

Breastfeeding Is Associated With Reduced Obesity in Hispanic 2- to 5-Year-Olds Served by WIC

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ABSTRACT

Objective: To examine the relationship between breastfeeding (BF) and odds of childhood obesity in a large, primarily Hispanic *Special Supplemental Nutrition Program for Women, Infants, and Children* (WIC) population.

Setting: A large urban WIC program in California.

Participants: Infants enrolled in WIC born between 2004 and 2007 and observed to age 5 years (N = 39,801; 88.6% Hispanic).

Intervention: Level of BF: fully BF, fully formula feeding, or combination feeding.

Main Outcome Measure: Obesity at age 2–5 years, measured by body mass index (BMI) \geq 95th percentile.

Analysis: Logistic regression analyses to evaluate the association between initiation, duration, and exclusivity of BF and odds of obesity at age 2–5 years, controlling for ethnicity, preferred language, family size, poverty level, and maternal BMI.

Results: Infants exclusively formula fed at birth were significantly more likely than fully breastfed infants to be obese at age 2–5 years (χ^2 [2, N = 39,801] = 123.31; $P < .001$). For every additional month of any BF, obesity risk at age 2–5 years decreased by 1%. Every additional month of full BF conferred a 3% decrease in obesity risk. Ethnicity, preferred language, family size, poverty level, and maternal BMI were also significantly related to obesity risk.

Conclusions and Implications: Breastfeeding may have a role in the attenuation of obesity in early childhood among Hispanic children. The BF promotion and support offered at WIC may have a significant role in reducing rates of early childhood obesity.

Key Words: WIC, breastfeeding, obesity, Hispanic (*J Nutr Educ Behav.* 2017;49:S144–S150.)

Accepted March 6, 2017.

Breastfeeding (BF) is well-established as the preferred method of infant feeding.^{1,2} National advisory groups and public health researchers encourage BF for a number of maternal and child health benefits, including the prevention of childhood obesity.^{3–8} Although many studies found BF to have a protective association with obesity, the validity of these observational studies and meta-analyses were increasingly called into question.^{9–18} Several studies did

not find an association between BF and obesity, and others observed only an association before adjustment for confounders.^{19–28} In addition, a cluster-randomized trial to promote BF did not find increased duration of exclusive or any BF to affect any measures of adiposity at aged 6.5 or 11.5 years.^{29,30} Such findings resulted in claims that the observed association between BF and obesity was due to residual confounding and selection

bias.^{12,13,23} The relationship between BF and obesity, however, is unarguably complex and the results of the BF promotion trial were limited by its study population.³¹ Most recently, a systematic review and meta-analysis of 105 studies that employed various designs and were conducted in many different countries concluded that BF decreased the odds of overweight/obesity by 13%.³²

According to the latest national estimates, 22.4% of Hispanic children aged 2–19 years are obese, compared with 14.1% of non-Hispanic white children and 20.2% of non-Hispanic black children.³³ Children whose households have low incomes and education levels may be at an even higher risk of childhood obesity.^{34–37} Despite the disproportionate burden of childhood obesity in Hispanic and non-Hispanic black children in low socioeconomic families, most studies on BF and obesity were conducted in predominantly non-Hispanic white children of middle to high socioeconomic levels.^{13,38,39} The results of such

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Conflict of Interest Disclosure: The authors' conflict of interest disclosures can be found online with this article on www.jneb.org.

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<http://dx.doi.org/10.1016/j.jneb.2017.03.007>

studies may not be applicable to Hispanic children from low-income families because the relationship between infant feeding and child obesity was found to differ by racial/ethnic and socioeconomic groups.^{13,40-43}

