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Household Income, Maternal Acculturation, Maternal Education Level and Health Behaviors of Chinese-American Children and Mothers

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Abstract

Objective—A cross-sectional study was conducted to examine factors associated with health behaviors, including physical activity and dietary intake, of Chinese women who have immigrated to the United States and their children.

Participants—Using convenience sampling, a total of 65 Chinese-American children and their mothers in the San Francisco Bay Area participated in the study.

Measures—Information related to children's weight, height, level of physical activity (Caltrac accelerometer), and dietary intake (Kids' food frequency questionnaire) was collected using standardized instruments. Mothers completed questionnaires regarding household income, their levels of education and acculturation (Suinn-Lew Asian Self-Identity Acculturation Scale), dietary intake (SWAN Food Frequency Questionnaire), and level of physical activity (Seven-day physical activity recall).

Results—36.9% ($n = 24$) of the children were overweight (body mass index higher than the 85th percentile). A high household income was related to low maternal body mass index ($R^2 = .08$, $P = .04$), high maternal fat intake ($R^2 = .21$, $P = .0001$), and high maternal intake of sweets ($R^2 = .08$, $P = .033$), and a high level of maternal acculturation was related to low body mass index in children ($R^2 = .07$, $P = .034$).

Conclusions—The results suggest that an intervention aimed at reducing obesity and promoting health behaviors must be appropriate for different ethnic groups with various incomes and levels of acculturation.

Keywords

SES; Acculturation; Chinese-American; Health behavior; Children; Women

Introduction

The number of Chinese Americans, the largest and fastest growing Asian subgroup in the United States, increased by 48% between 1990 and 2000. It is estimated that Asian and Pacific Islanders comprise 4% of the U.S. population and will increase to 8% by the 2050 [1]. Unfortunately, Asian Americans and Pacific Islanders also have the fastest growing rate of overweight and obese children. Recent data indicate that the prevalence of overweight and risk

of becoming overweight among Chinese Americans between the ages of 6 and 11 years is 31% [2]. In California, about 33–39% of Asian and Asian-American children (grades 5–9) have a poor aerobic capacity [3].

Studies [4–7] have suggested that the health and health behaviors of immigrants deteriorate as they become acculturated to American society. Minority adolescents, including Asian Americans [8–11], with a low level of acculturation, low household income, and parents with a low level of education are at increased risk of overweight, a low level of physical activity, and a high level of fat and sugar intake. Abraido-Lanza and associates [12] found that in Hispanic adolescents in the United States, a high level of acculturation is related to increased risk of overweight but also a high level of physical activity. However, Chen and Kennedy [13] found that a low level of maternal acculturation is related to an increased risk of overweight in Chinese-American children. In children, the relationship between household income and overweight and health behaviors varies based on ethnicity [10]. For instance, in one study [10], a low level of household income was associated with an increased risk of overweight in Caucasian girls but not in African American girls. In Chinese children, a high risk of overweight was related to a high household income [14]. Additionally, a low level of maternal education was related to an increased risk of overweight, a low intake of fruits and vegetables, and a high intake of sweets in children [15,16]. Nevertheless, factors related to Chinese-American children's health and obesity-related health behaviors (physical activity, sedentary activity, and dietary intake) have not been examined thoroughly. Furthermore, the relationships between maternal acculturation, household income, and maternal education level and Chinese-American children's health and their obesity-related health behaviors have not been explored in the literature.

Studies on immigrant women's health and health behaviors also have suggested an increased risk of poor health and unhealthy behaviors as these women acculturate to American society [7,15–17]. Acculturation is an important factor in changing the health behaviors of immigrants who are more westernized with poor dietary behaviors [16–18]. After immigrating, these women increase their consumption of Western foods and decrease their intake of Eastern foods. Two of the strongest predictors of dietary change after immigrating to the United States are cost of food and availability of healthy food [15]. Although immigrant women understand the relationship between poor diet and low level of physical activity and health issues, they may not be familiar with U.S. dietary guidelines and other sources of health-related information [15]. A high level of education and high income were related to an increased consumption of grains, vegetables, and fruits compared to women with a low level of education and low income; the longer amount of time that an immigrant woman spends in the United States, the greater her consumption of vegetables, fats, sweets, and all types of beverages [17].

