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Processes of Cumulative Disadvantage: Socio-economic and Intergenerational Transmission of Child Under- and Over-Nutrition in Brazil

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Abstract: Obesity among children and adolescents is a global public health problem that is increasing at alarming rates in mid- and low-income countries. With more rapid nutrition and epidemiological transitions than developed countries, Brazil is an example of a country that currently experiences the burden of under-nutrition and over-nutrition, hence the ideal context for the understandings of how the socio-economic and intergenerational transmission of (dis)advantages intertwines with child nutrition. The goal of this paper is to examine the trend in adolescent under- and over-weight in light of the many disadvantages children and adolescents face at this stage of the life course in Brazil. We use unique nationally representative data with information on height and weight of all members of the household, including parents, to implement quantile and sibling fixed-effect models. Our results suggest that parental obesity is an important factor associated with child obesity above and beyond nutritional behavior in the household. Additional results from quantile regression models suggest that family socio-economic disadvantages operate very differently for children considered under-weight, normal weight or over-weight. Our preliminary findings from siblings fixed-effect models suggest that adolescents who work and who are out of school have a higher probability of being obese or overweight, suggesting that socio-economic and health disadvantages intertwine and are accumulated throughout childhood and adolescence. All in all, our findings suggest that socio-economic and intergenerational disadvantages can also lead to health disadvantages, contributing to perpetuate the poor conditions of large proportions of children and adolescents in an already highly stratified society.

Introduction

Obesity among children and adolescents is a global public health problem that is widespread in most developed countries and is increasing at alarming rates in mid- and low-income countries. With more rapid nutrition and epidemiological transitions than developed countries, Brazil is an example of a country that experiences concomitantly the burden of undernutrition and overnutrition, hence the ideal context for the understandings of how the intergenerational transmission of (dis)advantages intertwines with child nutrition.

The first goal of this paper is to examine the trend in adolescent obesity in light of the many disadvantages children and adolescents face at this stage of the life course in Brazil. We are particularly interested in the intergenerational transmission of disadvantage and whether child obesity is associated with socio-economic disadvantages and the reproduction of obesity. Using unique nationally representative data from 2003 and 2009 that contain information on children's and parents' height and weight, we examine the extent to which family socio-economic status and parental nutrition are associated with child obesity.

To more broadly encompass the reality of children welfare in Brazil and in most developing and mid-income countries, in the second goal of this paper we propose a conceptualization of adolescent nutrition that considers both undernutrition and overnutrition as disadvantaged conditions. Although Brazil is experiencing sharp increases in obesity, a large proportion of adolescents still suffer from malnutrition and stunting, particularly in the Northeast region. Importantly, examining the two extremes of the BMI distribution will also provide a more detailed picture of adolescents' welfare in Brazil and in most developing countries, an important counterpoint to the current literature that focuses primarily on the United States and other developed countries. The second goal of this paper is therefore to examine whether parental nutrition status and socio-economic background characteristics are associated differently with child nutrition depending on whether children are malnourished or obese. We address our second goal by using quantile regression models.

The parent-child transmission of obesity can occur through family habits as well as through a genetic predisposition to obesity. To that end, the third goal of this paper is to address a current debate in the literature on the transmission of disadvantages everywhere: To what extent the intergenerational transmission of obesity is due to family behaviors such as availability of poor nutritional food in the household? Or, to what extent is the parent-child transmission of obesity due to genetic predisposition? Using sibling fixed-effect models, we address the shared observed and unobserved characteristics associated with obesity.

The significance of this work is both conceptual and methodological. First, the analysis uses recent data from Brazil on an increasingly public health concern in mid- and low-economy countries. In addition to examining obesity, we also examine under-nutrition. By considering that children and adolescents in Brazil, as in large portions of the world, face both public health problems, this research is in a unique position to underscore the role of poverty and the cumulative transmission of disadvantage. Thus, a key contribution of this study is the incorporation of theoretically-informed variation into the effects of poverty, cumulative disadvantage and the intergenerational transmission of disadvantage—variation that depends on the social context and the course of the nutrition and epidemiological transitions.

The second contribution is related to the implications of unequal understandings of adolescence. We examine the hypothesis that socio-economic disadvantages are cumulative throughout adolescents' life course, leading to poor health outcomes. Finally, while previous research has examined child and adolescent nutrition, only a few studies have addressed unobserved and observed factors shared by siblings. We apply sibling fixed-effect models to underscore within-family factors that contribute to child obesity.

