DEER WELFARE RESEARCH - RUAKURA FINDINGS

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INTRODUCTION

Velvet removal from farmed stags is a major area of welfare concern (Wilson, 1989) This concern arises from the perception that significant stress occurs when the velvet is cut Matthews *et al* (1990) reported that handling and yarding of stags prior to velvet removal is somewhat stressful, and that the process of removing the velvet under analgesia did not appear to cause additional stress Stress was assessed using a variety of behavioural indicators, together with measures of electrocardiogram (ECG) disturbance and changes in plasma chemical and progesterone levels Another technique that has been used to assess stress in deer is the change in plasma cortisol levels following handling (Smith and Dobson, 1990)

The first experiment reports on the plasma cortisol profiles in the stags velvetted in the study mentioned above

EXPERIMENT 1

Methods

The full details of the animals and procedure used are presented in Matthews *et al* (1990) Briefly, 18 mature stags were subjected to three handling-drug treatments at weekly intervals The treatments were

1 velvet removal under local anaesthesia (10 ml lignocaine hydrochloride given as a nerve block) and chemical restraint (xylazine 0 9 mg/kg IM),

2 velvet removal under local anaesthesia alone, or

3 administration of the drugs without velvet removal

Another group of animals (controls) was restrained in the crush (no manipulation) on each of three occasions On the fourth occasion the hard antlers were removed from these animals without using drugs

Blood samples were obtained via jugular catheters at regular intervals before, during and up to 24 hr following the manipulations Cortisol was assayed by radioimmunoassay (RIA) after an indirect extraction procedure

Results

Within a particular drug treatment there were no significant differences in plasma cortisol levels between animals that were deantlered and those left intact Therefore, the data within treatments were combined and the averaged plasma cortisol values during the experiment are shown in Figure 1 The cortisol levels of the control animals in the hard antler (removal) stage were markedly lower than in the velvet (non-removal) stage Thus, the cortisol data for the two stages are shown separately in Figure 1

