

# Dairy calf housing strategies to maximize welfare and meet producer goals

W. Knauer, VMD PhD

Department of Veterinary Population Medicine, College of Veterinary Medicine  
University of Minnesota,  
St. Paul, MN 5508

## Abstract

Social housing of dairy calves during the pre-weaning period is slowly becoming more popular in the North American dairy industry. The current body of literature suggests that calves housed in a group (> 2 calves housed together) during the pre-weaning period can have improved growth, social and cognitive skills as compared to individually housed calves. However, there are distinct challenges to group housing, particularly as group size increases beyond 8 calves/group. Veterinarians can and should get involved in producer decision-making when changes to calf management are considered, and can play a key role in protocol development and monitoring programs to help drive success of these systems. The following discussion will describe the current best practices for calf rearing during the pre-weaning period, focusing on large group and pair housing.

**Key words:** social housing, pair housing

## Introduction

There are a myriad of ways to successfully raise dairy calves from birth to weaning. However, there are producer and calf-centered factors that we should consider when making changes to a calf rearing program, particularly when changes to housing and housing management are considered. Producers considering changes to their calf rearing program should consider what is best for their operation. Rearing dairy calves through the milk fed period is expensive. A recent economic analysis found that feed costs account for 46% of total pre-weaning rearing costs, with labor, fixed and variable costs accounting for 33%, 9% and 12%, respectively, with total pre-weaning costs ranging from \$250-\$580 overall management and milk allotment scenarios evaluated.<sup>11</sup> On average, one calf requires 7-12 labor hours (7-10 min per day) during the pre-weaning period.<sup>1</sup> In addition, lack of skilled farm labor is becoming an increasing problem, driving some changes to calf housing management to become more labor efficient.

Producers and veterinarians should also consider what is in the best interest of the calf, her welfare and her future in the herd. When thinking about calf welfare in relation to housing management, we should consider factors related to her performance, behavior, and how she feels.<sup>9</sup> As veterinarians, we tend to focus on performance (growth rates, morbidity, mortality), but other factors such as development of natural behavior and social cognition can also impact these important measurable metrics. For example, pair housing during the pre-weaning period results in calves that are less reactive upon entry to a weaned calf pen,<sup>32</sup> and more easily learn a task<sup>27</sup> as compared to individually housed calves. This reduction in reactivity and ability to learn new things may have important impacts on post-weaning stress and morbidity incidence. Conversely, we know that despite positive benefits to the social development of the calf, housing in large groups (>10 calves/group) can have detrimental effects on calf health.<sup>35</sup> Therefore, it is important

to consider all producer and calf factors when making a change and/or advising a client on changes to their calf management program.

## Best practices for all calves

When considering a change to a calf program, especially one from individual to group housing, we need to plan for success through the use of current best practices, starting with best practices for all calf programs. Excellent colostrum management is the single most important factor in determining calf health and survival.<sup>10</sup> Therefore, greater than 90% of calves should be achieving serum total protein levels greater than 5.1g/dL, with greater than 40% achieving serum total protein levels greater than 6.2g/dL.<sup>25</sup> In addition, producers should be achieving pre-weaning mortality, scours, and respiratory disease rates of <3%, <15% and <10%, respectively.<sup>5</sup> Regardless of the feeding program, calves should be growing at a rate of at least 1.6 -1.8lb/d (0.7kg/d). Calves should be offered high milk allowances, and peak milk should be achieved as fast as possible as delays are associated with increased morbidity in group housed calves<sup>17</sup> and reduced growth in individually housed calves.<sup>22</sup> Bedding should be clean, dry, abundant and well-drained, providing calves with adequate coverage (nesting score=3) in cold weather.

Housing should be well ventilated with adequate air exchange at the calf level with protection from both heat and cold stress. An excellent discussion of calf barn design can be found elsewhere.<sup>31</sup> Free-choice water and access to a high-quality starter grain should be available and readily accessible to all calves by day 3 of life.<sup>8</sup> Social housing requires producer commitment and attention to detail, even more so than when calves are individually housed.

## Best practices for large group housing

### Age at group introduction

Overwhelming evidence suggests that an older age at introduction benefits the calf. Calves introduced to a group pen at 6 days (vs. 14 days) were more restless 1 day after introduction, needed more guidance to the feeder, spent less time in the feeder and drank less milk.<sup>15</sup> When comparing introduction at 5 days vs. 24 hours, the younger calves needed more assistance to the feeder, took longer to learn how to use the feeder, and consumed less milk in the first 7 days of life.<sup>28</sup> In addition, calves introduced earlier than 12 days had a 50% increase in the risk of respiratory disease treatment during the pre-weaning period,<sup>35</sup> though this result is not consistent.<sup>29</sup> However, early introduction requires less feeding labor overall (e.g. less individual feeding), so it is an option for some producers, but they should be aware of the calf training needs and individualized attention needed for successful introduction. Practically, a vigorous calf with a strong suckle is likely the best candidate for introduction, regardless of age.