The association between BF and obesity may be different in low socioeconomic Hispanic families for several reasons. Hispanic mothers are known to exhibit infant feeding behaviors different from those of mothers of other race/ethnicities. Researchers found that Hispanic mothers were more likely than non-Hispanic white mothers to initiate BF, resort to a combination of BF and formula feeding shortly after birth, introduce solid foods at an early age, and practice restrictive feeding.^{42,44-48} In Hispanic populations, combination feeding of breast milk and formula was not associated with shortened duration of any BF, unlike in non-Hispanic white populations.⁴⁴ In addition, results of several studies suggested that the effect of BF on childhood obesity may differ based on characteristics that vary among demographic groups, such as maternal weight status, genetic profile, and maternal smoking status.⁴⁹⁻⁵⁸ Understanding early life risk factors for obesity in the Hispanic population is essential because the number of Hispanics in the US continues to increase at the fastest rate of any racial/ethnic group.⁵⁹

As of 2012, over one quarter of children aged <5 years in the US is of Hispanic origin.⁶⁰ Each month, the *Special Supplemental Nutrition Program for Women, Infants, and Children* (WIC) serves approximately 7 million infants and children aged <5 years, of whom over 40% are Hispanic.⁶¹ If increased duration and/or exclusivity of BF can prevent childhood obesity in the growing high-risk population of Hispanic families, such evidence would inform the initiatives and policies of WIC and other health programs that serve this population. Limited studies conducted in predominantly Hispanic populations suggested that BF may well provide modest but significant protection against childhood obesity.⁶²⁻⁶⁷

In this study population of predominantly Hispanic WIC participants, researchers documented that the WIC food packages issued to infants and postpartum mothers were a valid measure of whether an infant was being fed breast milk exclusively,

formula exclusively, or a combination of breast milk and formula.⁶⁸ In addition, information on potential confounders of the BF-obesity association is collected at enrollment into WIC and children's heights and weights are measured every 6-12 months. The aim of this study was to use the information available in a large, primarily Hispanic WIC population in Southern California to assess the relationship between BF duration and weight status at age 2-5 years in this understudied and growing population.

METHODS

Dataset Description and Sample Selection

Public Health Foundation Enterprises (PHFE) WIC is the largest local agency WIC program in the country, serving over 250,000 participants monthly in 53 sites in Los Angeles, Orange, and San Bernardino counties. All WIC administrative data in California are entered by WIC staff into the California WIC Administrative Database. This database captures participant demographic data as well as WIC food package information and height and weight measurements for each participant. The Ethical and Independent Review Services Institutional Review Board reviewed this study and determined it to be exempt owing to use of existing administrative data with no confidential client information.

All data used in this study were captured from the monthly download of all PHFE WIC participants born between 2004 and 2007. Of the 205,283 infants born in the selected years, 75,451 had at least 1 anthropometric measurement at age 2-5 years. Of those 75,451, infants with missing maternal BMI ($n = 22,890$), those who were enrolled in WIC after they were aged 2 months ($n = 9,685$), twins ($n = 1,816$), infants with no age data ($n = 961$), infants with no infant feeding package data ($n = 291$), and low-birth weight and preterm infants ($n = 7$) were excluded from analysis. The final analytical sample was composed of 39,801 records.

Compared with the 39,801 eligible infants, the 164,521 ineligible infants were less likely to be Hispanic (88.61% vs 80.08%; $\chi^2 [1, N = 204,322] = 1559.94; P < .001$) and more likely to have mothers who reported English

as the preferred language (38.88% vs 53.45%; $\chi^2 [1, N = 204,322] = 2720.84; P < .001$); the mothers also reported a smaller family size (mean [SD], 4.35 [1.34] vs 3.74 [1.33]; $t[59,956] = 81.37; P < .001$).

Variable Selection

BF. A recent study validated the use of the 3 WIC postpartum woman-infant food packages as a proxy for BF behavior.⁶⁸ The current study included the rate of issuance by infant age in months of these 3 WIC food packages for postpartum women-infants: (1) the fully BF package (receiving no infant formula from WIC, an indicator of full BF without the use of infant formula); (2) the combination BF package (receiving some infant formula from WIC, an indicator of partial BF); and (3) the formula-only package (receiving the maximum allowable amount of formula from WIC, an indicator of no or limited BF). In the previous validation study, agreement between postpartum women-infant food packages and research study measurements for fully BF, combination feeding, and formula-only feeding packages was 0.89, 0.76, and 0.90, respectively.⁶⁸

