

No Association between Obesity and Behavior in Low-income, Preschool Latino Children

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Abbreviations: BMI—body mass index; DSM—Diagnostic and Statistical Manual; CBCL—Child Behavior Checklist

Abstract: **Background.** The relationship between behavioral problems and obesity in early childhood in Latinos is largely unknown. **Methods.** Cross-sectional anthropometric and behavioral data of children at three years of age were gathered from a cohort of 174 infants of Latina mothers at two San Francisco hospitals. Child behaviors were assessed using the preschool Child Behavior Checklist (CBCL/1½–5). Logistic regression was used to analyze the association between behavior and obesity. **Results.** At three years, 27.7% were obese. There were no associations between affective (OR = 1.89; 95% confidence interval [CI] 0.42–8.59), anxiety (OR = 1.86; 95% CI 0.53–6.47), pervasive developmental (OR = 0.42; 95% CI 0.13–1.36), attention deficit hyperactivity (OR = 0.58; 95% CI 0.12–2.76), or oppositional defiant (OR = 6.49; 95% CI 0.65–64.49) problems and obesity. **Conclusions.** Though psychological problems and obesity are associated among older children and adolescents, there was no association in Latino three-year olds in a low-income sample.

Key words: Obesity, overweight, body mass index, behavior problems, depression, preschool, early childhood.

The prevalence of obesity is higher among Latino children than among non-Latino White children in the United States. In 2011–2012, 16.7% of Latino children aged two to five years were obese compared with 3.5% of non-Latino White children aged 2–5 years,¹ placing them at higher risk for related health problems including hypertension, metabolic syndrome, diabetes, nonalcoholic fatty liver disease, bone and joint problems, and sleep apnea.^{2,3} Though such detrimental physiologic effects of obesity are well-established, in this study we examine the relationship between behavior and obesity in Latino three-year old children.

Obese children may be at higher risk for low self-esteem, problems at school, and compromised peer relationships.^{2,4} Increasing evidence demonstrates that late child-

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hood and adolescent behavioral problems are associated with obesity through various mechanisms.^{5,6} Children with behavior problems may have an underdeveloped capacity for self-regulation, which may affect their diet choices.⁷ In addition, obese children may experience frustration leading to behavior problems if they are physically less able to participate in common activities with others or are rejected by their peers.⁸ Finally, brain pathways governing appetite and emotion are interrelated and are influenced by the dopaminergic system.^{9,10} Dopamine, a neurotransmitter in the brain, plays a major role in reward-motivated behavior. Increasing evidence shows that behavior traits,¹¹ food and taste preferences,¹² and the regulation of appetite are governed by the dopaminergic system. Therefore, this system of shared, biologically-based factors may contribute to both a child's risk for obesity and behavior problems.

Reviews of several cross-sectional and longitudinal studies have documented a relationship between psychological problems and obesity in childhood.^{13,14} One review of four cross-sectional studies demonstrated a positive association between depressive symptoms at age six to 19 years and overweight in later life.¹⁴ However, the few studies that have focused on the association in early childhood (younger than five years) have had mixed findings. Three studies (in Japan, Australia, and the Netherlands) found associations between obesity and behavior problems,¹⁵⁻¹⁷ while one Norwegian study found none.⁵

To our knowledge, there has been no examination of the association between psychological problems and obesity in the three-year old age group in the United States, particularly among Latino populations at the highest risk for obesity. Prior studies have not applied the validated Diagnostic and Statistical Manual (DSM)-based scales from the Child Behavior Check-List (CBCL) as indicators of potential clinical psychological problems in association with obesity.¹⁸ The objective of this study was to explore the hypothesis that behavior problems, determined by the CBCL, are associated with obesity among Latino three-year old children.

