Can Exclusive Breastfeeding Reduce the Likelihood of Childhood Obesity in Some Regions of Canada?

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ABSTRACT

Objectives: The prevalence of childhood obesity in Canada is a major concern. Studies report a small but significant inverse relationship between exclusive breastfeeding and childhood obesity. The study objectives were to determine the prevalence of overweight and obesity in a preschool population living in Newfoundland and Labrador (NL) and to examine the relationship between exclusive breastfeeding and preschool obesity.

Methods: This was a cross-sectional analysis of 1,026 children born in 2001 who participated in the Pre Kindergarten Health Fairs in 2005. Heights and weights were collected and body mass index (BMI) calculated. The BMI-for-age references used by the Centers for Disease Control (CDC) in the United States were used to classify the weight status of children. Infant feeding information was collected through a survey. The relationship between breastfeeding and childhood obesity was examined using logistic regression models controlling for child's age and gender, mother's education and smoking status, and whether the baby was preterm or full term.

Results: In 2005, 65%, 19% and 16% of preschool children were normal, overweight and obese, respectively. 74% of women initiated breastfeeding and 43% exclusively breastfed to 3 months. Exclusive breastfeeding to 3 months was protective of preschool obesity (adjusted odds ratio (AOR) 0.65, 95% CI 0.45-0.96).

Conclusion: Obesity is prevalent in preschool children in NL. Exclusive breastfeeding appeared to be a protective factor for obesity in preschoolers. Given the known benefits of breastfeeding and the adverse health consequences of obesity, efforts should be made to increase exclusive breastfeeding which may help to prevent the development of obesity in young children.

Key words: Child; obesity; body mass index; child health; breastfeeding

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Can J Public Health 2010;101(1):36-39.

Obesity is one of the most significant public health problems in the world for adults and children.¹ According to the Canadian Community Health Survey 2.2 (CCHS), in 2004 the combined overweight and obesity rates of young people aged 2 to 17 living in Newfoundland and Labrador (NL) were significantly above the national rates in Canada (NL: 43.7%, CA: 27.0%).² Studies on children living in NL demonstrate an increase in the prevalence of overweight and obesity from 25.1% for children born in 1984 to 36% for those born in 1997.³ The short- and long-term physical health risks for children associated with being overweight or obese include: hypertension, hyperinsulinemia, glucose intolerance, type II diabetes, dyslipidemia, increased risk of early cardiac disease⁴ and psychosocial difficulties.⁵

Recently, research has turned its attention to breastfeeding as being protective of childhood obesity. Studies, including a review of systematic studies and a meta-analysis and a large RCT, have reported inconsistent results.^{6,7} The findings from a large intervention study, the Promotion of Breastfeeding Intervention Trial (2008) that followed over 13,000 breastfed infants in Belarus, did not find any significant difference in weight, BMI or adiposity measures when compared to the non-breastfed population at a follow-up at 6.5 years.⁷

The objectives of this study are to confirm and update the prevalence of overweight and obesity in preschool children living in a predominantly urban area of NL and to investigate whether "exclusive" breastfeeding is protective of preschool obesity in this population.

METHODS

The Memorial University of NL Human Investigations Committee and the Health and Community Services Boards ethics committees approved this study. Consent to participate in the study was implied through completion of the questionnaire which was voluntary.

Study design and population

This is a cross-sectional analysis of 1,026 children born in 2001 in the Eastern region of NL who participated in the Pre Kindergarten Health Fairs in 2005. The Fairs held in the summer of 2005 were open to all children registered to start school in September 2005 and provided an opportunity for children to receive immunizations and be tested for vision, hearing and developmental problems. Through local advertisements and media, parents of children registered to start school in September were requested (but not

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Acknowledgements: The Janeway Research Foundation funded this study. Thank you to Marie Grant, pediatric research coordinator; Sarah Day, study coordinator; Beverley Clarke, Ann Manning, Delores McNeil from the Department of Health & Community Services, Eastern Health; as well as the research assistants who helped with the collection of data.

