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Tactile stimulation reduces reactivity but does not improve the performance of Brahman's calves

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ABSTRACT. This study aimed to evaluate the effects of tactile stimulation on the reactivity and performance of Brahman calves. One hundred and nine calves were randomly assigned to two treatments: calves that received tactile stimulation (TS, n = 57) and those that did not (NTS, n = 52). Tactile stimulation was performed for eight minutes, 12 hours after birth. The behavioral variables were collected at weaning (209.50 ± 55.83 days) by assigning reactivity scores in the squeeze chute, which ranged from one to five (one was assigned to a calm calf and five to the most reactive). A flight speed score was assigned when each calf exited the squeeze chute. Performance was assessed using the adjusted weaning weight (WW) and daily weight gain (ADG). TS female calves showed lower reactivity scores in the squeeze chute ($p < 0.05$) and when leaving it ($p < 0.05$) than NTS calves, but no significant differences were observed in male calves between the treatments ($p > 0.05$). WW and GMD did not differ between the treatments ($p > 0.05$). In conclusion, tactile stimulation performed in Brahman's calves at birth resulted in less reactivity in female calves without affecting their performance.

Keywords: Animal welfare; behavior; beef cattle; temperament; human-animal interaction.

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Introduction

Beef cattle production is the most frequent livestock activity in Panama, in which cow-calf operations represent around 68% of the total Panamanian herd (Instituto Nacional de Estadística y Censo [INEC], 2021), with calves being the leading source of income for farmers. Due to the pasture raising system in Panama, animals experience few interactions with humans or, when they occur, they are often negative, resulting from aversive handling such as hot-iron branding, castration and dehorning, among other practices (Acharya et al., 2022; Hemsworth & Coleman, 2011), which affect animal welfare and can result in accidents, illnesses, or even animals' death (Paranhos da Costa et al., 2014).

A positive relationship between humans and animals has been described by livestock farmers as relevant for positive welfare (Vigors & Lawrence, 2019). In this sense, studies carried out on dairy cattle indicate that tactile stimulation induces positive emotions during interactions with humans (Lange et al., 2020, 2021), and when carried out at an early age (regardless of its frequency and time), can reduce fear and facilitates handling procedures in several species, as reported by sheep (Boivin et al., 2000), goats (Boivin & Braastad, 1996), horses (Ligout et al., 2008) and rabbits (Verwer et al., 2009). Furthermore, previous studies have demonstrated that positive relationships between humans and animals have the potential to improve immunity in sheep (Caroprese et al., 2006) and performance in piglets (Oliveira et al., 2015) and Holstein calves (Lürzel et al., 2015).

A study carried out with crossed Limousin calves demonstrated that tactile stimulation in early life had long-term effects by reducing the fear of humans and the stress response at slaughter (Probst et al., 2012). Therefore, we hypothesized that tactile stimulation during the sensitive period of beef calves' lives (Bateson, 1979; Boivin et al., 1992) is an efficient strategy to promote positive interactions with humans, creating good memories that can reduce calf reactivity and facilitate handling (Paranhos da Costa, 2022), thereby positively affecting animal and human welfare. Thus, this study aimed to evaluate the effects of tactile stimulation on the reactivity and performance of Brahman's calves.

Material and methods

All animals were treated following the practices and experimental protocols reviewed and approved by the Institutional Bioethics Committee of the University of Panama (CEIBA-UP-021-2021).

The study was carried out in a commercial cow-calf operation farm located in Divalá, Alanje, Panama (8°30'40” N and 82°36'43” W, 216 m high from the sea level), where the averages of air temperature and relative humidity were 27°C (ranging from 26.4 to 28.1 °C) and 83.4% (ranging from 75.5 to 87.9%), and the average annual precipitation was 2374.4. mm (Instituto de Meteorología e Hidrología de Panamá [IMHPA], 2020).

One hundred and nine Brahman calves (52 male and 57 female calves) born between March and August 2020, with an average birth weight of 32.31 ± 4.03 kg, all descendants of cows with 3.02 ± 2.39 parities, were randomly distributed in two treatments: those that received tactile stimulation (TS; n = 57, 26 male and 31 female calves) and those that did not (NTS; n = 52, 26 male and 26 female calves). Cows and calves were kept on pasture (*Urochloa brizantha cv. Marandú*) with free access to mineral supplements and water.

