Early Introduction of Non-Formula Cow's Milk to Southern Ontario Infants

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ABSTRACT

Background: Early introduction of cow's milk is a risk factor for the development of anaemia and iron deficiency, which is associated with lower childhood developmental scores. The objective of this paper is to describe the incidence of the introduction of cow's milk before the recommended age of nine months and factors associated with early introduction.

Methods: Mothers of healthy term infants were invited to take part in the Infant Feeding Survey in 2002-2003. These mothers, from Southern Ontario, were interviewed by telephone at three and nine months postpartum to determine infant feeding practices.

Results: One in eight (12.7%) mothers completing the second interview indicated that they were feeding their infant non-formula cow's milk as the primary source of milk before nine months. Multivariate logistic regression analysis showed that mothers feeding cow's milk before nine months were younger, lived in households with lower annual incomes, and were less likely to have attended prenatal classes or to recall receiving information on the introduction of solid foods. They were also more likely to have introduced solid foods or skimmed milk before the recommended ages.

Conclusion: A substantial proportion of Southern Ontario infants are receiving cow's milk before the recommended age, putting them at increased risk for iron deficiency and the resulting sequelae. Further research into why guidelines are not followed is indicated.

MeSH terms: Infant nutrition; milk; health survey

Adequate nutrition in infancy is essential for optimal growth and development. The early introduction of non-formula cow's milk is associated with higher rates of anaemia and occult blood loss in stool.¹ Several studies indicate that feeding cow's milk is a leading factor in iron deficiency in infancy and early childhood.²⁻⁵ Iron deficiency in infancy and early childhood may lead to lower developmental scores in young children, which appear to persist even after treatment.^{6,7}

The joint statement of the Canadian Paediatric Society, Dietitians of Canada, and Health Canada recommends that infants be given breastmilk exclusively for the first six months. At six months, solid foods are to be introduced while continuing to breastfeed for up to two years or longer. Infants who are not breastfed, or who are weaned from breastmilk before nine months of age, are to be fed infant formula. After nine months, whole milk may be introduced. At no time in the first twelve months of life is the use of partly skimmed or skim milk or non-formula soya-based beverages recommended.¹

Governments and health agencies in many other developed countries recommend the use of infant formula until twelve months.^{8,9} From the few studies looking at the introduction of cow's milk by nine months, as recommended in Canada, one multinational study done in Europe in the early 1990s determined that 18% of infants were fed cow's milk as their main drink at nine months.¹⁰ In 1992-93, 17% of Scottish infants were reportedly receiving cow's milk as their main drink by nine months.¹¹

Even fewer studies describe the factors associated with the early introduction of cow's milk. Ummarino et al.¹² report that the introduction of cow's milk by six months of age to Italian infants was higher in mothers with fewer years of education.

There are studies describing maternal factors associated with the introduction of solid foods before the recommended age. Factors associated with the early introduction of solid foods (not cow's milk) include younger, less educated mothers who smoke, live in less densely populated areas, who do not initiate breastfeeding or stopped breastfeeding before their child was one year of age.^{13,14}