## Pen management

If possible, an “all-in-all-out” strategy should be used to manage calves’ entry to and movement from the weaned calf pen. Separation between younger and older weaned calves should be achieved, if possible, as it is associated with lower prevalence of diarrheal and respiratory disease during the pre-weaning period.<sup>29</sup> Age range within a pen should be no more than 14 days, with lower age ranges within a group correlated to lower risk of mortality during the pre-weaning period.<sup>18</sup> However, this strategy is only feasible on large farms, not medium or small farms utilizing group housing. Smaller farms could consider a “young (<30 days of age)” and “older (30 days to weaning)” calf pen, as this strategy is associated with lower odds of diarrheal disease when compared to one big dynamic group pen.<sup>29</sup> Stocking density is also correlated to calf health, with increased space available per calf within a pen associated with lower risk of calf hood disease.<sup>17</sup> Producers should aim to have > 40ft<sup>2</sup> of well bedded resting space per calf in a group housing setting.<sup>12</sup>

## Group size

Though not feasible on many large farms utilizing automatic feeding and social housing during the pre-weaning period, small groups (< 8-10 calves/group) are overwhelmingly more successful than large groups. Small groups have a reduced risk of respiratory disease and mortality as compared to larger group sizes.<sup>24,35</sup> While low mortality is achievable with group housing,<sup>18</sup> we must consider that antibiotic treatment rates can be high in large group settings anywhere from 63-80% of calves receiving at least one antibiotic treatment during the pre-weaning period.<sup>4,20</sup> In addition to morbidity and mortality, group size can affect feeder utilization and competition at the milk feeding station. Larger group sizes (24 vs. 12) are associated with less time at the feeder and more competition and disturbance during milk consumption.<sup>14</sup>

## Milk feeding practices

Cross sucking is one of the biggest behavioral challenges associated with social housing that can have detrimental effects to heifer longevity in the milking herd through heifer mastitis and blind quarters at first calving. One way to mitigate cross sucking is to eliminate its development through milk feeding practices that result in satisfied, satiated (and tired!) calves. Group housed calves should not be limited in their milk allowance per day. The average Holstein calf will drink 10-12L/d (2.5-3 gal/d)<sup>13</sup> and should receive this as 1.8-2lbs DM per day fed at 12-15% total solids (equivalent to ~140-150g/L, 6L/d, setting on an automatic milk feeder (AMF)). Another consideration particular to automatic milk feeders that will help with calf satiation is adequate meal size. Meal sizes can be changed manually on most AMFs, and should be set at an allowance that will allow calves to drink as much as they want at one time. Larger meal allowances and fewer meals (1.6L/4 meals vs. 0.8L/8 meals) result in less time in the feeder and less calf frustration, measured through unrewarded visits to the milk feeder.<sup>14</sup> One challenge of feeding high levels of milk replacer is space in the hopper of the machine for adequate powder to feed all calves for a full day. Protocols should be developed to ensure that calves do not run out of powder, particularly if worker shifts end prior to ~5PM, as most calves in a pen will visit the feeder and consume a milk meal around dusk.<sup>21</sup>

## Sanitation, calibration, and monitoring

High total bacterial counts (>100,000cfu/mL) in the milk and/or the hoses carrying milk from the feeder to the calf have been associated with diarrheal disease as well as increased odds of an abnormal ear and attitude score as well as increased odds of fever.<sup>17,29</sup> One longitudinal study of 10 autofeeder herds in Minnesota and Virginia showed a large range both within and between farms in total plate count with only 4/10 farms achieving an average total plate count <20,000cfu/mL (goal).<sup>6</sup> Factors associated with lower bacterial counts included higher number of cleaning cycles per day (at least 1 manual clean with at least 4 automatic cleaning/d), the use of chlorine bleach during cleaning, the use of vinyl or plastic feeder hoses (vs. silicone) and an increased number of L/d delivered per machine.<sup>6</sup> The nipple should also be changed frequently to prevent damage, cracks, and a nidus for bacterial growth. Calibration of total solids level should also be performed routinely. The same survey of autofeeder herds in Minnesota and Virginia found that total solids levels are highly variable, and are greater than 2% under or over target feeding levels 26% and 12% of the time, respectively.<sup>6</sup> This variation can have implications for calf health and growth.<sup>29</sup> Protocols should be developed to monitor bacterial counts, machine or milk feeding equipment cleaning, and as-fed total solids level.

