

Cement Hutches Over Metal Boxes for Dairy Heifer Calves: Weaning Performance and Health

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Abstract

Calf welfare plays a critical role in determining future health and performance of dairy cows as profitable milk producers. It was hypothesized that calves housed in cement hutches vs. metal/iron boxes would have superior growth performance. The objective of this study was to determine the effect of housing type (cement hutches vs. iron boxes) on average daily gain (ADG) until weaning and body weight (BW) at weaning of Holstein heifer calves in a commercial setting. Forty one Holstein heifer calves were randomly assigned to either cement hutches (n = 17) or iron boxes (n = 24) in a completely randomized design study from birth until weaning. Dimensions were 1.2 × 3m² for cement hutches and 1 × 1.2m² for metal/iron boxes. Bedding materials for cement hutches were sand and for iron boxes were plastic nets. Calf growth performance until weaning and the occurrence of diarrhea and pneumonia were determined. Data were analyzed using linear mixed models of SAS program. Results demonstrated that calves housed in cement hutches with soft sand bedding vs. iron boxes with plastic net bedding had superior (P < 0.01) weaning BW (83.6 vs. 75.8 kg) and ADG (656 vs. 581 g/d) and lower rate of pneumonia (1.2 vs. 17%), respectively. The cost of bedding for each calf was 22800 Toman in cement hutches and 58000 Toman in iron boxes. In conclusion, cement hutches with soft sand bedding proved to be much more economical and more favorable for calf growth and health over iron boxes with plastic net bedding.

Keywords: Calf; Cement Hutch; Iron Box; Economy; Housing; Weaning Growth

Introduction

The modern dairy farming profitability is greatly dependent on the quality of replacement heifers [1]. Heifer calf growth and health until weaning can largely impact on future cow performance as a milk producer. Calf welfare comprising housing type and quality is a major effector of weaning calf performance [2-5]. Optimizing calf housing can improve herd health through reducing respiratory and infectious diseases [6]. In Iran, there are currently two more common types of housing for young calves including 1) cement hutches with soft sand bedding and 2) metal/iron boxes with plastic net bedding (Figure 1). The cement hutches are usually more spacious, and thus, probably more hygienic than the metal/iron boxes. This is mainly because the bedding used in hutches boxes is sand, whereas the bedding used in iron boxes is plastic net. As a result, cement hutches would likely provide more safety and better welfare to young heifer calves, when compared to iron boxes. Nonetheless, it is unknown if cement hutches vs. iron boxes would significantly improve weaning calf growth performance. In addition, our large commercial farm observations suggest that calves housed in cement hutches are less prone to pneumonia and diarrhea compared to calves housed in iron boxes. However, this has not been studied systematically.



Figure 1: The cement hutches ($1.2 \times 3\text{m}^2$) with soft sand bedding (top) and iron boxes ($1 \times 1.2\text{m}^2$) with plastic net bedding (bottom).

It was hypothesized that heifer calves housed in cement hutches would have superior weaning BW and ADG and less occurrence of pneumonia, when compared to calves housed in iron/metal boxes.

Objective of the Study

Therefore, the objective of this study was to compare the effect of housing type (cement hutches vs. iron boxes) on weaning BW and ADG from birth until weaning as well as pneumonia occurrence in Holstein heifer calves.

Materials and Methods

This experiment was conducted at Ghiam Commercial Dairy Farm (Isfahan, Iran) during October to December of 2018 under the guidelines of the Iranian Council for Animal Care [7]. Forty one heifer calves were randomly assigned to either cement hutches (n = 17) or iron boxes (n = 24) in a completely randomized design study. All calves were treated similarly from nutritional and health perspectives for the entire study. Calves received colostrum (10% of birth BW) within 6 h of birth and transition milk until day 3 of age. After that, calves had free access to a starter concentrate and fresh water. The starter concentrate contained 5% barley straw (DM-based). Cows received pasteurized milk from day 3 until weaning as following: 4 liter per calf for weeks 1 and 2, 5 liters per calf for weeks 3 and 4, 6 liter per calf for week 5, 7 liters per calf for week 6, 6 liter per calf for weeks 7, 5 liters per calf for week 8, 4 liters per calf for week 9 and 2 liters per calf for week 10. Calves were weaned at approximately 70 of age. The starter ingredients were ground corn grain, ground barley grain, soybean meal, canola meal, corn gluten meal, extruded soybean, fish meal, protected fat powder and minor supplements such as sodium bicarbonate, salt, macro- and micro-minerals, vitamins, and feed additives. Body weights were recorded for individual heifer calves at birth and weaning.

A linear mixed model using PROC MIXED of SAS Program (SAS, V. 9.4) [8] was used to analyze weaning and growth performance. The statistical model used included the fixed effect of treatment and random effects of calf within treatment and residual errors. Inter-treatment significant differences were declared at $P < 0.05$.