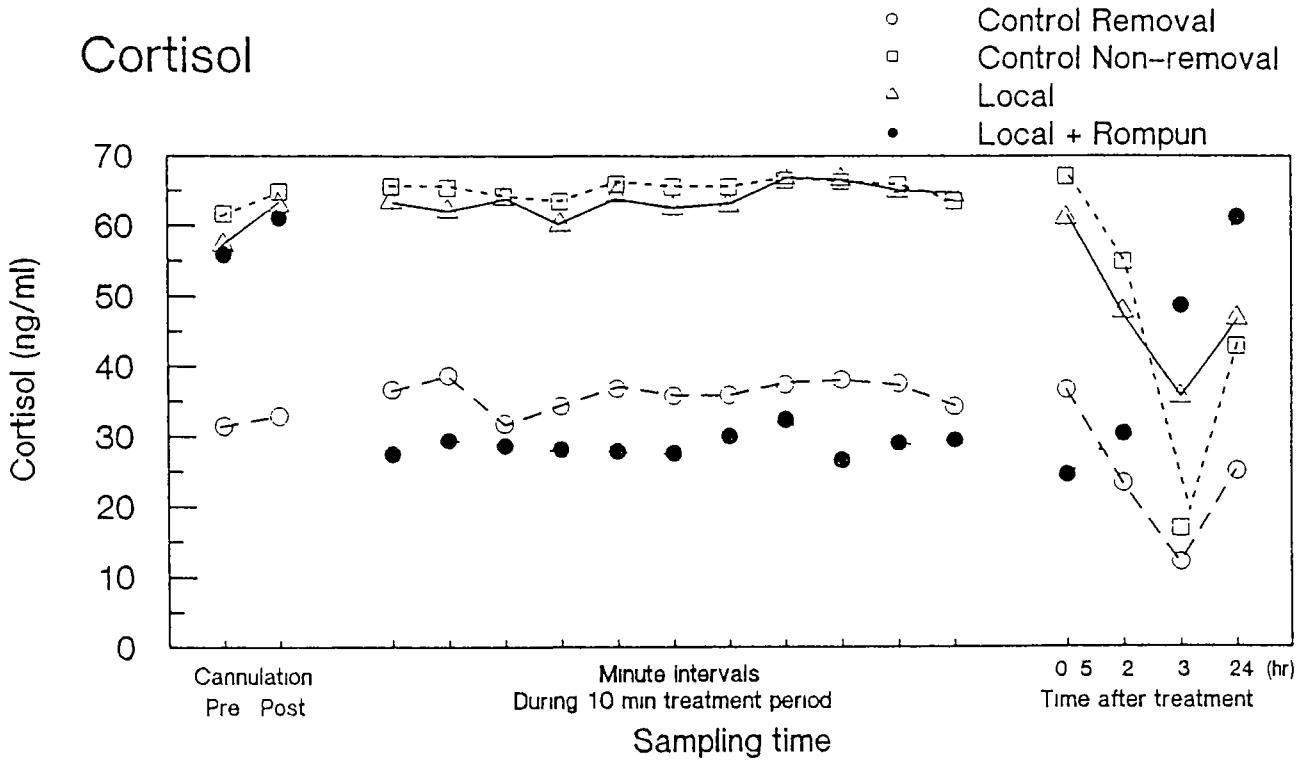

Fig. 1 Plasma cortisol levels during each phase of the treatments

Cortisol levels tended to increase during cannulation for all groups For all animals restrained in the crush, cortisol levels remained steady during the (nominal) velvet removal period, declined to about one-half of baseline values over the next 2-3 hrs and returned to about 75% of baseline at the 24 hr sampling Although the magnitude of the cortisol levels differed in the control animals between the removal and non-removal treatments, the pattern of change during the two treatments was similar

Plasma levels of cortisol in the chemically-restrained animals fell to 50% of baseline values and remained low throughout the immobilisation period There was a gradual return to baseline values over the following 24 hr

Discussion

Cortisol levels in stags appear to be a sensitive measure of stress as the plasma levels of this hormone increased following the initial yarding, restraint and insertion of the catheter The absence of a difference in the cortisol profiles between velvetted and non-velvetted stags suggests that velvet removal was not a major source of stress This supports observations by MacIntosh (pers comm) who showed that cortisol levels in velvetted and non-velvetted stags were similar, and the results of the previous study by Matthews *et al* (1990) where a variety of other hormonal and behavioural indicators were used to assess stress during velvet harvesting

The similarity of the cortisol profiles (present study) and the progesterone profiles (previous study) suggests that either hormone could be used as a stress indicator, although both would appear unsuitable for use in chemically-restrained animals due to the suppressive effects of xylazine on the plasma hormone levels

EXPERIMENT 2

The results of Experiment 1 and the earlier study (Matthews *et al* 1990) showed that stress in deer can be assessed reliably using a variety of measures of behaviour, endocrine hormones and the ECG These measures indicated that handling prior to velvet harvesting rather than velvet removal itself was somewhat stressful

The significance of this result to the overall welfare of deer can be better assessed by making a comparison of the relative stressfulness of a range of other handling and management practices

This experiment evaluated the effects of ear tagging and velvet removal in spikers with and without the use of local anaesthetic in yearling stags

Methods

Animals

Fifteen one-year old red deer spikers were used Animals were grazed in 0 5 ha paddocks and drafted off from the main group of about 25 animals on the morning of the study

Procedure

The general procedure was similar to that used in Experiment 1 and the previous study (Matthews *et al* 1990) Animals were assigned at random to the treatments listed in Table 1 Two animals only were used in the velvet only treatment to limit the number of animals subjected to a potentially stressful procedure Handling treatments comprised method of velvet removal (lopping with pruning shears or sawing) use of a local anaesthetic (20 ml lignocaine hydrochloride perfused s c around the base of the pedicle serving as a ring block) or no anaesthetic and ear tagging A control procedure involved yarding only (no crush restraint, cannulation, blood sampling or ECG measurement)

Table 1 Sequence of experimental conditions

n	Handling Treatment	
	Left Velvet (or ear)	Right Velvet
2	RB + VL	RB + VS
2	RB + VS	RB + VL
1	VL	VS
1	VS	VL
3	ET	-
6	C	C

RB = ring block
VL = velvet removed with pruning shears
VS = velvet removed using a saw
ET = ear tag inserted in left ear
C = yarded only (no crush restraint or velvet removal)

Each experimental animal was cannulated (in the jugular) while restrained in a crush 1 to 2 hr prior to treatment, brought back to and held in the crush for 35 min while a handling treatment was administered, and lastly released to pasture with other animals in the group

ECG recordings were made for the duration of the 35 min crush restraint period The recordings were made using three sterile subdermal electrodes inserted behind the shoulder and the data were stored on tape for later analysis The behaviour of the animals during all manipulations and at pasture were recorded

