Prevalence of Childhood Overweight among Low-Income Households

Chung L. Huang
Dept. of Agricultural & Applied Economics
313-E Conner Hall
The University of Georgia
Athens, GA 30602-7509

Tel: (706) 542-0747; Fax: (706) 542-0739
E-mail: chuang@agecon.uga.edu

Biing-Hwan Lin
Economic Research Service
U.S. Department of Agriculture

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Obesity represents one of the most serious health conditions facing adults and youth alike in the United States today. Evidence suggests that the threat continues to worsen rapidly, reaching epidemic proportions among U.S. children and adolescents. Childhood overweight prevalence increased among all gender and age groups. The most recent data from the National Center for Health Statistics (NCHS) indicate the prevalence of children and adolescent overweight has increased from 11.3 percent in 1988-94 to 15.3 percent in 1999-2000 for children 6-11 years old and from 10.5 percent to 15.5 percent during the same period for adolescents 12-19 years of age (NCHS 2003).

Among the children, a greater proportion of boys (16 percent) than girls (14.5 percent) are considered to be overweight. In contrast, the proportion of overweight adolescent was the same (15.5 percent) between males and females in 1999-2000. However, the proportion of overweight female adolescents has increased more rapidly from 9.7 percent in 1988-94 to 15.5 percent in 1999-2000 as compared to an increase from 11.3 percent in 1988-94 to 15.5 percent in 1999-2000 for male adolescents. More significantly, the prevalence of children and adolescent overweight is most alarming among boys of Mexican origin (27.3 percent and 27.5 percent for children and adolescents, respectively) and among non-Hispanic African-American female adolescents (25.7 percent) (NCHS 2003).

A major concern about childhood obesity is that obese children appear more likely to become obese adults, who carry serious risks of obesity-related chronic conditions such as Type II diabetes, coronary heart disease, hypertension, gallbladder disease, breast cancer, endometrial cancer, colon cancer, and osteoarthritis. The immediate consequences of overweight in childhood are often psychosocial and also include cardiovascular risk factors such as hypertension, high blood cholesterol, and abnormal glucose tolerance (Ogden et al. 2002). All of these conditions considerably reduce the quality of life, increase mortality, and can ultimately lead to premature death. In addition, obesity also represents a social problem and constitutes a substantial economic burden on the U.S. healthcare system. The expectation that the next generation of children will likely be fatter and less fit than the current generation (Hill and Trowbridge 1998) implies a tremendous future economic and social burden.

Obesity refers to an excessive accumulation of fat in adipose tissue, which is the body storage form of excess energy. It results from a positive balance of body energy, that is, when total caloric intake exceeds total expenditure (Smith 1999). This excess of body fat is characterized by an increase in the body weight. As a result, the terms overweight and obesity are used somewhat interchangeably in the literature. A commonly used measure of overweight and obesity is a weight to height ratio called body mass index (BMI) and defined as body mass in kilograms divided by the square of the height in meters (Lau 1999). However, clinical standards for defining obesity in children are not well established because of growth and development in children and adolescents. In practice, pediatricians and researchers use anthropometric measures and growth charts to determine if a child is overweight or at risk for overweight. Due to potential negative connotations associated with the term “obesity,” “at the risk of being overweight” and “overweight” are used to classify children when their BMI-for-age are at the 85^{th} and 95^{th}

percentiles of the growth charts, respectively. In this study, children with their BMI-for-age at or greater than the 85^{th} percentiles are labeled as overweight.

The scientific knowledge of the relationship between diet and health is being used increasingly to study the quality of children's diet. It is logical to expect that the more knowledgeable and well-informed parents are about the nutrient content of food items and health consequences of various diets, the better they can translate this information in planning household meals, implying healthier diets for household members. Although inconclusive, many previous studies have found a significant positive relation between children's diet quality and mothers' health and nutritional knowledge (Blaylock et al. 1999; Guthrie et al. 1999; Variyam 2001). There is a need to ascertain how nutrition and health knowledge of parents and a variety of other factors may affect the likelihood of overweight among school age children.

