Influence of pre-slaughter management on cortisol level in lambs

Evaldo Antonio Lencioni Titto[1], Thays Mayra da Cunha Leme[1], Cristiane Gonçalves Titto[1], Cláudia Caroline Barbosa Amadeu[1], Paulo Fantinato Neto[1], Reíssa Alves Vilela[1], Alfredo Manuel Franco Pereira[2]

[1] Biometeorology and Ethology Laboratory - Animal Science and Food Engineering Faculty - University of Sao Paulo – FZEA/USP, Pirassununga - São Paulo, Brazil; titto@usp.br

[2] Biometeorology and Animal Welfare Laboratory - Institute of Agricultural and Environmental Sciences Mediterranean, Animal Science Departament – University of Évora –, Apartado, 94, 7000-554 – Évora,Portugal

INTRODUCTION

The transportation of animals on highways is a very important economic factor, because it can cause physical, psychological and physiological stress in farm animals (KNOWLES, 1998), as well as deleterious effects on the health, well-being, performance of these animals, and finally, on the quality of the final product (VON BORELL, 2001). Stress is the primary indicator for assessing animal well-being. Out of all the endocrine axes, the hypothalamus-pituitary-adrenal axis has been widely studied (CHACKLEU, 1996) and plays a key role in response to internal and external stimuli, which act as stressors, being its activation and the consequent changes in plasmatic cortisol levels the first responses from an animal facing stressful conditions (COSTA e SILVA, 2004). According to Encarnação (1989) the average plasmatic cortisol concentration ranges between 6 and 14 ng.ml^{-1} in sheep. However, Minton, Apple and Parsons (1995), when dosing this hormone in sheep, without imposing any kind of stress, reported values lower than the average value of 20 ng.ml-1.

This study aimed to verify the influence of the transport in open or closed compartments, followed by two resting periods (1 and 3 hours) for the slaughter process on the levels of cortisol as a indicative of stress level.

MATERIAL AND METHODS

Eighty six crossbred lambs of the Santa Ines breed were studied and slaughtered with a minimum live weight of 35 kg. The slaughterhouse was located 85 km away from the place of confinement and the transportation of the lambs was in a cage truck type with a density of one animal per 0.5 m^2. Each cage had a divider in the middle making the front part of it fully closed, with air circulation coming from the topside of the cage only and without external visual access to the environment (Figure 1). The back portion of the cages presented two cracks of 5 cm between the side boards, at the height of the animal head, allowing visual access to the road, vehicles and other components of the route (Figure 2). The first blood samples for the analysis of plasmatic cortisol levels were collected from each animal immediately after the animals were unloaded. Each lot of animals was subdivided into two groups of different resting periods before slaughter; one and three hours rest. The resting area at the slaughterhouse comprised an area of 36m^2, resulting in an approximate area of 2m^2 per animal. At the end of each resting period blood was collected for the determination of cortisol levels. Blood samples were taken through jugular venipuncture in Vacutainer tubes containing sodium heparin and kept under refrigeration. The DS-10-2000 ACTIVE kit was used for the immunoenzymatic (EIA) cortisol dosing to assess the quantitative determination of cortisol in plasma.

Variables were evaluated through the PROC GLM procedure from the *Statistical Analysis System* ©, version 9.1.3 (SAS, 1995) software, with a significance level of 5%.

Figure 1. Closed compartment

Figure 2. Open compartment

RESULTS AND DISCUSSION

A significant interaction between the transportation method and the resting period was not observed for the cortisol. Therefore the presentation and discussion of these results were conducted separately.

The method of transport affected significantly the plasmatic cortisol concentration after the transport as described in Table 1.

Table 1 – Average values of cortisol and descriptive levels of probability in the F test of the analysis of variance in relation to the transportation method.