Blood samples were obtained pre- and post-cannulation, and at -5, -2, 0, +1, 5, 10, 20, 30 and 70 min and +2, 3 and 24 hr relative to the time of treatment The levels of cortisol and progesterone in the plasma were determined using extracted RIA procedures, the ECG was analysed for heart rate and cardiac cycle disturbance, and the behavioural reactions were scored for intensity of movement at the time of treatment

Results

Behaviour During Treatment

The spikers generally moved onto the crush without requiring much assistance and remained calm while restrained The behaviours during ear tagging or velvet removal were scored as either no movement, some, moderate or strong movement and are summarised in Table 2

As there were no obvious differences in the reactions to the two velvet removal procedures Therefore, the data for sawing and lopping were combined There was little movement in response to velvet removal under anaesthesia, a moderate to strong response when no anaesthetic was used, and a consistently strong reaction to ear tagging (1 to 2 sec)

Table 2 Number of animals in each behaviour movement category

Handling procedure	Behavioural Reaction			
	None	Some	Moderate	Strong
Ring block + velvet	4	4		
Velvet only			2	2
Ear tagging				3

Behaviour at Pasture

The proportion of time spent in each activity (walking, standing, grazing, lying) during successive half-hour periods was averaged across individuals within treatment and control groups Although there was a tendency for yarded animals to graze sooner and walk less than the remaining animals there were no significant differences between the handled groups for all behaviours Therefore, the data for all these groups was combined in subsequent analyses

The percentages of time spent in each activity throughout the afternoon and following morning are shown in Figure 2 for both the handled and undisturbed control animals The handled groups spent much time (about 70%) walking and pacing the fencelines upon release to pasture About 15% of the time was spent grazing and 15% standing Animals began to lie down 3 hr after release In contrast, the undisturbed controls tended to spend much time grazing or lying and little time walking, except for early in the morning

