MATERNAL IMMIGRANT STATUS AND HIGH BIRTH WEIGHT: IMPLICATIONS FOR CHILDHOOD OBESITY

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Objectives: Childhood obesity, a growing epidemic, is associated with greater risk of several chronic diseases in adulthood. Children of immigrant mothers are at higher risk for obesity than children of non-immigrant mothers. High birth weight is the most important neonatal predictor of childhood obesity in the general population. To understand the etiology of obesity in children of immigrant mothers, we assessed the relation between maternal immigrant status and risk for high birth weight.

Methods: Data about all births in Michigan (N=786,868) between 2000–2005 were collected. We used bivariate chi-square tests and multivariate logistic regression models to assess the relation between maternal immigrant status and risk for neonatal high birth weight.

Results: The prevalence of high birth weight among non-immigrant mothers was 10.6%; the prevalence among immigrant mothers was 8.0% (P<.01). In multivariate regression models adjusted for maternal age, education, marital status, parity, and tobacco use, children of immigrant mothers had lower odds (odds ratio=0.69, 95% confidence interval=0.67–0.70) of high birth weight compared to those of non-immigrant mothers.

Discussion: Although maternal immigrant status has been shown to be associated with greater childhood obesity, surprisingly, children of immigrant mothers have lower risk of high birth weight than children of non-immigrant mothers. This suggests that factors in early childhood, potentially cultural or behavioral factors, may play a disproportionately important role in the etiology of childhood obesity in children of immigrant vs non-immigrant mothers. (*Ethn Dis.* 2011;21:47–51)

Key Words: Immigrant, Intergenerational, Childhood Obesity, Macrosomia, First Generation

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INTRODUCTION

Childhood obesity is a growing epidemic in the United States. The prevalence of obesity among children is more than 30% and is similar to that among adults.[1] The sequelae of childhood obesity include poor self image, social isolation, auto-aggression, suicide, drug and alcohol abuse, hypertension, sleep apnea, hyperinsulinemia, non-insulin dependant diabetes mellitus, precocious puberty, dyslipidemia, and chronic back pain.[2] Moreover, 60–85% of obese school-aged children will remain obese into adulthood.[3–5]

There is also evidence suggesting that childhood obesity is associated with increased risk for morbidity in adulthood, regardless of the persistence of obesity.[3–5]

Several studies have shown that American-born first-generation ethnic minority children have increased risk for obesity compared to their White counterparts and immigrants.[6–8] A study by Popkin and Udry found that, among a nationally representative sample of US adolescents, first-generation Asian-American and Hispanic adolescents were at increased risk for obesity compared to White adolescents and were at almost twice the risk for obesity compare to immigrants.[6] These findings have since been replicated.[7,8]

Although important lifestyle factors, such as eating and physical activity, have been shown to increase risk for childhood obesity,[9–10] there is a strong empiric relationship between perinatal and neonatal factors and the risk for subsequent childhood obesity.[11–14] The link between neonatal high birth weight (HBW) and childhood obesity is one of the most consistently documented associations in the literature about perinatal and neonatal risk factors and childhood obesity.[9,10,14–25]

The proposed causal mechanism linking high birth weight to obesity later in life implicates fetal programming in utero *as a determinant of childhood obesity in high birth weight infants.*

The proposed causal mechanism linking HBW to obesity later in life implicates fetal programming *in utero* as a determinant of childhood obesity in HBW infants. In particular, maternal characteristics affecting the uterine milieu may program appetite and energy expenditure and thus permanently affect hormonal, neuronal, and autocrine mechanisms that contribute to the maintenance of energy balance.[16–26]

If first-generation ethnic minority children have higher risk for obesity than native-born children, it is possible that perinatal or neonatal factors associated with maternal immigrant status (MIS) may play a role in this disparity. To characterize the etiology of obesity

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Table 1. Descriptive statistics and bivariate associations between each covariate and high birth weight from among all births in Michigan from 2000–2005

