Milking Management and Bulk Milk Iodine Concentrations in Ontario Dairy Herds

K. L. Leslie, D. F. Kelton, L. C. Wagter, K. J. Day, D. L. Storey, J. Melichericik, M.A. Godkin[1]
University of Guelph, Guelph, Ontario, Canada
[1]Ontario Ministry of Agriculture Food and Rural Affairs, Ontario, Canada

Introduction

The role of hygiene in the prevention of new intramammary infections has been well understood since the late 1950's. In 1965, Newbould reviewed the literature on disinfection in the prevention of udder infections.[1] Throughout the next decade, numerous disinfectant products were approved and marketed. Even though significant extension education efforts were mounted, in 1981 a formal observational study reported that the implementation of proper milking management methods on Ontario dairy farms had not kept pace with the current knowledge on mastitis control.[2] Barely 50% of herds were using post-milking teat dipping. Since that time, there has been relatively little published regarding implementation of recommended mastitis control practices.[3] During the same time period, the iodine content of fluid milk has been questioned. The concentration of iodine has been reported for raw farm milk[4] and for retail milk samples.[5] Some evidence of samples with high milk iodine content was documented in these reports. Even though iodine is essential, it is a potentially harmful dietary element, and cause for public concern. The impact of pre-milking teat disinfection on the iodine content of milk has been studied.[6] However, recent literature is lacking on the prevalence of elevated iodine in the farm-gate milk supply. The objective of this project was to determine the current status of the Ontario dairy industry for frequency of use of various milking management procedures, and to study the association between the use of these practices and bulk milk iodine concentrations.

Materials and Methods

In the fall of 1997, Ontario dairy producers were asked to participate in a survey of milking and farm management practices through a questionnaire administered by Ontario Dairy Herd Improvement Customer Service Representatives (CSR's). The survey took the form of a questionnaire that inquired about general farm characteristics and milking management procedures used on the farm. Specific information was requested about the approach and the products used in pre-milking udder preparation, pre-milking teat disinfection, and post-milking teat disinfection. Completed questionnaires were returned to Ontario DHI by the CSR's. Responses were entered in a FoxPro database.

During the same time period, two bulk milk samples were collected and frozen at -20°C. In the spring and summer of 1998, these two samples were thawed and pooled prior to analysis. Iodine concentration was determined using high pressure liquid chromatography (HPLC). The iodine content data was linked with the farm management survey information in an Access database. Descriptive statistics and simple associations between bulk milk iodine concentration and potential risk factors were determined using the Statistix program. A multivariate logistic regression model was used to determine the impact of specific factors on iodine concentration, while controlling for other factors.

Results and Discussion

A total of 2946 producers completed the survey for the Ontario DHI CSR's. The vast majority of Ontario producers use a traditional approach to pre-milking udder preparation, with 65.2% of producers using a wet wash/dry approach to cow preparation (Figure 1). Of these herds, 23.5% reported using an iodine sanitizer in their wet wash prep. The frequency of pre-milking teat disinfection by dipping or spraying was 29.4% of herds (866 of 2960 herds) (Figure 2). This rate of use of pre-milking teat disinfection in herds completing this survey is considerably lower than the 58.3% of herds recently reported in the 1996 National Animal Health Monitoring System (NAHMS).[6] The NAHMS report documented an important herd size effect, with greater than 70% of herds of 100 cows or more using pre-milking teat disinfection.

The distribution of post-milking teat disinfection use among the 2960 herds responding to the survey is shown in Figure 3. Approximately 94% of herds (2960 herds) reported using post-milking teat dipping or spray