This study intends to address this need and provide additional insights to help understand the environmental factors that may influence the likelihood and extent of overweight among school children in the United States. Thus, the primary objective of the study is to investigate the potential connection between parents' BMI, health and nutritional knowledge, and the likelihood for their children to become overweight. More specifically, socioeconomic and demographic characteristics and other factors that may be related to the prevalence of overweight among low-income children and adolescents are examined. The results should provide important policy implications to public health officials with respect to the development of nutritional education, information delivery, and modification of food assistance programs, if needed.

The Model and Estimation Procedure

For the purpose of analyzing childhood overweight, a probit function that estimates the probability of being overweight and a regression model that estimates children's BMI are formulated and used in the empirical analysis. Although individuals do not choose to become overweight per se, it is assumed that the observed weight status reflects at least partially individual choices and attitudes toward lifestyle, diet, and health (Kuchler and Lin 2002). Given that the observed weight status is considered a self-selection process, individuals who fall in the overweight regime are likely to have characteristics that are systematically different from those who are not overweight.

Thus, the empirical model is specified as:

(1) $I_i = 1$, if $I_i^* = \gamma Z_i - \varepsilon_i \geq 0$ (when a child becomes overweight)

$I_i = 0$, if $I_i^* = \gamma Z_i - \varepsilon_i < 0$ (otherwise)

(2) $BMI_{i1} = \beta_1 X_{i1} + u_{i1}$,

(3) $BMI_{i0} = \beta_0 X_{i0} + u_{i0}$,

where I_i is a binary dependent variable that takes the value of 1 and 0, for overweight and non- overweight children, respectively. I_i^* is a latent variable (critical threshold) and BMI_{i1} and BMI_{i0} denote the Body Mass Index for overweight and non-overweight children, respectively. The β_1, β_0, and γ are vectors of unknown parameters to be estimated. Z_i, X_{i1}, and X_{i0}, are vectors of independent variables and ε_i, u_{i1}, and u_{i0} are error terms. The set of independent variables includes those socioeconomic, environmental, and diet-related factors that may affect the probability of being overweight and BMI, as discussed in the previous section.

We assume that the error terms in equations (1), (2), and (3) have a trivariate normal distribution with mean vector zero and a covariance matrix:

$$\operatorname{cov}(u_{i1}, u_{i0}, \varepsilon_i) = \begin{bmatrix} \sigma_1^2 & \sigma_{1,0} & \sigma_{1,\varepsilon} \\ \sigma_{0,1} & \sigma_0^2 & \sigma_{0,\varepsilon} \\ \sigma_{\varepsilon,1} & \sigma_{\varepsilon,0} & 1 \end{bmatrix},$$

where σ_1^2, σ_0^2, and 1 are the variances of u_{i1}, u_{i0}, and ε_i respectively, and the off-diagonal elements of the matrix are co-variances. The error terms in equations (2) and (3) have non-zero expected values:

(4) $$E[u_{i1} \mid I_i = 1] = -\sigma_{1\varepsilon} \frac{\phi(\gamma Z_i)}{\Phi(\gamma Z_i)}, \text{ and}$$

(5) $$E[u_{i0} \mid I_i = 0] = \sigma_{0\varepsilon} \frac{\phi(\gamma Z_i)}{1 - \Phi(\gamma Z_i)},$$

where $\phi(.)$ is the standard density function and $\Phi(.)$ its cumulative distribution function.

For empirical implementation, the equation (1) can be estimated using a probit procedure to obtain parameter estimates $\hat{\gamma}$ for γ. However, the BMI equations (2) and (3) should not be estimated using the ordinary least squares (OLS) procedure because the expected error terms are nonzero as shown in equations (4) and (5). In practice, a two-step estimation procedure has been widely used to correct for selectivity bias resulting from equations (2) and (3). The application of the two-step estimation method entails the addition of the selectivity regressors $\hat{\phi}/\hat{\Phi}$ in equation (2) and $\hat{\phi}/(1-\hat{\Phi})$ in equation (3), where $\hat{\phi} = \phi(\hat{\gamma}Z)$ and $\hat{\Phi} = \Phi(\hat{\gamma}Z)$, and estimating one equation at a time with the OLS procedure.

