# COMPARATIVE RESPONSES OF BULLS AND STEERS TO TRANSPORTATION

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Seven groups of six bulls and seven groups of six steers were transported separately by truck for either 10 min or 2 h. Body weight, rectal temperature, respiratory rate, serum cortisol, and a chute score were recorded before and after trucking. Heart rate was monitored by telemetry in one animal per group. The bulls were significantly heavier than the steers (513 vs. 473 kg), and had significantly lower serum cortisol levels (1.9 vs. 4.8 μmg/dL). The steers showed a significantly greater increase in rectal temperature than the bulls during the 2-h haul (0.5 vs. 0°C); there were no other statistically significant differences between the two genders. Overall, the reactions of the bulls and steers to trucking were similar and minor. The longer haul caused a greater percentage weight loss (2.2 vs. 1.6%) than the shorter haul. It is concluded that transportation by road for up to 2 h need not be a stressful experience to bulls or steers.

Key words: Transportation, steers, bulls, stress

[Effet comparatif du transport sur les taureaux et les bouvillons.]
Titre abrégé: Transport de taureaux et de bouvillons.
Sept groupes de six taureaux et de six bouvillons chacun ont été transportés séparément par camion pendant 10 mm ou 2 heures. Le poids corporel, la température rectale, le taux respiratoire, la teneur en cortisol sérique et le comportement en couloir ont été enregistrés avant et après le transport. Le rythme cardiaque a été suivi de près par télémétrie chez un animal par groupe. Les taureaux sont significativement plus lourds que les bouvillons (513 contre 473 kg) et présentent des teneurs en cortisol sérique significativement plus faibles (1,9 contre 4,8 μg/dL). Les bouvillons affichent une plus grande élévation significative de la température rectale que les taureaux au cours du transport de 2 heures (0,5 contre 0°C), mais il n'existe pas d'autres différences statistiquement significatives entre les deux genres. Dans l'ensemble, les réactions des taureaux et des bouvillons au transport sont comparables et peu marquées. Cependant, le transport le plus long entraîne une plus grande perte de poids relative (2,2 contre 1,6%) que le transport plus court. Les auteurs concluent que le transport par camion pendant 2 heures aux maximum ne représente pas une expérience agressante pour les taureaux ni les bouvillons.

Mots clés: Transport, stress, taureaux, bouvillons

There is a considerable body of information showing that bulls in feedlots grow faster and more efficiently than steers (Field 1971; Jones et al. 1981) and that bull carcasses are leaner and more likely than steer carcasses to achieve a Canada A1 grade. The feeding and marketing of bulls for beef may pose some management problems not encountered with steers — fighting and riding among bulls in the feedlot, and stress re-

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sulting from encounters among unfamiliar bulls during marketing. The latter has been shown to precipitate a high proportion of dark cutting carcasses (Price and Tennessen 1981) resulting in downgrading. Bulls are more susceptible than steers to this type of stress (Tennessen et al. 1983).

Another possible preslaughter stressor is the handling and transportation that takes place when cattle are moved from feedlot to abattoir. Taylor (1978) argued that hunger, thirst, fatigue, and unfamiliar environmental stimuli all act as possible stressors during transportation. Grandin (1978) suggested that exposure to changes in temperature, noxious exhaust fumes and frightening noises during transportation may be disturbing to livestock. In this connection, it has been found that the frequency of dark-cutting beef from bulls increases with the time elapsed between departure from the feedlot and arrival at the abattoir (Monin and Royant 1980).

But do bulls and steers respond similarly to truck transportation? The answer has a bearing on the economic feasibility of the husbandry of young bulls. The purpose of this study was to compare the responses of bulls and steers to transportation by road.

## MATERIALS AND METHODS

The experimental cattle were male crossbreds born and raised at The University of Alberta Ranch, Kinsella, Alberta. Half of the cattle had been selected at random and castrated at 1–3 mo of age. After weaning at 5–6 mo the cattle were fed a high-energy, mainly grain diet and were held in groups of eight to ten in single-gender pens. At 15–16 mo of age, seven lots of six bulls and seven lots of six steers were transported by truck in pen lots for either 10 min (four lots) or for 2 h (three lots). The longer period was intended to mimic the time needed to transport cattle from the Ranch to an abattoir in Edmonton. The shorter period was used to evaluate the combined effect of loading-and-leaving and arriving-and-unloading. The truck held six animals at a density of approximately 1.5 $m^2 \cdot head^{-1}$. The longer haul was undertaken on good paved road, except for a 0.5-km stretch of road between the ranch and the main highway. Speed was kept at roughly 75–80 $kg \cdot h^{-1}$. The 10-min haul took place entirely on gravel road. The experiment was carried out over a period of 5 wk. Trucking of bulls and steers was performed alternately, as were pairs of short and long trips. Ambient temperature during the experiment ranged from 17 to 28°C.

