



## Effect of group size on processing time and some stress-related behaviors in cattle in straight chutes



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### Abstract:

Stress during handling can affect welfare in beef cattle and pose a risk to handlers. An evaluation was done of processing time and stress-related behavior (vocalization, turning, jumping, hitting, falling) in cattle during transit through a straight chute. Eight herds of 50 Brahman x Swiss Brown animals each were processed over an 8-d period. Each herd contained the same proportions of young to adult animals, and female to male ratios. Four herds were processed in small groups of four to five animals (TS), and the remaining four in groups of ten to twelve animals (TG). Processing involved moving the animals through a 13-m long straight chute during which they were injected with 1% Ivermectin. Processing time was shorter ( $P<0.05$ ) in the TS ( $42.5 \pm 2.2$  min) than in the TG ( $51.04 \pm 1.9$  min). Vocalization ( $5.5 \pm 0.6$  vs  $7.7 \pm 0.2$ ), turning ( $6.3 \pm 0.4$  vs  $9.5 \pm 0.6$ ), and jumping ( $2.7 \pm 0.5$

vs.  $5.2 \pm 0.5$ ) occurred less frequently ( $P < 0.05$ ) in the TS than in the TG. No differences between treatments ( $P > 0.05$ ) were observed for hitting (TS:  $2.7 \pm 0.4$ ; TG:  $5.5 \pm 1.7$ ) or falling (TS:  $2 \pm 0.4$ ; TG:  $3.7 \pm 1.0$ ). Processing small groups resulted in shorter processing times, less stress to animals and lower risk of injury to animals and handlers. This practice is a viable option for improving processing efficiency and animal welfare in semi-intensive tropical beef cattle systems.

**Key words:** Animal welfare, Behavior, Installations, Straight chute.

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In extensive and semi-extensive cattle systems animals graze most of the time and are only driven to corrals once or twice a year for management practices such as marking, castration and administration of preventive medicine<sup>(1)</sup>. Under some circumstances management practices are implemented in inadequate facilities; for example, in tropical rural areas in Mexico infrastructure is often deficient and rustic, consisting of a straight handling chute and sometimes a corral, generally built with local materials<sup>(2)</sup>. Lack of facilities prevents management of homogeneous lots (size, age and sex), and infrequent management does not allow livestock to adjust to facilities and the presence of wranglers. These factors, in conjunction with inadequate wrangler training<sup>(3)</sup>, can cause stress in the animals and difficulty in handling, which in turn can increase risk of injury for both wranglers and animals<sup>(4,5)</sup>. Economic losses can result due to misapplication of treatments, livestock injuries, personnel accidents<sup>(6)</sup>, weight loss, reproductive failures or mortality in animals, and compromised meat quality<sup>(7)</sup>.

Overcrowding and handling of large groups are among the variables that generally increase tension and stress in cattle<sup>(8)</sup>. Animals stressed during handling exhibit important physiological alterations that stimulate behaviors such as urinating, defecating and salivating, as well as vocalizations, falls, slips, blows and jumping<sup>(9)</sup>. Stressful conditions can cause animals to emit pheromones that can be perceived by other animals, leading to alertness and stress, and preventing them from being moved easily<sup>(10)</sup>. In contrast, calm cattle more easily enter a squeeze chute; however, if an animal struggles and becomes stressed, the remaining animals in the group often refuse to enter easily, hindering flow<sup>(11,12)</sup>.

Handling small groups can facilitate animal flow through chutes, reducing stressful situations and risky behaviors. This can help to improve animal well-being and promote more efficient handling. The present study objective was to evaluate transit speed and stress-related behavior incidence during processing of cattle groups of different sizes through a straight chute for application of medication.

The study was done in conjunction with commercial beef cattle producers in the state of Guerrero, Mexico (18°25' N; 100°31' W). Regional climate is dry warm (AW0), vegetation in the study area is dry tropical forest, and altitude is 250 m asl. The study was done during the dry season, with a 35 to 40 °C high temperature and 25 % average relative humidity. Cattle in this region are handled once to twice a year using a straight chute and a basic corral shared by different ranchers in the area.

Handling was done using a 13 x 0.8 m straight chute, built of steel pipe and concrete posts, with a dirt floor and no shade. At one end the chute was a sliding steel pipe gate and at the other a pipe crossbar to prevent the last animal in the group from backing out. After transport and before handling the animals were housed for 20 min in a 300 m<sup>2</sup> holding pen with 50 % shade and free access to water in a 2.0 x 1.0 x 0.8 m trough. Corral walls formed a funnel feeding into the chute. Upon exiting the chute the animals were housed in another corral very similar to the previous one. Here they remained until the entire herd had been processed, and were then returned to grazing areas.