The objectives of this paper are to:
a) determine the proportion of infants

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TABLE 1

Characteristics of Mothers by Use of Non-formula Cow's Milk

	Cow's Milk Used as Primary Source of Milk		Unadjusted Odds Ratio (S.E.)	p-value
	Before 9 months (n=226)	9 months or older* (n=1,555)		
Maternal age (mean)	27.1	28.9	0.93 (0.01)	0.007
Education				
< high school (%)	14.1	10.0		
Completed high school	37.6	24.9		
College or trade	37.6	44.4		
University	10.6	20.7	0.68 (0.05)	0.005
Income				
<\$20,000 (%)	7.1	4.0		
\$20,000-59,999	53.1	44.6		
\$60,000+	21.7	35.2		
Not stated	18.1	16.2	0.75 (0.02)	0.001
Married/common law (%)	93.4	96.3	0.54 (0.21)	0.19
Maternal				
First child (%)	35.4	38.6	1.15 (0.27)	0.60
Smoked during pregnancy (%)	22.6	15.9	1.54 (0.50)	0.25
Person smoked in house (%)	8.0	4.4	1.89 (0.54)	0.09
Prenatal plans to:				
Breastfeed (%)	80.1	89.0		
Formula feed	17.7	9.9		
Combination	2.2	1.1	1.43 (0.11)	0.009
Initiated breastfeeding (%)	77.9	86.2	0.56 (0.06)	0.007
Information Received				
Attended prenatal classes (%)	64.1	77.1	0.53 (0.05)	0.002
Pregnancy information (%)	70.2	72.7	0.88 (.013)	0.44
Start of solid foods (%)	77.7	88.7	0.44 (0.06)	0.003
Formula feeding (%)	75.1	80.4	0.74 (0.10)	0.08
Infant Feeding Practices				
Ever fed infant nuts (%)	13.3	7.9	1.78 (0.24)	0.01
Ever fed egg white/whole egg (%)	18.1	14.6	1.30 (0.07)	0.01
Ever fed honey (%)	7.5	4.5	1.72 (0.49)	0.13
Ever fed unpasteurized milk (%)	2.6	0.6	4.21 (1.15)	0.006
Fed cereal before 4 months (%)	36.7	16.8	2.88 (0.18)	0.001
Fruit/vegetable before 4 months (%)	8.0	2.9	2.90 (0.97)	0.03
Fed skim milk or soya/rice beverages before 12 months (%)	28.3	9.5	3.76 (0.56)	0.001
Cereal, fruit/vegetable, meat, or skim milk before recommended (%)	51.3	24.0	3.33 (0.37)	0.001

* Includes those not feeding cow's milk at time of interview

being fed non-formula cow's milk before the recommended age within a sample of Ontario mothers, and b) describe the maternal and household factors associated with the early introduction of cow's milk.

METHODS

The analyses were performed with data from the Southern Ontario Infant Feeding Survey. The survey was conducted by eight health units* in Southern Ontario in 2002-2003 as part of the Early Child Development projects of the Ontario Ministry of Health and Long-Term Care, which were in response to the September 2000 *First Ministers' Communiqué on Early*

Childhood Development.¹⁵ Data from five of the eight collaborating health units – those whose data collection was comparable and complete at the time of the analysis – are included in this study.

Women living in the participating public health unit areas, who had given birth to a healthy term infant between January 1, 2002 and January 20, 2003, were caring for their infant, had a telephone, spoke English, were 16 years or older, and consented to public health follow-up were eligible for inclusion in the study. Mothers who were known to have infants with significant health problems or whose infants were known not to be residing with them were not included.

A letter outlining the study was sent by the reproductive health manager of the local health unit to each eligible mother three to four weeks before the first (three-month) interview was scheduled. The study was described and verbal consent was obtained from each subject before the beginning of each interview. All health

units secured approval from their respective ethics review committees prior to data collection.

The survey collected socio-demographic data along with questions to determine breastfeeding initiation and duration rates as well as barriers and supports to breastfeeding at three and nine months. The nine-month interview also asked about the introduction of breastmilk substitutes and solid foods in addition to maternal knowledge about infant dental care and postpartum depression.

At the nine-month interview, infants ranged in age from 270 to 349 days (mean 279 days or 9.2 months). Mothers of infants who were 274 days or younger and were being fed non-formula cow's milk (whole, 2%, 1%, or skim) as a primary source of milk were categorized as early users (before 9 months). The other category (9 months or later) included mothers of infants who were 275 days or older and being fed non-formula cow's milk as well as infants (all ages) who were being fed

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TABLE II

Final Multivariate Logistic Regression Model: Non-formula Cow's Milk as a Primary Source of Milk

	Odds Ratio* (S.E.)	p-value
Maternal age	0.96 (0.01)	0.008
Household income	0.92 (0.01)	0.003
Attended prenatal classes	0.81 (0.05)	0.033
Information on start of solid foods	0.44 (0.05)	0.003
Ever fed unpasteurized milk	8.22 (3.23)	0.006
Cereal, fruit/vegetable, meat, or skim milk before recommended age	3.08 (0.49)	0.002

* Adjusted for other variables in model

breastmilk, formula, or a combination of breastmilk and formula.

