Factors Associated with Childhood Overweight and Obesity among Acculturated and New Immigrants

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Objective: To examine the relationship between acculturation and obesity among low socioeconomic status (LSES) children.

Design: Cross-sectional study.

Setting: Children from 12 preschools in LSES neighborhoods were recruited.

Participants: Anthropometric measurements were obtained from 238 children (aged 4–7 years) and 224 mothers. Sociodemographic characteristics and perceptions of child's weight were collected from mothers. We compared native Israelis and immigrants for risk factors for obesity, using a 9-year cut-off to define new and acculturated immigrants.

Results: The combined prevalence of overweight and obesity (OWOB) among children was 29.8% (71/238) using the World Health Organization (WHO) growth standard. Mean age, sleeping hours, sex distribution and poverty level were similar between immigrants and natives. Prevalence of OWOB and current parental smoking were significantly lower among children of new immigrants ($P=.02$). More than 82% of mothers underestimated their child's weight status, 74.2% of OWOB children were perceived as normal-weight (NW) and 8% as thin. In a multivariable logistic-regression analysis comparing NW to OWOB children, maternal underestimation of the child's weight status (OR=7.5; 95%CI: 3.4–16.5, $P<.0001$) and being born to acculturated immigrants (OR=2.3 95%CI:1.1–4.7, $P=.03$) were associated with OWOB. Ethiopian children were at lower risk for obesity. Paternal smoking increased the risk for obesity by 2-fold in non-Ethiopian, and 5-fold in Ethiopian children (OR=2.0 and 5.0, respectively; P for interaction=.026).

Conclusions: Acculturation, perception of child's weight status and parental smoking are associated with childhood OWOB. Immigration status should be considered when programs to prevent childhood obesity are implemented in mixed populations. (*Ethn Dis.*2013;23[3]:329–335)

Key Words: Childhood Obesity, Acculturation, Smoking, Socioeconomic Status, Preschool Age

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Introduction

Immigration and acculturation are associated with a gradual trend of adoption of the new country's lifestyle and health behaviors and create alterations in health risks in both parents and children. One adverse health effect, found in immigrants[1–4] and ethnic minorities,[5] increases the risks for childhood overweight and obesity. Existing studies examining the relationship between acculturation and obesity among children of first-generation immigrants are scarce and have produced inconsistent results.[6–8]

Among adults and adolescents in the United States, the prevalence of obesity has been shown to increase with years since immigration.[9,10] Adverse health behaviors, such as smoking, alcohol use, and less leisure-time exercise activity, were associated with longer acculturation as well as higher body mass index (BMI).[11] Adverse birth outcomes and infant mortality were also associated with longer acculturation.[12] Among immigrants to Canada, intima-media thickness (IMT) increased by 2% for every 10 years of residence in Canada.[13]

Israel has seen massive immigration waves since the 19th century. In 2009, first-generation immigrants comprised 30% of the population and an additional 30% were second-generation immigrants. The two most recent immigration waves, in 1990–2001 and 2002–2009, included immigrants mostly from Ethiopia and the former USSR.[14] Despite the unique population structure in Israel, data are lacking regarding the impact of immigration and acculturation on childhood obesity and on the interaction between obesity and maternal, residential and sociodemographic factors.

We designed our study to identify risk factors for childhood obesity in relation to immigration and acculturation status, as a first step in the development and implementation of

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age- and culture-specific interventions to prevent childhood obesity.

METHODS

Participants

The study was carried out in Beer-Sheva in southern Israel. The town was one of those participating in an educational program to improve lifestyle among preschool children aged 4–7 years. Preschools were recruited from September 2008 through November 2008 using the local municipality and Ministry of Education list. Twelve preschools were randomly selected from low socioeconomic areas (LSES). Each kindergarten had 28–35 children per class.

Study Procedure

After obtaining permission from local authorities and Ministry of Education (via their ethics committees), all parents were sent a preliminary letter inviting them to participate in the study. Of 380 eligible children, parental consent to participate was obtained for 258 children (67.9%). Twelve families had two siblings in the sample. The protocol of the study was approved by the Ethics Committee of Soroka University Medical Centre.

Data Collection

Data collection was performed by research assistants who were trained to administer the required measurements and questionnaires. Data were also obtained by interviewing the mothers. Research assistants from the same culture interviewed the new immigrants in their own language.