The application of the endogenous switching regress technique is appropriate to account for the subsample heterogeneity when unobserved characteristics are distributed differently across overweight and normal weight individuals (Kim et al. 2000). Thus, instead of using the two-step estimator, the full information maximum likelihood (FIML) estimation is used in the estimation of the switching regression model. The FIML estimator is preferred because it yields consistent and asymptotically efficient parameter estimates (Lee and Trost 1978). Recently, Kim et al. (2000) also use the FIML to estimate an endogenous switching regression model to examine the impact of consumers' use of food labels on selected nutrient intakes.

The probit equation for the probability of childhood overweight is estimated separately based on the total sample while the endogenous switching regression model on children's BMI is estimated for a subsample of low-income children. The empirical analyses are implemented by using LIMDEP program (Greene 2002), which yields the correct asymptotic covariance matrix for equations (2) and (3). Furthermore, weighted switching regression is used in the estimation process to account for potential heteroscedasticity problem associated with the residuals of equations (2) and (3).

The Data

Survey data from the USDA 1994-96 Continuing Survey of Food Intakes by Individuals (CSFII) and the 1994-96 Diet and Health Knowledge Survey (DHKS) are used in this study. The CSFII was designed to obtain a nationally representative sample of non-institutionalized persons residing in the United States. Personal interviews were conducted to collect all individual food intake data on two nonconsecutive days using 24-hour recalls. After the 1994-96 CSFII respondents provided the first-day dietary data, adults 20 and above were randomly selected to participate in the DHKS. The DHKS collected data on knowledge and attitudes toward dietary guidance and health. Only children ages 5 to 19 were included in this study. In order to focus specifically on childhood overweight and relative weight status among children from low-income households, a subsample of low-income households is obtained by using the 185% of poverty guideline: the guideline represents a federal threshold for determining eligibility for USDA's WIC program.

Weight gain among children is likely due to a combination of factors. Factors related to genetic or parental influences include parent's BMI and parent's (meal planner's) nutrition knowledge and health awareness. If available, BMI of the child's father is used; if not, mother's BMI is used. Questions from the DHKS questionnaire that focused specifically on the individual's knowledge of nutrient content of various food items and her/his awareness of health consequences caused by any excess or insufficient intake of some nutrients are used to construct nutrition knowledge and health awareness. Fourteen questions pertaining to a respondent's knowledge on the nutrient content of food items and seven questions assessing a respondent's awareness of diet-related health problems make up the nutrition knowledge and health awareness variables used in the analysis, respectively. The nutrition knowledge and health awareness variables are calculated as the sum of correctly answered questions. Thus, the maximum score is 14 for nutrition knowledge and 7 for health awareness. The influence of the parent's BMI on a child's weight status is expected to be positive while nutrition knowledge and health awareness are expected to correlate negatively with children's weight status.

Socioeconomic and demographic factors include a variety of variables such as household size and income, race and ethnicity, age and gender, as well as location and urbanization. Some of these variables, such as household size and income may be considered as environmental or household influence on childhood overweight. Other variables, such as age and gender, may indicate different abilities to manage caloric intake. There is no clear a priori expectation on the relationship between children's BMI and most of the socioeconomic and demographic variables. In general, household income has been found to have an inverse relationship with individual weight status (Goodman 1999; Kuchler and Lin 2002). African Americans and Hispanics are likely to face a higher risk of being overweight than other races and ethnicities (Nayga 2000; Kuchler and Lin 2002).