Issuance of these food packages to the 39,801 infants in the sample was examined from birth through age 11 months, when WIC food packages change to support the nutritional needs of children aged 1-4 years. Rates of issuance of each package type at infant enrollment into WIC were used as a proxy for BF initiation: issuance of the fully BF or combination BF indicated that BF was initiated; issuance of the formula-only package indicated that BF was not initiated. Duration of issuance of the combination BF package was examined as an indicator of duration of any BF, meaning that infants were fed some breast milk and some infant formula. Duration of issuance of the fully BF package was examined as an indicator of duration of full BF, meaning that infants were fed only breast milk.

Child height/weight. The PHFE WIC clinic staff were trained to follow a standardized height-weight measurement protocol upon hire, and then were audited annually to confirm protocol adherence. The protocol for obtaining height and weight measurements

required WIC staff either to measure the child at the WIC site during the recertification visit or to obtain measurements from health care provider records (typically pediatrician visit records) brought to the WIC recertification visit by the caregiver. The health care provider visit had to be within 60 days of the WIC recertification visit. The WIC protocol called for children to remove shoes and outerwear before they were measured; height was measured to the nearest quarter inch and weight to the nearest quarter pound. The WIC height measurements were obtained using a wall-mounted stadiometer (Model PE-WM-60-76; Perspective Enterprises, Portage, MI) and WIC weight measurements were obtained using a Health-O-Meter 402LB scale (Pelstar LLC, McCook, IL). Scales were calibrated every 6 months by WIC administrative staff. Height and weight measurements were taken every 6–12 months and data were entered into the California WIC Administrative Dataset. For measurements obtained from health care provider records, the date of the measurement to be recorded in the database was the date of the provider visit. Children aged 2–5 years were considered obese if their body mass index (BMI) was \geq 95th percentile with regard to the standard reference population.⁶⁹ About 80% of height and weight measurements were taken by WIC staff; the remainder were taken from pediatric provider records. A recent validation study demonstrated the accuracy of height and weight measurements taken by both PHFE WIC staff and research staff for 287 PHFE WIC children aged 2–5 years. Correlations between WIC and research study measurements for height, weight, and BMI were 0.97, 0.99, and 0.92, respectively.⁷⁰

Demographic variables. In addition to data on BF and childhood weight status, demographic data were extracted from the California WIC Administrative Database and included ethnicity, preferred language, family size, poverty level, age at weight date, and maternal BMI at postpartum recertification into WIC. All demographic data were routinely collected by WIC staff following standardized protocols for certification into the WIC program.

Analysis

The researchers conducted data analysis using SAS software (Version 9.3; SAS Institute, Inc, Cary, NC, 2011). Descriptive statistics were used to describe sample characteristics. Means and SDs were employed to describe family size and maternal BMI. The researchers computed frequencies to describe the percentage of participants below 100% of the federal poverty level, the percentage of Hispanic participants, preferred language, and obesity rates at age 2–5 years. Simple logistic regression was used to evaluate the association among the 3 types of infant feeding at birth and odds of obesity at age 2–5 years. Two separate multiple logistic regressions were performed and odds ratios (ORs) and 95% confidence intervals (CIs) were computed to examine (1) the association of obesity rates at age 2–5 years with duration of any BF and (2) the association of obesity rates at age 2–5 years with duration of full BF.

RESULTS

Table 1 displays characteristics of the study sample. Participants were mainly Hispanic (88.6%) and the majority (60.6%) did not choose English as their preferred language. The majority had incomes below 100% of the federal poverty level and most mothers were overweight or obese. Overall, 23.9% of children aged 2–5 years were obese but obesity rates varied significantly based

on the type of food package issued at birth. Of the infants issued the formula-only package at birth (N = 10,225), 26.0% were obese; of infants issued the combination BF package at birth (N = 22,053), 24.5% were obese; and of infants issued the fully BF package at birth (N = 7,523), 19.1% were obese. In unadjusted analysis, infants who received the fully BF package at birth had decreased odds of obesity at 2–5 years, compared with those who received the formula-only feeding package at birth (OR, 0.67; 95% CI, 0.63–0.73; $P < .001$) and compared with infants who received the combination BF package at birth (OR, 0.73; 95% CI, 0.68–0.78; $P < .001$). Infants who received the combination BF package at birth also had decreased odds of obesity at 2–5 years, compared with those who received the formula-only feeding package at birth (OR, 0.93; 95% CI, 0.88–0.98; $P = .005$).