Conflict of Interest: None to declare.

required) to take part in the Health Fairs. Children who do not attend the Health Fairs are immunized and assessed throughout the school year. Approximately 62% of the eligible sample attended the Health Fairs and of these there was 96% ascertainment. The Health Fairs took place across ten sites in and around St. John's that included community centres, church halls and community gymnasiums. The Fairs were staffed by public health nurses, however two trained research staff collected the information required for the study.

Data collection

Three research assistants were trained by a pediatrician (co-investigator) in taking anthropometric measures. Children were asked to take their shoes off for the height measure and to take off any over clothing for the weight measure. Direct measures were collected by the research assistants using a Tanita digital weighing scale (kg) rounded to one decimal place which was calibrated to the hospital digital scale; the same digital scale was used for all children in the study as well as an Invicta stadiometer (cm) rounded to one decimal place. One research assistant took the weights while the other took height measures. Two measures each were taken and the averages were recorded.

Questions on infant feeding practices were adapted from the Canadian Community Health Survey 3.1.⁸ The questionnaire collected information on demographics, infant feeding practices and other lifestyle/health factors (mother's age, level of education, smoking status and child's age, sex, birth weight, preterm versus full term).⁸ Exclusive breastfeeding was defined as only breast milk (no formula, juice, water) up to and including the age of 3 months. Questions on initiation included: "For this baby did you breastfeed or try to breastfeed your child even if only for a short time?" "How long did you breastfeed this child?" Or "Did you feed this child formula as a baby?"

Data analysis

Age in years and months was collected and rounded to the nearest half year. Body mass index (BMI) was calculated as weight (kg) divided by height (m) squared. The BMI-for-age references published by the Centers for Disease Control (CDC) of the United States were used to classify the weight status of children into three categories using software downloaded with permission from the CDC.⁹ The classification included:

Normal: BMI <85th

At risk for overweight: BMI ≥85th

Overweight: BMI ≥95th

In the current study, "at risk for overweight" is referred to as overweight and "overweight" is referred to as obese. The relationships between breastfeeding and obesity and breastfeeding and overweight were investigated using logistic regression models and by calculating crude and adjusted odds ratios, controlling for variables known to be associated with overweight/obesity in children. In the unadjusted models, the relationship between exclusive breastfeeding to 3 months was compared to formula feeding and mixed feeding (a combination of breastfeeding and formula feeding) to 3 months. Method of feeding was treated as an independent variable and preschool overweight and obesity as dependent variables. In the second model, adjusting for covariates we examined the relationship between exclusive breastfeeding to 3 months as an inde-

Table 1. Characteristics of Study Population (n=1026)

Characteristic		
Male, n (%)	537	(52.3)
Child's age in years, mean (SD)	4.5	(0.5)
Height (cm) mean (SD)	110.3	(5.2)
Weight (kg) mean (SD)	20.4	(3.7)
BMI kg/m ² mean (SD)	16.7	(2.1)
Normal, n (%)	660	(64.3)
Overweight, n (%)	196	(19.1)
Obese, n (%)	170	(16.6)
Mother's education	826	(80.5)
High school, n (%)		
Mother a smoker, n (%)	132	(13.1)
Infant feeding practices		
Initiated breastfeeding, n (%)	737	(73.0)
Exclusive breastfeeding to 3 months, n (%)	435	(42.6)
Exclusive formula feeding to 3 months, n (%)	511	(50.1)
Mixed feeding, n (%)	73	(7.2)

Table 2. Adjusted Logistic Regression Model: Dependent Variable Childhood Obesity (BMI ≥95th percentile) Compared to Normal (BMI <85th percentile) as per CDC

Breastfeeding	n	%	Adjusted OR*	95% CI
EBF to 3 months*	435	42.6	0.66	0.45-0.97
Male infant†	537	52.3	1.01	0.70-1.45
Full term‡	957	93.3	0.72	0.34-1.53
Child's age	1026		1.30	0.90-1.85
Mother's education				
High school§	826	80.5	0.77	0.47-1.25
Maternal smoking	132	13.1	1.48	0.90-2.44

Unadjusted OR 0.67, 95% CI 0.47-0.96

* compared to exclusive formula feeding

† compared to female infant

‡ compared to preterm infant

§ compared to ≤high school

|| compared to non-smoker

Adjusted for gender, age, mother's education and smoking status, and whether the baby was preterm or full term

pendent variable and preschool overweight/obesity compared to normal weight as the dependent variable, but included potential covariates in the analysis: child's birth weight and gender, whether the child was preterm or full term, mother's level of education (≤high school compared to >high school) and current smoking status (yes or no). Odds ratios with associated confidence intervals are reported for both the unadjusted and adjusted models. All data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS 14.0).