Methods

Design and participants. Cross-sectional anthropometric and behavioral data of children at three years of age were gathered from a cohort of Latina mothers recruited during the second and third trimesters of pregnancy at prenatal clinics at the University of California, San Francisco (UCSF) Medical Center and San Francisco General Hospital (SFGH) from May 2006 to May 2007. Full details of recruitment and enrollment for the cohort are described elsewhere.¹⁹⁻²¹ Mothers and infants were followed from labor and delivery until the infants reached age three. All study procedures were administered via interview with a bilingual research assistant in the participant's choice of English or Spanish. We excluded non-Latina mothers, mothers who were abusing drugs or alcohol, and mothers who had polycystic ovarian syndrome, eating disorders such as anorexia nervosa or bulimia nervosa, pre-existing diabetes mellitus or gestational diabetes mellitus treated with insulin, or any health problems that would prevent breastfeeding. Infants at delivery were excluded if they had chronic disease, special care needs, or Apgar scores of less than seven at five minutes. Low Apgar scores at five minutes are associated with later development of language impairment,²² cerebral palsy,²³ and

motor or developmental delays.²⁴ Approximately 90% of those who met the inclusion criteria for the study agreed to participate.

Ethics. Our study protocol was approved by the Committee on Human Research at UCSF and the Institutional Review Board at SFGH. Mothers who participated were informed of all aspects of the study including the behavioral questions evaluating for psychological problems and signed informed consents. Children who tested in the clinical range for psychological problems were provided with information to see further evaluation for follow up care.

Measures. Following informed consent, baseline socio-demographic data of participants were gathered including gender, ethnicity, marital status, education, and length of time in the United States.

Body mass index. Anthropometric measurements of the child, including weight (using standard digital scales) and length (using standard tape measurements), were obtained at age three years. A small percentage of the cohort (approximately 3%) was not available to be measured, so weight and height were extracted from the medical record. For three-year data, children were assessed at age of 3.20 years \pm standard deviation 0.16 years. Body mass index (BMI) was calculated (kg/m²), and the BMI percentile was calculated from United States Centers for Disease Control reference curves.²⁵ Body mass index was categorized as overweight ($85 \leq \text{BMI} < 95$ th percentile) and obese (≥ 95 th percentile BMI), using standard definitions.²⁶ All CDC percentiles were calculated based on children's exact age.

Psychological problems. Psychological and behavior problems were assessed using the Child Behavior Checklist (CBCL/1½–5) which comprises validated preschool items that experienced child psychiatrists and psychologists from 16 different cultures rated as being most consistent with clinical Diagnostic and Statistical Manual of Mental Disorders (DSM) diagnostic categories.²⁷ Independent research studies have validated CBCL syndrome scales in over 30 societies, including among Hispanic populations in Puerto Rico and Mexico.^{28–30} The DSM-Oriented Scales included affective problems, anxiety problems, pervasive developmental problems, attention deficit/hyperactivity problems, and oppositional defiant problems. After administration of the questionnaire, T scores and percentiles were calculated for each participant using CBCL/1½–5 scoring guidelines; T scores that were greater than 65 for any given DSM-oriented scale were identified as in the “clinical” or “borderline clinical” range per scoring guidelines.²⁷ It should be noted that a high score on the CBCL DSM-oriented scale is not equivalent to a DSM-IV or DSM-V diagnosis, but rather indicate that children met criteria for clinically significant symptoms. The items of the DSM-oriented scales do not precisely correspond to criteria for DSM diagnoses.

Statistical analysis. Bivariate and multivariate logistic regressions were used to analyze the association between obesity and behavior problems. Regressions included obesity as the dependent variable and each DSM-oriented behavior scale as the independent variable. In the multivariate analysis, all five DSM-oriented behavior scales were included in the analysis as well as gender and maternal education level. Given a sample size of $n=174$ and an approximate one-third proportion of obesity (the outcome), the study was powered to detect an odds ratio of 1.6, with an alpha of 0.05 and power of 0.80.^{31,32}

Results

Overall demographic, anthropometric, and behavioral data were available for 174 children from the original cohort of 201 (Table 1). The majority of the cohort was of Mexican descent (59.8%), while the remainder was primarily of Central American origin including El Salvadorian (13.2%), Guatemalan (10.9%), Honduran (5.2%), and Nicaraguan (4.6%). A slight majority (55.2%) of mothers were single but living with a partner, while 28.2% were married and 14.4% were single but not living with a partner. On average, mothers had been living in the United States for seven years. Concerning education, 76.4% of mothers had a high school diploma or less.