Body weight, rectal temperature, respiratory rate (based on movements of the animal's flank while breathing), and a chute score 1 (docile) to 6 (wild) (Heisler 1979) were recorded before loading and after unloading, and at the same time a blood sample was collected via the caudal vein. The blood samples were assayed for serum cortisol by means of a solid-phase $^{125}I$ radioimmunoassay kit (Diagnostic Products Corporation, Los Angeles, Calif.). In addition, 0.5 h before transport one animal chosen at random from each lot was fitted with a VHF radio telemetry system (Biotelemetry Systems Inc., Rush, New York) which allowed heart rate to be monitored during the trucking. The transmitter was mounted on a harness which was attached to the animal. Two self-adhesive Stress Test Electrodes (3M Corporation, Minneapolis, Minn.) were fastened to the skin, one underneath the harness between the scapulae, and the other about 60 cm behind the harness.

Data were analyzed by least squares analysis of variance (Harvey 1978).

## RESULTS

Bulls were significantly heavier than steers ($P = 0.001$), and had considerably lower ($P < 0.001$) serum cortisol levels (Table 1) prior to loading. Steers had slightly lower respiratory rates than bulls ($P = 0.173$), but rectal temperatures and chute scores were similar.

There was a greater increase ($P = 0.004$) in rectal temperature in the steers than the bulls (Table 2); the difference was, however, apparent only on the longer haul, the interaction of hauling time and gender being significant ($P = 0.018$). No other significant gender effects were evident. The longer haul resulted in a greater percentage weight loss ($P < 0.001$) than the shorter haul; trucking time had no other significant effects. Heart rate data (Fig. 1) showed that a peak was reached as the animals were loaded onto the truck. Thereafter, heart rate

Table 1. Values of behavioral and physiological measures before loading onto trucks (means ± SE)

| | Body weight (kg) | Respiratory rate (breaths/min) | Rectal temp. (°C) | Serum cortisol (μg/dL) | Chute score† |
|---|---|---|---|---|---|
| Bulls | 513 ± 8.5 | 66.6 ± 2.0 | 39.2 ± 0.1 | 1.9 ± 0.2 | 2.5 ± 0.2 |
| Steers | 473 ± 8.6 | 62.7 ± 2.0 | 39.3 ± 0.1 | 4.8 ± 0.4 | 2.3 ± 0.2 |
| | $P = 0.001$* | $P = 0.173$ | $P = 0.510$ | $P < 0.001$* | $P = 0.637$ |

†1 = docile, 6 = wild (Heisler 1979).
*Level of probability considered to be significant.

Table 2. Physiological and behavioral responses of bulls and steers to truck transportation (means ± SE)

| | % weight loss | Increase in respiratory rate (breaths/min) | Increase in rectal temp. (°C) | Increase in serum cortisol (μg/dL) | Increase in chute score |
|---|---|---|---|---|---|
| *Two hours* | | | | | |
| Bulls | 2.2 ± 0.1 | 4.0 ± 2.8 | 0.0 ± 0.11 | 0.6 ± 0.6 | 0.1 ± 0.2 |
| Steers | 2.2 ± 0.1 | 3.7 ± 2.5 | 0.5 ± 0.10 | −0.1 ± 0.5 | 0.2 ± 0.2 |
| *Ten minutes* | | | | | |
| Bulls | 1.6 ± 0.2 | 0.3 ± 3.0 | 0.4 ± 0.10 | 0.0 ± 0.5 | −0.4 ± 0.2 |
| Steers | 1.6 ± 0.1 | 8.1 ± 2.9 | 0.4 ± 0.11 | 1.1 ± 0.6 | 0.3 ± 0.3 |
| Effect of gender | $P = 0.903$ | $P = 0.185$ | $P = 0.004$* | $P = 0.663$ | $P = 0.085$ |
| Effect of time | $P < 0.001$* | $P = 0.904$ | $P = 0.311$ | $P = 0.580$ | $P = 0.472$ |
| Effect of gender × time | $P = 0.999$ | $P = 0.158$ | $P = 0.018$* | $P = 0.106$ | $P = 0.208$ |

*Level of probability considered to be significant.

