1   **Pasture access and social housing influence the behavior of dairy calves**

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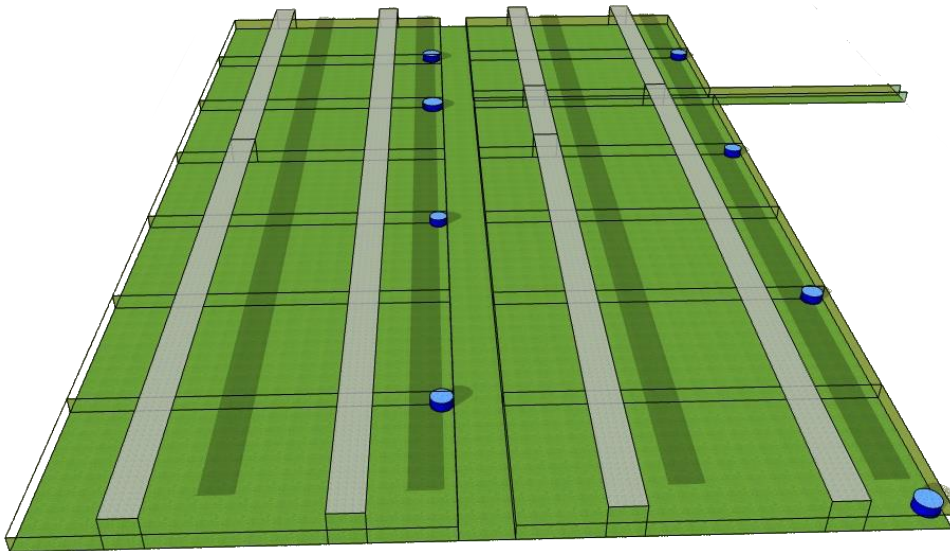10   [3]Centro Universitário Central Paulista, São Carlos, São Paulo, Brazil
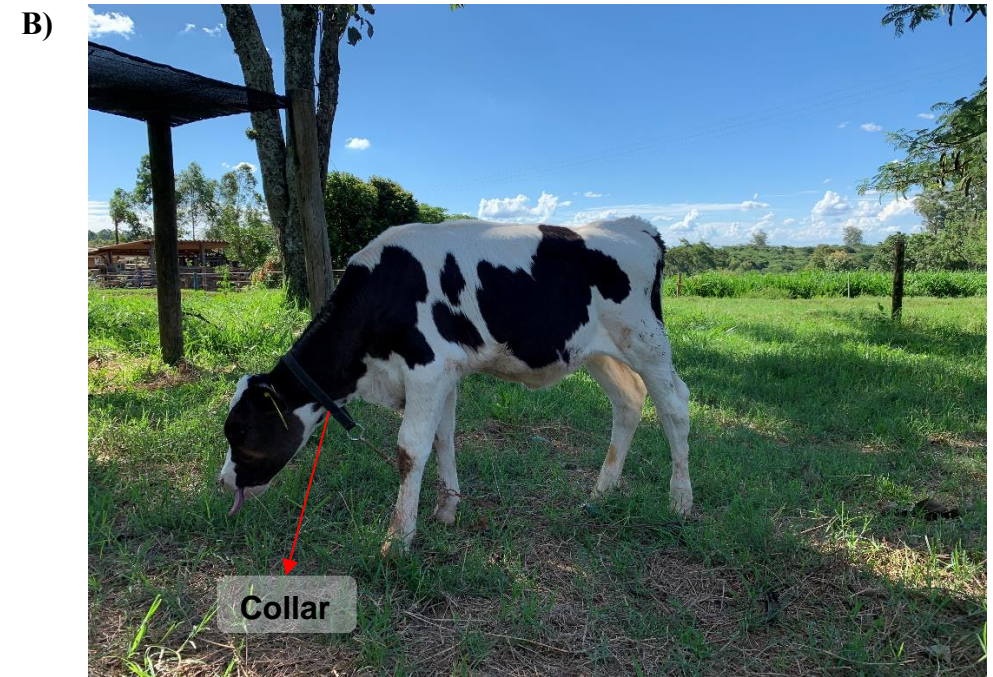
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14   **SUPPLEMENTARY FILE**

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Figure S1. Schematic representation of the paddocks under a rotational grazing system with shade, water, and feeder available. Paddocks had the same dimensions (8 m × 8 m) and were not drawn precisely to scale.