Immigration Status and Ethnicity

Acculturation was defined as the time from immigration to Israel to the date of the interview, which is a single-dimension measure for acculturation.[15,16] Parents who immigrated 0–9 years prior to the interview were identified as ''new immigrants''; parents who immigrated 10 years or more from baseline were considered ''acculturated immigrants.'' These definitions were the ones used in previous studies.[17] Most of the new and acculturated immigrants were first-generation immigrants who arrived in Israel after adolescence (12 years) and are considered by immigration scholars as socialized primarily in their country of origin.[18] Israeli-born parents were defined as ''native Israelis.'' Countries of origin were grouped into three regions: Europe and former USSR, Ethiopia and East Africa and others. Immigrants from Ethiopia and East Africa were termed Afro-Israelis.

Measurements

Definitions of Demographic and Sociodemographic Parameters

Information on maternal age, parity, marital status, educational level, parental smoking status and household SES were obtained during an interview. Maternal education was divided into 3 categories: did not complete high-school (<12 years), completed high-school, and post-secondary education. Family's poverty status was determined by comparing the reported net household income to the national poverty line for families of similar size.[19] Following the World Bank's criterion gross national income (GNI) per capita, we considered Ethiopian-origin immigrants as arriving from low-income countries and the former USSR immigrants as arriving from middle-income countries.

Household availability of snacks was measured by a list of 10 calorie-dense foods common in Israel. The resulting measure could have values from 0 to 10 according to how many of the 10 foods were reported to be available in the home.

Anthropometric Measurements

Height and weight of each child were measured in the preschool using a standardized protocol. Weight was measured with a portable digital scale (Tanita HD-318; Tanita Ltd, Illinois, USA) while children were barefoot and dressed in light clothing, and height was measured with a portable stadiometer (SECA-217; Seca Ltd, Hamburg, Germany). Measurements were obtained twice to the nearest .1 kg and .1 cm, respectively, and the mean value was used in the analysis. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared (weight [kg] / height [m^2]). We used the growth curves of the World Health Organization (WHO) to compare the prevalence of excess weight among LSES children, using AnthroPlus version V1.0.2 software.[20] According to WHO recommendations, normal weight, overweight and obese ranges were defined as $-2SD<BMI\ z\text{-score}\leq 1SD$, $1SD<BMI\ z\text{-score}\leq 2SD$, BMI z-score $>2SD$, respectively. Maternal weight and height were measured according to the same protocol, and categorized into 3 levels: underweight=BMI<18.5, healthy weight=18.5<BMI<25, overweight=25<BMI<30 and obese=30<BMI.[21]

Definitions of Physical Activity and Sedentary Behaviors

Regular physical activity of both children and mothers was determined based on intentional leisure time physical activity and the time spent playing outdoors (hours/week). Sedentary hours were derived from the sum of the usual time spent by the child watching television, videos, DVDs, or playing computer games (hours/week). Usual night time sleeping hours were reported in the interview.

Definitions of Maternal Perceptions

To assess maternal perceptions of the child's weight status, mothers were asked to define the child as thin, normal weight or overweight. Underestimation occurred when overweight children were defined as normal weight, and severe underestimation occurred when

overweight/obese (OWOB) children were defined as thin. Overestimation occurred when thin or normal-weight children were defined as overweight or obese. Maternal answers to a question regarding the need to put the child on a diet (no need, need for a weight-loss diet or need for a weight-gain diet) were used to confirm the maternal perception of the child's weight status. Underestimation occurred when OWOB children were defined as not requiring a weight-loss diet whereas overestimation occurred when normal-weight children were defined as requiring a weight-gain diet. Severe underestimation occurred when mothers of OWOB children were defined as needing a weight-gain diet.

Statistical Methods

The $\chi 2$ test or Fisher's exact test were used, as appropriate, to compare categorical variables. One way analysis of variance (ANOVA) was used to compare continuous variables between the groups (acculturated, new immigrants and the native Israelis) with the Scheffe test as the post-hoc test. Normality of children's' BMI z-scores distribution was checked with Shapiro-Wilk W[22,23] and skewness-kurtosis[24] tests. The McNemar's test was used to evaluate the association between the children's actual measured weight and weight status and that perceived by their mothers. Multivariate logistic regression analyses were performed to identify independent risk factors for childhood OWOB with normal weight (NW) as the reference. All covariates with $P \leq .10$ in univariate models were considered candidates for inclusion in multivariable models. The best model was chosen using -2LL goodness of fit test. Age and sex were not included in the multivariable analyses as BMI z-scores were computed relative to age- and sex-specific reference growth curves. Odd ratios (OR) and 95% confidence intervals (95% CI) were computed. We assessed the power of the models to discriminate OWOB children from NW children by the C statistic, which is analogous to the area under the receiver operating characteristic (ROC) curve.[25] All statistical analysis was performed using SPSS 17.0 for Windows package (PASW Inc., Chicago, IL, USA). Values of $P<.05$ were considered statistically significant.

