Environment quality in 3 types of calf housing in United Kingdom

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The environment for young calves can vary considerably depend on housing type and ambient temperature/humidity. Generally, the ***zone of thermal neutrality*** in young dairy calves is from 15 to 26 (59 to 79) C/Fº (NASEM 2021). Previously, we reviewed studies dealing with heat stress (Carmickle et al., 2022; Dado-Senn et al., 2023). This study (Mahendran et al., 2023) focused on calf housing in the United Kingdom (UK).

The UK has a temperate climate that typically features cool, wet winters and warm, wet summers, with mean winter and summer temperatures in 2021 of 3.5/33°C/F and 15.3/60°C/F, respectively; and specific ranges for the southern UK being 0.5/32.5 to 9.0/48°C/F and 13.8/57 to 22.9/73°C/F, respectively. So, even the upper temperature range of the latter temperatures would not be above the zone of thermal neutrality and heat stress. But most of the winter temperatures would be cold stress being below the zone of thermal neutrality. In the United States, northern climates even have heat stress in summer as found by Dado-Senn et al., (2023); and heat stress was even more pronounced in Florida and California as found by Carmickle et al., (2022).

Housing affects calves' environment based on stocking density, insulation, bedding, and ventilation. Lago et al., (2006; Kertz 2019) found that ventilation should be about four air exchanges per hour, that humidity increases bacterial load, and that the average moisture content of bedding was 52 % with a range of 32 to 73 %! Wet bedding exacerbates heat loss as it "wicks" heat from the calf.

A sample of 9 dairy farms in the south of England were selected and the study conducted between June and July 2021 to provide summer readings, and with revisits to 9 premises between January and March 2022 to provide the winter readings.

"All farms kept their calves within the same pen from birth until after weaning, with 3 pens used for observations from each farm. All calves were fed milk manually twice per day at a rate of between 3 and 4 L per feeding in both seasons, with additional dietary fiber consisting of straw from bedding (7 farms), straw in racks (2 farms), or silage (1 farm), and access to *ad libitum* concentrates and water from buckets. All farms used un-chopped straw bedding for the calf pens. Only one farm cleaned out the calf pens while the calves were still being reared in them; all other farms cleaned out the pens once the calves had been weaned and moved into another housing area. Fresh bedding was added on top of soiled bedding daily in 30% (3/10) of farms, and 2 or 3 times a week on the remaining farms.

- Hutches placed outside were used on 4 farms, with a single farm using a polytunnel (greenhouse) with group pens created using gates within it.
- The remaining 5 farms housed calves in a shed with either gates (2/5 farms) or solid walls between calf pens (3/5 farms).
- At the initial visit, multiple measurements to describe the physical properties were taken from the calf housing (**Table 1** in the JDS article), including housing dimensions, pen sizes, and the number of calves housed.
- No formal measurements of calf health were made during the visits."

No significant differences were found between mechanically ventilated (n = 3) and non-ventilated sheds (n = 2) for temperature, temperature humidity index (THI), or particulate matter (PM).

Authors acknowledged that mechanical ventilation may not have been optimized, and that this was beyond their expertise.

All 3 ventilated housing used positive pressure ventilation tubes which have been popularized and optimized by Wisconsin work (Nordlund and Halbach 2019).

Table 1. Environmental data from the various types of calf housing used on farms in this study,

Parameter	Season	External C/F°	Shed (n = 5)	Hutch (n =4)	Tunnel (n = 1)
Temperature	Winter	6.7/44	8.1/47	7.1/45	8.5/47
	Summer	17.2/63	17.4/63	17.7/64	19.0/66
Humidity	Winter	84	81	87	74
	Summer	77	77	79	73
THI	Winter	45	48	46	49
	Summer	62	62	62	64
Light, lx	Winter	20,653	440	1,148	4,647
	Summer	66,669	1,462	4,603	16,900
Airspeed, m/sec	Winter	1.1	0.004	0.03	0.08
	Summer	0.89	0.1	0.03	0.08
Bacteria, cfu/m3	Winter	NA	8,183	10,031	3,217
	Summer	NA	19,175	18,335	5,572
PM_{total}[3], mg/m3	Winter	NA	1.53	0.55	0.28
	Summer	NA	0.64	0.11	0.20
PM_{10}[3], mg/m^3	Winter	NA	1.48	0.47	0.24
	Summer	NA	0.58	0.27	0.16

Data in **Table 1** indicated:

- Winter **temperatures** on average were below the zone of thermal neutrality from 15 to 26 (59 to 79) C/Fº while summer temperatures averaged well below the upper limit of this zone. However, upper range summer temperatures were as high as 100/37 ºF/C which is well above the zone of thermal neutrality.
- **Humidity** was above 74% in all housing during the winter and above 73% in summer in all housing with this lower level in the polytunnel (greenhouse) housing.
- **Temperature Heat Index (THI)** followed the pattern of temperatures above and was exacerbated by high humidities.
- **Light** levels were lowest in sheds. and especially darker in the summer.
- **Airspeed** was much lower in all housing than the external speed. Hutches reduced airspeed the most.
- **Bacteria** were lowest in the polytunnel most likely due to more direct sunlight in that housing.
- **Particulate matter (PM)** was higher in sheds and increased as number of calves in a pen increased. Considerable variation was present in PM. All housing used straw to bed, but no attempt was made to characterize the type and quality of straw used.

Authors noted that with hutches, calves had both an internal and external environment which could impact calves either positively or negatively. Types of hutches also can vary considerably (disclosure I have worked with a major manufacturer of calf hutches), as can their placement and management.

The Bottom Line

Calf housing can influence calf exposure to temperature, humidity, the resultant Temperature Humidity Index (THI), airspeed, light, bacteria load, and particulate matter/dust. This study evaluated and characterized how these factors may vary with type of housing and management.

References

Carmickle, Allie T., Colleen C. Larson, Froylan Sosa Hernandez, Jessica M. V. Pereira, Fernanda C. Ferreira, McKenzie L. J. Haimon, Laura M. Jensen, Peter J. Hansen, and Anna C. Denicol. 2022. Physiological responses of Holstein calves and heifers carrying the SLICK1 allele to heat stress in California and Florida dairy farms. J. Dairy Sci. 105: 9206–9215.

Dado-Senn, B., V. Ouellet, V. Lantigua, J. Van Os, and J. Laporta. 2023. Methods for detecting heat stress in hutch-housed dairy calves in a continental climate. J. Dairy Sci. 106:1039–1050.

Kertz. Alois *F. Dairy Calf and Heifer Feeding and Management—Some Key Concepts and Practices*. Outskirts Press, July 31, 2019, 166 pages. **https://outskirtspress.com/dairycalfandheiferfeedingandmanagement**

Lago, A. , S. . M. McGuire, T. B. Bennett, N. B. Cook, and K. V. Nordlund. 2006. Calf respiratory disease and pen microenvironments in naturally ventilated calf hosing in winter. J. Dairy Sci. 89:4014-4025.

Mahendran, Sophie A., Nicola Blackie, D. Claire Wathes, and Richard E. Booth. 2023. Comparison of environment quality measurements between 3 types of calf housing in the United Kingdom, j. Dairy Sci. 106:

National Academies of Science Engineering Medicine (NASEM). 2021. Nutrient Requirements of Dairy Cattle, Eighth Revised Edition. Washington, DC.

Nordlund, K. V., and C. E. Halbach. 2019. Calf barn design to optimize health and ease of management. Vet. Clin. North Am. Food Anim. Pract. 35:29–45.