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Calf Note #149 – Group housing and weaning strategies

Introduction

Calf management, feeding and housing strategies are continually refined in light of new research to help calves reach their full genetic potential. One strategy – separating newborn calves from each other in individual housing – has been evaluated periodically, more recently in light of increased availability of computerized calf feeders in the U.S. According to USDA, 74.9% of dairy operations in the U.S. housed calves individually prior to weaning in 2006. Group housing is also increasing in some countries as governments require calves be grouped for welfare concerns.

On May 18, 2010, the Dairy Calf and Heifer Association published a "Tip of the Week" that suggested that individual housing of calves prior to weaning "may not be as important as first believed". Previous Calf Notes (Calf Note #56, Calf Note #64 and Calf Note #82) argued that individual calf housing preweaning is preferable to group housing. So, I was interested in the arguments posed in the Tip. It is the focus of this Calf Note to consider those arguments.

Previous published work

A number of studies have compared behavior, health and production of calves housed under different management conditions prior to weaning. Many (Curtis et al., 1988; McKnight, 1978; Olsson et al, 1993, Perez et al., 1990; Waltner-Toews et al., 1986a; 1986b) concluded that housing individually reduced morbidity and/or mortality compared to group housing. Others (Wells et al., 1996) concluded that reported calf mortality to 21 days of life was not affected by housing. James et al. (1984) also concluded that group vs. individual housing did not affect calf mortality in Virginia DHI herds.

Effects of calf housing on subsequent milk production has been evaluated. In their 1985 work, Arave et al. (1985) reported that calves housed individually and in isolation (without visual access to other calves) prior to weaning produced significantly ($P < 0.05$) more milk than calves housed in hutches or in groups of six. Calves housed in isolation produced 922 kg more milk than calves housed in groups. Behavioral measurements (vocalization, defecation, and urination during handling experiments) were greater in calves housed in groups and the authors suggested that these behaviors could indicate increased stress in group-housed calves when handled. It was also hypothesized that calves reared in isolation bonded more quickly to humans and were more docile after calving. However, subsequent work (Arave et al., 1992) did not show an increase in milk production nor changes in calf behavior. Finally, Creel and Albright (1985)

reported that calves reared in isolation appeared more stressed as indicted by greater standing behavior and increased serum cortisol following stress as yearlings. However, no studies have shown reduced animal performance when individual housing is properly managed.

California Research

The DCHA Tip of the Week cited a paper by Reed and coworkers (1999) and suggested that this research showed lower death loss and lower production costs when colostrum-deprived calves were raised in groups compared to calves in isolated pens. There are several problems with this conclusion – indeed, the authors of the Reed paper actually concluded that mortality was not statistically different between the two groups ($P = 0.14$). The reported mortality in this study was 44 and 20% in pen and "mob" calves, respectively. This high mortality suggests fundamental problems with the herd used for the research. Another issue is the interpretation of the term "pen". In this study, the pen was an elevated metal pen (8 ft x 6 ft) whereas the "mob" group was housed on a pasture at the stocking rate of 20 calves/acre. Calves in the pens had contact with other calves, thereby violating an important reason for placing calves in isolation in the first place (i.e., separation). Finally, the diet of the two groups of calves differed (pen calves were fed chopped alfalfa hay whereas mob calves were fed irrigated pasture). Milk and grain were fed separately to pen calves and as a group to mob calves. Calves on pasture could eat as much pasture as desired whereas calves in pens were limited to 7 lb of hay per day. Both groups received up to 5 lb of grain/calf daily. Thus, it seems difficult to conclude that (1) death loss differed meaningfully; and (2) housing was the cause of any perceived difference.

Spanish Weaning Study

The DCHA Tip of the Week cited a study by Bach et al. (2010) as an example of a weaning study that showed that calves moved out of hutches into group pens at 49 days of age had one-half as many cases of respiratory disease as calves housed in pens to 56 days of age. The Tip implies that these data support early movement out of individual housing and into groups. A closer reading of this paper suggests that these results need to be put into context.

In this study, 320 calves were housed in individual covered hutches bedded with straw until 56 days of age. Then, half of the calves were moved out of hutches into superhutches while the other half remained in the individual hutches until 62 days of age, when they were also moved into superhutches. Calves were then monitored until 104 days.

The authors (Bach et al., 2010) reported that 41.4 and 61.2% of calves grouped at 56 and 62 days of age, respectively, developed a respiratory infection after weaning. They further stated that the odds ratio was 2.13 greater in calves left in the hutches to 62 days of age.