The Rapidly Changing Social Context of Brazil

Malnutrition was the leading cause of death for Brazilian children throughout the 1980s and 1990s. By the late 2010, 15% of Brazilian children and adolescents were considered obese or overweight. The proportion of children and adolescents (10-19 years old) considered obese or overweight went from 3.7% in 1970 to 21.7% in 2009 (IBGE, 2010). Moreover, in the South and Southeast regions, for each malnourished child there are 9 children considered overweight. This rapid change in child nutritional status is in line with the multitude of social, economic and demographic changes Brazil has been through over the last three decades.

Child and Adolescent Obesity

Obesity continues to be a public health concern across the globe for children, adolescents and adults. However, while research notes that childhood and adolescence are critical periods for the development of obesity and overweight, most research focuses on adults (Wang & Lobstein, 2006), thereby limiting the understanding of this epidemic during these stages of the life course. As obese children tend to become obese as adults, understanding the mechanisms and processes as to the development of overweight and obesity is critical. Obesity in adulthood is linked to health concerns such as diabetes, certain cancers and cardiovascular disease (Ogden et al., 2010), while obesity in childhood and adolescents has been shown to influence psychosocial development (Must & Strauss, 1999; Wang, 2006). Since the 1970s the increase in obesity among children and adolescents has been large in countries across the world, doubling and tripling in some areas (Wang, 2006). In countries such as the U.S. and Canada the rates of overweight or obesity have doubled for school aged children, while in countries such as Brazil and Chile the rates have recently tripled (Wang, 2006). Obesity has long-term effects on mortality and morbidity, hence understanding this epidemic in childhood in a global context is necessary in an effort to combat this growing public health concern.

Cumulative Disadvantage and Intergenerational Transmission of Obesity Risk

Obesity is often measured with respect to socioeconomic status, race, gender and ethnicity. However, recent research is moving towards the study of obesity through the lens of intergenerational transmission (Whitaker et al. 2010; Classen 2010). Indeed, parental obesity is one of the strongest risk factors for childhood and adolescent obesity. Large-scale studies from Europe, Asia, and Australia found correlations between paternal or maternal body mass index (BMI) and children's adiposity of '0.20 (Withaker et al. 2000; Linabery et al. 2013).

Specifically, when it comes to the intergenerational transmission of obesity, the effects are stronger between mothers and children (Whitaker et al. 2010). Classen (2010) for instance found that "having a mother who was obese between 16 and 24, dramatically increases the likelihood that her child will also be obese or overweight at a similar life stage…" (pp. 11). Such research raises questions about children's weight status as either a product of fetal effects, or a consequence of the mothers charge of feeding practices. There is a continued need to examine the intergenerational transmission of obesity, and focus on mothers as well as fathers.

The concept of cumulative (dis)advantage theory broadly postulates that adversity gives rise to adversity, whereas advantage gives rise to advantage, for example growing up in a financially stable, emotionally supportive familial environment can lead to better educational opportunities, which in turn can lead to better occupational and health outcomes (Carr and Umberson 2013). Within the social sciences, cumulative (dis)advantage theory has been used to discuss poverty, social mobility, education and more (Carr and Umberson 2013). From a health perspective, cumulative (dis)advantage theory focuses upon the importance of taking the "long view" to study inequality over the life course (Ferraro and Kelly Moore 2003; Blackwell, Hayward and Crimmins 2001). Though there are certain risks that have immediate effects, others take time to manifest (Ferraro and Kelly-Moore 2003).

With the growing concern around issues of obesity and overweight, the risk of excess body weight is one that has garnered a lot of attention. Cumulative disadvantage theory's emphasis upon the consequences of early life inequalities makes it a useful framework for examining body weight trajectories linked to issues such as overweight and obesity. Specifically, Ferraro and Kelly-Moore (2003) note that early on in the life course there is heterogeneity in body weight, while the health consequences of obesity may take years to manifest. Thus, they argue that examining whether or not obesity early on in the life course leads to increases in health inequality later on makes obesity an appropriate area for examining the effectiveness of cumulative (dis) advantage theory. In support of their arguments of the potential utility of cumulative (dis)advantage theory, Ferraro and Kelly-Moore found that the effects of obesity "were largely long term, with lags of more than 10, 20 and 50 years" (pp. 723). These findings illuminate the advantages of utilizing a cumulative (dis)advantage perspective when studying obesity, especially as we consider the move towards research on the intergenerational transmission of obesity. Using a cumulative (dis)advantage perspective in relation to the intergenerational transmission of obesity would consider early childhood experiences that contribute to later life effects; especially as research has noted that parental obesity is one of the strongest predictors of child and adolescent obesity (Whitaker et al. 1997).

