



A survey of dairy calf management practices among farms using manual and automated milk feeding systems in Canada

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ABSTRACT

Dairy calves in North America traditionally are housed individually and fed by manual milk feeding (MMF) systems with buckets or bottles. Automated milk feeders (AMF) allow for more natural milk feeding frequencies and volumes, and calves are usually housed in groups. The objectives of this study were to (1) determine the prevalence of various milk-fed calf management and feeding practices and (2) compare these practices between dairy farms using MMF and AMF systems. A national online survey was performed from January to May 2015 to quantify management practices for the care of milk-fed dairy calves in Canada. A total of 670 responses were received (6% of all dairy farms in Canada). Among respondents, 16% used AMF and 84% used MMF. Seventy percent of the farms using AMF had freestall barns compared with only 48% of those using MMF. A greater proportion of AMF farms (30%) also had automatic milking systems (AMS) compared with MMF farms (8%). Among tie-stall farms, a herd size of >80 milking cows was associated with having an AMF [odds ratio (OR) = 3.8; 95% confidence interval (CI): 1.6–11.4]. For freestall or bedded-pack farms, a herd size of >80 milking cows (OR = 3.5; CI: 1.8–6.6), having an AMS (OR = 3.1; CI: 1.6–5.7), and use of cow brushes (OR = 3.1; CI: 1.3–6.9) were associated with having an AMF. Calves fed with AMS typically were housed in groups of 10 to 15, whereas almost 76% of the farms with MMF housed calves individually. Although both AMF and MMF farms fed similar amounts of milk in the first week of life (median = 6 L/d), the cumulative volume fed in the first 4 wk differed significantly,

with a median of 231 versus 182 L for AMF and MMF, respectively. Median peak milk allowance was higher for AMF than for MMF (10 vs. 8 L/d, respectively). In summary, farms using AMF were larger, provided more milk to calves, and used more automation in general (i.e., in other areas of their operation). These data provide insights into calf-rearing practices across Canada and into how the use of AMF is affecting calf feeding and management on dairy farms.

Key words: dairy calf, management, automation, manual feeding

INTRODUCTION

Under conventional dairy systems in North America, most calves are individually housed and fed by manual milk feeding (MMF) systems through open buckets or bottles (Vasseur et al., 2010; USDA, 2016). In addition, dairy farms traditionally use restricted milk feeding plans, providing calves 10% of their BW in milk per day (Khan et al., 2011). These practices may allow for early weaning of calves by promoting early solid feed intake and reduction of rearing costs. The latter often is achieved by feeding restricted volumes of milk with restricted frequency (i.e., 2 meals per day; Khan et al., 2011). In the United States, the USDA's National Animal Health Monitoring System (USDA, 2016) found that 85% of dairies housed calves individually, 72% fed milk through open buckets, and 56% offered 4.7 L of milk/d or less to calves. Similarly, in Canada, 88% of farms in Quebec housed calves individually and 92% used open buckets, and the median amount of milk offered to calves was 5.5 L/d (Vasseur et al., 2010).

Research from Canada, Denmark, and the United Kingdom has shown that restricted milk feeding and the lack of socialization associated with individual housing constrain the welfare of calves by limiting their expression of natural behaviors such as sucking for milk and social play (de Passillé et al., 1993; Jensen et al., 2015),

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subjecting calves to hunger and frustration (Thomas et al., 2001; Borderas et al., 2009; Rosenberger et al., 2017) and impairing calf health (Appleby et al., 2001; McCorquodale et al., 2013). These common practices also do not realize calf growth potential (Miller-Cushon et al., 2013; Rosenberger et al., 2017), and although other factors such as genetics play a role (Davis Rinker et al., 2011), these practices may also reduce future milk production performance (Soberon et al., 2012; Soberon and Van Amburgh, 2013; Gelsinger et al., 2016).

Automated milk feeders (**AMF**) are an alternative to MMF systems. They involve the use of computer-controlled systems and typically are associated with housing calves in groups while providing individualized feeding of milk (Jensen and Weary, 2013). They provide for more natural and efficient rearing of calves than MMF systems by allowing larger amounts of milk to be fed several times a day, resulting in improved calf welfare (Käck and Ziemerink, 2010; Jensen and Weary, 2013). Nonetheless, good management practices are required when using AMF because there is some potential for intensive group housing to have detrimental effects on calf health and welfare if not managed properly (Svensson and Liberg, 2006). For example, when calves are housed in large groups, risk of respiratory disease and mortality rate increase (Svensson et al., 2003, 2006; Svensson and Liberg, 2006) and feeding patterns of newly introduced calves are altered (Jensen, 2003).

Information on current calf management practices is necessary to assess changes in practices and the effect of potential on-farm interventions and adoption of technology to improve calf welfare and performance on dairy farms. Therefore, the objectives of this study were to (1) determine the prevalence of various milk-fed calf management and feeding practices and (2) compare these practices between dairy farms using MMF and AMF systems.

MATERIALS AND METHODS

A cross-sectional online survey of dairy farmers across Canada was conducted from January 2015 to the end of May 2015. The survey was administered via a web-based survey platform (FluidSurveys; SurveyMonkey, San Mateo, CA). An email with an introductory letter and the hyperlink to the survey was sent by the 2 dairy herd management centers in Canada (CanWest DHI, Guelph, Ontario; Valacta, Sainte-Anne-de-Bellevue, Quebec) to dairy producers registered in their databases (implied sampling frame = ~80% of dairy producers in Canada). Additionally, the survey was advertised in the Dairy Farmers of Canada (Ottawa, Ontario) internal

newsletter, the Dairy Research Cluster blog (<https://dairyresearchblog.ca>), and 2 dairy cattle magazines distributed across Canada (*Milk Producer* and *Le Producteur de Lait Québécois*) and on social media (e.g., Facebook). This study was reviewed and approved by the University of Guelph Research Ethics Board (REB no. 14JN025).

Sample Size Estimation

The WINPEPI statistical program (version 11.62; Abramson, 2011) was used to estimate the number of farms required to describe population attributes ($n = 11,962$) such as mean daily milk allowance and proportion of farms housing calves in groups. Using an assumed standard deviation of 2.5 L/d and an acceptable error of 0.2 L/d for daily milk allowance, the required sample size was 574 farms for a confidence level of 95%. Using an assumed proportion of farms housing calves in groups of 0.3 and an acceptable error of 0.035, the required sample size was 685 farms.

Collection and Description of Data

The survey was designed in consultation with a panel of experts (11 dairy specialists from academia, industry, and government) and was pretested by 8 dairy producers, an equal number of which used MMF or AMF systems. The final version of the survey (available in English and French) consisted of 2 questionnaires with closed- (i.e., multiple choice, ranking, and 5-point Likert scales) and open-ended questions; 1 questionnaire was for producers using MMF systems (i.e., milk offered via open bucket or teat—bottle, bucket, or milk bar), and 1 questionnaire was for producers using AMF (i.e., computer-controlled systems).

Both questionnaires started and ended with 2 identical sections: generalities of the farm (e.g., location, breed of cattle, type of housing) and demographics of the personnel responsible for calves (e.g., age and education level). At the end of the first section, producers were asked what type of automated devices they had on their farm, and based on their answer for AMF (i.e., yes–no question) they were directed to the corresponding questionnaire. We collected data on management and calf care during calves' first days of life (i.e., cow–calf separation, colostrum management) and management and care during the entire milk feeding period. Both questionnaires gathered the same type of information (thus allowing comparisons), but questions were worded differently to be consistent with the milk feeding system being used. In addition, a set of

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