Eight commercial herds were involved in the experiment. Each consisted of fifty Brahman x Swiss Brown individuals (crosses in different proportions) reared in a semi-extensive management system. Each herd contained 20% animals between 8 months and 2 yr of age (n = 10), 30 % between 2 to 4 yr (n = 15) and 50 % of 4 or more yr of age (n = 25). The sex ratio in each herd was 90 % female to 10 % male.

A different herd was processed each day for eight contiguous days (13 to 20 February 2018). General handling conditions were uniform throughout the evaluation period. On the day a herd was to be processed the animals were moved at 0600 h from the grazing area to the handling facilities. Movement was done by herding for 30 or 40 min using low intensity handling techniques until they entered the holding pen.

The eight herds were randomly assigned to one of two treatments: small groups (TS) or large groups (TG). In the TS, groups of four to five animals were randomly chosen from the herd, moved into the chute and the medication (1% Ivermectin) applied. Once processing of the group was complete, a group of similar size was moved into the chute, and this repeated until the entire herd was processed. In the TG, groups of ten to twelve animals (i.e. maximum chute capacity) were moved into the chute and processed. Again this was repeated until the entire herd was processed. The treatments were conducted alternately during the eight-day period. Handling was low intensity and done by four experienced wranglers. A veterinary

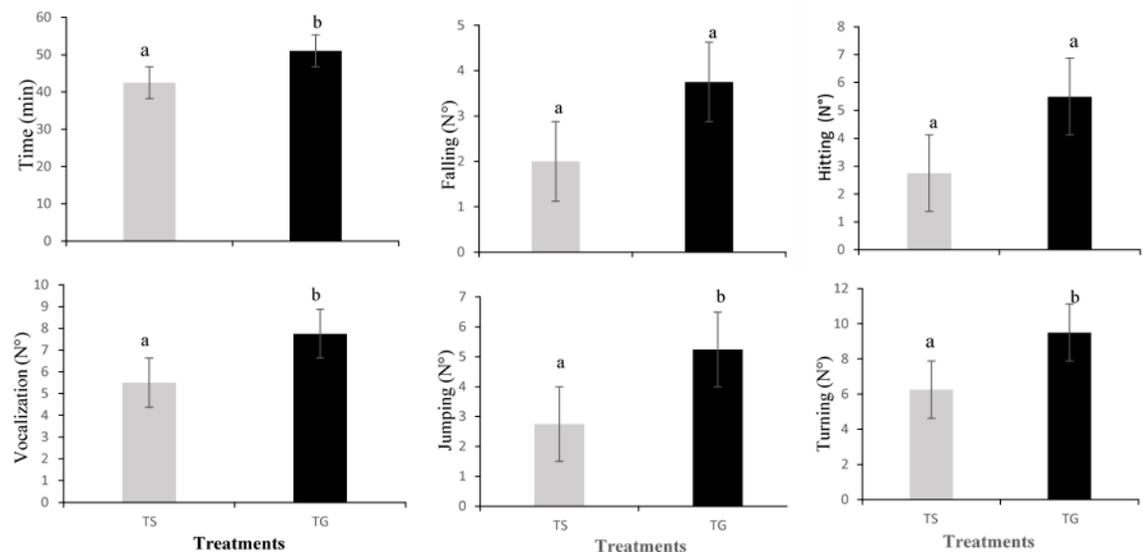
doctor applied the subcutaneous injection while the animals were in the chute. Data (i.e. times, behavior) was recorded by a trained technician (Table 1).

**Table 1:** Ethogram of behaviors evaluated during cattle processing in a straight chute using small and large groups

Variable	Measurement
Vocalization	Animals emitted sounds or calls from throat or snout.
Falling	Animals lost support of limbs and fell to ground.
Hitting	Animals hit or tried to hit other animals, wranglers and/or installations using hooves or head, or tried to trample.
Jumping	Animals advanced or tried to advance over other animals in group.
Turning	Animals turned around in chute and tried to move against the flow.

During evaluation only the number of animals that exhibited the recorded behaviors was considered, regardless of the frequency with which they occurred. Animal processing time was analyzed with a Student t test comparing TS vs TG. Each animal was considered an experimental unit within each replicate, and each herd was treated as a replicate within each treatment. Behavioral variable data was compared between the two treatments using the Mann-Whitney test. Finally, a correlation analysis of Kendall's Tau ranges was run between the variables of time and number of animals that vocalized, fell, hit, jumped and/or turned.