Data and Methods

Data: Expenditure and Income Household Survey (POF)

We use data from the Expenditure and Income Household Survey (POF) from 2002-2003 and 2008-2009. The POF is a family budget survey conducted by the Brazilian Census Bureau (IBGE). These surveys have detailed information about household´s expenditures, as well as socioeconomic and demographic variables, making it possible to draw a profile of the living conditions of the population departing from household budgets (IBGE, 2002). A partnership between the Ministry of Health and IBGE made it possible to include anthropometric measures in the survey, which are the focus of our paper. Trained interviewers measured the height and weight of every person in each household surveyed, including children and their parents.

Analytical Samples

We use three analytical samples to address our questions. Our first and second analytical sample corresponds to our first goal and includes all children of the head or spouse of the household ages 10 to 16 in both years. Our sample is composed of 29,761 observations. In our third analytical sample we include pairs of siblings ages 10 to 16. There are 16,337 siblings in our third analytical sample. In the siblings model we included only one child (or only one pair of siblings in the siblings sample) per household to eliminate problems of non-independency of observations. Those were selected randomly using Stata.

Measures

Parental BMI was calculated as weight divided by height squared. Overweight was defined as a BMI of 25–29.9 while obesity was defined as a BMI greater than 30. We converted children's BMI to standardized scores (BMI-SD score) and categorized obesity and overweight according to the International Obesity Taskforce criteria, which identifies BMI values for each age associated with a predicted BMI of 25 or 30 at age 18 (). The advantage of using the IOTC is that the parameters were constructed based on samples of children and adolescents from several countries, including Brazil. These parameters have also been recommended by the WHO (1995).

We use individual, parental and household information in our analyses. On the individual side, we include age, years of education, sex and race. Our parental variables are *parental nutrition status* (categorical variable that defines if none of the parents are overweight or obese, if only the father is overweight or obese, if only the mother is overweight or obese, or if both parents are overweight or obese), years of education of the father, years of education of the mother and if the mother works. Finally, our household variables are per capita log of household income, region of residence, an indicator of the availability of food of poor nutritional value in the household, such as candy and soda.

Methods

To address the first goal of the paper we use logit models; our dependent variable indicates whether the child is obese or overweight. For our second goal we examine the entire BMI distribution to underscore both under- and over-nutrition. We use quantile regression models, which assume that the associations between independent variables and BMI vary according to the dependent variable. Quantile regression estimates are more robust against outliers in the response measurements, which is the case in Brazil because of the country's significant proportions of children under- and over-nourished. To address the third goal of this paper, we implement sibling fixed-effect models with and indicator of obesity as our dependent variable. The focus here is on within-family determinants of obesity, with special interest on adolescent cumulative disadvantages such as working and dropping-out of school.

Preliminary Results

Descriptive Results

Table 1 shows BMI over time and by region in Brazil. The categories for BMI we examine are: underweight, normal weight, overweight and obese. We observe that the Northeast presents, in both years, a higher percentage of underweight youths compared to other regions. The Southeast and South regions present the highest percentages of child overweight and obesity, with an upward trend over the two years (about 76.5 and 80.2% respectively). This pattern reflects Brazil's regional inequalities where the South and Southeast are the most developed regions and the ones where the nutrition transition has been under way longer. We plan to explore regional differences in the next versions of the analysis.

Table 2 shows means and proportions of all variables we include in the models. Table 3 shows BMI categories by each co-variate we examine in the multivariate analyses, and for our two analytical samples, all children and adolescents ages 10-16, and siblings ages 10-16. The categories for BMI are: underweight, normal weight, overweight and obese. Findings from Table 3 show several interesting patterns. First, children considered obese and overweight have completed higher years of schooling than their underweight and normal weight counterparts. Similarly, larger proportions of children considered obese and overweight are enrolled in school in the right grade for their age. In terms of family characteristics, a larger proportion of children of obese or overweight parents are also considered obese or overweight; and the proportion is even larger when both parents rather only one parent is obese or overweight.

Logit Models – Between-Family Cumulative and Intergenerational Disadvantages

Table 4 shows odds ratios from Logit regression models with a dummy variable indicating whether the adolescent is obese or overweight. All models include controls for region of residence, age and sex. Model 1 includes our first independent variable of interest, parental obesity. This variable is coded 0 if none of the parents are obese or overweight; coded 1 if only the mother is obese or overweight; coded 2 if only the father is obese or overweight, and coded 3 if both parents are obese or overweight. As expected, when both parents are considered obese or overweight, there is a much higher likelihood that the child will also be considered obese or overweight—children with both parents considered obese have 278% higher chances of also being considered obese than if none of the parents were obese. Interestingly, there seems to be no statistically significant difference in the magnitude of the coefficients when we consider only mother versus only father obese or overweight. In the next version of the paper we plan to explore the role that child's gender might have on the influence of mother versus father obesity on child's nutrition status.