The researchers examined independent variables in 2 separate multiple logistic regression analyses with obesity at age 2–5 years as the outcome variable (Table 2). In the first logistic regression, in which any BF was the predictor variable of primary interest, months of any BF, ethnicity, preferred language, family size, age at weight date, and BMI of the mother were all significant predictors of obesity at age 2–5 years. For every 1-month increase in the months of any BF, there was a 1% decrease in the odds of obesity at 2–5 years. Hispanics were 59% more likely to be obese at 2–5 years than were non-Hispanics. Children from families whose preferred

Table 1. Characteristics of Special Supplemental Nutrition Program for Women, Infants, and Children Participants in Study Sample (N = 39,801)

Variable	%
Income below 100% of federal poverty level (%)	72.8
Hispanic (%)	88.6
Preferred language: English (%)	39.4
Obese at age 2–5 y (%) ^a	23.9
Family size (mean [SD])	4.4 (1.3)
BMI of mother ^b (mean [SD])	28.3 (5.5)
% overweight (BMI 25–29.9)	38.4
% obese (BMI \geq 30)	32.0

BMI indicates body mass index.

^aPercentage of children with BMI at \geq 95th percentile. The BMI was computed using measured weight and height; ^bThe BMI of mother was computed using measured weight and height.

Table 2. Logistic Regression Models Predicting Obesity^a at Age 2–5 y Among *Special Supplemental Nutrition Program for Women, Infants, and Children* Participants (N = 39,801)

Effect	Model 1: Any BF		Model 2: Full BF	
	Odds Ratio	95% Confidence Interval	Odds Ratio	95% Confidence Interval
Months of any BF	0.99	0.98–0.99	N/A	N/A
Months of full BF/no formula	N/A	N/A	0.97	0.96–0.97
Poverty (below 100% federal poverty level vs above)	1.11	1.05–1.17	1.10	1.04–1.16
Ethnicity (Hispanic vs non-Hispanic)	1.59	1.45–1.74	1.58	1.44–1.73
Preferred language (English vs Spanish)	0.77	0.75–0.84	0.82	0.77–0.86
Family size	0.92	0.90–0.94	0.92	0.91–0.94
Body mass index of mother ^b	1.09	1.09–1.10	1.09	1.09–1.10

N/A indicates not available.

^aPercentage of children with BMI at ≥ 95 th percentile. The BMI was computed using measured weight and height; ^bThe BMI of mother was computed using measured weight and height.

language was English were 21% less likely to be obese at age 2–5 years than were children from families whose preferred language was other than English. For every 1-unit increase in family size, there was an 8% decrease in the odds of obesity among children at age 2–5 years. For every 1-unit increase in mother's BMI, there was a 9% increase in the odds of obesity among children at age 2–5 years.

In the second logistic regression model, months of full BF/no formula was the primary variable of interest. Results were similar in this model, with months of full BF/no formula, ethnicity, preferred language, family size, age at weight date, and BMI of the mother all significant predictors of the outcome. In this model, every 1-month increase in the months of full BF was associated with a 3% decrease in the odds of obesity at age 2–5 years. As shown in Table 2, other results were largely similar to the first model.

DISCUSSION

Results of this study of the relationship between early BF behavior and childhood obesity at age 2–5 years suggest that in this primarily Hispanic population of low-income children served by WIC, BF contributed to reductions in the development of childhood obesity. Initiating BF was associated with reduced obesity at age 2–5 years, particularly when no formula was introduced. For each additional month of BF, obesity

risk at age 2–5 years decreased by 1%, and each additional month of full BF (with no formula) conferred a 3% decrease in obesity risk.