Individuals engaging in active lifestyles, such as exercising regularly and spending less time watching television, tend to expend more energy and hence are expected to have lower BMI. To capture the potential relationship between dietary patterns and children's weight status, a number of dietary factors, such as consumption of school lunch, food away from home and intakes of various nutrients are included in the empirical analysis. Consumption of foods prepared away from home often represents a diet that is high in fat and energy. Meals provided through school cafeteria have also been shown to contain more fat than recommended (Burghardt et al. 1995). Thus, eating out at fast food or other restaurants and eating school lunches may have a positive relationship with weight status. Note that the USDA launched the School Meal Initiative for Healthy Children (SMI) in June 1994 to improve the dietary quality of school meals. Because many school districts applied for a delay in implementing the required changes, the CSFII data might not have captured the full effect of the SMI. Eating out is represented by the share of calories consumed from foods prepared away from home including school breakfasts and lunches. Consumption of soft drinks or other sugar-sweetened beverages may increase the risk for excess energy intake (Ludwig et al. 2001). We create a variable representing the share of carbonated soft drinks and juice drinks as a percentage of total consumption of beverages to test if beverage consumption is associated with BMI. In addition, we include another dietary variable representing the amount of sodium in each thousand calories consumed to examine the association between sodium consumption and BMI. A list of all variables included in the regression analyses and their definitions are presented in Table 1.

The sample characteristics of low-income children and all children ages 5 to 19 years old are shown in Table 2. The prevalence of childhood overweight is evident from Table 2. Almost 42 percent of children age 5-19 from low-income households are either at risk of being overweight or overweight, compared to 33 percent of all children of the same age range. It is interesting to note that the average BMI of parents is over 27, which is considered overweight for adults. The low-income households sample is also characterized with lower scores of nutrition knowledge and health awareness and larger household size, compared to the total sample.

As to be expected, a larger proportion of low-income children (30 percent) participated in the food stamp program, compared to a12-percent participation for all children ages 5-19 years old. Almost 55 percent of the low-income households are headed by a single parent while only 40 percent of the sample is single-head households. In addition, a large proportion of low-income households are African-Americans and

Hispanics. Children in the low-income sample, on average, also spent a significantly greater amount of time watching television or playing video games than all children in the sample. Low-income household children are more likely to consume school lunches and prefer soft drinks than their counterparts.

Empirical Results

The probit estimation based on the total sample is discussed first followed by the switching regression results based on low-income households.

The Probit Estimation of Childhood Overweight

Results of probit estimation of equation (1) for the full sample are presented in Table 3. The results are satisfactory in general given that many of the explanatory variables are found to be statistically significant with expected signs. As shown in Table 3, the results support the contention that there is potentially a hereditary or behavioral link between a child and the parents' weight status. The estimated coefficient on parental BMI is positive and highly significant. This result suggests that a one point increase in a parent's BMI is associated with a 1.3 percent increase in the probability of childhood overweight. This could reflect a genetic linkage. Exposure to similar lifestyle and diets among household members represents another plausible explanation for the estimated relationship. However, no significant associations were found between the likelihood of a child being overweight and a parent or an influential adult's nutrition knowledge and health awareness.

Among the socioeconomic characteristics, household income is found to be associated negatively with a child's likelihood of being overweight. The negative and significant income effect suggests that as household income increases the likelihood of a child being overweight decreases. This result appears to confirm previous findings that children from low-income households might be at a greater risk of becoming overweight (Mei et al. 1998). African-American children are more likely to become overweight than children from other races. The estimated marginal effect shows that being an African American is associated with an increase of 12.6 percent in the probability of overweight. The magnitude of the marginal effect suggests that more attention in the development of health and educational programs concerning weight control should target African-American youths.

It is alarming to note that there is a negative and significant relationship between age and the probability of being overweight. Because the data are cross-sectional, the result does not necessarily imply that children are less likely to be overweight as they age. Rather, the result indicates that a lager proportion of younger children is overweight, compared to older children. Most of the other socioeconomic characteristics do not appear to have any significant impacts on the probability of being overweight except for children residing in rural areas.

For factors related to physical activity, the results show that hours spent watching TV or playing video games is positively and significantly associated with the likelihood of a child being overweight as expected. The calculated marginal effect suggests that each additional hour spent watching television or playing video games is associated with a 2.4 percent increase in the probability of being overweight. Among the dietary related variables, the results indicate that higher sodium density in food (the amount of sodium per kilocalories from food) is positively and significantly related to the probability of childhood overweight. An increase in sodium density by 1 milligram per kilocalories would increase the marginal probability of being overweight by 11.1 percent. The sodium intake has the second largest marginal probabilities, smaller only to the effect of being African American.

