

Stress response of extensively reared young bulls being transported to growing-finishing farms under Spanish summer commercial conditions

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Received 24 October 2007; received in revised form 7 April 2008; accepted 7 April 2008

Abstract

To evaluate the effect of Spanish summer commercial journeys on the stress response of young bulls born and reared under extensive conditions, 2 replicates of a transport from an assembly centre to a growing-finishing farm were studied. Journeys lasted 27 h, involving a total of 62 young bulls. Variables under study included haematocrit, red blood cell count (RBC), total white blood cell count (WBC), differential WBC counts, serum haptoglobin (Hp), cortisol, glucose, creatine phosphokinase (CPK), lactate dehydrogenase (LDH), total protein, and albumin at loading, at the end of an intermediate market stop, and at the unloading. Before the beginning of the journey elevated WBC and neutrophil counts, and high Hp values were detected, reflecting high stress levels probably as a consequence of previous procedures associated with the grouping at the assembly centre. Some stress was also detected at the end of the market stop, with cortisol increasing from 6.5 to 12.6 ± 2.0 ng/mL ($P < 0.001$), although a change in Hp concentration was not observed. Neither CPK and LDH activities, related to muscular tissue damage, nor haematocrit and RBC count, related to dehydration revealed a significant effect of this first stage of the journey on the physical stress of the young bulls. Subsequent 13 h transport to the growing-finishing farm induced an increase in Hp levels from 0.48 to 0.78 ± 0.16 mg/mL ($P < 0.001$), reflecting an onset of the acute stress response, although cortisol levels immediately after the unloading were similar to those found before loading at the market, suggesting that calves got accustomed to transport. At the end of the journey some dehydration and physical stress were also detected. Overall, our study provides new information to the discussion of the effect of temperatures during cattle transport. Although an improvement in pre-transport conditions is essential if the welfare of assembled and transported cattle is to be improved, the stress-related alteration of cattle physiology under Spanish summer commercial transport conditions is similar to that observed under colder conditions.

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Keywords: Acute stress response; Temperature; Transport; Welfare; Young bulls

1. Introduction

Growing and finishing calves in farms different from those where they were born is a common commercial practice in beef cattle production. The Spanish North-

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western, Atlantic region provides calves that, once weaned, are transported to growing-finishing farms situated in the North-eastern, Mediterranean region. Both regions have different climatic typologies that become more accentuated, within each region, due to a strong seasonal effect. Summer temperatures are usually high, with average maximum values between 18 and 20 °C in the Atlantic region, and between 21 and 25 °C in the Mediterranean region (Elías and Ruiz, 1973).

There is growing concern about the welfare of livestock species during transport. Welfare may be defined as the state of an animal as regards its attempts to cope with its environment (Broom, 1986), and it is known that transport is associated with a stress response that may affect physiology and behaviour of cattle, with a negative effect on their health and welfare, as well as on productivity, and meat and carcass quality (Tarrant et al., 1992; Tarrant and Grandin, 2000; Buckham Sporer et al., 2007; Gupta et al., 2007). There are a number of blood parameters affected by transport stress (Crookshank et al., 1979) that may be used as welfare indicators. Stress is reflected both physically and psychologically, so that the activation of the sympatho-adrenal axis (Saunders and Straub, 2002) and the hypothalamic-pituitary-adrenal (HPA) axis (Haddad et al., 2002) affect immunity blood cell counts and cortisol levels respectively, both of them being widely used as welfare indicators. Additionally, stress-related physiological changes are associated to changes in blood glucose levels and different muscle enzyme activities such as CPK, the latter being also associated with muscle tissue injury (Stephens, 1980; Tripp and Schmitz, 1982). Other blood variables such as total protein, albumin, and other haematological variables have also been proposed as physiological indicators of dehydration during transport (Knowles and Warriss, 2000), which might be of particular importance in the assessment of welfare under hot conditions.

Acute phase proteins (APP), a group of molecules showing changes in their concentration in animals subjected to internal or external challenges, have been proposed as welfare indicators as well (Eckersall, 2000; Murata et al., 2004), being widely used in current research. Despite this the APP mechanisms remain unclear, although an hypothesis on a neuroendocrine-immune network was proposed recently (Murata, 2007) and was confirmed in pigs (Piñeiro et al., 2007). Nevertheless, little knowledge exists with respect to other species. Haptoglobin (Hp), the major acute phase protein for bovine species, together with other physiological variables, may therefore be useful in determining the influence of transport on cattle (Murata and Miyamoto, 1993; Arthington et al., 2003).

Literature has extensively reviewed those journey aspects with a potential effect on cattle (Tarrant, 1990; Knowles, 1995, 1999), with two main factors being the journey duration and the environmental conditions during transport. Many studies support the notion that long duration journeys are detrimental to the health, the welfare, and meat quality of cattle (Kent and Ewbank, 1983, 1986a,b; Tarrant et al., 1992; Knowles et al., 1999a,b; Gallo et al., 2003; Minka and Ayo, 2007; Qiu et al., 2007). Recent studies have also shown that both high and low temperatures during the journey affect livestock species, with a negative effect on their welfare and, in extreme cases, causing death (Gosálvez et al., 2006; Malena et al., 2006; Averós et al., 2007, accepted for publication). Although some particular information on carcass problems related to the welfare of cattle transported to slaughter under hot and dry conditions is currently available (Minka and Ayo, 2007), little is

Table 1
Summary of the experimental conditions of the journeys of young bulls reared under extensive conditions transported to growing-finishing farms

	Journey A	Journey B
<i>Animals</i>		
<i>n</i>	32	30
Breed	Asturiana	Asturiana
Average weight (kg)	162	160
<i>Short transport</i>		
Distance (km)	92	92
Duration (min)	120	130
Stocking density (m ² /animal)	0.56	0.60
Bedding	Straw	Straw
Water availability	No	No
<i>Market stop</i>		
Resting time (h)	13	11
Bedding	Straw	Straw
Water availability	Yes	Yes
<i>Long transport</i>		
Distance (km)	730	730
Duration (min)	720	840
Stocking density (m ² /animal)	0.71	0.71
Bedding	Straw	Straw
Water availability	Yes	Yes
<i>Blood collection timing</i>		
Loading at the assembly centre (hour of the day)	2100	2100
Loading after the market stop (hour of the day)	1200	1200
Unloading at the growing-finishing farm (hour of the day)	0100	0100

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