The Association of Breastfeeding Duration and Early Childhood Cardiometabolic Risk

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Objective To evaluate the association between breastfeeding duration and early childhood cardiometabolic risk.

Study design A cross-sectional study of 1539 healthy children, 3-6 years of age, recruited through The Applied Research Group for Kids! practice-based research network between October 2009 and August 2015. Adjusted multivariable linear regression was used to examine the association between breastfeeding duration and cardiometabolic risk z score and individual cardiometabolic risk factors of waist circumference, systolic blood pressure, glucose, high-density lipoprotein cholesterol, and triglycerides.

Results The mean breastfeeding duration was 12.5 months (SD = 8.4). Breastfeeding duration was associated with lower cardiometabolic risk z score (beta = −0.03; 95% CI −0.05, −0.01). In analysis of cardiometabolic risk factors, each additional 3 months of breastfeeding was associated with a 0.13 cm (95% CI −0.20, −0.05) lower waist circumference and 0.16 mm Hg (95% CI −0.30, −0.02) lower systolic blood pressure. Compared with children who breastfed for 6-12 months, those who breastfed for 12-24 months had a lower systolic blood pressure of 1.07 mm Hg (95% CI −2.04, −0.10). There was no association between breastfeeding duration and cardiometabolic risk for those who breastfed beyond 24 months.

Conclusions Breastfeeding duration is associated with lower cardiometabolic risk, although the magnitude of association is small. Causation cannot be inferred. Breastfeeding beyond 24 months may not have an added benefit for cardiometabolic health. *(J Pediatr 2018;192:80-5).*

Nutrition during critical windows in early life can influence and program later cardiometabolic health.[1,2] Breastfeeding is the best source of nutrition for infants to optimize growth and development.[3] The World Health Organization recommends exclusive breastfeeding for the first 6 months of life, introduction of complementary foods at 6 months of age, and continued breastfeeding up to 2 years of age and beyond.[4] The American Academy of Pediatrics recommends continued breastfeeding until at least 12 months of age and continued for as long as mutually desired by mother and baby.[3] Similar recommendations have been endorsed by Health Canada[5] and worldwide.[6,7]

The relationship between cardiometabolic risk factors and breastfeeding duration is unclear. However, cross-sectional studies have linked cardiometabolic risk factors to breastfeeding in childhood.[8-11] A longitudinal cohort study in the United Kingdom found that early breastfeeding was associated with lower blood pressure at a median age 7.5 years follow-up; the association was greater among those who had been breastfed for at least 6 months.[9]

We hypothesized that longer breastfeeding duration may have a protective effect on cardiometabolic risk in childhood. The primary objective of our study was to examine the association between breastfeeding duration and a summary measure of cardiometabolic risk factors in children 3-6 years of age. For the secondary objectives, first, we examined the association between breastfeeding duration and individual cardiometabolic risk factors including waist circumference (WC), systolic blood pressure (SBP), glucose, high-density lipoprotein (HDL) cholesterol, and triglycerides. Second, we modeled breastfeeding duration as a categorical variable to assess the effects of lower and upper ranges of breastfeeding duration on cardiometabolic risk.

Methods

This was a cross-sectional study of healthy urban children between October 2009 and August 2015. Participants were children aged 3-6 years who attended scheduled

HDL	High-density lipoprotein
SBP	Systolic blood pressure
TARGetKids!	The Applied Research Group for Kids
WC	Waist circumference

healthcare visits at pediatric and family practices affiliated with The Applied Research Group for Kids (TARGetKids!) in Toronto, Canada. TARGetKids! is a primary care practice-based research network that recruits and follows children through scheduled well-child healthcare visits.[12]

Research personnel embedded in 9 participating pediatric and family medicine practices recruited study participants. Sociodemographic, lifestyle, and dietary information were collected using a standardized parent-completed survey instrument based on the Canadian Community Health Survey.[13] Nonfasting blood samples and physical measures were collected at study visits. MediData Rave (MediData Solutions, New York, New York) was used as the secure electronic data capture system and data repository for all TARGetKids! data.[12] Children were excluded if they had chronic conditions except asthma, severe developmental delay, failure to thrive, and gestational age of less than 32 weeks. In addition, families who were not fluent in English were excluded. Excluded children were less than 10% of the population. Children with missing data on exposure or outcome variables were also excluded.