BMI Results for Low-Income Household Children

The switching regression results for children from the low-income households are presented in Table 4. The results suggest a distinct pattern of factors that affect weight status in the overweight (regime 1) and normal weight (regime 2) children from the low-income households. Overall, the results show that the model performs better with the overweight regime than the normal weight regime. It is also noted that the estimated coefficients for σ_1 and σ_0 are statistically significantly different from zero, suggesting that there is evidence of selectivity bias presence in the sample and the application of switching regression analysis is appropriate.

For the overweight group, the result indicates that parental BMI has a positive and significant effect on children's weight status as to be expected. Of particular interest is the result that indicates a negative and significant relationship between overweight children's BMI and the proxy variable for parental nutrition knowledge. This finding seems to support the notion about the positive effects of nutrition knowledge on health outcome. This result may imply that nutrition information available to parents and other influential adults can play an important role in improving a child's weight status among those who are already overweight. Among the socioeconomic characteristics, household size and income, race, and location are also found to correlate significantly with overweight children's BMI. The negative association between household income and children's BMI suggests that children from high-income households tend to weigh less than their counterparts. African-American and Hispanic children are heavier than children of other races. In addition, among the overweight children, those who reside in the Southern region are also found to be heavier than children from other regions of the United States. As expected, the amount of time spent on non-physical activities such as watching television and sodium intake are found to be positively associated with BMI among overweight children. However, the negative effect of the food away from home on overweight children's BMI is unexpected.

For the normal weight regime, the results are less satisfactory with only four variables are significant in accounting for the variation in children's BMI. Nevertheless, the results again show that a child's weight status is positively linked to a parent's BMI. However, the results also indicate that male children and children from a single-parent household tend to weight less than their counterparts. Another unexpected result is that hours spent watching television was found to correlate negatively with children's weight status.

Summary and Conclusions

Based on the data from the USDA 1994-96 CSFII and its DHKS companion, a high proportion of low-income children ages 5-19 that are at risk of overweight or overweight. Past studies have used the CSFII and DHKS data to show that, among adults, there is an important relationship between nutrition and diet knowledge and body weight. These analyses also demonstrate that personal choices do matter for adiposity. However, little has been done to examine the link between childhood overweight and parental influences. Furthermore, previous studies seek primarily to quantify the relationship between BMI measure and various explanatory variables without taking into account the potential self-selectivity bias that may exist between overweight and normal weight individuals.

In this study, a probit equation is first estimated to identify important factors that may be associated with the likelihood of becoming overweight among children. To ascertain the relationship between individual BMI measure and a host of environmental variables, a switching regression model that separates low-income children into two weight status regimes is estimated. The results support the hypothesis that the effects of socioeconomic factors and behavioral patterns on BMI may differ between overweight and normal weight children. The probit model fits the data relatively well and the variables that exhibit statistically significant relationships are found to have expected signs.

Overall, the study found that parental BMI, household income, race, gender, age, urbanization, TV viewing, and sodium intake are important factors for predicting the probability of childhood overweight. For example, the results show that children from higher income households are less likely to become overweight than those from lower income households. Male children are more likely than females to become overweight. The likelihood of developing childhood overweight is higher for African Americans than children of other ethnicities. In particular, the results indicate that the marginal probability of being overweight is highest among African-American children. This finding suggests that future health information campaign can improve its effectiveness by paying attention to the food choices and activities of African-American children.

As expected, the BMI of overweight and normal weight groups of children are found to be associated positively and significantly with the parents' BMI. This result suggests a possible link in terms of heredity, genetics, and exposure to similar lifestyle for members of the same household. This study also supports the hypothesis that overweight in children may be related to parents' dietary knowledge and health awareness. The result shows that increasing the guardian's health awareness and dietary knowledge would decrease his/her children's BMI. The result provides an important policy implication for public health officials with respect to the development of nutritional education and information delivery.

