

Voluntary Colostrum Intake in Holstein Heifer Calves

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Abstract

An observational study was done to determine voluntary colostrum intake at the first feeding in nipple bottle-fed Holstein heifer calves. Thirty-two Holstein heifer calves resulting from observed births were hand fed using a nipple bottle for a total of 15 minutes at two hours of age. Each calf was offered a maximum of 3 liters (L) total intake. Median colostrum intake was 2.34 L with a range of 0.0 to 3.0 L. Ten (31.25%) calves consumed less than 2 L and 14 calves (43.75%) consumed the maximum 3 L offered. Exclusive voluntary intake using a nipple bottle is an inadequate method of colostrum administration unless more rigorous feeding practices than those described are used. Under conditions of limited labor availability, bottle-fed calves should be offered an unlimited volume of colostrum at the time of the first feeding, and tube fed using an oroesophageal feeder if they fail to ingest a minimum of 2 L in a timely manner. This practice improves the likelihood that calves will achieve consistent, adequate passive transfer of colostrum immunoglobulins.

Keywords: bovine, colostrum, neonatal calves

Résumé

Une étude observationnelle a été menée afin de déterminer la prise volontaire de colostrum au premier abreuvement chez des veaux de taures Holstein nourris au biberon avec tétine. Un total de 32 veaux de taures Holstein produits lors de naissances observées ont été nourris à la main avec des biberons pour un total de 15 minutes à deux heures d'âge. Chaque veau pouvait recevoir un maximum de 3 L de colostrum. La prise médiane de colostrum était de 2.34 L avec une plage de 0.0 à 3.0 L. Un total de 10 veaux (31.25%) ont consommé moins de 2 L et 14 veaux (43.75%) ont consommé le maximum de 3 L qui était offert. La prise volontaire à l'aide du seul biberon est une méthode d'administration du colostrum inadéquate à moins que d'autres méthodes plus rigoureuses que celles décrites soient utilisées.

Lorsque la main d'œuvre est limitée, les veaux nourris au biberon devraient recevoir un volume illimité de colostrum au moment du premier abreuvement. On suggère l'utilisation d'un tube d'alimentation par voie oro-césophagienne si les veaux n'ingèrent pas le minimum de 2 L dans un laps de temps raisonnable. Cette méthode augmente les chances que le transfert passif des immunoglobulines du colostrum se fasse régulièrement et adéquatement.

Introduction

Passive transfer of immunoglobulins is important in dairy calf management. Calves are born with negligible concentrations of serum immunoglobulins. Consequently, the absorption of colostrum immunoglobulins is required to establish passive immunity and maximize the potential for calf health.^{1,3,6} Calves with inadequate absorption of colostrum immunoglobulins are at greater risk for disease, mortality and decreased productivity.^{1,4,5,9} Currently accepted recommendations state that calves should ingest 3-4 liters (L) of colostrum or in excess of 100 g of IgG in the first day of life.^{1,4,8} Bottle-fed calves typically receive 2 L of colostrum soon after birth and an additional 2 L 12 hours later. Volume and timing of colostrum intake are the factors related to adequacy of passive transfer which are most amenable to management inputs.^{4,8,11} Other factors like colostrum IgG concentration and calf absorptive capacity are less subject to constructive intervention.

Alternative approaches whereby large volumes of colostrum are routinely administered early in life using an oroesophageal feeder have been advocated.¹¹ Current data suggests, however, that the preponderance (59.2%) of US dairy calves receive colostrum using a nipple bottle, and smaller proportions of calves receive colostrum by either natural suckling of the dam (36.5%) or tube feeding (4.3%) using an oroesophageal feeder.¹⁰

The feeding of colostrum has the potential to become more problematic on larger modern dairies. Increasing size of dairy farms places a premium on efficient use of limited labor resources. Labor intensive activities, such

as colostrum feeding, may be subject to compromises due to economic constraints. For example, colostrum is often collected from newly calved cows twice daily, and these cows may be greater than 12 hours post-calving at the time of colostrum collection. Delayed colostrum collection will result in decreased colostrum IgG concentrations.⁷ Likewise, calf feeding on larger farms is typically a scheduled activity which occurs twice daily at 12-hour intervals, and delayed intake has long been recognized as having an adverse effect on the absorption of colostrum IgG.⁴ Consequently, labor, management and throughput constraints may have a negative effect on the passive transfer of colostrum IgG in calves. Previous reports state that as many as 35% of dairy calves suffer from failure of passive transfer (FPT),^{2,4,9} clearly demonstrating that inadequate passive transfer of colostrum immunoglobulins is a persistent problem on dairy farms despite the recognition of the critical importance of this activity.

The goal of this study was to determine whether dairy calves will ingest an adequate volume of colostrum when hand fed for 15 minutes using a nipple bottle. Our intent was to determine the proportion of calves receiving adequate colostrum intake, defined as greater than or equal to 2 L, when bottle fed and to further assess whether calves will voluntarily ingest larger volumes of colostrum than 2 L. These observations will be used to formulate alternative recommendations regarding the administration of colostrum in dairy calves.