RESULTS

Descriptive data are presented in Table 1. According to CDC reference criteria, 64%, 19% and 17% of children were classified as normal, overweight or obese, respectively. Approximately 73% (n=737) of all women initiated breastfeeding and 43% (n=435) of the total sample reported exclusive breastfeeding to 3 months (Table 1). After running the logistic regression models, exclusive breastfeeding up to and including 3 months was found to be protective of preschool obesity, Unadjusted Odds Ratio (UOR) 0.67 (95% CI 0.47-0.96). Exclusive breastfeeding remained protective after controlling for child's gender, whether the child was preterm or full term, child's age, mother's education and current maternal smoking status: Adjusted Odds Ratio (AOR) 0.66 (95% CI 0.45-0.97) (Table 2).

DISCUSSION

There is a high prevalence of childhood overweight or obesity in the preschool population in NL, as demonstrated by an alarming 35% of study participants being classified as overweight or obese.

Our study results are consistent with previously published provincial data in 1997,¹⁰ demonstrating that our sample was representative of the provincial population. However, both these studies suggest a higher proportion of overweight and obesity in NL preschoolers when compared to similar populations in other regions of Canada. The current prevalence of overweight and obesity is concerning but even more so is the trend over time. In a study of Canadian children 7-13 years of age, the authors examined the prevalence of overweight and obesity between 1981 and 1996.¹¹ Over this period, the percentage of overweight in boys increased from 11% to 33% and the percentage of overweight in girls increased from 13% to 27%. The corresponding increases for obesity were from 2%-10% for boys and 2%-9% for girls. This results in a combined prevalence of overweight and obesity of 42% for boys and 36% for girls in 1996.

It is well documented that breastfeeding offers many health-related advantages when compared to other forms of feeding.⁸ Exclusive breastfeeding is the practice of feeding infants only breast milk, without the addition of water, juice, tea, breast milk substitutes, other liquids or foods. Guidelines prepared by the Public Health Agency of Canada in 2004,¹² which align with those of the World Health Organization (WHO), recommend exclusive breastfeeding for the first six months of life, because "it [breastfeeding] provides all the nutrients, growth factors and immunological components a healthy full term infant needs."¹³

Several studies have examined the relationship between the duration of exclusive breastfeeding and the risk of being overweight or obese, however the findings are inconsistent. A systematic review examined the prevalence of overweight in children older than 3 years of age which demonstrated a lower risk of overweight in children who had been breastfed, after controlling for potential confounders. A dose-response relationship with the duration of breastfeeding was observed in some but not all of the "positive studies".¹⁴ The WHO published a report on 'Evidence of the Long-Term Effects of Breastfeeding: Systematic Reviews and Meta-Analysis' and concluded "that the evidence suggests that breastfeeding may have a small protective effect on the prevalence of obesity... [and] the effect of breastfeeding was not likely to be due to publication bias or confounding."⁸ A critical review of this report suggested that the current evidence available does not support this statement.¹⁵ Although the findings from a large intervention study – the Promotion of Breastfeeding Intervention Trial (2008) that followed over 13,000 breastfed infants in Belarus – did not show any significant differences in weight, BMI or other adiposity measures when compared to the non breastfed population after 6.5 years,⁶ these results may not be generalizable to a North American population. Differences in the sample population, the prevalence of childhood obesity, and the current rates of breastfeeding may partly explain differences in study findings.

