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Effects of gentling on behavior and meat quality of lambs

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RIASSUNTO – Effetto del gentling sul comportamento e la qualità della carne di agnello. A 4 gruppi di agnelli di razza Comisana, ognuno costituito da 8 soggetti, è stato assegnato, dalla nascita a 49 giorni di età, un diverso trattamento, e precisamente: allattamento naturale (gruppo ER), allattamento naturale + gentling (gruppo ER+G), allattamento artificiale (gruppo AR), allattamento artificiale + gentling (gruppo AR+G). I soggetti sottoposti a gentling hanno espletato una maggiore attività di esplorazione, risultando nel complesso più attivi. Inoltre, i gruppi ER+G e AR+G hanno mostrato un miglioramento del rapporto con l'uomo nel corso dell'esperimento, come dimostrato dall'incremento di soggetti entrati in contatto con l'operatore durante il test dell'uomo stazionario ($P < 0,05$). Tale rapporto ha consentito un più rapido declino del pH della carne. Pertanto, i risultati ottenuti indicherebbero che il gentling consente un aumento del livello di benessere degli agnelli e può contribuire favorevolmente alla trasformazione del muscolo in carne.

Key words: lambs, gentling, behavior, meat quality.

INTRODUCTION – Within few hours after parturition lambs develop a strong and selective relationship with their mothers (Poindron and Le Neindre, 1980). In order to increase the amount of milk available for transformation, lambs often are prematurely separated from the ewes, thus inducing an early disruption of the mother-young relationship. A number of authors demonstrated that the lack of the maternal bond can inhibit the welfare state of the lambs (Sevi *et al.*, 2001) and reduced animal welfare can have detrimental effects on meat quality in many animals species (Gregory, 1998) as well as in sheep (Napolitano *et al.*, 2002a). A possible recover from conditions of poor animal welfare may be attained through the administration of gentle contacts by humans (Boivin *et al.*, 2000) which may supply an additional social bond with members of a different animal species. The present study aims to verify the effect of artificial rearing on lamb welfare and meat quality, and assess the possibility to increase both by means of gentling.

MATERIAL AND METHODS – The experiment involved 32 Comisana twin-lambs, divided into four groups of 8. Each group was housed separately in 3x8 m straw-bedded pens in the same building and balanced for age, weight and sex of lambs. The ewe reared lambs (ER/ER+G) were kept with their dams throughout the experimental period. The artificially reared lambs (AR/AR+G) were maintained with their dams 24 to 30 h after parturition to receive maternal colostrum and then separated from them, and offered a milk substitute. The ER+G and AR+G lambs were subjected to gentling treatment by trained stockmen. Gentling treatment consisted of gently handling the lambs for 5 min each, once a day for 49 days. At d 13, 23, 33 and 43 behavioral activities of all lambs were video-recorded for 4 h and scan samples were taken every 5 min. Grooming and playing activities were measured by continuous recording. Lambs were tested for their responses to two stationary

human tests performed at d 10 and 30 according to Markowitz *et al.* (1998). At 49 days of age all the lambs were subjected to a test consisting in loading and transporting the animals on a covered lorry of 4x2.5 m for 10 min. Blood samples were individually collected in vacuum tubes from the jugular vein immediately before loading, at discharging of lambs and 60 min afterwards. Cortisol concentration was determined by a radioimmunoassay (ICN Biomedicals, Costa Mesa, CA). The animals were weighed at d 1, 21, and on the morning of slaughter (50 d). Dressed carcasses were weighed within 1 h (hot carcass weight), chilled for 48 h at 3°C, and weighed again (cold carcass weight). One and 24 hours after slaughter, pH was measured using a portable pH meter (Hanna, HI 9025) provided with glass electrode which was inserted approximately two inches into *Longissimus dorsi* (LD), *Semimembranosus* (SM) and *Semitendinosus* (ST). Cortisol levels were evaluated on log₁₀ transformed data to homogenize variance. Behavioural activities, behavioural response to stationary human test, cortisol level and meat pH value were processed using ANOVA for repeated measures with gentling and feeding as non repeated factors, whereas time and muscle (the latter only for pH) were used as repeated factors. Weight gains and dressing percentages were analyzed using ANOVA with two factors (gentling and feeding) and the interaction; differences among groups in the number of lambs which came into contact with the stockpersons were assessed using the χ^2 test. When significant effects were found, the LSD test was used to locate significant differences between means. Statistical analyses were performed using SAS version 6 (1990).