Household characteristics have shown different effects on the development of childhood overweight. Household income is found to have a significant negative effect on the BMI of overweight children. The results also show that African American and Hispanic children and children from the southern region are positively related to being overweight. Finally, the amount of time spent on non-physical activities and amount of sodium consumed are found to be positively associated with higher BMI among overweight children. However, it is important to note that many of these lifestyle and dietary choices are amendable suggesting that information campaigns designed to inform consumers about choices available for weight control would be most effective if they are targeted at the specific group of children.

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Table 1. List of variables used in regression analyses

Variable	Definition
Overweight	= 1 if gender-specific BMI-for-age ≥ 85th percentile, 0 otherwise.
BMI	Body mass index (kg/m^2), calculated from self-reported weight and height.
Parental influences	
Parent's BMI	Father's or mother's BMI.
Nutrition knowledge	Parent's or influential adult's knowledge of food nutrient content.
Health awareness	Parent's or influential adult's awareness of diet-related health problem.
Social, economic, and demographic	
Household size	Number of persons in the household.
Log (income)	Logarithm of annual household income.
Food Stamp	= 1 if a household member is authorized to receive food stamps, 0 otherwise.
Single-head household	= 1 if the household is headed by a single parent, 0 otherwise.
White	= 1 if respondent is non-Hispanic white, 0 otherwise.
African American	= 1 if respondent is African American, 0 otherwise.
Hispanic	= 1 if respondent's race is of Hispanic origin, 0 otherwise.
Male	= 1 if respondent is male, 0 otherwise.
Age	Age in years of the respondent.
Age squared	Age in years squared.
Northeast	= 1 if respondent resides in the northeast region, 0 otherwise.
Midwest	= 1 if respondent resides in the mid-west region, 0 otherwise.
South	= 1 if respondent resides in the southern region, 0 otherwise.
Rural area	= 1 if respondent lives in rural area, 0 otherwise.
Urban area	= 1 if respondent lives in metropolitan area outside central city, 0 otherwise.
Lifestyle, physical activity and dietary factors	
TV hours	Hours spent on watching TV or playing video games per day.
School lunch	Number of school lunches eaten per week.
Food away	Percent calories consumed from foods prepared away from home.
Soft drinks	Share of carbonated soft drinks and juice drinks in the total consumption of beverages.
Sodium intake	Amount of sodium intake in milligrams per kilocalories.

Table 2. Sample characteristics of low-income households and all children ages 5 to 19 years old

	Low Income (≤ 185% Poverty)		Total (Children 5-19 Years old)	
Variable	Mean	Std. Deviation	Mean	Std. Deviation
Overweight	.419	.494	.332	.471
Child's BMI	21.449	5.469	20.550	4.885
Parent's BMI	27.702	5.915	27.129	4.981
Nutrition knowledge	7.590	2.552	8.454	2.473
Health awareness	5.576	1.691	5.949	1.461
Household size	4.396	1.548	4.185	1.290
Log (income)	9.508	.662	10.367	.850
Food Stamp	.301	.459	.118	.323
Single-head household	.545	.498	.397	.489
White	.579	.494	.752	.432
African American	.276	.448	.151	.359
Hispanic	.219	.414	.133	.339
Male	.503	.500	.501	.500
Age	11.957	3.982	11.975	4.008
Age squared	158.802	95.117	159.457	96.478
Northeast	.162	.369	.180	.385
Midwest	.228	.420	.244	.430
South	.398	.490	.367	.482
Rural area	.317	.466	.262	.440
Urban area	.351	.478	.460	.499
TV hours	3.530	2.409	3.064	2.124
School lunch	3.354	2.255	2.605	2.310
Food away	25.040	22.489	25.781	22.151
Soft drinks	73.029	38.944	70.113	39.346
Sodium intake	1.602	.373	1.599	.391
Sample size	561		1,486	

Table 3. Probit estimation for childhood overweight, all children ages 5 to 19 years old