The sample of three-year old children was 49.4% male and 50.6% female. The average BMI percentile for the sample was at the 72nd percentile. Twenty seven percent of the sample was classified as obese and an additional 11.5% were overweight.

In bivariate logistic regression models, odds of meeting the minimum threshold for clinically significant psychological problems as defined by the instrument developers (T score greater than 65) in any of the five DSM-oriented behavior scales including affective, anxiety, pervasive developmental, attention deficit/hyperactivity, or oppositional defiant were not significantly associated with obesity (Table 2). In multivariate analysis—which included all five of the DSM-oriented behavior scales as independent variables and controlled for gender and maternal education—no variables were significantly associated with obesity. Simple and multiple linear regression using CBCL DSM-oriented scales raw scores (as continuous variables) and BMI percentile (as a continuous variable) were conducted and similarly demonstrated no significant associations (data not shown). Furthermore, simple and multiple linear regression using CBCL empirically-based scales and BMI percentile were conducted and consistently demonstrated no significant associations (data not shown).

Discussion

We found no association between psychological problems and obesity in bivariate and multivariate models among low-income Latino children three years of age. This is in contrast to the increasing evidence in the literature reporting associations among psychological problems and BMI in children aged six and older.^{33,34} Despite the evidence for a relationship between behavior and obesity in older children, the few international studies on children in the three-year age group have shown mixed results.^{5,15–17,35,36}

Older children with behavior problems may have less capacity for self-regulation, which may affect their behaviors such as diet and activities.³⁷ Obese older children may be teased, rejected, or excluded from common activities by their peers, leading to emotional and behavioral problems.⁸ Behavior and temperament traits, appetite regulation, and taste preferences may be commonly influenced by the dopaminergic system.^{9,10}

The reasons for a lack of association between behavioral or psychological problems and obesity among younger children may be several. While young children with behavior problems may have less capacity for self-regulation³⁷ and may be more inclined to eat unhealthy foods,⁷ this age group may be too young to detect the development of obesity

Table 1.**SELECTED SOCIO-DEMOGRAPHIC, ANTHROPOMETRIC,
AND BEHAVIORAL CHARACTERISTICS OF CHILDREN AND
MOTHERS**

	n	%/Mean	SD	Range
<i>Child demographics</i>				
Gender (%)	174			
Male	86	49.4%		
Female	88	50.6%		
<i>Maternal socio-demographics</i>				
Ethnicity (%)	174			
Mexican	104	59.8%		
El Salvadorian	23	13.2%		
Guatemalan	19	10.9%		
Honduran	9	5.2%		
Nicaraguan	8	4.6%		
Other ^a	11	6.3%		
Years in the United States	167	7.0	5.9	0.1–25.0
Marital Status (%)	174			
Married	49	28.2%		
Single living with partner	96	55.2%		
Single	25	14.4%		
Divorced or separated	3	1.7%		
Education (%)	169			
High school	133	76.4%		
Some college	27	15.5%		
College	5	2.9%		
Post-college	4	2.3%		
<i>Child anthropometric characteristics</i>				
Body mass index percentile ^b	174	71.9	26.4	1.7–100.0
Overweight (85 ≤ BMI < 95th percentile)	20	11.5%		
Obese (≥ 95th percentile BMI)	47	27.0%		
<i>Child behavioral characteristics</i>				
Affective score in clinical range	11	6.3%		
Anxiety score in clinical range	18	10.3%		
Pervasive developmental score in clinical range	31	17.8%		
Attention deficit/hyperactivity score in clinical range	13	7.5%		
Oppositional defiant score in clinical range	4	2.3%		

^aOther includes nationalities from: Colombia, Dominican Republic, Peru, Puerto Rico, and other.