Despite the previous study results on the effects of maternal acculturation, education level, and household income on children's health and health behaviors, little is known about the relationships between these factors and the health and health behaviors Chinese-American children and their mothers. Therefore, the purpose of this study was to examine the relationships between household income, maternal acculturation level, and maternal education level and health behaviors of Chinese-American women and their children. The independent variables were maternal acculturation levels, maternal education level, and the household income. The dependent variables included maternal BMI and health behaviors (physical activity and dietary intake) and child's BMI and health behaviors (physical activity, sedentary activity, and dietary intake). The research questions were: (1) to what degree does each independent variable relate to maternal outcomes; (2) to what degree does each independent variable relate to children's outcomes; and (3) which factors have the strongest impact on BMI and the health behaviors of Chinese mothers and their children.

Methods

A cross-sectional study was conducted to examine factors associated with health behaviors, including physical activity and dietary intake, of Chinese women who have immigrated to the United States and their children. Researchers determined the weight and height of the children in the study, and the children completed standardized questionnaires related to their activity levels and dietary intake. The mothers completed questionnaires regarding household income; their levels of education, acculturation, and physical activity; and dietary intake.

After receiving approval from the University of California, San Francisco Committee on Human Research, 8-to 10-year-old children who self-identified as Chinese and their mothers were invited to participate in this study. We used convenience sampling technique in this study. Participants were recruited from the Chinese community and after-school programs in the San Francisco Bay Area. Recruitment flyers and ads were posed and distributed at each study site. If parents were interested in taking part in this study, they contacted research assistants via phone or mail. The research assistants described the study to potential students and gave them an introduction letter and research consent form to take home. Parents who were interested in the study signed and returned the consent form, providing their names and contact information to the research team. Children and parents were informed that they could refuse participation or withdraw from the study at any time. Data were collected between November 2004 and July 2005.

Sixty-five children and their mothers participated in the study. Nearly half (49% [$n = 32$]) of the children were boys. The mean age of the children was 8.8 years ($SD = .5$). The mean age of the mothers was 38.9 years ($SD = 6.9$), and their mean year of education was 13.7 ($SD = 5.1$).

Procedure

The procedure for this study entailed administering questionnaires and taking several physiological measurements. The children and their mothers completed all questionnaires at home and returned them in sealed envelopes within 2 weeks of recruitment into the study. Questionnaires for mothers were translated into Chinese and demonstrated adequate validity and reliability. Children completed questionnaires in English.

Parental Measures

Family information (FI): This 12-item parent questionnaire includes questions regarding parents' and children's ages, parents' weight and height, parents' occupations, family income, and mothers' levels of education. The questionnaire is written at a third-grade reading level and takes approximately 5 min to complete.

Suinn-Lew Asian Self-Identity Acculturation Scale (SL-ASIA): The SL-ASIA was used to examine levels of acculturation [19,20]. This 21-item multiple-choice questionnaire covers topics such as language, identity, friendships, behaviors, general and geographic background, and attitudes. Scores can range from a low of 1.00, indicative of low acculturation or strong Asian identity, to a high of 5.00, indicative of high acculturation or strong Western identity. Validity and a moderate to good reliability (.79-.91) of the SL-ASIA have been reported for Chinese Americans [20].

Seven-day physical activity recall (PAR): This interview was developed to assess physical activity and energy expenditure based on mother's self-reported amount of time spent sleeping and engaging in moderate, hard, and very hard physical activities. The PAR is conducted using a standardized interview format [21]. During the interview, the mother is asked to estimate the

number of minutes spent engaging in these activities during the past 7 days. Standardized values of energy expenditure are assigned to the various activities. Sleep and light, moderate, hard, and very hard physical activities are categorized as 1.0, 1.5, 4, 6, and 10 METs, respectively. PAR was highly correlated with other objective measures (i.e., Uniaxial accelerometer, triaxial accelerometer, and pedometry) with a range from .82 to .94. Moderate to good reliability has also been reported (.87) [21].

SWAN Food Frequency Questionnaire (FFQ): The SWAN FFQs are modifications of the 1995 version of the Block Food Frequency Questionnaire [22]. The Chinese versions included the 103-item core food list plus between 16 additional foods appropriate for this ethnic group. These foods were primarily tofu, soy milk, soy sauce, and meat substitutes made from soy. For most foods, the frequency-of-consumption categories permitted a maximal frequency of “every day.” Breads and some snacks could be reported as being consumed as often as twice a day and beverages could be reported as five or more glasses or cans consumed per day [23]. In this study, we calculated daily caloric intake; percentage of calories from total fat, carbohydrates, sweets, and alcohol consumed daily; and daily intake of vegetables.