The average time required to process the fifty animals in each herd was shorter ( $P < 0.05$ ) in the TS ( $42.5 \pm 2.2$  min) than in the TG ( $51.04 \pm 1.9$  min). Fewer ( $P < 0.05$ ) animals vocalized, turned, and jumped in the TS than in the TG: vocalization,  $5.5 \pm 0.6$  vs  $7.7 \pm 0.2$ ; turning,  $6.3 \pm 0.4$  vs.  $9.5 \pm 0.6$ , jumping,  $2.7 \pm 0.5$  vs.  $5.2 \pm 0.5$  (Figure 1). No differences between treatments ( $P > 0.05$ ) were observed in the number of animals that fell or hit. Processing time was significantly correlated ( $r = 0.56$  to  $0.79$ ;  $P < 0.01$ ) with the number of animals that vocalized, fell, hit, jumped and turned (Table 2).

**Figure 1:** Average ( $\pm$  SE) processing time and number of animals exhibiting stress-related behaviors in cattle in small (TS) and large (TG) groups in a straight chute

<sup>ab</sup> Different letters above columns in the same factor indicate difference ( $P < 0.05$ ).

**Table 2:** Correlation of ranges (Kendall's Tau) for studied stress-related variables in cattle in small and large groups in a straight chute

	<b>Vocalizing</b>	<b>Falling</b>	<b>Hitting</b>	<b>Jumping</b>	<b>Turning</b>
Time	0.677**	0.624**	0.562**	0.790***	0.717***
Vocalizing		0.733***	0.699**	0.758***	0.794***
Falling			0.760***	0.803***	0.678**
Hitting				0.688**	0.740***
Jumping					0.812***

\*( $P < 0.05$ ), \*\*( $P < 0.01$ ), \*\*\*( $P < 0.001$ ).

Processing smaller groups led to more efficient handling that was apparently safer for animals and wranglers since less frequent occurrence of stress-related behaviors reduces the risk of injury to animals or wranglers during chute transit. The number of animals which exhibited the evaluated behaviors was highly correlated to processing time. This suggests that the longer processing time required for larger groups causes animals to exhibit aggressive behaviors, perhaps due to longer exposure to extreme climate conditions, invasion of individual space when inside the facilities, and contact with unfamiliar handlers. More frequent occurrence of these behaviors slows overall processing time, further exacerbating

the conditions causing these behaviors. These results coincide with previous reports indicating that animals exhibit progressively more aggressive behaviors as containment time increases<sup>(13,14)</sup>.

Group size determined the difference between the TS and TG treatments. When the chute was filled to maximum capacity with animals of different sizes, ages and sexes it caused inevitable invasion of individual space. Submissive animals were thus forced into proximity with dominant animals, propitiating a greater number of animals manifesting behaviors indicative of stress. Well-established dominance-submission relationships exist in established herds, and are important in allowing animals to coexist<sup>(15)</sup>. Forced interaction between animals of different hierarchical levels is a biological stressor, as are increased density and creation of new groups containing different age and weight ranges<sup>(16)</sup>. Stressors such as these are indicative of poor livestock management practices and are associated with greater reactivity, more undesirable behaviors and a higher risk of accidents<sup>(17,18)</sup>. In other words, any situation that unsettles normal social organization in an animal population can trigger different degrees of stress<sup>(14,19)</sup>. In the present study this was caused by changes in the spatial environment during chute loading.

Processing of larger groups may also have particularly negative effects on the final animals in the chute. Due to the number of animals in line before them, they may perceive a larger number of stress signals and consequently balk at advancing. Longer processing times can also promote increased emission of stress signals, both behavioral and chemical, generating stress among the final animals in a group<sup>(20)</sup>. Similar results have been reported previously in *Bos taurus* cattle in which small groups were found to move to slaughter more easily, with fewer vocalizations, slips and falls<sup>(21,22,23)</sup>.

The present results suggest that processing cattle in smaller groups is a relatively simple way of reducing stress-related behaviors at no extra cost. A main advantage is that it can be implemented using the basic infrastructure existing at most ranches in semi-extensive tropical conditions. Processing cattle in small groups requires less time overall and fewer animals exhibit stress-related behaviors during their time in the chute. This minor change in practices can therefore increase system efficiency while improving animal welfare.

### **Conflict of interest**

The authors declare no conflict of interest in the present study.

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