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Figure S2. Representation of calves rearing systems [A – Group Housing (GH); and B - Individual Housing (IH)] at *Embrapa Pecuária Sudeste,* São Paulo State, Brazil.

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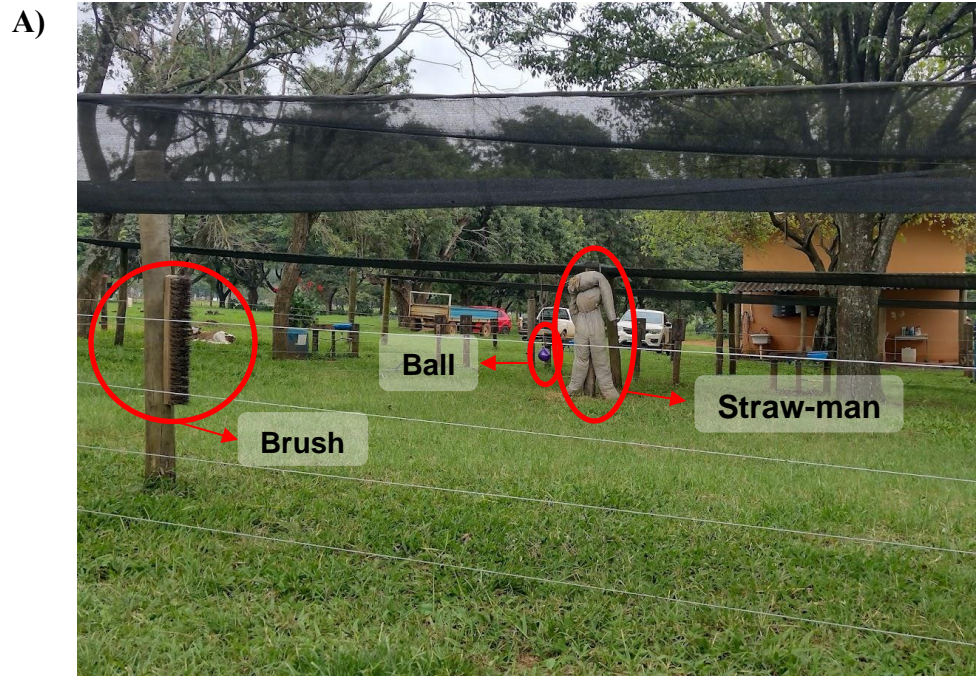**A)** [labels: Brush, Ball, Straw-man] **B)**

Figure S3. Representation of calves rearing systems [A – Group Housing with Physical Enrichment (PE); and B - Group Housing without Physical Enrichment (WPE)] at *Embrapa Pecuária Sudeste,* São Paulo State, Brazil.

Table S1. Definitions of behaviors.

Behaviors	Definition
Exploring	Animal with their muzzle in contact with or less than one muzzle length from the pasture (neck stretched and ears back)
Grazing	Animal with the mouth below or at the level of the forage or grabbing forage, may be stationary or moving forward
Rumination	Animal chewing with lateral jaw movements with the head at the same level or above its body
Non-nutritive oral	Animal sucking any body part of another calf or, animal with mouth opened and with visible movements in contact with pen fixtures
Eating concentrate	Animal with head down at the feeder with the mouth at the concentrate
Drinking	Animal with the lips immersed in the water, with neck movements indicating water ingestion
Social interaction*	Any interaction between animals including agonistic interactions (threats, head butts, avoiding, submission) and affiliative interactions (social licking, licking solicitation)
Scratching	Animal with any part of body in visible movements in contact with pen fixtures
Interaction with physical enrichment	Animal interacting with physical enrichment items with any part of body
Idle	Animal still, not engaged in any of the behaviors described above

*For calves housed individually we considered the social interaction when the animal showed a clear attempt to get close to the neighbour's calf.

Experiments 1 and 2: experimental design and statistical analysis

All analyses were performed in R (R Core Team, 2023) including packages glmmTMB (Brooks et al., 2017), dplyr (Wickham et al., 2021), ggplot2 (Wickham, 2016), and emmean (Lenth, 2022). The descriptive analysis was based on the data summary by treatment since they were all observed for the same period. The models were adjusted through the maximum likelihood-Laplace approximation method in the statistical package lme4 (Bates et al., 2015). The confidence intervals were estimated using Type II Wald chi-square tests and the fit of the model was given by a likelihood-test. The normality of the random facts was given by quartile plot means with a confidence interval of 95%.

References

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