Children's Measures

Anthropometric measures: The Seca 214 Road Rod (Vogel & Halke GmbH & Co., Hamburg) portable stadiometer, which has an excellent graduation of 1/8 inch (0.1 cm), was used to measure height. Children were instructed to have their head positioned in the Frankfort Plane and to inhale; stretch height was then measured. Body weight was measured using the 840 Bella Digital Scale (Vogel & Halke GmbH & Co., Hamburg), which has a graduation of 0.2 lbs (100 g). Before measuring each subject, the researchers calibrated the scales based on instructions provided by the manufacturers. BMI was calculated by dividing body mass in kilograms by height in meters squared (kg/m^2). BMI has acceptable ranges of sensitivities and specificity [24].

In this study, body weight and height were measured three times, and the mean values of the three measurements were used to determine BMI. BMI lower than the 5th percentile was defined as underweight, between the 6th and 84th percentile was defined as normal weight, and BMI higher than the 85th percentile was defined as overweight based on the growth chart developed by the Centers for Disease Control and Prevention (CDC) [25].

Physical activity: Caltrac accelerometer: The Caltrac accelerometer has been widely used in assessing physical activity among children and adults [26]. It is designed to be placed at the hip and measure vertical acceleration. Readings from the device have been used to predict oxygen consumption and net caloric expenditure, based on gender, age, height, and weight, during exercise. The Caltrac accelerometer indicates a moderate to high validity, ranging from .35 to .97, with heart rate monitors and observation methods [26]. A high reliability of the Caltrac accelerometer, ranging from .87 to .98, has been reported in children [26]. In this study, children placed the Caltrac accelerometer at the hip for three consecutive days. Average net caloric expenditure was used for analysis.

Kid's Food Frequency Questionnaire (KFQ): This is a quantitative self-report food frequency questionnaire developed by Block to measure a child's food consumption by indicating the exact number of times each food is eaten per week [27]. A picture of portion size is provided to help participants determine the portion size of their meals. Daily intake of energy and nutrients is estimated by multiplying frequency responses with the specific portion sizes and the nutrient values assigned to each food item. Parents completed the KFQ together with their children. In this study, we examined total caloric intake; percentage of calories consumed from total fat, carbohydrates, and sweets; and daily vegetable intake.

Statistics

Descriptive statistics were calculated for demographic characteristics and all major study variables. Log transformation was used for dietary and physical activity data in both women and children due to large variations in these variables. To answer research questions 1 and 2 regarding the degree of association between independent variables (maternal acculturation level, education level, and household income) and maternal and child's dependent variables (BMI, physical activity and dietary intake), univariate linear regressions using data transferred from a log file were calculated. To determine which factors have the strongest impact on BMI and the health behaviors of Chinese mothers and their children, we entered household income and levels of maternal education and acculturation as predictors of children's and mothers' health behaviors in a multivariate linear regression model. All analyses were performed in SPSS 13.0 for Windows.

Results

The average BMI was 18 (3.7) for children, 23.1 (4.1) for mothers, and 24.8 (4.2) for fathers. We found that 4.6% of children were underweight ($n = 3$), with BMIs lower than the 5th percentile based on CDC growth chart [25]; 58.5% of children ($n = 38$) were normal weight (BMIs between the 5th and 84th percentiles); and 36.9% of children ($n = 24$) were overweight (BMIs higher than the 85th percentile). Of the overweight children, 62.5% were boys ($n = 15$) and 37.5% were girls ($n = 9$). Approximately 5% of mothers were underweight, with BMIs lower than 18.5; 23.3% of mothers were overweight, with BMIs higher than 25. Thirty-three percent of mothers reported their annual household income as being less than \$40,000, which is considered low income in the San Francisco Bay Area. Average number of years of maternal education was 13.7 (Table 1). Bivariate correlation coefficient suggests that high household income was significantly associated with a high level of maternal education ($r = .48$, $P < .005$) and acculturation ($r = .32$, $P = .013$). High level of maternal education was also related to a high level of acculturation ($r = .32$, $P = .01$).

