EVALUATING THE STRESS OF PRODUCTION IN CATTLE USING HAPTOGLOBIN

Slocombe LL, Colditz IG
Cooperative Research Centre for Cattle and Beef Quality, University of New England, Armidale, Australia, CSIRO Livestock Industries, FD McMaster Laboratories, Armidale, Australia
Email: Lysandra.Slocombe@csiro.au

Introduction

Cattle production, whether intensive or extensive, exposes animals to a variety of stressors. These stressors can reduce growth through, altered priorities for nutrient utilization, and reduce disease resistance through immunosuppression. Evaluating the stress placed on cattle by a production environment or during a management procedure is not easy, because commonly measured indicators such as cortisol peak and decline rapidly. The acute phase protein haptoglobin (Hp) is a good candidate for measuring stress in cattle due to its half life of 2-4 days (Jain 1993) and its latency to peak (approximately 24-48 hours). These characteristics provide a broad window in which animals can be blood sampled. The aims of this research were firstly to develop a method for measuring Hp which can deal with variable levels of haemolysis in samples and secondly to quantify Hp expression in response to different production stressors.

Materials and Methods

The method used for measuring Hp in cattle plasma was based on the method of Jones and Mould (1984), which uses the preserved peroxidase activity of the haemoglobin-haptoglobin complex to oxidise a chromogen. A method was developed to correct for the variable levels of haemolysis that can occur at the time of sampling. This is achieved by measuring the endogenous peroxidase in each sample and free haemoglobin (Hb) resulting from haemolysis. Endogenous peroxidase is measured in each sample by substituting methemoglobin with saline. The Hb level within the plasma sample is then measured using a modification of the method described by Levinson and Goldman (1982), before being converted into its contributed Hp interference from the predetermined relationship: (Hp=0.118Hb +0.015; r2=0.97). The Hp values attributed to endogenous peroxidase activity and free Hb are then subtracted from the apparent Hp value determined in the Hp assay to yield a corrected Hp value. Thus

Corrected Hp = Apparent Hp – (Hp due to endogenous peroxidase activity + Hp due to free haemoglobin).

Blood samples from cattle undergoing different production stressors (weaning, transportation, social re-grouping and intensive management in a feedlot) were assessed for their Hp content. Comparisons were: unweaned versus weaned for 7 days post weaning; before and after transport for 150 km; prior to and during feedlot finishing, and control groups and groups mixed with unfamiliar cattle during feedlot finishing. Hp values were transformed using a natural log scale to obtain a normalised distribution.

Results

The effect of the different production stressors on Hp levels (range) are shown in Table 1.

Table 1: Production Stressors and their haptoglobin ranges

Stressor	Number of Animals	Hp Control Range (mg/ml)	Hp Treatment Range (mg/ml)	T-value*	P-value*
Weaning	38	0.000 to 0.259	0.000 to 1.476	t = -2.276	P = 0.025
Road Transportation	110	0.016 to 0.829	0.000 to 0.565	t = -1.986	P = 0.050
Intensive Management	96	0.011 to 0.148	0.000 to 0.853	t = -3.553	P = 0.001
Re-grouping	210	0.000 to 2.853	0.001 to 3.930	t = -3.293	P = 0.001

* The values presented here are from the transformed data

Discussion

Preliminary analyses have examined the main treatment effect on Hp but not on the other parameters measured (haematology and production traits such as weight gain). It appears as though production stressors increase plasma Hp concentration to varying degrees. Further analyses of these data will examine associations between Hp levels and production variables.

Jain NC (1993). Essentials of Veterinary Hematology; p354
Jones GE and Mould DL (1984). Research in Veterinary Science. 37:p87-92.
Levinson SS and Goldman J (1982). Clinical Chemistry. 28(3):pp471-474.