RESULTS

A total of 238 children (47.5% male), with a mean age of 64 ± 6 months, were included in the final data analysis. We compared the baseline demographic characteristics of the non-responders (data from the local municipally) with the study group and found them identical in SES, and distributions of age and sex.

Children to native-Israeli parents represented 50.2% of the sample. Most immigrants came from Russia, and the former Soviet Union countries (25.9% of the total sample) and Ethiopia and East Africa (17.5%). Parents from North Africa, the Far East, Eastern Europe, and South America cumulatively comprised only 6.4% of the sample. There were no differences between the new and acculturated immigrants in distribution of countries of origin ($P=.62$). The population included 43 Ethiopian mothers, 65.1% of whom were defined as acculturated, which is similar to the distribution between acculturated and new immigrants of other immigrant groups ($P=.49$).

As shown in Table 1, native-Israeli mothers weighed less on average, in comparison to acculturated and new immigrant mothers. More new immigrant parents completed less than 12 years of education as compared with native Israelis and acculturated immigrants. In comparison to new immigrants, children of first-generation acculturated mothers and native-Israelis were more likely to live with smoking parents and had more siblings. (Table 2) Although there was no significant difference in the distribution of maternal underestimation of the child's weight status by immigration status, when comparing maternal underestimation by nativity, 57.8% of the native-Israeli mothers perceived their child weight status correctly as compared with only 42.2% of the combined group of new and acculturated immigrants ($P=.05$). As presented in Table 2 household availability of snacks among new immigrants was 5.5 on average, compared with 6.3 for acculturated immigrants, and 7 for native Israelis ($P=.003$), post-hoc analysis indicate that the significant difference was between native Israelis to other groups.

Overweight and obesity (OWOB) was found in 71 children (29.8%) and the median of the weight status distribution (BMI for age and sex) was 15.7 (25th, 75th, and 97th percentiles were 14.8, 15.7, 17.2, respectively), whereas mean (SD) value was 16.3 (2.2). The distribution was positively skewed ($P<.001$ in all normality tests). The prevalence estimate for the obesity category was 11.3%. Among OWOB children, 52.1% of whom were native-Israelis, 42.3% children were born to acculturated immigrants and only 5.6% were children of new immigrants ($P=.02$).

Baseline characteristics of the children by family immigration status are presented in Table 3. Native-Israelis and acculturated immigrants were on average heavier than new-immigrants, had higher prevalence of OWOB and sedentary behavior ($P=.03$, $P=.02$, $P=.05$ respectively) as shown by the Scheffe post-hoc tests. There were no statistical differences between the groups in the levels of reported leisure time physical activity or sleeping hours.

We used a multivariable logistic-regression analysis (Table 4) to examine the associations between potential risk factors and OWOB. The strongest association for children's OWOB was maternal underestimation of the child's

Table 1. Selected characteristics of mothers and household by family immigrations status,[a] mean (and SD) are presented unless otherwise indicated, *N*=224

Variable	Native Israelis (*n*=108)	New Immigrants (*n*=36)	Acculturated Immigrants (*n*=80)	*P*
Maternal characteristics				
Age, years (SD)	34.57 (7.43)	33.67 (11.57)	35.36 (8.44)	.59
Height, cm (SD)	160.20 (6.83)	162.93 (7.53)	160.53 (6.63)	.21
Weight, kg (SD)	65.12 (13.83)	72.15 (14.53)	72.04 (17.84)	.01
BMI, kg/m,^{2} %				
≤25	56.7	44.0	37.3	.07
25–30	26.8	28.0	28.4	
≥03	16.5	28.0	34.3	
Physical activity, h/week (SD)	.87 (1.54)	.82 (1.38)	.70 (1.43)	.72
Level of education, %				
Less than high school	22.6	44.4	30.0	.001
Completed 12 years	66.0	25.0	53.8	
Post-secondary education	11.3	30.6	16.3	
Employed, %	59.2	63.6	71.3	.20
Maternal underestimation of child's weight status, %	60.2	38.2	51.3	.07

[a] Parents who immigrated 0-9 years prior to baseline data collection are identified as ''new immigrants.'' Parents who immigrated 10 years or later from baseline were considered ''acculturated immigrants.''

weight status (OR=7.5; 95%CI: 3.4–16.5, *P*<.0001). Other significant factors in the model were being a child of acculturated immigrants compared to others (OR=2.3 95%CI: 1.1–4.7, *P*=.03). The best model was one that included an interaction term between smoking and Ethiopian origin. Under the full model, controlling for maternal perception of the child's weight status and migration status, smoking was associated with increased risk for child obesity in non-Ethiopians household by 2.1 fold. Non-smoking Ethiopian household were at lower risk for childhood obesity (OR=0.2) compared to non-smoking non-Ethiopian households, however, in Ethiopian smoking households the odds for child obesity is 5.03 fold higher than in non-smoking non-Ethiopian homes.