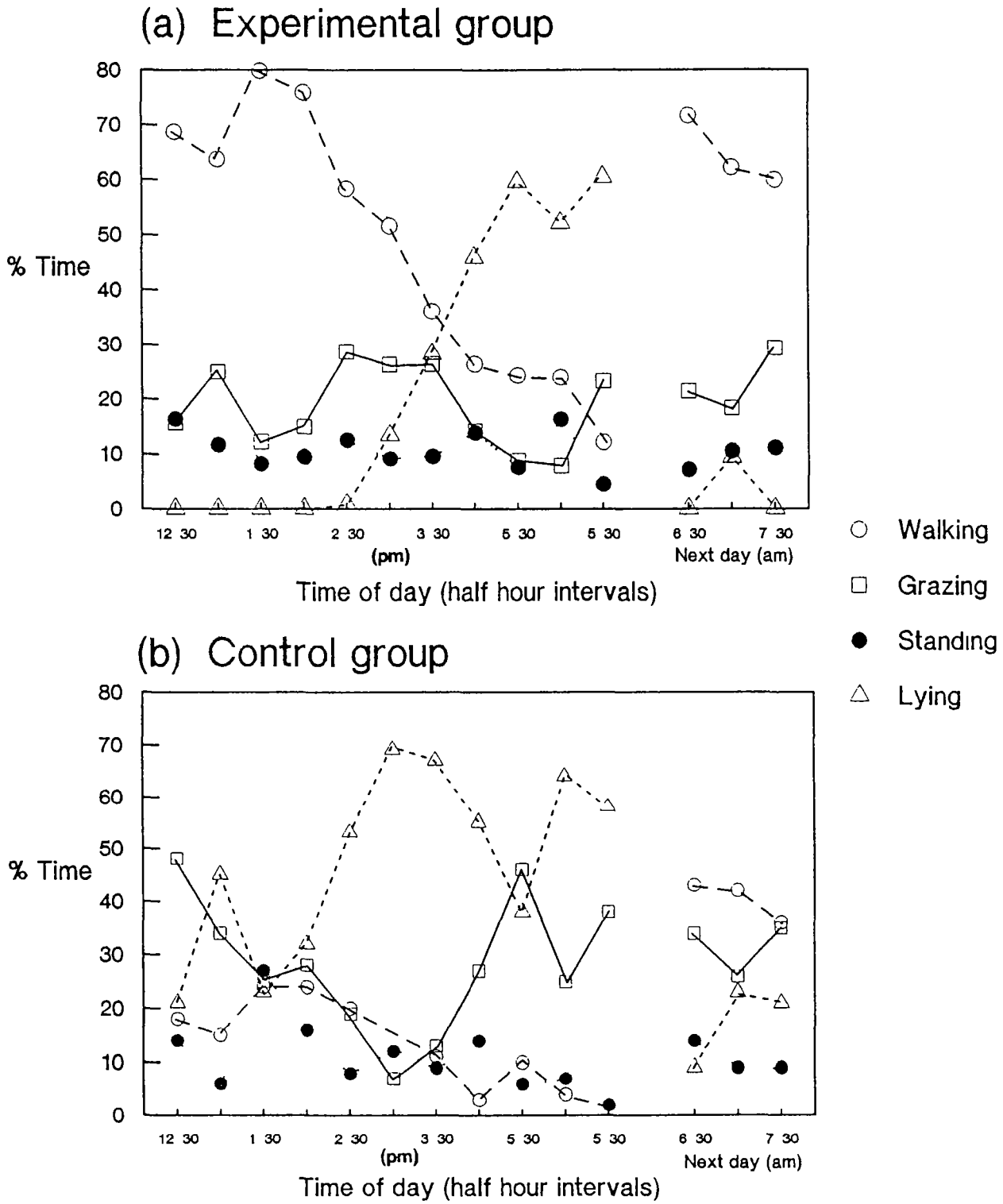

Fig. 2 Percent of time spent in each activity by the experimental animals (a) and undisturbed controls (b) throughout the day.

Plasma Hormones

As there was no significant effect of the method of velvet removal (sawing or lopping) on changes in plasma hormone levels these data were combined Figure 3 shows the changes in plasma cortisol and progesterone levels for animals velvetted with and without anaesthetics, and for ear tagged animals

There were no significant differences between treatments in the plasma levels of either cortisol or progesterone However, the concentrations of both hormones did vary during the experiment

Cortisol levels increased by about 20% during cannulation, peaked at 60% above baseline 25 min after entering the crush, and returned to baseline levels 2 hr later Cortisol concentrations were below baseline 3 hr and 24 hr after handling

Progesterone levels increased by about 35% during cannulation and peaked at four times baseline levels 25 min after crush entry before declining to baseline levels, and below, 1 to 24 hr post-handling

ECG

Heart rates before (2 minute period), during and after (2 minute period) each manipulation are shown in Table 3

As heart rates did not differ with method of velvet removal (sawing and lopping) the combined data only are presented in the Table. Heart rate did not change during the administration of the local anaesthetic. There was a moderate tachycardia during velvet removal under anaesthesia, which returned to baseline within 2 minutes of velvetting When no ring block was used there was a two-fold

Table 3 Heart rates before, during and after each treatment

Manipulation	Before	During	After
Ring block administration	86	83	76
Ring block + velvet	84	105	93
Velvet only	78	189	133
Ear tagging	82	167	102

increase in heart rate in response to both ear tagging and velvet removal Heart rates remained above baseline in the 2 minutes post-treatment for both manipulations Four minutes post-handling the heart rates had returned to pre-manipulation levels in ear tagged animals but remained slightly elevated in velvetted spikers.

Discussion

The rise in plasma hormones and increase in walking activity in spikers exposed to each handling treatment suggests that some aspect(s) of the manipulations were stressful The similarity of these stress responses between treatment groups suggests that some handling practice common to all manipulations and not the treatments per se (ie velvet removal with or without anaesthetics, or ear tagging) caused the stress responses