So, why would leaving calves in the hutches for 6 days result in greater incidence of respiratory disease? Well, the answer may lie in the definition of a "hutch". Bach et al. (2010) stated that their individual hutches were 1.1 x 1.6 meters (3.6 x 5.2 ft) in size. This calculates to 1.76 m^2 or

18.7 ft^2. To put this into context, a typical U.S. calf hutch is 3.5 x 6.8 ft (1.1 x 2.1 m), which provides 2.3 m^2 or 23.8 ft^2. Most calf hutches also allow calves to move into a fenced area or to exit the hutch with a chain. By any measure, the hutches used in the Bach study were small. It's possible that the calves kept in the small hutches in this study during were highly stressed, which may have reduced immunity and made them more susceptible to respiratory disease after grouping. The high overall rate of respiratory disease (51% of 320 calves developed respiratory disease in this study) supports this hypothesis. The authors stated "[It]…*could be that hutch dimensions limited the environmental quality as the calf body mass increased over time. Thus, the results of the current study should be applied only to calf rearing conditions similar to the ones described herein and should be applied to other rearing conditions with caution."* (Bach et al., 2010).

Tapkı and others (2006) compared health and behavior of calves housed in pens of 1 x 1.5 m, 1.5 x 1.5 m and 2 x 2 m. They reported that intake and growth were not statistically affected by space available to the calf, but increasing space available increased play, locomotor activities (walking, playing) and reduced time standing ($P < 0.05$). These authors concluded that stress was reduced with increasing space available to the calf. Thus, it the limited space available to calves in the Bach study could have affected performance of calves during the last weeks of the study.

Automated Milk Feeders

Automated milk feeders require group housed calves. The DCHA Tip of the Week contends that "…*death rates have not increased when the farm switched from individual housing to group housing of very young calves.".* The Tip did not support this contention with any data, so I tried to find published research that supported or refuted this contention.

Early work with automated feeders (Maatje et al., 1993) suggested that group housing of veal calves increased rate of disease compared to calves housed in individual crates. Hepola (2003) reviewed research related to group housing of calves and concluded that "*Group rearing of calves requires much skill. Different feeding methods require different skills, and all methods are not suitable for all farms. The risk of infection is higher in groups, whatever the milk feeding method is, and this can lead to health problems in big groups.*".

More recent research, using more intensive management have reported better results with group housed calves. Indeed, Svensson et al. (2006) reported that calves housed in small groups and fed milk by hand had lower risk of disease compared to calves fed individually or those housed in large pens (6 to 30 calves) and fed with automated milk feeders. However, farmers using automated milk feeders housed their calves individually until 1 or 2 weeks of age.

Our own research with automated feeders suggests that they can improve growth and efficiency of gain (Quigley and Bearden, 1996). Use of computer feeders has great potential to improve management. The flexibility to alter liquid volumes, solids content and composition is intriguing and may help improve calf management. However, calves must be healthy prior to

entering the group housing and observation to identify and remove sick calves is essential. It is also my experience with many producers in places like the U.S., Denmark, Japan and Germany that calves are not generally put into group housing with computer feeders immediately after birth; rather they are introduced at 1-3 weeks of age.

The Beef Example

The DCHA Tip also offers the example of beef cow herds wherein calves are housed on pasture as an argument for group housing to reduce mortality. There are many studies that have reported lower mortality in well managed pasture based systems. Why? Likely because the number of animal units per acre (hectare) in most pasture systems is far lower than animals reared in confinement. Further, there are many confounding factors – calving ease of beef cattle vs. dairy cattle, nutrition, access to ad libitum colostrum in the first 24 hours of life, etc. It is difficult to extrapolate death loss/disease from dairy calves in calf hutches and fed commercial milk replacer to beef calves on pasture with access to the dam (and other cows).

It should be noted that even beef pasture systems can suffer from high levels of pathogen exposure. Researchers at the University of Nebraska (Smith et al.) reported that implementation of segregation / isolation methods in their "Sandhills Pasture System" significantly ($P < 0.01$) reduced mortality of newborn calves reared on pasture in specific beef herds. Indeed, the Sandhills system would argue FOR separation of very young calves rather than grouping them.

Is it Better in New Zealand?

The DCHA Calf Tip of the Week contends that calves in New Zealand (5% calf mortality) are generally housed in groups whereas most calves in the U.S. (7.8% preweaning calf mortality, according to USDA) are housed in individual pens or hutches. I cannot confirm the rate of calfhood mortality in NZ; but if we do assume it is 5% - and we assume that 5% is statistically different from 7.8% – the question arises, are there factors OTHER than housing (pens vs. groups) that could account for the differences in mortality? Are there differences in colostrum quality, colostrum feeding practices, climate, maternity management, weaning age, preweaning ration, quality and quantity of starter, vaccination protocols, etc.? Even if preweaning mortality rates differ between New Zealand and the U.S., there are likely a myriad of differences between the way calves are raised. This makes it impossible to assume that all the difference in mortality is attributable to the way calves are housed.