Factors Related to Maternal Outcomes (BMI, Physical Activity and Dietary Intake)

Result indicates that high household income was related to low maternal BMI ($R^2 = .08$, $P = .04$), high maternal intake of fat ($R^2 = .16$, $P = .002$), and high maternal intake of sweets ($R^2 = .09$, $P = .02$) (Table 2). No factors were found to be associated with maternal education and acculturation levels and the health and health behaviors of Chinese mothers.

Factors Related to Children's Outcomes (BMI, Physical Activity and Dietary Intake)

High household income was related to low BMI and high physical activity level in Chinese-American children ($R^2 = .08$, $P = .03$; $R^2 = .07$, $P = .03$, respectively), and a high level of maternal education was related to a high physical activity level. A high level of maternal acculturation was related to low BMI ($R^2 = .09$, $P = .02$) and low level of sedentary activity in Chinese-American children ($R^2 = .09$, $P = .04$) (Table 2).

Factors have the Strongest Impact on BMI and the Health Behaviors of Chinese Mothers and their Children

Results suggested that high household income was related to low maternal BMI ($R^2 = .08$, $P = .04$), a high maternal intake of fat ($R^2 = .21$, $P = .0001$), and a high maternal intake of sweets ($R^2 = .08$, $P = .033$). A high level of maternal acculturation was related to low BMI in children ($R^2 = .07$, $P = .034$) (Table 3).

Discussion

Results suggest that a high household income is a risk factor for poor dietary behaviors in women but a protective factor against obesity in women and their children. Additionally, children in high-income families engage in a high level of physical activity. Although women from high-income families reported consuming more fat and sweets, they had low BMIs. Other studies found that high household income was related to low BMI in white but not in African-American and Hispanic children and adolescents. In fact, two studies [9,28] documented that the prevalence of childhood obesity is higher in high-income families in African-American and Hispanic populations than Caucasians. Although immigrant Chinese women from high-income families may consume foods high in fat and sugar because they have the economic means to afford such foods, they also may have access to healthcare information and resources that allow them to maintain a healthy weight.

Although only a few studies have examined the effects of household income and paternal education on Asian children's health and health behaviors, one study conducted by Gordon-Larsen and associates [9] found that a high household income and high parental education level was related to a low prevalence of obesity in Asian male adolescents in the United States. High parental education level was associated with a low prevalence of obesity in Asian female adolescents in the United States [9]. These findings are consistent with those of our study in which household income was associated with low BMI in Chinese-American children and a high level of physical activity, and a high level of maternal education was related to a high level of physical activity in the children. Chinese-American children from high-income families may have greater access to healthcare and physical activity facilities and mothers with a high level of education may have more knowledge regarding the benefits of physical activity.

In regression models, we found that a high household income and maternal acculturation level are related to health behaviors of Chinese mothers. High-income households were associated with poor dietary behaviors (high intake of fat and sweets) in mothers, and a high level maternal acculturation was associated with low BMI and a low level of sedentary activity in children. The study findings suggest that household income may be a better indicator of risk of obesity and health-related behaviors in Chinese immigrant mothers than acculturation and education levels. Furthermore, maternal level of acculturation may be a better indicator of Chinese-American children's relative weight and health behaviors. Although a high degree of correlation was found between household income and maternal education and acculturation levels, multivariate regression analyses that included these factors may result in one variable assuming primacy over the others in the regression model. Nevertheless, the results suggest that a high household income is related to obesity-related health behaviors in immigrant Chinese mothers but is a protective factor against obesity in these women and their children.

Another factor associated with Chinese-American children's relative weight is level of acculturation [29–32]. Our results suggest that children whose mothers had a low level of acculturation were more likely to be overweight than children whose mothers were highly acculturated. Acculturation affects one's beliefs, attitudes, and behaviors. Studies have found that immigrants' health status changed in the United States because of high levels of acculturation in second and third generations [33,34]. Davis and Katzman [33] assessed the relationship between acculturation, self-esteem, depression, and characteristics associated with eating disorders among Chinese students in the United States. Results indicated that higher acculturation in women was related to eating disorders, a drive for thinness, body dissatisfaction, and fear of maturation. These findings are consistent with a study by Root [35], who found that in an effort to assimilate, immigrants may overcorrect their real or imagined physical deficits. For female immigrants, the challenge to be part of mainstream society and meet what they perceive to be the beauty standards—being slim, tall, and blond—

becomes a struggle [36–38]. Studies [39,40] indicate a negative relationship between acculturation and body weight among other immigrants. However, one study [41] examined body weight among Chinese adults and Chinese-American adults and found no difference between foreign-born Chinese adults and Chinese-American adults born in the United States. In the current study, women with a high level of acculturation and their children had low BMIs, possibly because of an enhanced awareness of obesity and health issues related to obesity and a desirability for thinness that is reinforced in mainstream Western society.