Variable	Estimated Coefficient	Marginal Effect[b]
Constant	.231 (337)[a]	
Parent's BMI	.037*** (5.179)	.013
Nutrition knowledge	−.004 (−.230)	−.001
Health awareness	.018 (.707)	.007
Household size	.007 (.234)	.002
Log (income)	−.199*** (−3.531)	−.071
Food stamps	−.035 (−.264)	−.012
Single-head household	.059 (.746)	.021
White	.028 (.205)	.010
African American	.338** (2.006)	.126
Hispanic	.182 (1.507)	.067
Male	.161** (2.267)	.057
Age	−.069*** (−7.407)	−.024
Northeast	.028 (.236)	.010
Midwest	.049 (.429)	.018
South	.100 (.940)	.036
Rural area	.225** (2.174)	.082
Urban area	.113 (1.231)	.040

Table 3. Continued

Variable	Estimated Coefficient	Marginal Effect[b]
TV hours	.068*** (3.910)	.024
School lunch	−.011 (−.700)	−.004
Food away	.002 (1.434)	.001
Soft drinks	−.001 (−.680)	−.0002
Sodium intake	.312*** (3.392)	.111
Log likelihood function	−848.451	
R^2	.102[c]	
Sample size	1,486	

*, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

[a] Numbers in parentheses are t-statistics.

[b] Marginal effect or marginal probability is defined as the change in the probability for a change in x_i, ($\partial\Phi / \partial x_i$), which is the height of the normal density multiplied by the x_i coefficient, b_i; that is $\frac{\partial\Phi}{\partial x_i} = \phi(\bar{x}b)b_i$, where $\phi(\bar{x}b)$ is the standard normal density function evaluated at the means of the independent variables. For dummy variables, the marginal effect is calculated as the difference in probability for discrete change of the dummy variable from 0 to 1.

[c] McFadden's pseudo R^2.

Table 4. Regression results for low-income household children, ages 5 to 19 years old

Variable	Estimated Coefficient: Overweight (Regime 1)	Estimated Coefficient: Normal Weight (Regime 2)
Constant	23.642***	29.420***
	(2.453)	(3.423)
Parent's BMI	.271***	.079*
	(4.264)	(1.630)
Nutrition knowledge	−.262*	.055
	(−1.837)	(.462)
Health awareness	.377	.006
	(1.582)	(.031)
Household size	.534**	.129
	(2.026)	(.524)
Log (income)	−2.002**	−1.192
	(−2. 009)	(−1.388)
Food stamps	−1.143	−.672
	(−1.136)	(−.735)
Single-head household	1.005	−1.434**
	(1.461)	(−2.230)
White	1.722	−1.559
	(1.383)	(−1.220)
African American	3.625**	−.340
	(2.306)	(−.219)
Hispanic	3.838***	−1.278
	(3.712)	(−1.444)
Male	.872	−1.138*
	(1.306)	(−1.772)
Age	−.121	.298
	(−.222)	(.526)
Age squared	.014	.017
	(.595)	(.680)
Northeast	.269	−.995
	(.232)	(−.073)
Midwest	1.555	.164
	(1.308)	(.130)
South	2.573**	−1.178
	(2.403)	(−.967)
Rural area	.752	.052
	(.785)	(.057)
Urban area	1.064	.593
	(1.208)	(.666)

Table 4. Continued

Variable	Estimated Coefficient: Overweight (Regime 1)	Estimated Coefficient: Normal Weight (Regime 2)
TV hours	.293**	−.238*
	(2.046)	(−1.649)
School lunch	.125	.196
	(.743)	(1.114)
Food away	−.027*	−.014
	(−1.762)	(−.921)
Soft drinks	−.013	.008
	(−1.414)	(1.091)
Sodium intake	1.985**	1.297
	(2.106)	(1.448)
σ_1	6.119***	
	(16.001)	
σ_0		3.669***
		(18.553)
Log likelihood function	−1,883.147	
Sample size	235	326

*, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

[a] Numbers in parentheses are t-statistics.