Cold Stress in Single versus Pair Hutch-Housed Dairy Calves

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While there is a dearth of data on heat stress in dairy calves, data on cold stress in dairy calves are not much better! Previously, a study reviewed heat stress in hutches (Dado-Senn et al., 2023; Kertz 2023). Cold stress in young calves occurs at or below 46-50º F (NASEM 2021) when they need to expend additional energy to stay warm. Calves may be more prone to cold stress than cows because they, like human infants, have limited ability to regulate body temperature, and they have a greater surface area per unit body mass than cows. In cold weather, preweaned calves with low calf starter intakes, do not yet produce much heat of rumen fermentation which allows ruminants to fare well in colder climates. In cold weather, these calves can be fed more liquid, increased fat level in milk replacers, clothed in blankets, and use more deep bedded to help insulate or increase energy intake to meet increased energy needs. According to the most recent NAHMS survey (2014), calf hutch systems accounted for approximately 63% of all calf housing in the United States with 25% indoor and 38% outdoor.

This led to a study at the University of Wisconsin dairy farm (Reuscher et al., 2024) in which 48 Holstein heifer calves were housed in either individually (n = 16 calves) or pair housed (n = 16 pairs; 32 calves) in outdoor hutches from December 2019 to March 2020. Treatments were balanced in a 2 x 2 factorial across sequential hutches. Within 6 hours of birth, calves were separated from their dam, weighed, had their navels dipped with iodine solution, and were fed 4 quarts of colostrum.

Calves were excluded from the trial if they weighed over 106 lb. They were assigned to hutches sequentially by birth order, with the exception that to be assigned to the same pair, calves' birthweights had to be within 22 lb of each other (final difference = 4 ± 8.6 lb within pairs). Within a given pair, the difference in age was 2 ± 1 days (range: 0–4 days). Average birthweight for individually versus pair-housed calves was 87.4 ± 8.8 versus 85.2 ± 8.8 lb (mean ± SD). Once enrollment criteria were met, calves were moved to their treatment housing at day 2 ± 1 days of life.

Individually housed calves had a single hutch with an outdoor area (4 ft wide × 6 ft long) enclosed with wire fencing (3.2 ft tall). Pair-housed calves had 2 adjacent hutches connected with a white plastic board and an outdoor area enclosed with wire fencing. All hutches were south facing and deep bedded with straw, with additional bedding added according to farm staff judgment based on weather conditions. Pair-housed calves were initially separated with an additional wire fencing panel dividing the outdoor enclosure until both calves were determined by farm staff to be drinking milk consistently; this period lasted 7 ± 1 days with a range of 5–10 days.

Calves were fed hot water in plastic pail 3 times daily (0600, 1300, and 1800 hours). All calves were fed pasteurized whole milk in the outdoor enclosure twice daily between 0400 and 0530 hours and 1500 and 1600 hours. Calves were initially hand fed 2 quarts at each feeding by bottle until calves were determined by farm staff to be drinking sufficiently at day 5 ± 1 of life, and then milk volume was increased to 3 quarts per feeding. When calves reached day 14 ± 1 of life, milk allowance was increased to 4 qt per feeding. All calves were weaned in a step-down fashion based on age; for pair-housed calves, this was determined based on the younger calf in the pair. First, milk allowance was decreased to 2 qt twice daily at day 42 of life, then to 2 qt once daily on day 49 of life. Milk was completely removed on day 53 of life with pairs at day 54 ± 1 of life. Calves remained in their hutches for at least 6 more days after weaning, moving to postweaning group housing no earlier than day 60 of life. Beginning on day 3, calves were given texturized starter (corn 43.5%, soybean meal 28.5%, cottonseed hull pellets 12.5%, molasses 5.0%, roasted soybeans 2.8%, wheat middlings 2.2%, and 3.7% vitamins minerals. Amount of starter offered was increased daily based on consumption (>5% refusals by weight).

Table 1. Mean daily internal hutch temperatures (º F), standard deviation (SD), and range.

	Mean	**SD**	**Range**
Pair-housed calves			
Week 4	28.2	4.5	17.6 to 33.3
Week 5	26.6	4.9	18.5 to 34.0
Week 6	31.3	6.7	19.0 to 40.8
Individually-housed calves			
Week 4	25.3	4.3	17.8 to 31.1
Week 5	28.4	5.9	18,5 to 38.5
Week 6	31.1	8.6	18.0 to 46.0