Table 2. Selected household characteristics by family immigrations status[a]

Variable (*n*= 224)	Native Israelis (*n*=108)	New Immigrants (*n*=36)	Acculturated Immigrants (*n*=80)	*P*
Region of Immigration, %				
Europe Former USSR		48.7	44.7	.62
Ethiopia and East Africa		41.0	41.3	
Other Regions of Origin		10.3	14.0	
Below poverty line, %	32.8	20.6	36.1	.26
Single parents, %	18.9	17.9	29.9	.13
Current parental smoking, %	63	37.1	60	.02
Number of siblings, %				
0–1	30.6	56.4	54.0	.001
2	32.3	17.9	13.8	
3+	37.2	25.6	32.2	
Household availability of snacks (SD)	6.97 (2.33)	5.53 (2.14)	6.26 (2.33)	.003

[a] Parents who immigrated 0-9 years prior to baseline data collection are identified as ''new immigrants.'' Parents who immigrated 10 years or later from baseline were considered ''acculturated immigrants.''

DISCUSSION

Our study of predominantly LSES preschool children and their mothers demonstrates the interaction between smoking and country of origin in the association between childhood obesity and acculturation during preschool years.

We found an association between acculturation and higher prevalence of childhood obesity. Among OWOB children, more then 40% were children of acculturated immigrants; 18.1% of the children of acculturated mothers were obese, a value significantly higher than the prevalence of obesity in the entire sample (11.3%, *P*=.02). These findings are consistent with an analysis of the Early Childhood Longitudinal Survey Kindergarten (ECLS-K), which showed that the relation between family SES and weight gain was positive among the first-generation children who arrive from low-income countries.[6] We thus demonstrate the effect of a worsening health status among children of acculturated immigrants in comparison to children of natives and new-immigrants, a phenomena seen among adult populations[26] that describes a rapid change occurring worldwide during the last two decades in food

18.1% of the OWOB children of acculturated mothers were obese, a value significantly higher than the prevalence of obesity in the entire sample (11.3%, P=.02).

Table 3. Selected characteristics of the preschool children stratified by family immigrations status.[a] Mean (and SD) are presented unless otherwise indicated

Children (*n*=238)	Native Israelis (*n*=118)	New immigrants (*n*=37)	Acculturated immigrants (*n*=83)	*P*
Sex (% male)	47.2	48.7	47.1	.98
Age, months (SD)	63.5 (6.5)	63.1 (6.2)	63.5 (6.8)	.93
Weight z-score for age (SD)	0.23 (1.34)	−0.05 (0.97)	0.58 (1.34)	.03
Height z-score for age (SD)	−0.21 (1.09)	−0.21 (1.17)	0.14 (0.95)	.05
BMI z-score[b], %				
Normal weight	68.6	89.2	63.9	.02
Overweight	21.2	10.8	18.1	
Obese	10.2	0	18.1	
Physical activity, h/week (SD)	2.44 (1.17)	2.47 (1.43)	2.44 (1.23)	.99
Sedentary hours, h/day (SD)	2.75 (1.44)	2.09 (1.34)	2.54 (1.29)	.05
Sleeping hours, h/night (SD)	10 (1.26)	9.7 (1.16)	9.66 (1.37)	.18

[a] Parents who immigrated 0–9 years prior to baseline data collection are identified as ''new immigrants''. Parents who immigrated 10 years or later from baseline were considered ''acculturated immigrants''.