Consent was obtained from parents. Research ethics approval was granted through the Research Ethics Boards at The Hospital for Sick Children and St. Michael's Hospital, Toronto, Canada.

The primary exposure variable was breastfeeding duration which was determined from response to the questions (1) "Has your child ever been breastfed?"; (2) "Is your child currently breastfeeding?"; and (3) "At what age did you stop breastfeeding?" Maternal recall of breastfeeding duration estimate has been found to be valid and reliable, especially after a short period of ≤3 years.[14] Participants who had never breastfed were classified as having a breastfeeding duration of 0 months and those previously breastfed were assigned the duration at the age breastfeeding stopped. Those currently breastfeeding were classified as having duration equal to the child's current age. Breastfeeding duration was a continuous variable in the primary analysis. In the secondary analysis, breastfeeding duration was modeled as a categorical variable, defined as 0-6, >6-12, >12-23, and ≥24 months, to assess the effects of lower and upper ranges on cardiometabolic risk . Categories were determined from the mean breastfeeding duration and consistent with previously published studies that assessed breastfeeding duration and cardiometabolic risk.[8,15,16]

Trained research assistants measured child and parent height, weight, and WC using standardized anthropometric protocols. Child height was measured using a stadiometer (SECA) and weight was measured using a precision digital scale (SECA, Hamburg, Germany). Without established WC standards for young children, standardized WC was calculated within our study population by age (in years) and sex. Within each age and sex group, a mean and SD were computed for WC. Our standardized WC was similar to a large US sample of comparable age range from the National Health and Nutritional Examination Survey.[17]

Children >3 years old had their blood pressure measured during their scheduled healthcare visit as recommended by the National High Blood Pressure Education Program guidelines and using National Health and Nutritional Examination Survey cut-off points.[18] Systolic blood pressure was measured by auscultation using a standard clinical sphygmomanometer and recommended size blood pressure cuff bladder. Nonfasted blood samples were collected by research assistants who are trained pediatric phlebotomists and transported to Mount Sinai Services for laboratory analysis. Glucose was measured using enzymatic reference method with hexokinase; and lipid (triglycerides and HDL cholesterol) measurements using enzymatic colorimetric on the Roche Modular platform. Standardization was based on existing values for children.[19] Our group and others have shown that fasting status has small and likely unimportant differences on glucose and lipid measurements.[20,21]

The primary outcome was a continuous cardiometabolic risk z score that was calculated for each subject as follows: cardiometabolic risk z score = (z WC + z triglycerides + z SBP + z-glucose + [-z HDL cholesterol]) divided by the square root of 5. Because higher HDL cholesterol is indicative of a healthier metabolic profile the inverse of HDL cholesterol was used. A lower cardiometabolic risk z score indicates lower cardiometabolic risk. Although there is no consistent definition of the metabolic syndrome in young children, prior research has used similar cardiometabolic risk scores.[22-26] Continuous cardiometabolic risk score has construct validity in children[27] and may predict later cardiometabolic risk in children and adolescents.[26] For secondary outcomes, we examined continuous cardiometabolic risk factors including WC, SBP, glucose, HDL cholesterol, and triglycerides.

All potential confounders were selected a priori based on the literature and data collected using a parent-completed, standardized questionnaire.[12] Potential confounders included birth weight, maternal age, maternal ethnicity, maternal education, family income, household smoke exposure, and paternal or maternal history of cardiovascular disease or diabetes. Maternal ethnicity was categorized into European, East Asian, South Asian/Southeast Asian, and other. Other included Arab, African, Latin American, mixed ethnicity, and North American aboriginal. A positive paternal or maternal history of cardiovascular disease or diabetes was dichotomized to "any" or "none" if the child's parent reported being diagnosed with any of the following conditions: heart disease, hypertension, high cholesterol, diabetes, depression. Family history of cardiovascular disease, diabetes, or depression,[28] and overweight/obesity has been associated with cardiometabolic risk in children.[29-31] Outcomes were standardized for child age and sex and, therefore, age and sex were not included as potential confounders in the model.

Statistical Analyses

Descriptive analyses of primary predictor, outcomes, and potential confounders were examined. For the primary analysis, multivariable linear regression was performed to examine the association between breastfeeding duration and cardiometabolic risk z score. Similarly, in secondary analysis, individual cardiometabolic risk factors including WC, SBP, glucose, HDL cholesterol, and triglycerides were examined. In addition, breastfeeding duration was modeled as a categorical