GROWTH PERFORMANCE AND MEAT QUALITY OF LIGHT NORTH AFRICAN LAMBS ON STALL-FED AND PASTURE-FED SYSTEMS

Hajji H.[1]*, Smeti S[1]., Ben Hammouda M.[2] and Atti N.[1]

[1]Laboratoire de Productions Animales et Fourragères, INRAT, 2080 Ariana, Tunisia.

[2]IRESA, 30 rue Alain Savary Tunis, Tunisia.

Abstract – The experiment investigated the growth performances, tissular composition and meat quality of lambs from 3 breeds Barbarine (BB), Noire de Thibar (NT) and Queue Fine de l'Ouest (QFO), raised on stall-fed or pasture system. For this, 36 lambs with were used; for each breed, lambs were divided into two groups. The stall group received oat hay and concentrate ad-libitum. The pasture group grazed natural meadow and received the same amount of oat hay. At the experiment end, 67 days, all lambs were slaughtered. Tissular composition was determined on leg and meat quality on Longissimus dorsi muscle. The pasture lambs had lower ($p<0.05$) growth rate than stall-fed ones (94 vs. 111 g/d). The NT breed had higher ($p<0.01$) growth rate than both other breeds (125 vs. 92 g/day). The pasture lambs accumulated more muscle (65 vs. 57 %) and less fat (9.5 vs. 17.6 %) than stall fed lambs. The cooking loss, sensory quality and instrumental meat quality were affected neither by the feeding system nor by the breed. Even with slightly higher growth rate of stall-fed lambs, the pasture feeding system with leaner carcasses, and similar meat quality continues enhancing, given the green image of product.

Key Words – Feeding system, Lamb growth, Meat quality

• INTRODUCTION

Products from animals fed on grass are generally preferred by consumers as where they are considered healthy, natural and friendly to animal welfare [1, 2]. For this reason, it is important to study growth performance and differentiate meat quality of grazing lambs from feedlot lambs. In the other hand response of breed differ to each feeding system, so it's interesting to assign each genetic type to a production system.

• MATERIAL AND METHODS

The study was conducted on 36 lambs of three North African breeds, Barbarine (BB), Noire de Thibar (NT) and Queue Fine de l'Ouest (QFO); each breed was represented by 12 lambs, which were divided into two groups of 6. Lambs weighed 20.25 kg meanly at the beginning of the experiment. For each breed, one group has been kept in feedlot (stall-fed) receiving the concentrate ad-libitum and 500 g/ head/day of oat hay. The second batch was conducted on pasture (Pasture-fed group) and received indoor the same quantity of oat hay as the stall-fed one. Water is permanently available for all animals.

At the end of the experiment, which lasted 67 days, all lambs were slaughtered. The slaughter body weight was recorded before slaughter. The amount of oat hay intake of stall-fed lambs was calculated.

After slaughter, all meat quality parameters were determined on *longissimus Dorsi* muscle. The pH was measured at slaughter and 24h post-mortem with a penetrating electrode

connected to a portable pH-meter. For cooking loss determination, meat samples were weighed before (initial weight, Wi) and after (final weight, Wf) immersion of the plastic bags in a water-bath at 75 °C and heated for 30 min until the internal temperature reached 75°C. The cooking loss (g kg -1) was calculated as 1000 x (Wi - Wf) / Wi. A Minolta CM-2006 d spectrophotometer (Konica Minolta Holdings, Inc, Osaka, Japan) was used to measure color parameters on the muscle surface 24 hour after slaughter; CIE L* (lightness), a* (redness) and b* (yellowness) parameters were recorded.

For sensorial quality, samples from the longissimus dorsi muscle were roasted in aluminum paper in a pre-heated oven at 180ºC without salt, then served in random order for testing by panelists to determine sensory evaluation of meat. Carcass tissular composition was estimated by the leg dissection in muscle, bone and fat (pelvic, subcutaneous and intermuscular). Data referring to all parameters were submitted to an ANOVA with two factors breed and regimen according to the software SAS through the GLM procedure.

- RESULTS AND DISCUSSION

There were no interaction between breed and regimen for all studied parameters.

Growth performances and tissular composition

Results concerning growth performances, body condition score and tissular composition of the leg are presented in table 1. Mean body weights of lambs were 20.25 and 26 kg at the beginning and the end of the experiment, respectively. The feeding system affected significantly the growth rate (GR), stall-fed had higher GR than pasture fed lambs (111 vs. 94 g/d). These results are in conflict with those shown by Atti and Abdouli (2001), [3], who found that lambs growth of pasture was better than indoor. The pasture lambs had more muscle (65.42 vs. 57.32 %) and less fat (9.47 vs. 17.56 %) than stall fed lambs, which confirmed other findings on better carcass composition of grazing system [3, 4]. Breed has significant effect on the final body weight and GR, but it had no effect on body condition score. In fact NT lambs had the highest final body weight and the highest GR (125g/d).