			High Birth Weight		
	N	%	*n*	%	*P*
Maternal immigrant status					<0.01
Non-immigrant	89234	11.3	7112	8.0	
Immigrant	697634	88.7	74057	10.6	
Mother's age					<0.01
<20	77240	9.8	8486	11.0	
20–25	191211	24.3	18793	9.8	
26–30	222319	28.3	21232	9.6	
31–35	193241	24.6	20067	10.4	
36–40	85137	10.8	10062	11.8	
41+	17626	2.2	2509	14.2	
Education					<0.01
<11 years	133766	17.0	15301	11.4	
GED or equivalent	248840	31.6	25799	10.4	
College	306030	38.9	30124	9.8	
Masters or above	80947	10.3	7656	9.5	
Unknown	17285	2.2	2289	13.2	
Parity					<0.01
0 previous	304503	38.7	30642	10.1	
1 previous	254085	32.3	23610	9.3	
2 previous	134683	17.1	13970	10.4	
3+ previous	90635	11.5	12491	13.8	
Unknown	2962	0.4	456	15.4	
Married					<0.01
Yes	274257	34.9	32868	12.0	
No	512611	65.2	48301	9.4	
Tobacco use					<0.01
None	659144	83.8	65740	10.0	
Yes	127724	16.2	15429	12.1	

in first-generation children, we were interested in the relation between MIS and HBW. Little is known about the relation between MIS and risk for HBW, although it has been shown that immigrant mothers have lower risk for low birth weight (LBW) children (here defined as <2500g) in the United States and Europe.[27–29] It is plausible, therefore, that MIS may be associated with HBW and, therefore, may partially explain the high risk of obesity among first-generation children.

METHODS

Data were collected on all births in Michigan between September, 2000 and March, 2005. Data were compiled from the birth records of the Michigan Department of Community Health.

The primary outcome of interest was HBW; infants weighing above 4000g at birth were considered HBW.[30–31] Birth data in Michigan includes information about maternal birthplace; self-reported birth outside of the United States was used as to determine MIS. Along with MIS, the following covariates were collected: marital status at parturition, parity, maternal age, maternal education, and maternal tobacco use during pregnancy.

This study was reviewed by the Health Science Institutional Review Board of the University of Michigan and the Institutional Review Board of the Michigan Department of Community Health.

Statistics

First, we calculated univariate statistics to describe our sample. Second, we used bivariate chi-square tests to identify significant associations (α=.05) between each of the covariates of interest and HBW. Third, we conducted multivariable logistic regression analysis of HBW by MIS adjusted for all other covariates. SAS 9.1 was used to carry out all statistical analyses. Statistical significance was set at the P=.05.

RESULTS

We collected data on 786,868 births. Table 1 shows descriptive statistics and two-tailed chi square tests between each covariate and HBW. Among all births in Michigan from 2000–2005, 11.3% of births were to immigrant mothers. The prevalence of HBW among non-immigrant mothers was 10.6%; among immigrant mothers, the prevalence of HBW was 8.0%. In stratified analyses, each of the covariates of interest, namely maternal age, education, parity, marital status and tobacco use was significantly associated with HBW.

Table 2 shows relationships between MIS and covariates of interest as well as *P*-values for two-tailed chi square tests between each of the groups; there were significant associations between MIS and each of the covariates. The prevalence of pregnancy out of wedlock was lower among immigrant mothers (17.2%) than among non-immigrant mothers (37.1%). Immigrant mothers were also less likely to report tobacco use (5.1%) than non-immigrant mothers (17.7%).

Table 2 also shows multivariable regression models assessing the relation between MIS and HBW taking into account all other covariates. Being an immigrant was associated with lower risk (OR=0.69, 95% CI=0.67–0.70) for HBW compared to non-immigrants after adjusting for maternal age, education, parity, marital status, and tobacco use.

Table 2. Bivariate associations between each covariate and maternal immigrant status and multivariable regression analyses of high birth weight by maternal immigrant status and other covariates among all births in Michigan from 2000–2005

Mother/ infant descriptives	%			High Birth Weight	
	Non-immigrant	Immigrant	*P*	OR	CI
Maternal immigrant status			N/A		
Non-immigrant	100.0	0.0		Ref	Ref
Immigrant	0.0	100.0		0.69	0.67–0.70
Parity			<.01		
0 previous	38.7	39.1		0.9	0.87–0.93
1 previous	32.3	32.3		Ref	Ref
2 previous	17.3	16.0		1.09	1.06–1.11
3+ previous	11.5	11.9		1.19	1.16–1.22
Unknown	0.3	0.7		1.21	1.18–1.25
Married			<.01		
Unmarried	37.1	17.2		1.18	1.13–1.24
Married	62.9	82.8		0.84	0.81–0.87
Mother's Age			<.01		
<20	10.4	5.5		0.97	0.95–1.00
20–25	24.9	10.0		1.03	1.01–1.06
26–30	27.9	31.4		Ref	Ref
31–35	24.1	28.1		0.96	0.91–1.02
36–40	10.6	12.3		Ref	Ref
41+	2.2	2.6		1.24	1.22–1.26
Education			<.01		
<11 years	15.8	26.2		1.28	1.25–1.31
GED or equivalent	32.5	25.0		1.32	1.29–1.36
College	40.0	30.1		1.04	0.91–1.20
Masters or above	9.7	14.9		1.44	1.41–1.47
Unknown	2.0	3.9		Ref	Ref
Tobacco Use			<.01		
None	82.4	94.9		Ref	Ref
Yes	17.7	5.1		0.54	0.53–0.56