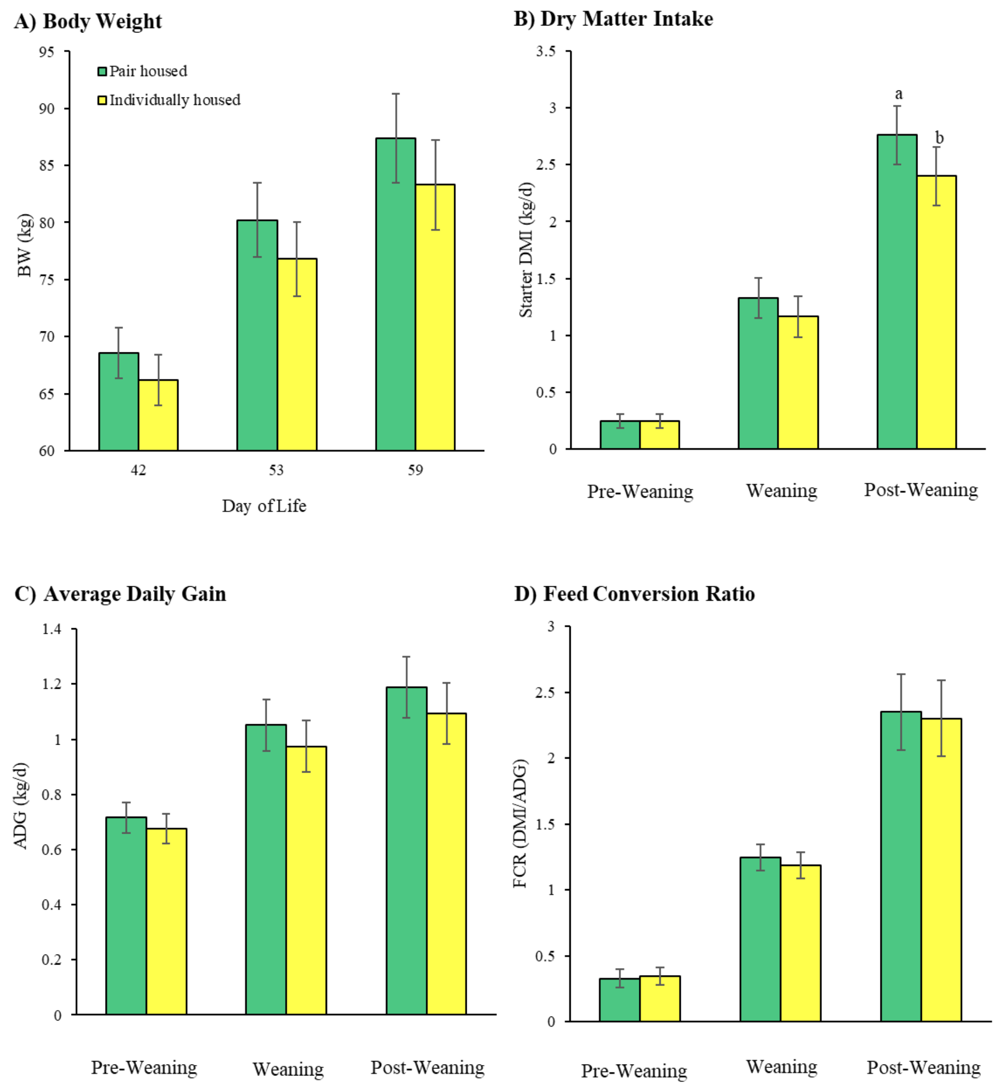
- Internal hutch temperature (**Table 1)** was greater for the 1-hour when both calves were restricted to being inside a hutch.
- There was no main effect of week or interaction of week by treatment.
- Numerically, temperature increased over weeks, as did variation (SD) and range.

Ocular and temperatures (data not shown, graphed in text) were greater in individually housed calves after the 1-hour restricted time than for pair-housed calves. But there was no main effect for treatment or interaction for rectal temperature.

Individually housed calves spent more of their time inside the hutch than pair-housed calves (93.9 versus 90.7%), but there was no effect of week or interaction. This may have been due to pair-housed calves wanting to and spending more time together. For all 3 weeks observed, pair- housed calves were together in the same hutch at the same time (89.7 versus 79.4% of observations for week 4, 6, and 9, respectively).

Taking into account birthweights, there was no difference in body weights at days 42, 53 or 59 (**Figure 3A,** kindly provided by Dr. Jennifer Van Os), Dry matter intake (DMI) was also not different (**Figure 3B**, $P > 0.19$) between the two treatments as authors had hypothesized DMI would be greater for pair housed calves. A similar pattern was evident for average daily gain (ADG, **Figure 3C**) and feed conversion ratio (FCR, **Figure** 3D).

Figure 3.



However, the same pattern was evident for body weight, ADG, DMI, and FCR in that for each day of measurements, these values were all numerically greater for pair-housed versus individually housed calves. Thus, I think more calves per treatment would have resulted in statistically significant differences between treatments. Number of calves per treatment is often limited by factors such as herd size, calving pattern, season of year, and research facilities. This and related issues are discussed and referenced in more detail elsewhere (Kertz and Chester-Jones 2004; Kertz 2019). Impact of calf performance on subsequent lactation performance tended to show benefit, but it was only when over 1,000 calves in a single herd over a 10-year period that this was clearly established (Soberon et al., 2012).

The Bottom Line

Pair-housed calves versus individually hutch housed calves may be beneficial during cold weather, but it is likely more calves per treatment may be needed to detect statistically significant differences.

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