Table 1 Effect of feeding system and breed on growth performances, body condition score (BCS) and tissular composition

	feeding system (FS)		Breed			Stat		
	Pasture	stall- fed	BB	QFO	NT	SEM	FS	breed
IBW(kg)	20.30	20.26	19.75	19.87	21.16	2.10	0.99	0.22
FBW (kg)	25.32	26.71	25.05	25.00	27.99	2.67	0.08	0.007
GR (g/d)	94	111	93	91	125	29.71	0.04	0.002
BCS	1.50	1.70	1.63	1.68	1.52	0.27	0.03	0.33
Muscle (%)	65.4	57.3	57.0	64.5	61.9	8.18	0.10	0.008
Bone (%)	25.9	22.9	24.34	24.0	24.6	5.62	0.96	0.12
Total fat (%)	9.5	17.6	17.8	15.8	9. 7	3.45	0.001	0.001

IBW: initial body weight; FBW: final body weight; GR: growth rate.

Sensory and Instrumental meat quality

Water cooking loss (WCL) was affected by neither breed nor regimen (Table 2). The initial pH was significantly affected by breed and the lowest value was attributed to the NT breed. The ultimate pH seems to be effected by feeding system (P = 0.09) and breed (P = 0.07). The ultimate pH of the stall-fed lambs was lower than that of the pasture fed ones (5.59 vs. 5.66, respectively). These results confirmed findings of other authors [5, 6] in which they reported high-energy diets protect animals from potentially glycogen-depleting stressors resulting in lower pH. Color parameters were not influenced by both factors (Table 2). All lambs displayed average L* values of 40, indicating a light-colored and acceptable meat by

consumers. According to Velasco et al. (2004), [7], meat with a lightness value equal to or exceed 34 was acceptable on average and above 44 was acceptable by 95% of consumers. Tenderness, juiciness, taste and general impression evaluated by panelists showed no differences by breed and regimen. Meat was averagely tender , since all samples received a mean note of 6.58 and juiciness value was about 5.95 . However, lamb and fat residual taste was more responded in pasture group than in stall-fed group (65.14 *vs.* 60.38 % and 21.10 *vs.* 14.15, respectively). The liver residual taste was more detected in meat from stall-fed lambs than in meat from pasture lambs (16. 98 *vs.* 4.59 %). These finding are in contradiction with those of Priolo et al., (2002), [6].

Table 2 Effect of feeding system and breed on water cooking loss, pH and color parameters

	feeding system (FS)		Breed			Stat		
	Pasture	stall-fed	BB	QFO	NT	SEM	FS	breed
WCL	15.49	13.47	11.14	14.62	17.71	8.05	0.57	0.16
PH1	6.54	6.50	6.60	6.75	6.20	0.33	0.60	0.0001
PH2	5.66	5.59	5.62	5.68	5.57	0.11	0.09	0.07
L*	42.79	42.25	43.29	41.66	42.65	3.10	0.59	0.47
a*	14.81	14.55	14.85	14.23	14.96	1.62	0.64	0.53
b*	6.44	6.21	6.66	6.27	6.06	1.62	0.67	0.69

WCL : Water cooking loss

- CONCLUSIONS

Under North African pasture conditions and using native light lambs, stall-fed regimen is associated to the highest growth rate and final body weight. For this range of weight and under both feeding systems, the NT lambs had higher growth rate than both other breeds. But stall fed lambs accumulated more fat and less muscle than pasture lambs.

Even with slightly higher growth rate of stall-fed lambs, the pasture feeding system with leaner carcasses, and similar meat quality continues enhancing, given the green image of product.

REFERENCES

- Grunert, K.G., Bredahl, L. & Brunso, K. (2004). Consumer perception of meat quality and implications for product development in the meat sector. Meat Science 66: 259– 272.
- Ädnoy, T., Haug, A., Sorheim, O., Thomassen, M. S., Varszegi, Z., & Eik, L.O. (2005). Grazingon mountain pastures: Does it affect meat quality in lambs. Livestock Production Science 94:25–31
- Atti, N. & Abdouli, H. (2001). Effets du niveau du concentré sur les performances bouchères des agneaux de race Barbarine conduits au pâturage ou en bergerie. Annales de l'INRAT 75: 239-250.
- Nuernberg, K, Dannenberger, D, Nuernberg, G, Ender, K, Voigt, J, Scollan, ND, Wood, JD, Nute, G.R. & Richardson, RI. (2005). Effect of a grass-based and a concentrate feeding system on meat quality characteristics and fatty acid composition of longissimus muscle in different cattle breeds. Livestock Production Science 94: 137– 147.
- Immonen, K., Ruusunen, M., Hassia, K. & Puolanne, E. (2000). Bovine muscle concentration in

relation of finishing diet, slaughter and ultimate pH. Meat science 55: 25-31.

- Priolo, A., Mico,l D., Agabriel, J., Prache, S. & Dransfield, E. (2002). Effect of grass or concentrate fending systems on lamb carcass and meat quality. Meat Science 62: 179-185.
- Velasco, S., Caneque, V., Lauzurica, S., Perez, C. & Huidobro, F. (2004). Effect of different feeds on meat quality and fatty acid composition of lambs fattened at pasture. Meat Science 66: 457–465.