As this is one of the first studies to examine the impact of household income and levels of maternal education and acculturation on the health behaviors of immigrant Chinese women and their children, there are limitations. The results of the study should be interpreted with caution because of the cross-sectional design, limited age groups and single geographical location. In addition, convenience sampling limits generalizability and poses the possibility that children and families who participated in this study were more aware of health issues related to physical activity and obesity and had healthier lifestyles than those who declined or dropped from participation. Furthermore, because the study used only self-reported measures of physical activity and dietary intake in both children and subjective maternal reporting of weight, height, and income, errors in measurement may have occurred. Use of observation technique and physiological measures may enhance the reliability and validity of study results. Future studies should include larger sample sizes, different age groups, and various geographical locations of Chinese-American children. Examining changes in health behaviors throughout children's different developmental stages is also warranted. As low household income and level of maternal acculturation was related to higher BMI, obesity intervention may want to target mothers and children who have lower household income and lower level of maternal acculturation.

Conclusion

This study revealed that high household income is associated with poor dietary behaviors in immigrant Chinese mothers and low BMI in both mothers and their children. Moreover, a high level of maternal acculturation is related to low BMI in Chinese-American children. The results suggest that an intervention aimed at reducing obesity and promoting health behaviors must be appropriate for different ethnic groups with various levels of income and acculturation.

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Table 1

Descriptive statistics

	Mean	SD	Log Transformation M (SD)
Mothers' variables			
BMI	23.1	4.2	
Educational level (year)	13.7	5.1	
Acculturation mean score	2.06	.48	
Daily physical activity (METs)	13.98	20.97	2.41 (0.65)
Total intake (kcal)	1374.93	725.33	7.11 (0.47)
% of daily fat intake	36.33	8.21	3.57 (0.24)
% of daily carbohydrate intake	43.33	9.66	3.74 (0.23)
% of daily sweet intake	6.11	4.80	1.58 (0.80)
# of fruits and vegetables consumed daily	3.07	1.19	1.05 (0.39)
Children's variables			
BMI	18.00	3.7	
Net caloric expenditure	484.3	285.6	6.29 (0.90)
Average television viewing/ computer game playing time (minutes)	59.00	78.17	4.10 (0.76)
Calories, kcal	1109.68	603.19	6.89 (0.50)
% of kcal from fat	30.37	6.44	3.39 (0.22)
% of carbohydrates consumed daily	55.45	9.18	4.0 (0.17)
% of sweet intake per day	12.02	8.95	2.30 (0.77)
# of fruits and vegetables consumed daily	2.82	1.77	0.85 (0.70)

Variables related to Chinese mothers' and children's BMI and health behaviors univariate regression

Table 2

Outcome	Predictor	R ²	B	95% CI	P
Maternal outcome					
BMI	Household income	.08	-.28	-1.06, -.028	.04
% of fat intake	Household income	.16	.40	.02, .08	.002
% of sweet intake	Household income	.09	.30	.02, .21	.02
Children's outcome					
BMI	Household income	.08	-.28	-.96, -.07	.03
	Maternal acculturation	.09	-.29	-4.14, -.37	.02
Physical activity	Household income	.07	.27	.01, .22	.03
	Maternal education	.16	.40	.03, .011	.001
TV/Computer time	Maternal acculturation	.09	-.30	-.94, -.02	.04

Table 3
Household income, maternal acculturation and maternal education Multivariate Regression

Outcome	Predictor	R ²	B	95% CI	P
Maternal outcome					
BMI	Income	.08	-.28	-1.08, -.03	.04
% of fat intake	Income	.21	.45	.03, .08	.0001
% of sweet intake	Income	.08	.28	.01, 0.21	.033
Children's outcome					
BMI	Acculturation	.07	-.273	-4.05, -.17	.034