Materials and Methods

This study was conducted at the University of Missouri Foremost Teaching and Research Dairy Farm. The study population consisted of 32 Holstein heifer calves. Prior to calving, dry cows were fed a total mixed ration (TMR) calculated to meet cow nutritional needs based on published National Research Council guidelines on an *ad libitum* basis. In addition to the TMR, free access to grass hay and pasture was provided. Cows were observed frequently throughout the dry cow period. After recognition of labor, cows were moved to a maternity barn where they calved. Only calves resulting from observed and attended calvings were enrolled in the study. The described study was one component of a series of related studies which were conducted over a two-year period spanning 2005 through 2007, and calves were enrolled throughout the study period. After parturition, each calf was immediately separated from its dam and weighed using a scale. Cows were milked using a portable milking machine. Each calf was assisted to stand and was hand fed colostrum with a nipple bottle for 15 minutes at two hours of age. Personnel feeding calves were all experienced in the feeding of calves and had participated in several previous studies. The volume of colostrum ingested was then recorded.

Each calf was offered a maximum of 3 L of fresh colostrum. Given the time constraints created by calf handling, separation from the dam and colostrum collection and feeding prior to two hours of age, all colostrum was collected in a rather narrow time frame preceding colostrum administration, therefore colostrum was not refrigerated prior to administration. Bottle and nipple type did not vary among calves. Calf weight and parity of the dam were also collected for further data analysis. The proportion of calves ingesting varying volumes of colostrum was determined as was the proportion ingesting an acceptable volume, defined as 2 L intake. Similarly, the proportion of calves ingesting the entire 3 L offered was calculated. A linear regression model was used to determine whether colostrum intake was associated with calf weight.

Results

Median colostrum intake was 2.34 L, with a range of 0.0 to 3.0 L. As shown in Figure 1, five calves ingested less than 1 L of colostrum during the defined feeding period, and an additional five calves ingested greater than or equal to 1 L, but less than 2 L of colostrum. A total of 10 (31.25 %) calves consumed less than 2 L, and these calves were defined as failures. Eight calves consumed greater than or equal to 2 L, but less than 3 L. Fourteen calves (43.75%) consumed the maximum 3 L offered. Calf weight was not significantly associated with colostrum intake ($P>0.05$).

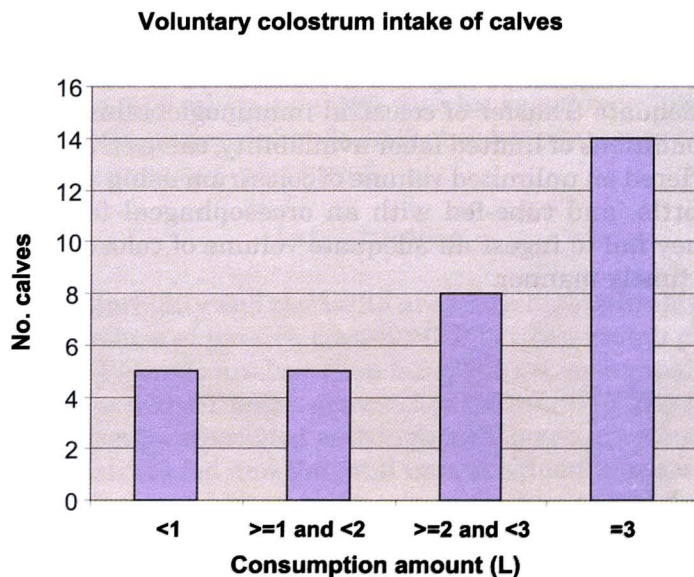


Figure 1. Histogram illustrating voluntary colostrum intake at the first feeding in 32 nipple bottle-fed Holstein heifer calves given the opportunity to nurse for 15 minutes.

Discussion

In this study, ten of 32 calves (31.25 %) consumed less than 2 L of colostrum at two hours of age and were deemed failures. Most sources recommend that calves ingest at least 2 L of colostrum.^{4,8} This observation gives credence to the persistent observations of high FPT rates on dairy farms. These results indicate that voluntary colostrum intake using a nipple bottle is an inadequate method of colostrum administration in a significant proportion of calves. The stated goal of a minimum of 2 L colostrum intake might have been met if calves had been offered colostrum for a longer time interval or repetitive efforts had been made to administer colostrum. However, more labor intensive colostrum administration strategies are likely unsuitable for many large, modern dairies with limited labor available. Fourteen calves (43.75%) consumed the maximum 3 L of colostrum, and likely would have consumed more had it been offered. This observation suggests that a significant proportion of calves will voluntarily ingest larger volumes of the colostrum than the traditional recommendation of 2 L. Administration of larger volumes of colostrum to these calves will likely increase the proportion of calves with adequate passive transfer, and limiting these calves to a maximum intake of 2 L at the time of the initial feeding is probably counterproductive.

Conclusions

Under the conditions of this study, exclusive voluntary intake of colostrum from a nipple bottle was an inappropriate method of colostrum administration. A large proportion of calves (31%) failed to ingest 2 L of colostrum when fed with a nipple bottle for a maximum of 15 minutes. To improve the likelihood of consistent, adequate transfer of colostrum immunoglobulins under conditions of limited labor availability, calves should be offered an unlimited volume of colostrum using a nipple bottle, and tube-fed with an oroesophageal feeder if they fail to ingest an adequate volume of colostrum in a timely manner.

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