Characteristics	Transport		
	Open	Closed	Pr > F
Cortisol (ng.ml^{-1})	45.55±3.03^a	30.44±2.89^b	0.002

Different letters on the same line indicate significant difference between treatments (P < 0.01)

Sheep transported in the front part of the cage, which was fully closed, presented lower cortisol concentrations (P < 0.01) when compared to the concentrations observed in the animals transported in the back part of the cage, which was considered open, demonstrating that animals subjected to closed transport underwent less stress. In this study's situation the stress was caused by the relative moving during the open transportation, with all the visual and moving events becoming perceptible by the animals, such as the images along the path, other vehicles and buildings, in agreement with evidences already cited by Grandin (1997). Similar results were found by Baldock and Sibly (1990), who observed that sheep heart rate did not increase when the animals were placed in a parked vehicle, but increased when they were transported, indicating an increase in stress with the movement of the vehicle.

After the resting period in the slaughterhouse there was a decrease in the concentration of plasmatic cortisol, with animals subjected to three hours of rest presenting a lower average for the plasmatic cortisol concentration (P < 0.05) when compared to the animals subjected to only one hour of waiting (Table 2).

Table 2 – Average values of cortisol and descriptive levels of probability in the F test of the analysis of variance in relation to the resting period

Characteristics	Resting period		
	1 hour	3 hours	Pr > F
Cortisol (ng.ml^{-1})	33.70 ± 2.96^a	25.08 ± 2.96^b	0.03

Different letters on the same line indicate significant difference between treatments (p < 0.05)

Lambs that stayed three hours in the resting area before slaughter were able to recover from the stress of traveling, as opposed to those that waited just one hour presenting the average value of 33.70 ng.ml^{-1} which is indicative of stress. Tadich et al. (2009) monitored the stress levels of lambs during the boarding time, transportation and resting periods and found that the stress increased significantly during transportation and decreased during the resting time. Similarly, assessments made by Bórnez et al. (2009) proved the reduction of stress during rest.

CONCLUSIONS

Visual access to the external environment during the transportation of lambs is a stressful factor, as verified by the changes in the plasmatic cortisol levels. The period of rest before slaughter was effective in reducing the levels of cortisol, reflected by the decrease in animal stress.

REFERENCES

BALDOCK, N. M., SIBLY, R. M. Effects of handling and transportation on the heart rate and behaviour of sheep. **Applied Animal Behaviour Science** 28: 15-39, 1990.

BÓRNEZ,R.; LINARES, M.B.; VERGARA,H. Haematological, hormonal and biochemical blood parameters in lamb: Effect of age and blood sampling time. **Livestock Science,** Netherlands, v.121, p.200-206, 2009.

CHACKLEY, S. The neuroendocrinology of depression and chronic stress. **Britsh Medical Bulletin**, v.52, n.3, p.597-617,1996.

COSTA E SILVA, E.V. Manejo Reprodutivo de Machos e Fêmeas em Monta Natural (Ambientes Estressantes). In: IV SIMPÓSIO DE PRODUÇÃO DE GADO DE CORTE, Viçosa, **Anais...**Viçosa: UFV, 2004.CD-ROOM.

ENCARNAÇÃO, R.O. Estresse e produção animal. In: CICLO INTERNACIONAL DE PALESTRAS SOBRE BIOCLIMATOLOGIA ANIMAL, 1., 1989, Jaboticabal. **Anais...** Jaboticabal: FUNEP, 1989. p.111-29.

GRANDIN, T. Assessment of Stress during handling and transport. **Journal of Animal Science**, v.75, p.249-257,1997.

MINTON, J.E.; APPLE, J.K.; PARSONS, K.M. Stress-associated concentrations of plasma cortisol cannot account for reduced lymphocyte function and changes in serum enzymes in lambs exposed to restraint and isolation stress. **Journal Animal Science**, v.73, n.2, p.812-817, 1995.

KNOWLES,T.G. A review of the Road transport of slaughter sheep. **Veterinary Record**, London, v.143, p.212-219, 1998.

TADICH, N. et al. Effects of weaning and 48 h transport by Road and ferry on some blood indicators of wealfare in lambs. **Livestock Science**, v.121, p.132-136, 2009.

SAS. **User's Guide: basic and statistic**. Cary: SAS, 1965. p.1.686.

VON BOREL,E.H. The biology of stress and its application to livestock housing and transportation assesment. **Journal of Animal Science,** v.79, p.260-267, 2001.

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