Results and Discussion

This study provides new information on optimal pre-weaning calf housing with practical significance for commercial dairy farms, especially in Iran. With adequately large sample size, the results demonstrated that cement hutches provide a healthier and more suitable physiological environment for pre-weaning heifer calf growth. The heifer calves housed in cement hutches had greater weaning BW (83.6 vs. 75.8 kg) and ADG (656 vs. 581 g/d) than did the calves housed in iron boxes. As illustrated in figure 1, cement hutches ($1.2 \times 3\text{m}^2$) were usually more spacious than iron boxes ($1 \times 1.2\text{m}^2$) that should have provided better calf welfare for pre-weaning growth and development. A minimal space allowance of $2 \text{m}^2/\text{calf}$ has been recommended to provide opportunities for active calf behaviors [9]. In addition, sand was used as bedding in cement hutches whereas a plastic net was used as bedding in iron boxes. As a consequence, cement hutches vs. iron boxes may have provided a softer and healthier bed for young and highly sensitive calves. Because of their metal nature, iron boxes are harder and less flexible for calf bones and joints. This can adversely affect young calf welfare and growth performance from birth until weaning. The much lower occurrence of pneumonia in cement hutches-housed calves (1.2 vs. 17%) would support the above reasoning. Moreover, because of access to direct sunlight and fresh air, cement hutches provide better ventilation over the iron boxes that are located indoor. Furthermore, the iron boxes are more humid than the cement hutches since they are washed every second day and drying becomes an issue. Housing of Holstein calves in a poor indoor environment has been shown to increase respiratory disease [10].

Because of its greater space, cement hutches may allow pair housing of dairy calves in both early and later stage of growth. Pair housing can indeed increase solid feed intake and weight gain in dairy calves [11,12]. Pair housing can also increase feeding and chewing times and decrease self-grooming time and thus alters cow social and feeding behaviors [2].

From an economical perspective, cement hutches are far more desirable than iron boxes. Assuming the use of 60 kg sand before calf arrival and daily use of 10 kg fresh sand after calf arrival, and the price of 30 Toman per kg of sand, the total cost of sand bedding from birth to weaning at 70d of age would be 22800 Toman [i.e. $(60 \times 30) + (70 \times 10 \times 30) = 22800$]. In contrast, assuming the use of 1 plastic net for each calf until weaning, the total cost of bedding in iron boxes would be at least 58000 Toman that is 2.54 times the cost of bedding for each calf in cement hutches. Therefore, maintaining the cement hutches requires much less financial resources, when compared to the metal boxes.

Variables	Housing Type		P-value
	Cement hutches	Iron Boxes	
Body weight (kg)	83.6 ± 1.37	75.8 ± 1.11	< 0.0001
Average daily gain (g/d)	656 ± 21	581 ± 17	< 0.0001

Table 1: Weaning body weight and average daily gain (least square mean ± SE) of Holstein heifer calves housed in cement hutches vs. iron boxes from birth until weaning.

Conclusion

Findings of this study demonstrated that cement hutches provide a healthier environment for calf growth and weaning over iron boxes. This was reflected in the higher ADG and BW and lower pneumonia occurrence of calves housed in cement hutches compared to calves housed in iron boxes. Considering the much more economical nature of maintaining the cement hutches compared to iron boxes, cement hutches are recommended for commercial use in dairy facilities.

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Bibliography

1. Nikkhah A. "Optimizing dairy herd starch efficiency via strategic heifer management". *International Journal of Dairy Science and Processing* 2 (2015): 1-2.
2. Liu S., et al. "Effects of pair versus individual housing on performance, health, and behavior of dairy calves". *Animals* 10.1 (2020): 50.
3. MaCaulay AS, et al. "Comparison of calf housing types and tympanic temperature rhythms in Holstein calves". *Journal of Dairy Science* 78.4 (1995): 856-862.
4. Cummins KA and Brunner CJ. "Effect of calf housing on plasma ascorbate and endocrine and immune function". *Journal of Dairy Science* 74.5 (1991): 1582-1588.
5. Heinrichs AJ, et al. "Survey of calf and heifer housing on Pennsylvania dairy farms". *Journal of Dairy Science* 70.9 (1987): 1952-1957.
6. McGuirk SM. "Disease management of dairy calves and heifers". *Veterinary Clinics of North America: Food Animal Practice* 24.1 (2008): 139-153.
7. Iranian Council for Animal Care. Isfahan University of Technology, Isfahan, Iran (1995).
8. SAS Statistical Software, SAS/ STAT 9.4 (SAS Institute Inc., Cary, NC).
9. Sutherland MA, et al. "The effect of rearing substrate and space allowance on the behavior and physiology of dairy calves". *Journal of Dairy Science* 97.7 (2014): 4457-4463.
10. Cobb CJ, et al. "Group housing of Holstein calves in a poor indoor environment increases respiratory disease but does not influence performance or leukocyte responses". *Journal of Dairy Science* 97.5 (2014): 3099-3109.

11. Costa JHC., *et al.* "Early pair housing increases solid feed intake and weight gains in dairy calves". *Journal of Dairy Science* 98.9 (2015): 6381-6386.
12. Jensen MB., *et al.* "Pair housing and enhanced milk allowance increase play behavior and improve performance in dairy calves". *Journal of Dairy Science* 98.4 (2015): 2568-2575.

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