THE INFLUENCE OF SOME TRANSPORT ASSOCIATED FACTORS ON HEART RATE RESPONSE IN SHEEP

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INTRODUCTION

This study is part of a multidisciplinary project aimed to assess transport stress in sheep, by evaluating several physiological, immunological and behavioural parameters.

AIM OF THE STUDY

To study the effect of stationary or moving vehicle, road type and slope on the variation of heart rate (HR) response in transported sheep.

MATERIALS AND METHODS

Animals and Treatments

The experiment was carried out on a group of 5 sheep randomly selected within a group of 20. All 5 experimental subjects were individually captured into the sheepfold to be equipped with a Polar Accurex Plus HR monitor. Each sheep was marked with a different colour on its back, therefore released into a pen before to be loaded in the truck. The 5 sheep were transported within a larger group, of a total of 20 sheep with their lambs at foot. These animals were loaded on a truck and transported for a 4.30 hour journey along different type of roads. During the 4.30 hour journey, three stops occurred, but behaviour was always recorded. At the end of the transport the sheep were unloaded and released in a pen, freed from the equipment then released in the pasture.

Heart Rate Monitoring and Video Recording

HR was recorded at 1 minute interval. Journey and road conditions were video-recorded. Individual HR monitors were synchronized with the video camera clock in order to correlate HR changes, behavioural response and road conditions. Videos were analysed by Instantaneous Scan Sampling at 1 minute interval to record vehicle status (Stationary *vs* Movement) and road conditions. In particular, each minute of transport was described by two 4-point rating scales (Road Cornering Score and Road Slope Score) (Table 1).

Statistics

ANOVA procedure for repeated measures (SAS/STAT, 1990) and linear regression were used to analyse the behavioural and HR data.

RESULTS AND DISCUSSION

HR was significantly influenced by truck motion ($P<0.001$): HR values were significantly higher when the vehicle was moving (118,88 bpm ± 3.8) compare with when stationary (105.28 bpm ± 3.8) (Graph. 1). The increase related to the factor "Movement" was of 13.6 bpm, but this explained only the 5.4% of the total variability of the HR.

Overall road conditions (cornering and slope) had also a significant effect ($P<0.001$) on HR. In particular the "type of road" (Table 1, Graph. 2) was responsible of the 6.7% the total variability of the HR. HR proportionally increased with the difficulty of the travel conditions: means HR ranged

from 105.28 bpm ± 3.82 when the vehicle was stationary, to 118.10 ± 4.11 when the vehicle covered straight roads, up to 125.86 bpm ± 5.94 along cornering roads.
The factors "Cornering" and "Slope" shown to have a significant effect ($P<0.001$) also when the HR variation was analysed by the RCS and RSS (Table 1) (Graph. 3-6). In particular, HR proportionally increased of 5.3 bpm for each cornering score (RCS) (Graph. 3 and 5) and of 14.77 bpm for each increasing slope score (RSS) (Graph. 4 and 5). These results confirm that transport stress is elicited by multiple stressors, among them the movement of the vehicle itself and road conditions.

CONCLUSIONS

In conclusion, within the transport associated factors considered in this study, vehicle movement itself and increasing number of climbs seemed to be the most relevant. Stationary vehicle significantly reduced the sheep response to stress, as showed by the rapid decrease of HR values. Movement and different road conditions (in particular slope) elicited at the activation of the neurovegetative response stress in sheep. HR variations were strictly associated with type of road (RCS) and slope (RSS). This confirms the importance of good driving when the difficulty of the journey increases.

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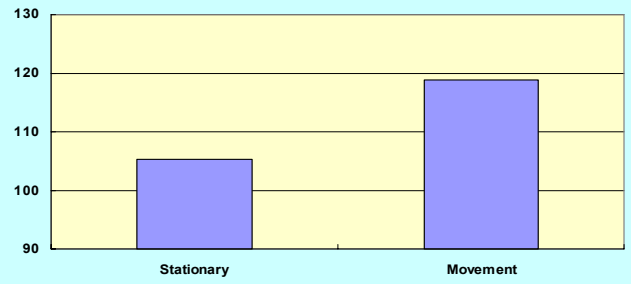
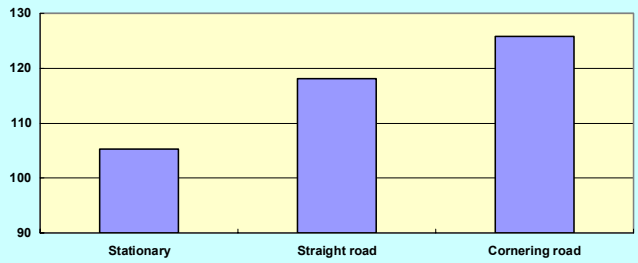
TABLE 1: ROAD CONDITIONS SCORE	
Road conditions	**Scores**
Movement *vs* Stationary Vehicle	Stationary = 0
	Movement = 1
Road Cornering Score (RCS)	Straight road (max 1 curve/min) = 1
	Straight-Cornering road (max 3 curves/min) = 2
	Cornering road (> 3 curves/min) = 3
Road Slope Score (RSS)	Level road (max 2 slope) = 1
	Slight slope road (3-6 slope) = 2
	Slope road (> 6 slope) = 3

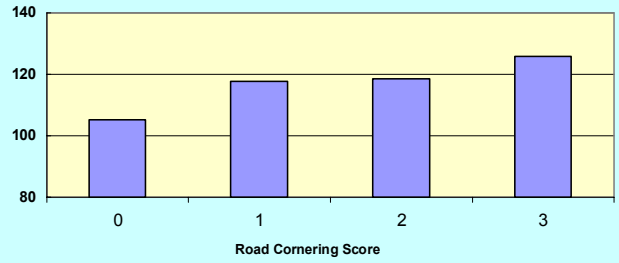
Graphic 1: Mean HR in stationary and moving vehicle



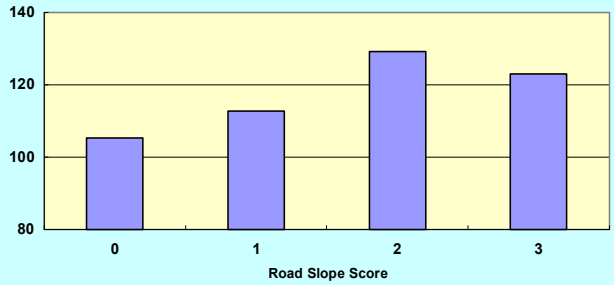
Graphic 2: Mean HR in relationship to the type of road (Cornering Score)



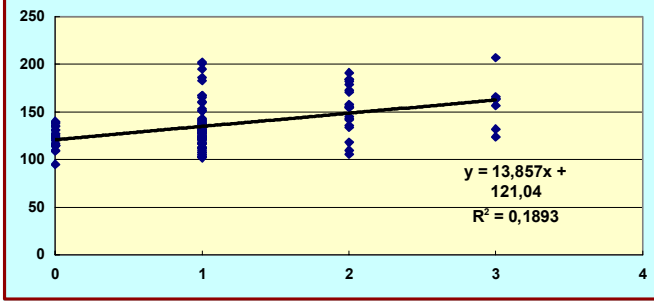
Graphic 3: HR means in relation with Road Cornering Score



Graphic 4: HR means in relation with Road Slope Score



Graphic 5: Mean HR and Cornering Score Regression



Graphic 6: Mean HR and Slope Score Regression