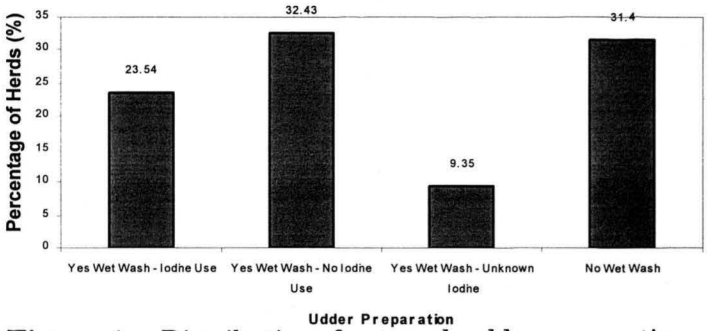

Figure 1. Distribution of wet wash udder preparation on Ontario dairy farms

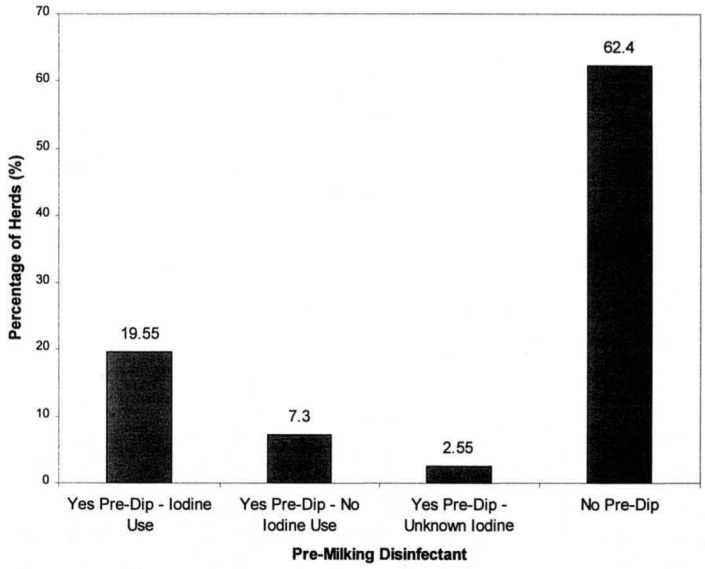

Figure 2. Frequency distribution of pre-milking disinfectant use on Ontario dairy farms

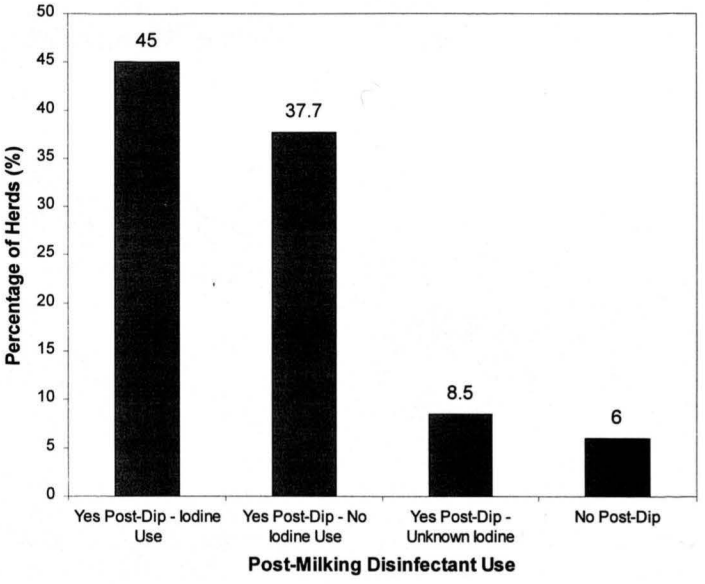

Figure 3. Distribution of post-milking disinfectant use on Ontario dairy farms

ing. This is slightly more than the 88.9% of herds reported in the NAHMS study.[3] The NAHMS project found a meaningful difference in use of post-milking teat dipping or spraying according to herd size, with rates of 86.9%, 95.1%, and 97.2% for herds of <100, 100-199, and >200 cows, respectively. Approximately 50% of the herds using post-milking disinfection were utilizing an iodine-based product. An additional 9.3% of herds did not wish to name their post-milking teat disinfectant. This distribution of iodine use is similar to that reported by NAHMS. The method of application of pre and post-milking teat disinfectant is shown in Figure 4. Teat spraying was used by 23.7% and 16.2% of herds for pre-milking and post-milking disinfection, respectively.