Tactile stimulation was performed 12 hours after calving, after the development of the cow-calf bond (Johnsen et al., 2015). To do this, a cowhand on horseback lassoed the calf calmly and carefully without pulling or dragging it across the maternity paddocks, while another cowhand maintained the cow at a distance. Then, the calf was held by the groin and neck and laid on the ground (Paranhos da Costa et al., 2014). Tactile stimulation was then initiated, massaging the animal's entire body with hands for eight minutes, and was performed gently, starting in the head, face, ears and nostrils, and then proceeding to the other parts of the body (neck, back, groin area, rump, legs and hooves). After completing the tactile stimulation, the navel was disinfected with 10% iodine, and the calves were identified with a tattoo in the ear and weighed (BW, kg). When they were approximately 15 days old, they were identified using electronic (RFID, EID HDX Tamper-Proof, and Allflex Livestock Intelligence) and visual (Allflex Livestock Intelligence) ear tags. Calves were weighed again at weaning (WW, kg) when they were 209.50 ± 55.83 days old. The average daily gain for each calf (ADG, kg d^{-1}) was calculated based on BW and WW.

At weaning, calves were individually subjected to two reactivity tests. Cows and calves were taken from the pasture to the corral and separated, maintaining the calves in one of the corral pens with free access to water and shade for approximately 30 minutes before starting the tests.

First, calf reactivity was scored at the squeeze chute without using any restraint structure by assigning one of the following scores: (1) calm, without movement; (2) agitated; (3) frequent movements with vocalization; (4) frequent movements with vocalizations and shaking the squeeze chute; and (5) violent and continuous struggles (adapted from Cooke et al., 2011). Immediately after carrying out the first assessment of reactivity, calves were released from the squeeze chute and the exit score was assigned as described by Vetters et al. (2013), as follows: (1) the calf leaves walking or (2) the calf leaves trotting or running.

Statistical analyzes

Statistical analyzes were performed using the R software with the RStudio integrated development environment (R version 4.0.4, 2022-02-15, RStudio, Inc.). The normality of the residual errors in the adopted models was verified using the Shapiro-Wilk test. Outliers were preserved because they represent individual variations within the reference values for the species.

Weaning weight and daily weight gain were evaluated using generalized linear models, considering the fixed effects of treatment, sex and their interactions, and birth weight, age, parity and cow weight as covariates. The reactivity scores in the squeeze chute were analyzed using generalized linear models adjusted by Poisson distribution, considering treatment, sex, and their interactions as fixed effects and cows' age and parity as covariates. The best adjustment of the model was performed with the 'step-up' procedure using Akaike information classifications (AIC) and Bayesian information classifications (BIC).

Multiple comparisons for the reactivity scores in the squeeze chute, WW and ADG were performed using the post-hoc Tukey test. The Chi-square test (χ^2) was used to compare the number of calves in the TS and NTS treatments that left the squeeze chute walking or trotting/running according to sex. Box plots were constructed to facilitate visual interpretation of the results (‘geom_boxplot{ggplot2} and bars geom_col{ggplot2}’).

Results and discussion

There was no significant effect of treatment ($p > 0.05$), sex ($p > 0.05$), nor the interaction between treatments and sex ($p > 0.05$) on WW and ADG (Table 1).

Table 1. Adjusted means ± standard errors of weaning weight (WW, kg) and average daily gain (ADG kg d^{-1}) of Brahman calves (n = 109) according to treatment (TS = received tactile stimulation and NST = not received tactile stimulation) and sex (male and female calves).

Performance traits	Treatment		Sex	
	TS	NTS	Male calves	Female calves
WW (kg)	159±3.35	158±3.50	159±3.54	158±3.38
ADG (kg day^{-1})	0.62±0.02	0.62±0.02	0.61±0.02	0.63±0.02

There was a significant interaction between treatments and the sex of calves, with TS female calves showing a lower reactivity score in the squeeze chute than NTS ones ($p < 0.05$; Figure 1).

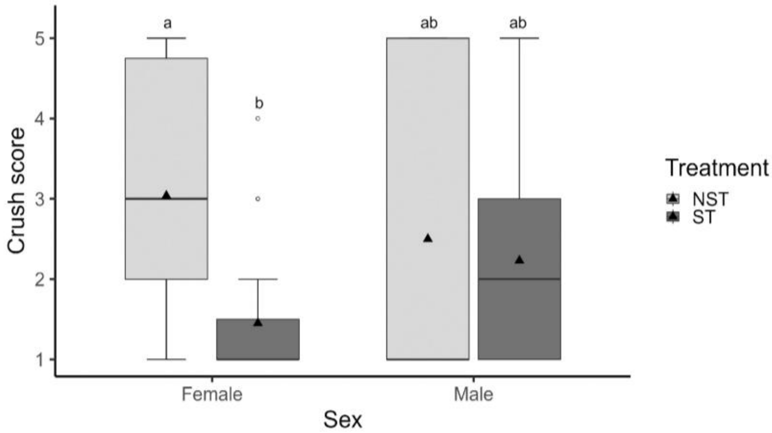

Figure 1. Box plot of the reactivity score in the squeeze chute of Brahman calves (n = 109) according to the treatments (TS = received tactile stimulation, NTS = did not receive tactile stimulation) and TS = with tactile stimulation) and sex (male and female calves). Different letters indicate statistical differences in the interaction treatment and sex; black triangles indicate the mean; grey circles indicate outliers.