The dependent variable was dichotomized into cow's milk 'before 9 months' and '9 months or later' as described above. Variables regarded as predictive of the early introduction of milk and other foods, as described in published studies, were used in the bivariate analysis. Demographic variables included mother's age at the infant's birth, mother's education, household income, and marital status. Maternal variables were first-time/experienced mother, smoking status during pregnancy, exposure to second-hand smoke in the home, prenatal infant feeding plans, breastfeeding initiation. Information variables included prenatal class attendance, and the receipt of information on pregnancy, infant feeding, and infant formula. Infant feeding practice variables included the introduction of nuts/peanut butter, egg whites/whole eggs, honey, cereals, fruit/vegetables, meat/alternates, or skim milk/soya/rice non-formula beverages before recommended ages, and the feeding of non-pasteurized milk. Variables with a p-value of 0.10 or less on bivariate analysis were introduced into Stata's survey logistic regression model¹⁶ using the public health unit as the primary sample unit. The final model was determined through backward stepwise regression modelling.

RESULTS

Of the 2,797 women eligible for interview in the five public health areas, 2,058 (73.6%) completed the three-month interview and 1,781 (63.7%) completed both interviews (range: 57.2% to 68.6% per health unit area). The mothers who completed both interviews ranged in age from 16 to 43 years (mean 28.7 years), which is similar to the mean age of all women registering live births in the areas for 2001

(28.2 years), the most recent available data. Just over one third (38.2%) were first-time mothers and 95.9% lived with a partner. More than half (62.9%) had a post-secondary education and 34.1% lived in households with an annual income of \$60,000 or more. About one in six (16.7%) of the mothers smoked at some point during their pregnancy and 80.2% of that subgroup reported continuation or resumption of smoking after the birth of their infant.

Over one third (35.9%) of the mothers responding to the nine-month interview indicated they had given their infant non-formula cow's milk 'more than once'. The age of first introduction of cow's milk ranged from 2 to 11.5 months with an average age of 8.2 months. Of those who had introduced cow's milk, 76% introduced whole (3.25% fat or homogenized) milk. Partly skimmed or skim milk (2%, 1%, or skim) was first introduced as early as three months, with 22% of mothers who had introduced cow's milk (7.9% of all mothers), introducing it by ten months of age (mean 7.9 months). Of note, 16 of the mothers responding to the nine-month interview (0.9%) reported having ever fed their infant unpasteurized (raw) cow's milk.

One in eight (12.7%) mothers interviewed said they had introduced and were using non-formula cow's milk as a primary source of milk before their infant reached nine months of age. The mothers who did so were younger, less educated, and lived in lower income households than mothers who did not. They were less likely to have attended prenatal classes, to have planned to breastfeed their infant, or to have initiated breastfeeding. These mothers were also less likely to state they received information on the introduction of solid foods. They were more likely to have introduced nuts, egg white, cereal, fruits and vegetables, skim or soya beverages before the ages

recommended by the joint working group of the Canadian Paediatric Society, Dietitians of Canada, and Health Canada (Table I).

Logistic regression modelling, used to adjust for the presence of other variables in the equation, indicates that younger maternal age, lower household income, non-attendance at prenatal classes, not receiving information about the introduction of solid foods, as well introducing cereal, meat/meat alternatives, or fruits/vegetables before four months, introducing skim milk/soya or rice beverages before twelve months, or ever having fed unpasteurized milk was predictive of the introduction of cow's milk before nine months (Table II).