Results suggested that efforts to increase BF rates within WIC are likely to have a significant impact on child obesity outcomes. These results were comparable to the meta-analysis of Horta et al,³² who found that breastfed individuals were less likely to be classified as obese/overweight later in life (pooled OR, 0.74; 95% CI, 0.70–0.78). Also, as shown in previous studies,^{37,41,43} income, ethnicity, and preferred language were all associated with obesity risk, with lower-income Hispanics demonstrating significantly higher obesity risk than non-Hispanics and families with slightly higher incomes. Despite the disproportionate burden of childhood obesity in Hispanic children in low-income families, most studies on BF and obesity were conducted in predominantly non-Hispanic white children of middle to high socioeconomic levels.^{13,38,39} In addition, maternal obesity has an important role in the development of obesity in the young child; high rates of obesity are evident among Hispanic women and children.^{5,6,33} Whether this is through a genetic predisposition passed to the child, the result of environmental factors, or some combination of the 2 cannot be addressed in this study, but maternal factors are clearly important in obesity risk.^{5,6}

This study also suggested that supporting BF among the Hispanic com-

munity holds promise in reducing the burden of obesity in this community. Studies found that Hispanic mothers were more likely than non-Hispanic white mothers to initiate BF, but less likely to be exclusively BF at 6 months.⁴⁸ Whereas studies demonstrated that WIC participation is associated with lower rates of BF,^{71–73} the type of support of BF provided in the WIC environment can significantly increase BF rates.^{74–77} In California, the 2009 changes to the WIC food packages were associated with significant improvements in BF initiation and duration.⁷⁸ Paired with high-quality nutrition education and BF support, 2 cornerstones of WIC, WIC staff have significant potential to support mothers not only to initiate BF but to continue BF throughout the infant's first year.

A strength of this study was the large sample of Hispanic children observed from birth to age 5 years. Use of existing administrative datasets represents a cost-effective way to demonstrate health outcomes without an additional burden of data collection on participants. In this study, the researchers employed a validated measure of BF, issuance of the mother–infant food package, to capture BF behavior in the first year of life. Although this measure is certainly not a perfect indicator of BF behavior in that some mother–infant dyads taking no formula from WIC (and therefore counted as fully BF) may have introduced formula received from other places or purchased it themselves, previous validation work of this

measure suggested misclassification of full BF in about 11% of cases (10% were combination feeding and 1% were formula feeding). Inasmuch as this misclassification would lead to an attenuation of the impact of BF on obesity risk, these results were unlikely to exaggerate the benefits of BF on obesity risk. In fact, the impact of BF on obesity may be greater than this study was able to demonstrate.

Demographic variables available were limited to those collected for administrative purposes. Therefore, some variables such as maternal BMI were not available for all children and limited the sample size available for analysis. As noted previously, no direct measure of BF was available, so a validated measure was used in its place. Finally, conclusions were limited to the largely Mexican American Hispanic population that was the focus of this study.

IMPLICATIONS FOR RESEARCH AND PRACTICE

Evidence suggests that obesity prevention efforts are likely to have the most impact when they target infancy and early childhood, when behaviors are modifiable and physiologic characteristics more elastic.⁷⁹ Although rates of obesity among Hispanic children aged 2–5 years are high even when breastfed, this study provided evidence that BF may have a role in the attenuation of obesity in early childhood among Hispanic children, and the BF promotion and support offered at WIC may contribute to reduced rates of early childhood obesity. Evidence from this study demonstrating the protective effect of BF on Hispanic children's obesity risk has the potential to support WIC-based efforts to promote BF. Interventions and policies that support the initiation and continuation of BF through infancy hold promise in combating social disparities that exist in early childhood obesity.

ACKNOWLEDGMENTS

This project was supported in part by First 5 LA through a research partnership with PHFE WIC.

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CONFLICT OF INTEREST

The authors have not stated any conflicts of interest.