OR, odds ratio; CI, confidence interval

DISCUSSION

In a study of 786,868 births in Michigan between 2000–2005, we found that, contrary to expectation, being an immigrant mother was associated with lower risk for HBW compared to being a non-immigrant mother. This is the first study of which we are aware that has explicitly assessed the relationship between MIS and risk for HBW. These findings suggest that cultural or behavioral factors in early childhood may play a disproportionately important role in the etiology of childhood obesity in children of immigrant vs. non-immigrant mothers.

Our findings contrast with our current understanding of the role of MIS in the etiology of HBW. Based on studies that have shown that being an immigrant was associated with lower risk for LBW, it has been hypothesized that immigrant mothers generally have higher birth weight children.[27–29] Our findings suggest otherwise. Our finding that being an immigrant is associated with lower HBW risk, coupled with the existing literature about the risk for LBW among immigrant mothers, suggest that children of immigrant mothers are less likely to have extreme birth weights (low or high) than non-immigrant mothers and that differences in obesity between immigrant and non-immigrant children may be driven by post, rather than by intra-partum differences.

We found that, contrary to expectation, being an immigrant mother was associated with lower risk for HBW compared to being a non-immigrant mother.

Data from this study have important implications for our understanding of the etiology of obesity among children of immigrant mothers in the United States. High birth weight has been shown to be the most compelling neonatal risk factor for obesity in later life.[9,10,18–25] If being an immigrant is associated with lower risk for HBW, and children of immigrant mothers have higher risk for obesity than both children of non-immigrant mothers and immigrants themselves,[6–8] then neonatal exposures are proportionally less important in the etiology of obesity among children of migrant mothers compared to children of non-immigrant mothers. This suggests that factors in early childhood, potentially cultural or behavioral factors, may play a disproportionately important role in the etiology of childhood obesity in children of immigrant mothers. This hypothesis is supported by studies that have shown that cultural factors may be associated with obesity in first-generation children. For example, in a study about the determinants of childhood obesity among preschool-aged Mexican-Americans, Alexander and colleagues found that mothers of obese children chose a "chubby baby" as ideal more often than did mothers of non-obese children.[32] Moreover, a review on the subject of the relation between ethnicity and risk for childhood obesity by Crawford and colleagues concluded that cultural and behavioral factors associated with ethnicity are central in the etiology of childhood obesity among ethnic minorities.[33]

It is important to consider the following limitations when interpreting

our findings. First, we used a limited covariate set. Of particular note, data about maternal anthropometric and pregnancy factors shown to be associated with HBW, such as obesity, diabetes mellitus, and pregestational weight and height, were not available for analysis and therefore were not included in our covariate set. Also, the only traditional socioeconomic status variable that we included in our analysis was maternal education. Second, our work is limited by the accuracy of birth certificate data recorded in vital registry files. Although birth weight and maternal social data on birth certificates has been shown to be highly accurate, it has also been shown that tobacco use estimates in birth certificate data can be unreliable.[34,35] Third, our data comes from one state. It is possible that contextual factors may introduce systematic differences in the determinants of childhood obesity between states. Replication of these findings in other states would be necessary before we could generalize from these results.

Despite these limitations, our findings suggest that our current understanding of the role of neonatal birth weight in the etiology of obesity among children of immigrant mothers may need revision, and therefore have important implications for future research. First, this work suggests the continued need for systematic research that considers the roles of cultural and/or behavioral factors in early childhood as potential determinants of inter-racial and inter-ethnic differences in childhood obesity. Second, future studies about the relation between MIS and obesity might explicitly consider the roles of maternal anthropometric and pregnancy factors in the etiology of obesity among children of immigrant mothers. Third, to understand the role of maternal ethnicity in the etiology of obesity among children of immigrant mothers, future studies in this area might fruitfully consider differences in the findings observed here among specific ethnic groups.

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