From approximately 2400 of the 2946 herds that completed the farm management survey through

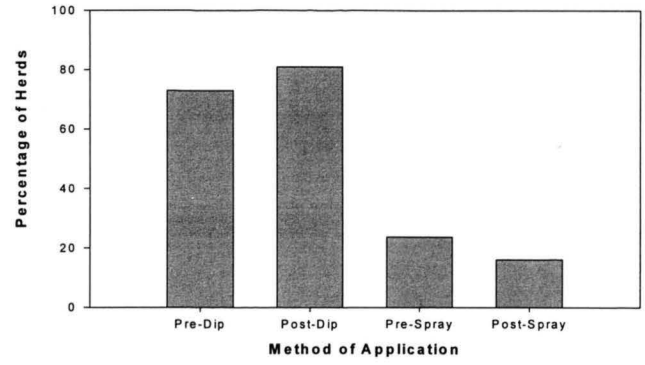

Figure 4. Distribution of method of disinfectant application

Ontario DHI, two bulk milk samples were retrieved from the routine quality monitoring program. Iodine (I_2) concentration was determined by the HPLC method for 1516 of these herds. The frequency distribution of bulk milk I_2 is shown in Figure 5. The mean I_2 content of bulk milk from the Ontario dairy herds studied was

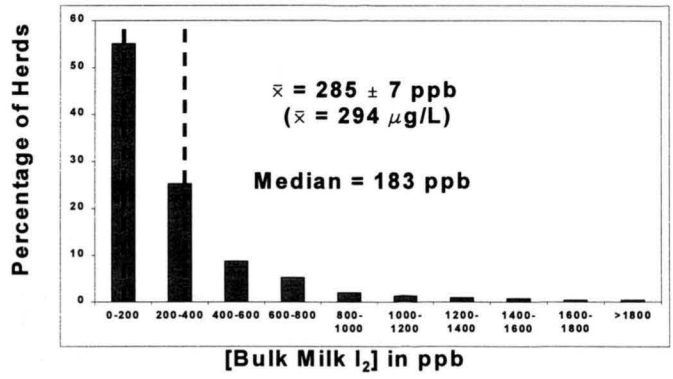

Figure 5. Frequency distribution of bulk milk iodine concentration

285±7 ppb. This level can be converted into a concentration of 294 µg/L of bulk milk. It is noteworthy that the distribution is markedly right-skewed. Thus, a better measure of central tendency would be the median I_2 content of 183 ppb. For further statistical analysis, the bulk milk I_2 concentrations were logarithmically transformed, which resulted in a normal distribution. Several factors were significantly associated with the bulk milk I_2 content in unconditional analyses. There was a significant association between bulk milk sample acquisition route and the I_2 content (Figure 6).

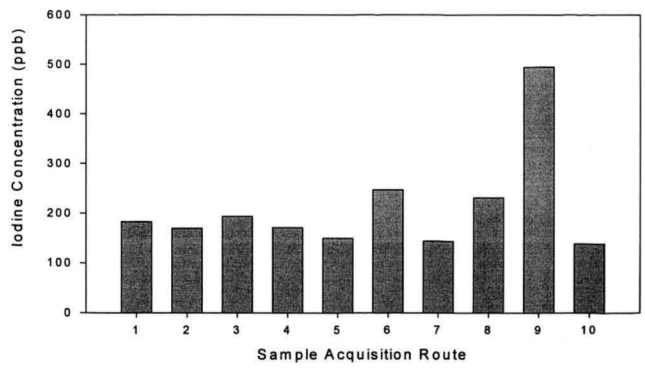

Figure 6. Bulk milk iodine concentration by geographical location

In other words, concentration varied by geographical location of the herd. Figure 7 shows the mean I_2 content by the type of housing system used in the herd. Free-stall housed herds and other housing systems (ie. combinations or bedded-pack/milking parlour herds) had significantly higher iodine content than tie-stall housed herds. Milking procedures were significantly associated

