EFFECT OF DOUBLE TRANSPORTS AND SEASON ON MEAT QUALITY TRAITS IN LIGHT LAMBS IN SPAIN[1]

E. Muela*, G. Miranda de la Lama, G.A. María, J.L. Olleta., G. Liste, M. Villarroel, C. Sañudo
Animal Production & Food Science Department. Faculty of Veterinary Medicine. University of Zaragoza.
Miguel Servet 177 (50013) Zaragoza. Spain
*462065@vetez.unizar.es

Keywords: transport, season, meat quality, light lambs, Spain

Introduction

Transport from farm to abattoir is a critical point in meat production systems (Escos et al. 2006). Animal welfare is also a growing concern in Europe, and, when respected, can help to provide additional value to the final price of the product (María et al., 2006). In the Spanish region of Aragón (NE Spain), the lamb meat production system includes an intermediate step between the farm and the abattoir: cooperative classification centres. Most animals are loaded at the farm, unloaded at feed lots called classification centres and loaded again to be transported to the abattoir. If lambs do not weigh enough upon arrival, they are kept in the classification centre until they reach the proper slaughter live weight (28 kg). This structure of the production system introduces new risk factors (i.e. novel environment, mixing groups with social stress or double transportation) that may compromise animal welfare and meat quality. The aim of this research was to assess the effect of three different types of double transports and season on instrumental meat quality traits in light lambs of the *Rasa Aragonesa* breed in the Aragón Region (NE Spain).

Material and Methods

One hundred and forty four male lambs were transported by road (along with non-target animals) for three hours from the farm to the classification centre and for one hour from the classification centre to the abattoir. The stocking density in the truck was 5 lambs per m^2. Three treatments were designed with 0 days (L0), 7 days (L7) or 28 days (L28) of feeding in the classification centre. Two replicates were carried out in winter and summer with 12 lambs in each group (3 types of double transports, 2 seasons, 2 replicates and 12 lambs in each group). The average carcass weight was 12 (±1) kg. The response variables analyzed included meat pH measured 24 hours *post mortem* at the longisimus dorsi muscle. Meat colour was expressed using colour coordinates L* (lightness), a* (redness), and b* (yellowness). Chroma (C*) and hue-angle (h) values were calculated as C* = (a*2 + b*2)1/2 and h* = tan–1 (b*/a*), respectively. The longissimus dorsi was removed from left side and sliced into three steaks for instrumental analyses. Water holding capacity (WHC) was assessed using the Grau and Hamm method. For the analyses of meat texture, longissimus dorsi muscles were vacuum-packaged and frozen at –18ºC. We performed compression and Warner-Bratzler (WB) analyses on sample slices using an Instron 4301. The texture of the raw meat was determined using a modified compression device that avoids transversal elongation of the sample. The stress was assessed at 20% (K20), 80% (K80) and 100% (K100) of maximum compression (N/cm²). The data were analysed using the least square method of the GLM procedure in SAS (SAS, 1988), using a two way model that included the fixed effects of type of double transportation (L0, L7 and L28), season (summer or winter) and the interaction effect.

Results and Discussion

A summary of the significant differences according to the main effects is presented in Table 1. Season affected all meat parameters analyzed ($p \leq 0.001$). The type of transport affected texture parameters evaluated by Warner Bratzler ($p \leq 0.001$) and slightly affected texture by compression at 80% (K80), colour (b*). Interaction effect was not significant in all cases. The least square means (±SE) of the meat quality traits analyzed in terms of journey type and season are presented in Table 2. The lower values of maximum load, maximum strength and toughness were observed in the L7 group. Meat pH was higher in winter than in summer but within the normal range of pH. All texture parameters evaluated by the compression cell were higher in summer than in winter. The opposite was observed for the texture traits evaluated by Warner Bratzler. In summer, the values of lightness were higher but redness and yellowness were lower. The effect of the transport type was independent of the season effect. In general, the introduction of classification centres in the lamb meat production system improved the logistics and the uniformity of the carcasses but can affect some parameters in terms of meat quality and probably in terms of welfare.

---

[1] Founded by CICYT Ministry of Education and Science of Spain Project number AGL-2005-00208 and by the Meat Company *Carnes Oviaragón* (Zaragoza, Spain)

Conclusions

Few studies have considered the effect of double transports on instrumental meat quality parameters in commercial lambs. Under the controlled commercial conditions of this work, transport affected meat quality and this effect was independent of the season of the year.

Table 1. Summary table of the significance of the two main effects and their interaction for the instrumental meat parameters.

Variable	Transport Type (TT)	Season (S)	Interaction TTxS
pH 24	NS	***	NS
Texture by Compression			
K20 N/cm^2	NS	***	NS
K80 N/cm^2	(*)	***	NS
K100 N/cm^2	NS	***	NS
Texture by Warner Bratzler			
Max. Load	***	***	NS
Max. Strength	***	***	NS
Toughness	***	***	NS
Colour			
L*	NS	***	NS
a*	NS	***	NS
b*	(*)	***	NS
Chroma	NS	***	NS
Hue	NS	***	NS

NS: no significance; *(p≤0.05); *** (p≤0.001); (*) (p≤0.10).

Table 2. Least square means (±SE) of the ultimate meat (pH24), water holding capacity (WHC), the texture variables analyzed by compression at 20% (K20), 80% (K80) and 100% (K100) and by Warner Bratzler maximum load (ML), maximum strength (MS) and toughness, and colour parameters lightness (L*), redness (a*), yellowness (b*), chroma and hue.

Variable	L0	L7	L28	Summer	Winter
K20	6.64±0.26a	7.14±0.42a	6.54±0.43a	7.58±0.36x	5.97±0.35y
K80	41.60±0.1.54a	45.80±1.50b	42.18±1.53a	52.07±1.27x	34.31±1.27y
K100	53.50±2.01a	57.43±1.97a	54.85±2.02a	66.67±1.67x	43.84±1.66y
ML	6.14±0.26a	5.32±0.25b	6.72±0.27a	5.53±0.22x	6.60±0.21y
MS	5.77±0.27a	5.09±0.24b	6.36±0.28a	5.24±0.23x	6.25±0.22y
Toughness	2.47±0.10a	2.09±0.10b	2.61±0.11a	2.21±0.09x	2.58±0.09y
L*	38.97±0.0.31a	39.71±0.30a	39.56±0.32a	40.12±0.26x	38.71±0.25y
a*	11.81±0.19a	11.89±0.18a	11.87±0.18a	11.67±0.15x	12.04±0.16y
b*	8.34±0.19a	8.92±0.18b	8.70±0.19ab	7.43±0.15x	9.87±0.16y
Chroma	14.50±0.22a	14.77±0.21a	14.94±0.21a	13.87±0.18x	15.61±0.17y
Hue	35.07±0.61a	36.59±0.59b	36.10±0.60ab	32.38±0.50x	39.46±0.51y
pH24	5.67±a0.01a	5.63±0.01(b)	5.65±0.01a	5.51±0.01x	5.80±0.01y
WHC	18.92±0.40a	18.94±0.39a	18.11±0.40a	19.71±0.34x	17.11±0.33y

Different letters within treatment represent significant differences (p≤0,05)

References

Escós J., María G.A., López J., Alierta S., García Belenguer S., Liste G. (2006). Critical points in the transport of lambs to slaughter in Spain that may compromise the animals' welfare. 52nd International Congress of Meat Science and Technology. Dublin. pp. 529-530.

María G.A. (2006). Public perception of farm animal welfare in Spain. Livestock Science 103:250-256.

SAS (1988). User's Guide: Statistics. Release 6.03. Cary, NC USA