[b] Normal weight defined as −2 SD <BMI z-score ≤1SD, overweight and obese defined as 1SD <BMI z-score ≤2SD, BMI z-score >2SD, respectively, based on the World Health Organization (WHO) growth standard.

consumption and physical activity patterns. Major nutritional shifts relate to greater intake of fat, especially animal source fat, sugars and refined grains that are low in fibers. A common belief is that immigrant families assimilate into Western patterns of sedentary lifestyle, poor nutrition and consequently obesity. The acculturation hypothesis suggests that prior to immigration, cultural norms are healthier than those adopted later by the immigrant.[6,13] The nutritional transition is especially rapid in developing countries and countries with low and middle income.[6] We found that children of new immigrants had a lower prevalence of OWOB than children of acculturated migrants or native Israelis; this may be explained by the nature of immigration to Israel, either in terms of migratory countries (mainly Eastern Europe and Ethiopia) or in terms of the length of time it takes for specific migrant groups to become acculturated. The BMIs and body structure of children from Eastern African tend to be thinner than that of children from Russia. To exclude this explanation for weight differences, we examined whether the region of immigration played a role in explaining the significant difference between new and acculturated immigrants. As no difference was detected between the groups, the country of immigration could not explain lower rates of overweight and obesity in new immigrants.

Table 4. Factors associated with childhood overweight and obesity.[a] Results from a multivariate logistic regression analysis

	OR	95% CI	*P*
Maternal underestimation of child weight status (underestimation vs. accurate estimation)	7.52	3.43–16.46	<.001
Acculturation (Acculturated immigrants vs others; natives and new immigrants)	2.25	1.08–4.72	.031
Current parental smoking (Smoking vs. non-smoking)	2.07	0.98–4.34	.055
Ethiopian origin (Ethiopian vs. others)	0.17	0.03–0.82	.028
Interaction between Ethiopian origin and smoking	14.29	1.37–149.51	.026

[a] Normal weight defined as -2 SD <BMI z-score ≤1SD, overweight and obese defined as BMI ≥1sd BMI z – score based on the new World Health Organization (WHO) growth standards.

[b] Roc Analysis showed that the area under the curve accounting for the model was 78.4% (*P*<.001).

After controlling for maternal perception of the child's weight status and migrant status, current parental smoking status was associated with OWOB. These findings are in agreement with findings from Germany,[27] United Kingdom[28] and Israel, which showed a dose-response relationship between the number of household smokers and the risk for overweight.[29] Parental smoking may be a part of a cluster of unhealthy, obesogenic behaviors that may include unbalanced diet and lack of physical activity. The strong interaction effect of smoking in Ethiopian households is another interesting finding that requires further study. Maternal underestimation of child's weight status is a known predictor associated with children's OWOB. Children's OWOB was strongly associated with maternal underestimation of child's weight status; this finding is consistent with those in other populations.[30–32] More than half of the mothers underestimated their children's weight status. Studies that tried to understand the gap in maternal perception of obesity showed that LSES mothers tended to describe obese children as ''solid,'' having ''good appetite,'' and ''healthy.''[33] In

another trial, parents who underestimated their children's weight refused to use growth charts as a measure to describe their children weight status because they felt it was invalid to describe their children's uniqueness.[34]

Feeding is a central part in parenting of young children; food and feeding may help mothers to maintain their sense of competence. Baughcum et al found that LSES mothers believed that if children are larger they have greater chances of thriving,[35] LSES Latina mothers view moderately overweight children as healthiest.[36] Since parents perceived chubbier as cute, better and healthier, and the terms overweight and obese imbed a negative meaning, it may occur that parents found it difficult to relate their children as clinically undesired. Recognizing the child's weight as above average was one of the factors associated with parental readiness to make life-style changes for overweight children. New approaches are needed to address misperceptions about obesity that are held by mothers, and developing socioeconomic and culturally sensitive measures for overweight and obesity.

The main limitation of this study is that the data were cross-sectional in nature; consequently, we cannot draw clear conclusions or suggest mechanisms for causal associations between factors such as acculturation or smoking and child OWOB. It is, however, highly unlikely that migration status or parental smoking are caused by the child's obesity, therefore the effect of those factors on obesity can be cautiously examined in this study. Since we chose to focus on LSES, we cannot generalize the results to all school-aged children. However, our primary goal was to explore potential causes for the disproportionately high prevalence of obesity in LSES populations. Our sample was homogeneous with regard to SES level, hence no statistical differences were found when comparing NW children and OWOB children by socioeconomic factors. Such differences may have been found had we included a broader SES-level range in the study population.

CONCLUSION

In conclusion, we found that OWOB is highly prevalent among Israeli LSES preschool children, aged 4–7 years; OWOB is also positively associated with greater acculturation, maternal underestimation of child weight status, parental smoking and the synergic effect between Ethiopian origin and smoking. It appears that, when examining obesity in migrant populations, it is important to account for duration of residence since it may mask important disparities in childhood obesity between immigrants and non-immigrants, and between immigrant subgroups categorized by their duration of residence. Further research needs to examine longitudinal data, since BMI and other anthropometric and developmental measures may behave differently through time.

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