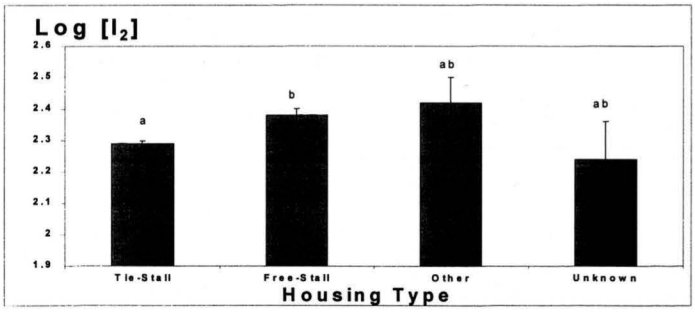

Figure 7. Distribution of bulk milk iodine concentration by housing type

with bulk milk I_2 content. Herds that used pre-milking teat disinfection with an iodine-based product had significantly elevated I_2 concentration compared to herds that used a non-iodine pre-dip or did not use pre-milking teat dipping (Figure 8). Similarly, herds that used post-milking teat disinfection with an iodine-based product had significantly elevated I_2 concentration compared to herds that used a non-iodine post-milking teat dip or did not use a post-milking disinfectant. In order to further examine the association between management factors and the log I_2 concentration in bulk milk, a multiple linear regression analysis was done. In this analysis, the use of iodine-based pre-dip, the use of iodine-based post-dip, free-stall management systems, and geographic

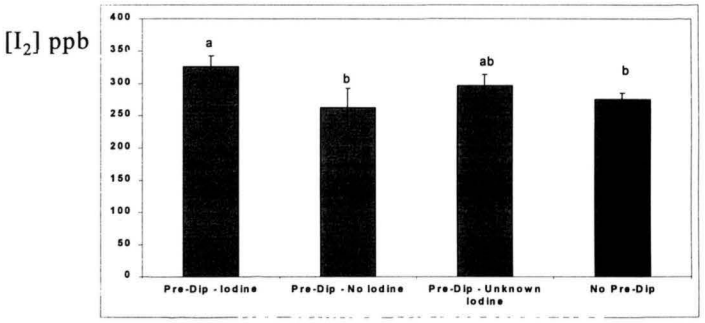

Figure 8. Bulk milk iodine concentration by pre-milking disinfectant use

region were significantly associated with the log I_2 content, while controlling for the effects of other variables. In conclusion, only a very small percentage of Ontario dairy herds have high bulk milk iodine concentrations. Geographic region and selected management procedures are significantly associated with bulk milk I_2 levels. Pre and post-milking teat disinfection with an iodine-based product are associated with higher I_2 concentrations. Further research should investigate the associations between milking management, udder health, and iodine content in milk.

References

1. Newbould, F.H.S. 1965. Disinfection in the Prevention of Udder Infections: A Review. CVJ 6:29.
2. Meek, A., Goodhope, R.G., Barnum, D. 1981. Bovine Mastitis: A Survey of 1200 of the 13,000 Ontario Dairy Producers. CVJ 22:46.
3. Leslie, K.E. 1994. Chapter 9 in Herd Health - Food Animal Production Medicine - 2nd Edition. Ed. Otto Radostits, Ken Leslie and John Fetrow, W.B. Saunders Company.
4. Bruhn, J.C., A.A. Franke, T.W. Smith. 1987. Iodine in California Farm Milk: 1985-1986. J. Food Protect. 50:765.
5. Fischer, P.W.F., A. Giroux. 1993. Iodine Content of Canadian Retail Milk Samples. Food Research Int'l. 26:277.
6. National Animal Health Monitoring System. 1996. Part III: Reference of 1996 Dairy Health and Health Management. P.6.
7. Galton, D.M., L.G. Petersson, H.N. Erb. 1986. Milk Iodine Residues in Herds Practicing Iodophor Premilking Teat Disinfection. J. Dairy Sci. 69:267.