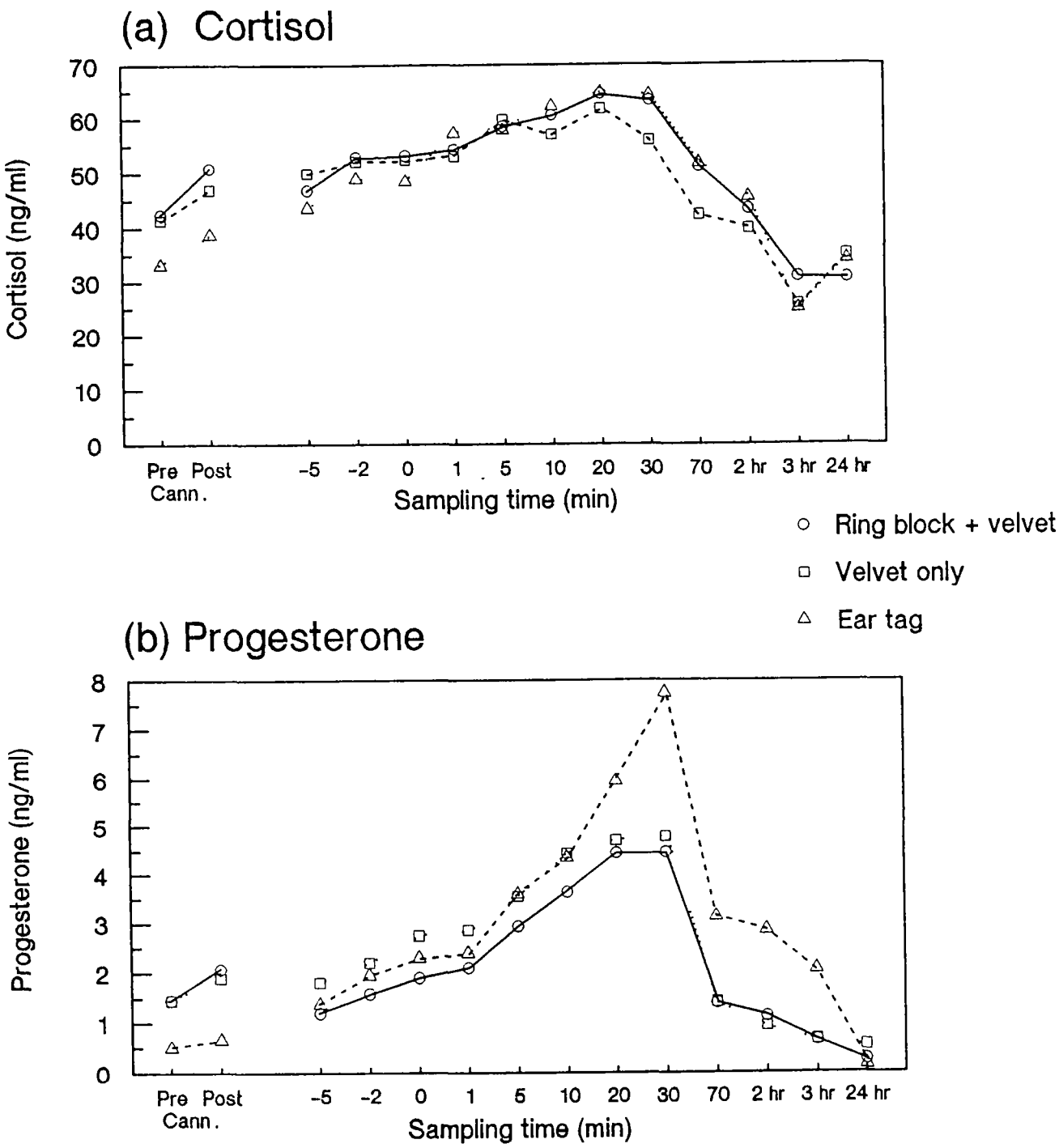

Fig.3 Plasma cortisol (a), and progesterone (b) levels during each phase of the treatments.

Handling common to all groups included collection from pasture, yarding, drafting and confinement indoors In addition, the experimental groups were subjected to restraint in a crush, catheterisation, blood sampling and isolation

Matthews *et al* (1990) also suggested that these common practices were the major cause of the stress responses They showed that there were no differences in the behavioural or physiological reactions between animals that were restrained only or restrained and velvetted under local anaesthetic In addition, Smith and Dobson (1990) reported that herding and yarding of red deer is associated with elevated cortisol levels and stress

There were differences in the behavioural reactions and heart rate changes between manipulations at the time of application of the treatments The stronger reactions associated with ear tagging and velvet removal without anaesthetics are suggestive of a pain response (Moreton and Griffiths, 1985) The absence of a difference between treatments on the other measures of stress suggests that the degree of pain experienced may not have been that great This is supported by the observed short duration of the behavioural reactions and the rapid decline in heart rates to pre-manipulation levels On the other hand, stress responses to the initial handling and restraint may have masked any effects of subsequent treatments on the hormonal parameters or behavioural changes at pasture Investigation of a greater range of routine farming practices using a variety of behavioural, hormonal and ECG measures is required before we can make firm recommendations on the degree of stress experienced Nevertheless, the reduced behavioural and heart rate changes observed when velvetting was carried out using a ring block demonstrates the benefits for animal welfare from the use of anaesthetics during painful manipulations

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