^bUsing CDC growth charts

Table 2.

**ODDS RATIOS FOR OBESITY AS DEPENDENT VARIABLE
AND CBCL 1.5–5 DSM-ORIENTED BEHAVIOR SCALES AS
INDEPENDENT VARIABLES CONTROLLING FOR GENDER AND
MATERNAL EDUCATION**

Variable	n	Bivariate analysis		Multivariate analysis	
		Odds ratio (95% CI)	p value	Odds ratio (95% CI)	p value
Affective	174	1.56 (0.43–5.58)	0.50	1.89 (0.42–8.59)	0.41
Anxiety	174	1.37 (0.48–3.88)	0.56	1.86 (0.53–6.47)	0.33
Pervasive developmental Attention deficit/ hyperactivity	174	0.58 (0.22–1.52)	0.27	0.42 (0.13–1.36)	0.14
Oppositional defiant	174	0.78 (0.20–2.96)	0.71	0.58 (0.12–2.76)	0.5
Gender: Female	174	2.69 (0.37–19.66)	0.33	6.49 (0.65–64.49)	0.11
Maternal education	174	1.15 (0.37–19.66)	0.68	1.23 (0.59–2.56)	0.58
High school	169		0.87		0.84
Some college	133	referrant		referrant	
College	27	0.80 (0.29–2.26)	0.66	0.80 (0.29–2.26)	0.67
Post-college	5	1.87 (0.30–11.64)	0.50	2.08 (0.32–13.38)	0.44
	4	0.93 (0.09–9.27)	0.95	0.83 (0.07–9.37)	0.88

Abbreviations: CI, Confidence interval

based on dietary changes. A genetic basis for the development of overweight through dysregulation of satiety often may not appear until school age.³⁸ In addition, younger children's food options may be more determined by their parents than older children's food options. Several studies have demonstrated strong stigma and prejudice against obese children,⁸ which may lead to low self-esteem and psychological problems. Less stigma may exist for very young children, who may be considered "chubby" and "cute" instead of obese.³⁹ However, one study showed that from kindergarten through fourth grade, the "chubby" stereotype had more stigma as ages increased.⁴⁰

The CBCL was created from a national sample of 700 respondents from diverse socio-economic, ethnic, and regional backgrounds from 40 states in the United States. For each DSM-oriented scale, the "clinical" or "borderline clinical" range corresponded to scores in the top 7% of the original sample.²⁷ The prevalence of behavioral problems seen in this cohort is within the clinical ranges reported in other studies from the United States,⁴¹ Italy,⁴² and Ireland⁴³ that have reported clinical ranges of affective (2.1%–33.5%), anxiety (2.0%–33.9%), pervasive developmental (4.5%–32.9%), attention deficit/hyperactivity (0.4%–18.1%), and oppositional defiant (0.0%–14.5%). In a similar study of children born to immigrant parents in Ireland, oppositional defiant problems had the lowest clinical rates whereas pervasive developmental problems had the highest clinical rates on the CBCL.⁴³

This study has several limitations. Its cross-sectional nature precludes any causal inferences. The assessment of childhood psychological problems was completely dependent on maternal report, which may have introduced reporter bias; however, the CBCL/1½–5 is a validated instrument standardly used to assess clinical-range problems in DSM-oriented psychological domains. Approximately 12% of the original cohort from birth did not have available BMI at age three, although no significant differences in socio-demographic factors were noted among those with and without BMI data at age three. Because the study was conducted in Latino populations in the San Francisco Bay Area, its generalizability to populations elsewhere in the United States and abroad may be limited.

Conclusion. Although behavior problems are known to be associated with obesity in children six years and older, this study documents that this association is not present in three-year old Latino children in the United States. Future research should focus on behavioral problems and obesity in children between three and six years to hone in on the critical developmental period when the two factors become related. Differences in subgroups based on socioeconomic and ethnic factors also need to be systematically investigated. Health care professionals must be conscious of the onset of the complex relation among behavior, psychological problems, and BMI among children.

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