

# The effect of individual vs pair housing during the pre-weaning period on dairy calf well-being to four months of age

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## Introduction

Pair housing of dairy calves during the pre-weaning period helps meet the natural social needs of the calf and has been shown to improve growth and starter intake during the pre-weaning period as compared to individual housing. However, there is little evidence to suggest that pair housed calves maintain their social and growth advantages past the weaning phase. The objective of this study was to investigate the effect of pair housing on measures of behavioral and physiologic well-being during the first four months of life.

## Materials and Methods

This randomized clinical trial was conducted at the UMN St Paul Dairy from Nov 2018-April 2019. All healthy Holstein (H) and Crossbred (XB) calves born after Nov 1 were enrolled after colostrum feeding, with the first calf randomly assigned to one of two treatment groups, Pair (P; two hutches with common outdoor space) or Individual (I; hutch plus outdoor space). Each successive calf was assigned to equalize the number of calves in I and P groups (i.e. I, P, P, I, I, P, P...). All calves were bucket fed 4L of milk replacer twice daily and weaned at 50d of age. Weaned calves (6/group) remained with their treatment group until exit from the study at 16w. A venous blood sample was collected from each calf between 24hr and 7 d of age to test for serum total protein (STP; g/dL). Body weights (kg) were obtained at birth, weaning, and 16w. Each enrolled calf was scored for health each week and farm treatments were also collected. A hair sample was collected from the left shoulder at birth and 16w to assess hair cortisol (pg/ml). At enrollment, each calf was fitted with a triaxial accelerometer on the left hind leg for continuous recording of standing and lying time (min/24h) for 16w. Natural behaviors of latency to find feed, water, lie down (min) at entrance to the weaned pen were recorded by continuous video observation. Open field testing with a novel object (NOT) was performed at 5, 10, and 16w. Behaviors analyzed by video observation

included; latency to approach the object (s), vocalizations, and time spent immobile, walking, or running (s/10min). Generalized linear mixed models were used to determine the effect of treatment (P/I) on calf health, performance, activity, and behavioral outcomes, accounting for the fixed effect of time, the interaction of time and treatment, the random effect of breed and pen, and accounting for repeated measurements when appropriate. Final significance was determined at  $P < 0.05$ ; trends at  $0.05 < P < 0.10$ .

## Results

Twenty-four H and XB calves (P: n=12, 6 pairs; I: n=12) were enrolled from Nov 2 to Dec 23 2018. Breed was balanced among treatment groups with no difference in enrollment STP ( $M \pm SEM$ ;  $5.9 \pm 0.1$ ;  $P = 1.0$ ) or birthweight ( $42.7 \pm 1.3$ kg;  $P = 0.63$ ). P calves were 7.25kg heavier ( $P = 0.0029$ ) at weaning and gained 0.15kg/d more ( $P = 0.0042$ ) during the pre-weaning period as compared to I calves. Four calves (P: n=2; I: n=2) were treated for diarrhea during the study but there was no effect of treatment on weekly health scores. Calves housed in pairs lay down more during the week of weaning ( $P = 68.3\%$  vs  $I = 62.5\%$ ;  $P = 0.0004$ ) compared to calves housed individually during the pre-weaning period. Overall, P calves vocalized more during NOT compared to individual calves ( $20 \pm 4$  vs.  $11 \pm 4$ ;  $P = 0.039$ ).

## Significance

Under the conditions of this study, calves that were pair housed during the pre-weaning period had a greater average daily gain and were heavier at weaning, spent more time lying down immediately after weaning, vocalized more during NOT but did not differ in health status compared to individually housed calves. Further analysis will elucidate if there are differences between P and I calves in hair cortisol, behavior at weaned pen entrance, and NOT.