DISCUSSION

About 13% of mothers in these five health unit areas of Southwestern Ontario were using non-formula cow's milk as a primary source of milk for infants younger than nine months of age. Findings from this study are similar to research done in the early 1990s in several European nations, where 17-18% of nine-month-old infants were being fed cow's milk as their main drink at nine months.^{10,11}

The mothers who introduced non-formula cow's milk early were less likely to attend prenatal classes, where information about the introduction of foods is often made available. They were also less likely to recall receiving information about the introduction of solid foods. Mothers who introduced non-formula cow's milk before nine months were also more likely to have fed non-pasteurized milk to their infant. This indicates a possible lack of knowledge about recommendations and/or a lack of understanding about the reasons for following such recommendations. In addition, there may be other factors that encourage the use of non-formula cow's milk.

Mothers with lower levels of education were more likely to introduce non-formula cow's milk before their infants were nine months old. These findings are consistent with those from Ummarino et al. who found that fewer years of education was linked to the early introduction of cow's milk.¹² Ummarino et al. argue that the lower education level of the mother, not financial resources, is responsible for the

early introduction of cow's milk. In the current study, it was determined that living in households with lower annual incomes was predictive of the early introduction of cow's milk, even when controlling for maternal education. Thus, maternal education and knowledge is only one piece of the puzzle. Families also need the financial resources to purchase formula, which is more expensive than non-formula cow's milk. Public health should advocate for policy changes that support healthy choices.

The study sample is from Southern Ontario with a predominantly white, English-speaking population. About 30% of the women of childbearing age in the study area reside in rural communities. This limits the generalizability of the findings to similar populations. A second limitation is the loss to follow-up in the sample. Mothers who completed both interviews were older, had completed more years of education, lived in households with higher annual incomes, were more likely to be married, to have initiated breastfeeding, and to be breastfeeding at three months than those completing only the first interview. Women completing both interviews were also less likely to have smoked during their pregnancy than mothers who completed only one interview. The loss of these subjects may have biased the results by creating a lower estimate of the proportion of mothers who introduced cow's milk before nine months. It is also likely to have reduced the magnitude of the association between the early introduction of non-formula cow's milk and other factors under investigation. A study of the early introduction of cow's milk, specifically looking at the underlying reasons for it, would provide valuable information to health professionals.

It is important to provide nutrition education and support for prospective and new parents and their supports. A consistent clear message, that cow's milk is not recommended before nine to twelve months of age, must come from all health

professionals. Public health must continue to provide information about infant nutrition, specifically targeting those with lower levels of education, to improve adherence to the recommendations and ultimately improve infant nutrition and health in Canada. More research looking at how best to overcome the barriers to keeping infants on formula until 9-12 months of age is also indicated.

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RÉSUMÉ

Contexte : L'introduction précoce du lait de vache est un facteur de risque lié à l'anémie et à la carence en fer, lesquelles sont associées à de moins bons indices de développement du jeune enfant. Nous avons voulu décrire l'incidence de l'introduction du lait de vache avant l'âge recommandé de neuf mois et les facteurs associés à son introduction précoce.

Méthode : Nous avons invité les mères de nourrissons en bonne santé nés à terme à participer à l'enquête *Infant Feeding Survey* en 2002-2003. Ces mères, qui habitent le Sud de l'Ontario, ont été interviewées par téléphone trois et neuf mois après l'accouchement au sujet de l'alimentation de leur nourrisson.

Résultats : Lors de la deuxième entrevue, une mère sur huit (12,7 %) a déclaré que le lait de vache (non offert en préparation lactée) était la principale source de lait de son nourrisson avant neuf mois. Une analyse de régression logistique multivariable a montré que les mères qui nourrissaient leurs bébés de moins de neuf mois au lait de vache étaient relativement jeunes, qu'elles vivaient dans des ménages dont le revenu annuel était relativement faible, et qu'elles étaient moins susceptibles d'avoir assisté à des rencontres prénatales ou de se rappeler avoir reçu de l'information sur l'introduction des aliments solides. Elles étaient aussi plus susceptibles d'avoir introduit les aliments solides ou le lait écrémé avant l'âge recommandé.

Conclusion : Une proportion importante de nourrissons du Sud de l'Ontario sont nourris au lait de vache avant l'âge recommandé, ce qui accroît leur risque de présenter une carence en fer et ses séquelles. Il faudrait pousser la recherche sur les raisons de la non-observance des lignes directrices.