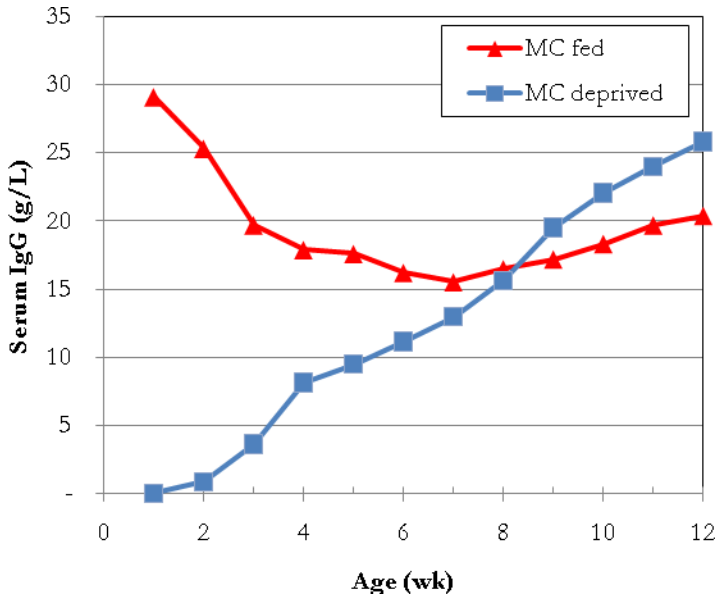
Individual housing – dogma or sound logic?

If calves can be raised successfully in groups, then why does it make sense to separate calves? Under what conditions is separate housing preferred? Or, is the idea of separating calves some antiquated dogma that should be banned?

I would argue that separation remains essential to young calf health, particularly for the first few weeks of life. If we think back to the biology of the animal and it's immunity, there is logic to the idea of separating calves prior to weaning.

If disease is a function of exposure x resistance (immunity), then our management should be sensitive to changes in the calf's immune status and it's susceptibility to disease. Calves obtain antibodies (immunoglobulins) from colostrum (passive immunity) and rely on these until their own active immune system begins producing antibodies.

Sasaki et al. (1977) reported that the half-life of I^{125}-labelled IgG1 was 11.5 days in newborn, colostrum-fed calves. They also reported that endogenous production of IgG began at about the same time. Micusan et al., (1976) also reported that production of IgG began by about 3 weeks of age in colostrum deprived neonatal kids. The chart shows concentration of IgG in kids either fed or deprived of maternal colostrum.



Serum IgG concentrations in neonatal goat kids fed or deprived of maternal colostrum. Adapted from Micusan et al. (1976).

Thus, moving calves at the time when passive humoral is still declining and endogenous humoral immunity has not yet compensated for this decline in passive transfer could set the calf up for disease.

Unfortunately, many of our newborn calves continue to suffer from failure of passive transfer (FPT). Notwithstanding the recent publication from USDA that suggested that rates of FPT in the U.S. have fallen significantly (see Calf Note #143 for more information on this research), there is still a large portion of young calves that receive inadequate passive immunity and are especially susceptible to disease. Thus, if disease is a function of susceptibility and exposure, then reducing exposure in a susceptible population should logically lead to lower disease.

Organic dairies are more sensitive to management strategies to reduce the risk of infection because they minimize the use of antibiotics (note: most organic regulations state that must not withhold medical treatment from a sick animal in order to preserve its organic status). Thus, it's not surprising that Zwald et al. (2004) reported that 63% of organic dairies in WI (20 of 32

herds) housed preweaned calves so that there was no contact with other calves. The authors stated that such housing "…*could reduce the spread of disease.".*

Other research also supports the idea that increasing contact among calves increases the risk of disease. Gulliksen and coworkers (2009) surveyed 135 Norwegian dairy herds to determine factors associated with preweaning diarrhea. They found that housing in free stall increased the risk of diarrhea compared to tie stalls. These authors wrote "*Free-stall compared with tiestall housing systems increase contact between animals, and in larger herds, cows and calves may be more densely housed, which could promote the spread of infections and increase environmental contamination."*. Thus, these data lend support to the idea that increasing contact among animals, particularly young calves, increases the risk of infection and disease.

Animal Welfare and Housing

Cattle are social animals and have requirements for socialization. More and more studies have shown that concern for the social needs of animals (including calves) can improve animal welfare and even in certain cases, animal performance. Therefore, the idea of separating calves from their social groups should be considered carefully and calves should be separated only as long as necessary to minimize the risk of death and disease. I would argue that the greatest insult to a calf's welfare is to allow it to get sick and die. Thus, when exposure exceeds resistance on a farm, strategic use of individual calf housing remains the best option.

Summary

Many arguments can be made for various calf management options. I believe that individual housing is preferred, particularly for calves that have inadequate passive immunity. Many research studies that support group housing (along with other calf management strategies such as accelerated feeding) have relied on calves that received adequate or optimal amounts of passive immunity. Unfortunately, that is not the case on many (most) dairy farms. Unless and until we solve the colostrum feeding "problem", our ability to aggressively feed and manage young calves will be limited.

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