RESULTS AND CONCLUSIONS – The proportion of animals observed standing tended to be affected by gentling and feeding (P<0.10) with gentled and ewe-reared subjects displaying more often this posture compared to non gentled and artificially reared animals (P<0.10), respectively. Gentling and feeding also tended to affect the proportion of idling subjects (P<0.10 and P<0.05, respectively). Less ewe-reared lambs and gentled subjects were observed idling compared to artificially reared and non gentled animals (P<0.10), respectively. The effect of feeding on the proportion of investigating animals was significant (P<0.01) whereas the effects of gentling and time tended to be significant (P<0.10). In particular, ewe-reared, gentled and older animals were more often involved in investigation activities than their corresponding control groups (artificially reared, non gentled and younger subjects; P<0.05, P<0.10 and P<0.05, respectively). Sheep have been described as a “follower species” in the sense that new born lambs follow their mothers as soon as they are able to stand and walk properly, which typically happens within few hours after parturition (Poindron and Le Neindre, 1980). However, when reared without their mothers, these animals display reduced active behaviors and poor exploration of the surrounding environment (Napolitano *et al.*, 2002b). Therefore, along with Napolitano *et al.* (2003), lambs staying with their mothers are likely to be standing more often in order to be ready to follow the dam. In addition, the provision of human contacts stimulated gentled subjects to explore. As a consequence, gentling resulted in a reduction of idling subjects and in a higher proportion of investigating animals. Obviously, investigation also increased with increasing age as the lambs performed more independent activities.

Table 1. Number (%) of lambs that came into contact with the person in the stationary human test

Test days	Group					Effects (p)	
	ER	ERG	AR	ARG	Gent	Feeding	Gent x Feed
10 d	2(25.0)a	2 (25.0) a*	7 (87.5)b	3 (37.5)a *	0.154	0.033	0.389
30 d	4 (50.0)	6 (75.0)	6 (75.0)	7 (87.5)	0.238	0.0238	0.581

Within rows means followed by different letters are significantly different at P<0.05.

* = P<0.05, within columns.

The number of lambs that came into contact with the person during the stationary human test (Table 1) was affected by feeding (P<0.05) only at 10 days of age, whereas at 30 days no significant effects were observed. However, at increasing age (10 vs. 30 days) only gentled groups showed a significant increase in the number of subjects contacting the person (P<0.05). These results indicated that a prolonged gentling treatment was able to increase lamb confidence towards humans, as also observed by Markowitz *et al.* (1998). Cortisol

response to loading was evident at 5 min ($P<0.001$). However, 60 min afterwards cortisol concentration returned to levels which were not different from those observed before loading. No significant effects of feeding, gentling and the interaction on cortisol level could be detected. Weight gain from 0 to 14 days of age was affected by feeding ($P<0.05$) with higher growth in animals fed by their mothers. However, prematurely separated lambs showed a compensatory growth in the following period (15-30 days; $P<0.05$) as a possible consequence of accostumation to artificial rearing conditions. Therefore, in the overall period (0-50 days) no feeding effect was observed. In the first 14 days of age, weight gain tended to be also affected by gentling ($P<0.10$), as gentle contacts induced the animals to gain more weight compared to non gentled lambs. Percent dressing and cold dressing were influenced by feeding ($P<0.01$) and the interaction feeding x gentling ($P<0.05$ and $P<0.10$, respectively). Lambs left with their dams showed higher carcass and cold carcass yields compared to artificially reared animals. In addition, group ERG, which benefited from both maternal care and gentling, had the highest dressing percentage ($P<0.05$). Ultimate pH can markedly affect meat quality. As expected, pH values were much lower at 24 h than at 1 h ($P<0.001$) as a consequence of *post-mortem* glycolysis (Table 2). Muscle also affected meat pH value ($P<0.05$), with LD displaying the highest value compared to SM and ST ($P<0.001$). More interestingly, a significant interaction time x gentling was observed ($P<0.05$). This result may be attributed to the fact that although the meat produced by gentled animals showed a higher pH compared with that of the non-gentled lambs 1 h after slaughtering (6.58 vs. 6.50; $P<0.10$), an opposite trend was observed at 24 h post-mortem with gentled groups showing lower pH values (5.55 vs. 5.62; $P<0.20$).

Table 2. Least square means+SEM of meat pH at 1 and 24 hours post mortem.

	Muscle	Groups				SEM
		ER	ERG	AR	ARG	
pH1	LD	6.73	6.8	6.62	6.72	0.08
	SM	6.31	6.37	6.36	6.59	
	ST	6.40	6.55	6.6	6.45	
	Mean	6.48	6.57	6.52	6.59	
pH2	LD	5.70	5.62	5.75	5.67	0.08
	SM	5.53	5.50	5.6	5.52	
	ST	5.59	5.47	5.57	5.56	
	Mean	5.61	5.53	5.64	5.58	

We conclude that, although cortisol response to loading was not improved by gentling, this treatment proved to be effective in reducing fear of humans, as observed in the stationary human test, and preventing dark cutting by promoting a marked *post-mortem* meat pH decline.

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