There was a significant effect of treatment ($\chi^2 = 4.63$, DF = 1; $p < 0.05$) on the exit speed score but not on sex ($\chi^2 = 0.94$, DF = 1; $p > 0.05$). A higher percentage of TS female calves walked relative to NTS animals (84% vs 46%, respectively), resulting in a lower percentage of TS female calves exiting the squeeze chute by trotting/running than NTS calves (16% vs 54% respectively), as shown in Figure 2.

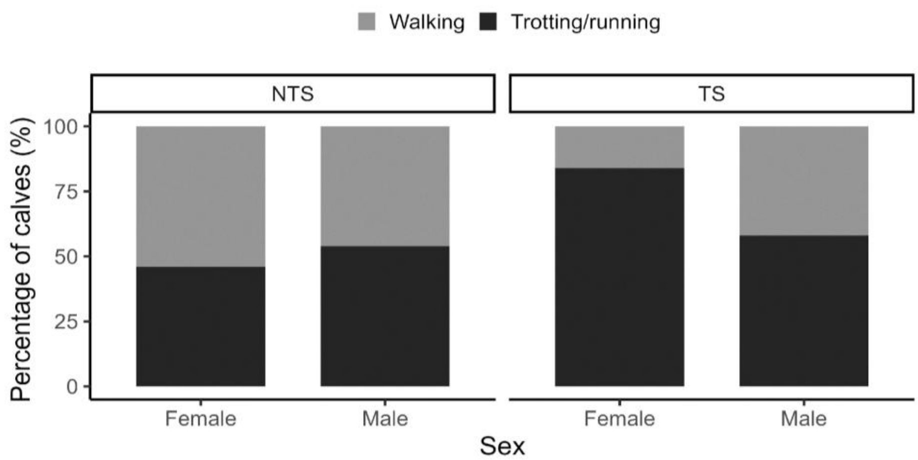

Figure 2. Percentages of Brahman's calves (n = 109) that left the squeeze chute walking or trotting/running according to treatments (TS = received tactile stimulation and NTS = did not receive tactile stimulation) and sex (male and female calves).

A series of studies have found no effects of tactile stimulation on the performance of animals from birth to weaning, as described for dairy calves (Lensink et al., 2000), lambs (Pascual-Alonso et al., 2015) and piglets (Muns et al., 2015), which is corroborated by the present results. On the other hand, other studies have shown divergent results with dairy calves, showing that tactile-stimulated calves had a higher average daily gain up to and after weaning. (Lürzel et al., 2015). Likewise, tactile-stimulated piglets showed better performance at weaning than those not stimulated (Oliveira et al., 2015).

Although our results did not show any effect of tactile stimulation on the calves' performance, it was observed that the tactile-stimulated female calves (TS) were less reactive than those not stimulated (NTS). Such behavioral changes may have positive effects when carrying out handling routines, resulting in better reproductive performance, as described by Cooke et al. (2012, 2017), for example, or in lower animal stress and reactivity at the time of slaughter, with positive implications for meat quality (Probst et al., 2012). It is worth noting that the assessment of the calves' reactivity occurred approximately seven months after the application of tactile stimulation, making our results more interesting, as its implementation resulted in a beneficial effect on positive long-term memory formation, potentially improving human-animal interactions during handling routines. Previous studies have shown that female cattle are more reactive than male (Voisinet et al., 1997), and probably by being more temperamental, they can respond better when getting used to handling conditions (Parham et al., 2019), as was the case with the reduction in reactivity in our female calves.

There are reports on commercial farms that have adopted this concept, indicating that in addition to promoting positive changes in animal behavior, there are also changes in the attitudes of cowboys towards animals (Paranhos da Costa, 2022).

On the other hand, the results of a study carried out on commercial beef cattle farms focusing on human-animal interactions during the handling of newborn calves showed that when handling is aversive, calves and cows become more reactive, which directly affects their well-being and increases the risk of accidents for both animals and people responsible for handling livestock (Costa et al., 2021).

Conclusion

In conclusion, tactile stimulation 12 hours after birth in Brahman's calves resulted in a reduction of their reactivity at weaning, with a marked effect in female calves, without changes in their performance.

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