minolta chroma Meter CR-400 was used to measure color directly on the muscle surface, the colorimetric indices lightness (L*), redness (a*) and yellowness (b*) were recorded.

A one-way analysis of variance for the feeding system effects on the slaughter parameters, non carcass components and physic-chemical composition of meat using GLM procedure in SAS (1989) was applied. Then, the test Duncan was used to compare these effects (α=0.05).

III – Results and discussion

1. Rearing system

The mountainous areas of the Northwest "Djebel" of Tunisia is characterized by rugged, and soil occupied by natural forests unsuitable for crops. The herbaceous layer is almost absent throughout the

year (Gasmi, 2005) especially in summer when this experiment was conducted. The feeding system in this region is based mainly on grazing forest plants (*Phillyrea angustifolia*, *Erica arborea, Myrtus communis, Pistacia lentiscus*…). While, in Bou-Rebiaa (BR) and Oueslatia (O), grazing pasture is based on herbaceous and lambs were supplemented with concentrate and hay (Table 1).

Table 1. Characterization of main grazed species and diets chemical composition

	DM (%)	Crude Protein (% DM)
Phillyrea angustifolia	65.3	6.05
Arbutus unedo	44.3	5.04
Myrtus communis	49.4	5
Quercus suber	53.5	9.2
Quercus coccifera	72.0	7.8
Erica arborea	67.4	6.1
Erica multifida	77.9	5.81
Oat hay	91.5	5.0
Concentrate	93.4	13.9

2. Slaughter parameters

Slaughter body weight (SBW) of lambs averaged 25.8, 26.8 and 22.6 kg for Djebel, Bou-Rebiaa and Oueslatia, respectively, with significant differences between the regions (P=0.001). The feeding system based exclusively on forest plants in Djebel region originates the same SBW as that of supplemented lambs from Bou-Rebiaa region. Statistical analysis of the HWC and the commercial dressing percentage revealed significant differences (P <0.01) between the three areas in favour to the regions of Djebel and Bou-Rebiaa (Table 2). This difference is related to the fact that these parameters are strongly correlated to the SBW itself affected by the feeding system (Atti and Khaldi, 1987; Sañudo *et al.,* 1993; Mahouachi and Atti, 2005).

Similarly, previous studies showed that lambs grazing natural pasture reached slaughter age with a higher weight and less carcass adiposity than feedlot ones leading to an improvement of the quality aspects of products (Demeyer, 1992) and a reduction of feeding cost.

Table 2. Slaughter body weight, carcass weights and dressing percentages

Group	D	BR	O	SEM	P
SBW (kg)	25.8^{a}	26.8^{a}	22.6^{b}	0.39	0.001
HCW (kg)	12.3^{a}	13^{a}	9.01^{b}	0.24	0.001
CCW (kg)	11.8^{a}	12.2^{a}	8.75^{b}	0.22	0.001
CDP (%)	47.5^{a}	48.3^{a}	39.2^{b}	0.38	0.001

CDP, commercial dressing percentage; HWC, hot carcass weight; CCW, cold carcass weight; SBW, slaughter body weigh.

3. Non-carcass components and lambs' meat quality

The pasture type affected the red organs (Table 3). This result did not corroborate previous findings of Atti *et al.* (2004) showing that red cut-down organs are not affected by SBW. The head and feet weights were significantly affected by the raising area; as indicated above, these weights are strongly correlated to SBW, which was higher for D and BR regions. The finding of Devant *et al.* (2006) can explain partially our results especially when considering that D and BR are situated in the Tunisian humid area (abundant grass over the year). They documented that the intake of aro-

matic plants in pasture originated changes in the rumen fermentation profile, gut weight, and consequently, on carcasses weight.

Meat physico-chemical properties analysis (Table 4) showed that higher ultimate pH and lower meat lightness (L*) were recorded for lambs from Djebel area. This higher ultimate pH could be related to the conditions of breeding in terms of altitude, which were less stressful for the O animals reared on medium altitude pasture. Redness parameters, which strongly affect consumers' choices, were similar among groups.

Table 3. Non-carcass components weights

	D	BR	O	SEM	P
Head (kg)	1.6^{a}	1.6^{a}	1.5^{b}	21.9	0.01
Skin (kg)	4.43	5.26	2.67	873	0.5
Feet (g)	658^{a}	693^{a}	596^{b}	9.9	0.001
Red Organs (g)	688^{c}	1107^{a}	781^{b}	17.6	0.001

Table 4. Meat physico-chemical properties

	D	BR	O	SEM	P
Ultimate pH	6.01^{a}	5.95^{a}	5.55^{b}	0.04	0.001
WCL (%)	21.4^{b}	28.3^{a}	25^{ab}	0.98	0.02
L*	40.8^{b}	44.5^{a}	46.9^{a}	0.55	0.001
a*	15.7	16.33	15.05	0.34	0.33
b*	2.43^{b}	3.29^{a}	1.95^{b}	0.17	0.01

IV – Conclusion

Lambs grazing natural forests in the mountainous area presented similar carcass weight and SBW to those supplemented with hay and concentrate. Investigations on meat composition and organoleptic quality are needed to characterize Djebel meat.

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