More research, especially experimental research, is needed to determine the true relationship, although several biological mechanisms have been hypothesized as to how breastfeeding may prevent childhood obesity, such as learned self-regulation of energy intake, metabolic programming in early life, and other confounding parental attributes.¹⁶⁻²¹

Our study included direct measures of children's heights and weights and not self-reported survey data which may underestimate the prevalence of overweight and obesity. We cannot deter-

mine whether the 62% who attended the Health Fairs are representative of the total eligible population. It may be that the mothers who attended the Health Fairs were those who were able to take time off work, were more interested in child health, had a higher education and were therefore less likely to have children who were obese and were more likely to breastfeed. Without knowing the demographics of those mothers who did not attend the Health Fairs, these findings may be generalizable only to those who attended the Health Fairs. The questions on infant feeding were taken from the CCHS 2.1. Although these are validated questions commonly used at a population level, they do not reflect the in-depth breastfeeding definitions established by Labbok and Krasovec.²² There is the social desirability bias associated with questionnaires as study participants may answer questions based on what they feel the researcher wants to know. Finally, as in all retrospective studies, there is the likelihood of recall bias. Some studies have suggested that as the amount of time increases between the time of lactation to the actual capture of the information on lactation, so does the reported duration of lactation.²³ These biases could lead to a positive finding or in essence a type I error, which could explain our positive finding. Observational studies cannot control for all confounders adequately, especially those unknown.

Our results suggest that in an urban population with high rates of childhood obesity, exclusive breastfeeding to three months had a protective effect against preschool obesity. Childhood obesity rates are increasing in Canada and therefore so are the associated adverse health consequences. Researchers and health care advocates recommend intervening during early childhood to prevent obesity,²⁴ and although there are many other factors shown to be associated with childhood obesity – such as socio-economic status, parental obesity, smoking, the number of children in a family, birth weight and rapid early weight gain – early infant nutrition is one modifiable behaviour that may protect for the development of childhood obesity. The promotion of breastfeeding is one population-based strategy aimed at obesity prevention; considering the many other benefits that breastfeeding provides, it is a strategy worth investing in.

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Received: June 3, 2009

Accepted: October 8, 2009

RÉSUMÉ

Objectifs : La prévalence de l'obésité de l'enfance au Canada préoccupe beaucoup. Les études font état d'une relation inverse, ténue mais significative, entre l'allaitement exclusivement au sein et l'obésité de l'enfance. Nous avons cherché à déterminer la prévalence du surpoids et de l'obésité dans une population préscolaire vivant à Terre-Neuve-et-Labrador (T.-N.-L.) et à examiner la relation entre l'allaitement exclusivement au sein et l'obésité préscolaire.

Méthode : Nous avons mené une analyse transversale de 1 026 enfants nés en 2001 ayant participé aux « foires sur la santé en prémaman » en 2005. Nous avons mesuré leur taille et leur poids et calculé leur indice de masse corporelle (IMC). Les tables d'IMC selon l'âge utilisées par les Centers for Disease Control (CDC) aux États-Unis nous ont servi à classer le statut pondéral des enfants. Les données sur l'alimentation des nourrissons ont été obtenues au moyen d'un questionnaire. La relation entre l'allaitement et l'obésité de l'enfance a été analysée selon des modèles de régression logistique après avoir apporté des ajustements pour tenir compte des effets de l'âge et du sexe de l'enfant, du niveau de scolarité et du tabagisme de la mère et de la naissance à terme ou avant terme du bébé.

Résultats : En 2005, 65 % des enfants d'âge préscolaire étaient de poids normal, 19 % faisaient de l'embonpoint et 16 % étaient obèses; 74 % des femmes avaient commencé l'allaitement et 43 % avaient exclusivement allaité leur enfant au sein jusqu'à l'âge de 3 mois. L'allaitement exclusivement au sein jusqu'à 3 mois était un facteur de protection contre l'obésité préscolaire (rapport de cotes ajusté [RCa] 0,65, IC 95% 0,45-0,96).

Conclusion : L'obésité est courante chez les enfants d'âge préscolaire à T.-N.-L., mais l'allaitement exclusivement au sein semble être un facteur de protection. Étant donné les avantages connus de l'allaitement et les conséquences négatives de l'obésité pour la santé, il faudrait agir pour augmenter l'allaitement exclusivement au sein, car il pourrait contribuer à prévenir l'obésité chez les jeunes enfants.

Mots clés : enfant; obésité; indice de masse corporelle; santé de l'enfant; allaitement au sein