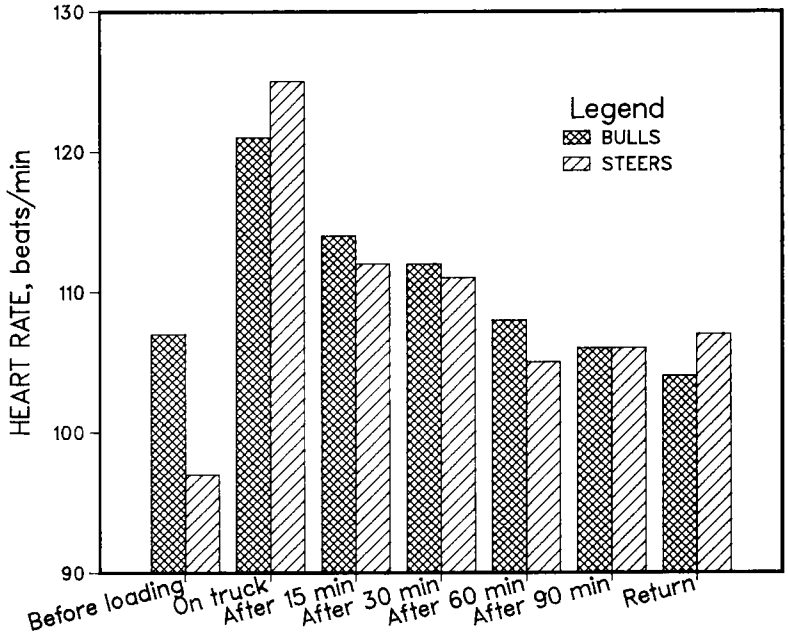


Fig. 1. The heart rate of bulls and steers transported for 2 h on paved highways. Values are means of three bulls and three steers.

decreased slightly during the 2 h of transport, but the differences between bulls and steers were not statistically significant.

## DISCUSSION

Few differences in response to transportation by 15- to 17-mo-old bulls and steers were found and neither gender was particularly disturbed by the experience. However, all animals were trucked in the company of pen-mates. Had they been regrouped among unfamiliar cattle considerable differences in physiological and behavioral parameters would have been expected due to the stress inherent in establishing new social relationships. In addition, factors likely to exacerbate the discomfort of trucking per se were kept to a minimum in this study: the cattle were loaded at optimum density; the road had a good surface and was free of heavy traffic; rapid changes in speed or direction were avoided. These factors may have contributed to the low impact of transportation.

The only large increase in heart rate occurred when the animals were loaded onto the truck (Fig. 1). The subsequent gradual decrease suggests that the animals were not stressed during the trucking. The increase in heart rate at loading may have been due to the novelty of the truckbed environment. In a study using Jersey calves, Stephens and Toner (1975) found that leading a calf (alone) onto a truck resulted in an increase in heart rate to 110 beats/min from 80 beats/min. The rate quickly dropped as the calves were allowed to accustom themselves to the truckbed and dropped further when the calves became recumbant. Similar results have been reported in a study done on the response of beef breed calves to transport related events (Stermer et al. 1981), though the trucking conditions in that experiment were not reported.

The generally higher serum cortisol levels of steers were most likely due to the altered steroid balance of castrated animals. Castration probably leads to loss of feed-

back effects between the pituitary-adrenal and pituitary-gonadal axes (Moberg 1983), and perhaps to deviations from normal steroid synthesis pathways (Brown 1978). In the present experiment bulls and steers showed similar changes in serum cortisol levels during handling and transport.

The treatment given to the animals can be separated into two components. One component is the trucking itself, and the other is the handling of the cattle before and after the trucking. The 10-min transport routine put most of the emphasis on the loading and handling component. The fact that steers showed somewhat greater increases in respiratory rate and cortisol level during the 10-min than the 2-h transport suggests that the castrates found the handling to be more disturbing than the truck ride itself. That pattern was not evident for the bulls. Every effort was made during handling to minimize disturbance to the animals. Although the cattle had to be coerced onto the truck, the unloading was achieved by simply opening the truck door and letting the animals exit at their own speed. It should be noted that the cattle were not tamed to human contact, and their usual response was to withdraw whenever people approached. Therefore, handling and blood sampling were probably stressful experiences in themselves.

The overall picture was that the reactions of the bulls and steers to trucking were similar and minor. Because all responses of animals result from interactions of genetic and previous experience factors, generalizations should not be made lightly. Studies with other species have shown more pronounced responses to handling and transport. Plasma corticosterone levels of mice subjected to transport by truck or plane were higher than in nonstressed controls and remained high for at least 48 h (Landi et al. 1982). Fenske et al. (1981) found that transport of prepubertal gilts for 50 km resulted in a significant increase in corticosteroid levels. Furthermore, the truck transportation led to greater increases in corticosteroids than did electric shock treatment. In another study using pigs, it was found that "simulated transport" resulted in heart rate being elevated during the first 30 min (Stephens and Rader 1982).

Presence of herd-mates may have a supportive effect on an animal's ability to cope with the novelty and uncertainty of trucking. In a study with sheep, Kilgour and deLangen (1970) reported only slightly elevated plasma cortisol levels in sheep after trucking as a group. Interestingly, cortisol levels after trucking were much lower than after 10–15 min of shearing. The authors suggested that handling of sheep becomes much more stressful if the animal is separated from the flock (as in shearing). They also noted that the animal's previous experiences influenced the cortisol response to handling. In the present study, the animals were transported in socially stable pen units, which may have served to buffer them against the novelty of the trucking experience.

The present study has shown that when handled carefully, bulls are as amenable to transportation as are steers. Therefore transportation need pose no obstacle to the husbandry of bulls, and is not necessarily a stressful experience. How the cattle react is largely a function of how well the handlers do their job, rather than of the androgen levels of the animals.

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