## Weaning

Weaning can be a particularly difficult time for calves housed in large groups if careful attention to step-down and grain feeding is not taken, particularly when large amounts of milk are being offered. Full weaning from milk should be delayed until 8 or 9 weeks of age, which will allow more time to adequately increase starter intake, leading to rumen development.<sup>7</sup> A step-down approach should be used to wean the calf off milk over a 14-day period, which will also give the calf time to nutritionally transition.<sup>33</sup> Gradual weaning can also help reduce cross sucking<sup>30</sup> which often starts developing around weaning when calves are frustrated with their reduced milk allowance. Additionally, there is some evidence that individualized weaning based on automatically captured starter intake could be a feasible option in the future as we move to more individualized management through the use of technology.<sup>2</sup>

## Best practices for pair housing

### Age at pairing/small grouping

The benefits of pairing are most evident when the pair is formed prior to 3 weeks of age. Pairing at 6 days (vs. 43 days, 14 days prior to weaning) resulted in improved weight gain and increased starter intake over the first 10 weeks of life.<sup>3</sup> In another study, there was no difference in starter intake or weight gain between calves paired at birth vs. at 3 weeks of age, but both groups consumed more starter as compared to individually housed calves.<sup>26</sup> The most important component of the decision of when to pair is farm and calf specific, and depends on calf vigor, housing, and feeding management. Similar to considerations for introduction to a large group, a calf that is not vigorous (weak suckle, hard time finding bottle, etc.) in the first days of life should have a delayed pairing. It’s possible that it might be easier for larger operations to delay pairing until calves are 1 or 2 weeks of age rather than make decisions on the individual calf level. In addition, most recommendations suggest no more than 7 (14 at very most) days age difference between calves in a pair.

## Facility changes to facilitate pair housing

The pair can be created in a variety of ways, and depends on feeding management, facilities/infrastructure already available, and producer goals. Single hutches can be modified in a variety of ways, either in a “side-by-side” manner or as a fence between two front-facing hutches. This author prefers the side-by-side option as it facilitates drive-by feeding and makes calf observation easier as having to walk between hutches to observe calves in the front-facing option is more difficult for calf health teams. If calves are housed in a barn with plastic dividers between calves, the center divider can simply be removed to form the pair. Importantly, square footage requirements on a per calf basis do not change with the transition to pair housing. DCHA recommends a minimum of 35ft<sup>2</sup> (3.3m<sup>2</sup>) of resting space per calf,<sup>5</sup> which correlates to approximately 2 hutches or 2 calf pens per pair.

## Cross sucking mitigation

Feeding a milk allowance of ≥ 6qts(L)/day through a nipple (nipple bucket or bottle) should be considered as a best practice when calves are housed in a pair. This feeding method increases the amount of time it takes a calf to consume her milk meal<sup>34</sup> as compared to bucket feeding, which has several important implications. This slowing down allows calves to feel more satiated and fulfills their natural behavioral desire to suckle, which in turn reduces the risk of cross sucking.<sup>36</sup> If a nipple is available, even after all milk is consumed, calves will be more likely to continue to suckle from the teat as compared to performing less desirable behaviors including non-nutritive sucking or suckling on another calf.<sup>19</sup> As described previously, cross sucking can significantly reduce a heifer’s longevity in the herd, particularly if it results in blind quarters at first calving.

Another way to reduce the risk of cross sucking during milk feeding is to add a barrier between the calves or simply to completely separate them at feeding time. A barrier between calves that is at least 3ft (1m) long reduces calves ability to suckle on her pair mate or her pair mate’s milk bottle.<sup>16</sup> While separating calves at milk feeding time is labor intensive and can add up to 1min in labor per feeding per pair,<sup>23</sup> it can totally eliminate the observation of cross sucking.<sup>32</sup> While not a feasible solution for many farms, separating calves at feeding time is an option for producers who want to pair-house their pre-weaned calves, but also want to offer milk in a bucket which is still common practice in many areas of the country. In addition, each calf in the pair should have their own water and starter grain bucket available as was described earlier in this document.

## Other calf rearing options: Small group and cow-calf pairs

There is currently not a lot of literature to describe the impact of these two strategies on calf health, performance or welfare outcomes. Producers who are utilizing small social groups (most typically 4-5 calves in a pen, fed with a mob feeder of some sort) to rear their calves typically talk about the benefits to labor efficiency compared to individual housing (which they have typically transitioned from). All of the best practices related to large group and pair housing apply to this subset of calf rearing. It is likely that small groups may be the calf housing strategy of the future, as it has labor benefits compared to pair housing without the health detriment of large group housing. An even smaller subset of producers (mainly organic or small niche farms) are experimenting with nurse cows or having

the cow rear her own calf. There is still much to be worked out from a management standpoint as to how to make this work on a medium or large farm, but producers who utilize this strategy rave about the big healthy calves they wean at 6 months.

## Conclusion

Social housing of dairy calves during the pre-weaning period is slowly becoming more popular in the North American dairy industry. Careful attention to best practices for group and pair housing can ensure calves will make it through the pre-weaned period successfully. Veterinarians can and should get involved in producer decision making when changes to calf management are considered, and can play a key role in protocol development and monitoring programs to help drive success of these systems.

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