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Stress indicators in steers at slaughtering

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ABSTRACT: This work aimed to assess the blood modifications of some slaughtering-linked stress hormones in cattle subject to butcher standardized procedures. The blood samples of 20 Limousine 12-13 months old steers have been collected before slaughtering, during lairage, and after stunning by captive bolt gun, during exsanguination. The plasma level of epinephrine, norepinephrine, cortisol and beta-endorphin have been assayed by EIA. The data indicate that catecholamines, cortisol and beta-endorphin did not significantly increase after stunning in these animals.

Key words: Cattle, Stress hormones, Slaughtering.

INTRODUCTION – It is well known that animals exposed to stress situations, such as transport and manipulation, react activating both the sympatic and the hypothalamic-pituitary-adrenal axis (Schaefer et al., 2001). The activation of the first axis determines the release of epinephrine and norepinephrine in the blood flow as a preparatory event: the animal perceives a problem and prepares its immediate reactions. The activation of the second axis determines the increase of cortical-adrenal hormones; therefore the blood cortisol increase is a consequence of the stress and, generally, this causes, in the first time, positive adaptation effects, even though not completely clarified (Sapolsky *et al.*, 2001). Also other physiological mechanisms, such as the opioid system (Nanda *et al.*, 1992), are involved in stress responses. As a consequence of these interactions, the determination of some stress hormones (catecholamines, cortisol, beta-endorphin) may offer an evaluation tool for testing animal welfare in adverse environment or management systems. These plasma indicators of stress may acquire further importance if conceived as a useful tool for highlighting the low attention to animal welfare, frequent in the slaughtering system (Grandin, 1994). In this research we have intended to evaluate the changes of some hormone plasma levels (epinephrine, norepinephrine, cortisol and beta endorphin) in bulls soon before and after the stunning.

MATERIAL AND METHODS – This study was carried out in Sannicandro Garganico (Foggia – Italy) commercial slaughterhouse during spring 2005. 20 Limousine 12-13 months old steers, reared for fattening in province of Foggia, have been used. The animals had reached the slaughterhouse 2 hour before stunning, coming from a near farm and after short road transport (<50 Km). The handlig was the same for all animals. Mean live weight at their arrival at the slaughter was 458 ± 21 Kg. They had access to water but no food. A blood sample was collected from the tail vein of all subjects in lairage, at 8.30 a.m., *2* hours before stunning. The distance between the lairage area and the stunning box, approximately 40 meters (131,23 feet), was covered in 1 min. The animals were conducted by the operator with a halter and tied up, and waited before stunning for about 45 min. After stunning by captive bullet blood samples were collected directly during exsanguination. All procedures have been conducted according to legislation on animal welfare. The slaughter-operators involved during the management procedures had been adequately trained in order to minimize all further stressor to the animals, but the usual timing of these operations were not been varied. The samples, collected into prechilled Vacutainer® EDTA 10 ml, were immediately refrigerated, transported to laboratory, separated after centrifugation (at + 4° C for 10 min at 1500xg) and stored at -20°C until they were analysed by EIA (MP Biomedicals for the catecolamines, MBS for cortisol and Peninsula Laboratories for beta-endorphin). All samples were processed in 1 day using the enzyme immunoassay protocol procedure reccomended by the supplier to minimize variability. One way analysis (ANOVA) have been used to analyse statistical differences among data. The data are presented as the mean ± S.E. Differences were considered significant with a value of $P < 0.05$.

Figure 1. Epinephrine

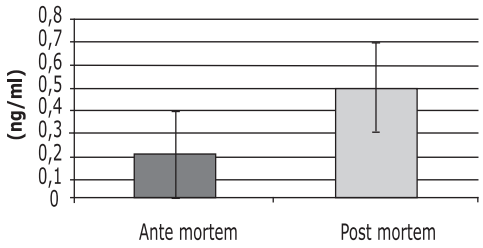


Figure 2. Norepinephrine

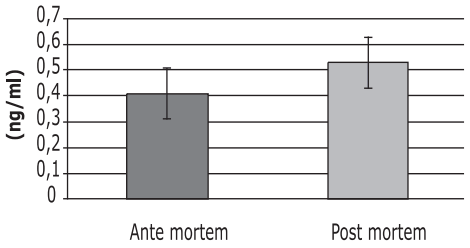


Figure 3. Cortisol

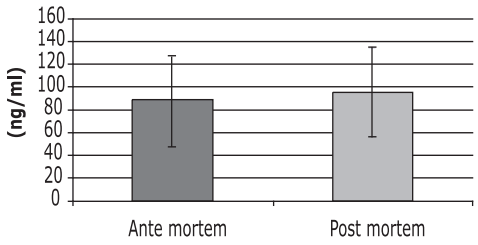
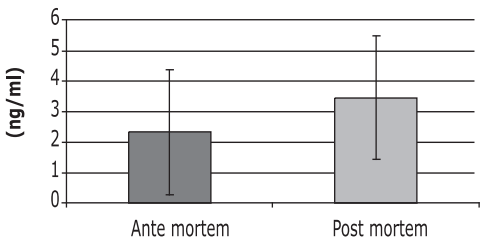


Figure 4. Beta endorphin



RESULTS AND CONCLUSIONS – The mean plasma concentrations of the selected stress-linked hormones are reported in the figures. According to consulted literature we can observe a great individual variance for all parameters. The epinephrine level (Figure 1) increases in the animals from 0.2 ng/ml before to 0.5 ng/ml after the stunning. The increase is not statistically significant. The norepinephrine (Figure 2) increases from 0.4 ng/ml before to 0.5 ng/ml at exsanguination, but the increase is not significant. Also the cortisol content (Figure 3), highly variable (Bertoni *et al.*, 2005; Dunn *et al.*, 1990; Lay *et al.*, 1992; Mitchell *et al.*, 1988; Tume and Shaw, 1992; Zavy *et al.*, 1992), increases after stunning from 89.1 ng/ml to 95.5 ng/ml, without any statistical significance. The plasma concentration of the beta-endorphin before and after stunning (Figure 4) changes a little but without statistical significance between the two samples, increasing from 2.3 ng/ml to 2.6 ng/ml. From the analysis of the collected data in these steers we can observe that, although all parameters of the considered hormones tend to raise, their increase is not statistically significant. Several studies have examined the effects of different stressors (transport, restraint, isolation, environmental adaptation, management and human interactions) on behavioral and physiological changes (Fazio *et al.* 2001, 2002; Hollenbeck *et al.*, 2002; Apple *et al.*, 2005) in cattle. In most cases, an elevation in cortisol, in epinephrine, norepinephrine and beta-endorphin plasma levels was recorded. Moreover a less respons was showed too, probably depending on the specific breed or when comparing aggressive with calm subjects. Hollenbeck *et al.*, (2002) compared the extent to which the adrenal glands from diverse Bos indicus and Bos taurus breed types of beef steers respond, and confirmed different basal value of cortisol and that adrenal responsiveness to exogenous ACTH differs significantly among breed types of beef cattle. Therefore very different results are reported among cattle stress responsiveness.

In conclusion we think that the not significant increase of the tested hormones may be due to the domestication and the docility of this breed, together with a good operating management.

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