The intergenerational transmission of obesity can be understood as representing several factors, including a genetic component (which we will examine with the siblings fixed-effects models in Table 6) and a behavior component such as the types of food available in the household and parental socio-economic status. In Model 2 we include a dummy variable corresponding to whether there is food of poor nutritional value available in the household. This variable comes from answers to an extensive set of questions indicating every food available in the household. Because the POF data is originally intended to measure household consumption, there are accounts of availability of every food in great detail. For this preliminary version we include availability of candy, ramen noodles, fried nuggets, soda, and typical Brazilian fried snacks. For the final version of the paper we will explore several possibilities of index construction such as principal components analysis. We will also include a more nuanced index indicating not only availability but also the amount of money per household income per capita spent in food of poor and good nutritional value.

Results from Model 2 indicate that the availability of foods of poor nutritional value in the household is positively associated with the likelihood of obesity and overweight. However, this variable looses statistical significance when indicators of parental socio-economic status are included in Model 3. Interestingly, parental education is positively associated with the likelihood of obesity and overweight. Log of household income is also positively associated with the likelihood of obesity. This finding that parental socio-economic status is positively associated with obesity and overweight is related to Brazil's stage in the nutritional transition. Finally, in Model 4 we include two measures of adolescent disadvantage: whether the adolescent works and whether the adolescent is enrolled in school. Adolescents enrolled in school have lower chances of obesity, reflecting the important role school meals and positive health models have on children nutrition.

Quantile Regression Models – Between-Family Cumulative and Intergenerational Disadvantages

Table 5 shows results from quantile regression models. The advantage of quantile regression estimates is that they are more robust against outliers in the response measurements. This way, we can investigate if the same characteristic, family socio-economic status for example, operates differently when associated with normal weight versus underweight or overweight. This variation is likely because of the point in the nutrition and epidemiological transitions the country is.

Findings from Table 5 suggest that working outside the household is positively associated with BMI in the lower quantiles of the BMI distribution; however, among children in the top groups of the BMI distribution, those considered overweight or obese, working outside the home decreases BMI. This suggests that adolescent work is beneficial for those children considered malnourished because it helps the family put food on the table and therefore remove children from malnourishment. Similarly, school enrollment is protective of BMI increases in normal BMI categories. This suggests that free food provided in Brazil are likely healthier than the foods provided in most homes. Interestingly, mother's educational attainment increases BMI among those children in the normal and overweight categories. As for household income, the magnitude of the positive association with BMI is five times larger for children considered obese. A different relationship between family SES and BMI was also found in different contexts (Van Hook and Balistreri 2007), and will be explored with more detail in the next version of the paper.

Sibling Fixed-Effect Models – Within-Family Cumulative Disadvantages

Table 6 presents results of sibling fixed-effects regression models. In these models all observed and unobserved characteristics shared by siblings are controlled for by construction. Working outside the household reflects a socio-economic disadvantage not shared by siblings, while school enrollment exposes children and adolescent to a series of rules and habits that go beyond simply acquiring years of schooling. Findings from Table 6 suggest that adolescents working are 30% more likely to be obese or overweight. Those adolescents have some income at their disposal to spend with unhealthy foods. At the same time, they are in disadvantageous conditions, with less time to study and practice physical activities and play. Adolescents enrolled in school have about 35% fewer chances of being obese, suggesting that schools can be protective of overweight and obesity. Schools are conducive to healthy habits in Brazil. Interestingly, schools in Brazil also offer free lunch meals, which for large proportions of children means healthier meals than the meals offered at home. Working outside the home and dropping out of school are not isolated behaviors; these are decisions that reflect situations of cumulative disadvantages. All in all, our findings suggest that such socio-economic disadvantages can also lead to health disadvantages, contributing to perpetuate the poor conditions of large proportions of children and adolescents in an already stratified society.

Subsequent Analysis

As next steps we will: 1. Refine our index of the availability of poor nutritional foods in the household; 2. Include an index of availability of healthy foods in the household; 3. Include a measure of whether child/adolescent ate at fast-food restaurants in the week; 4. Look at whether maternal or paternal obesity matters the most for girls and boys separately.

Tables and Figures

Table 1 – Child and Adolescent BMI per Region and Year: Brazil, 2003-04 & 2008-09

BMI	North		Northeast		Southeast		South		Midwest		Total	
	2003	2008	2003	2008	2003	2008	2003	2008	2003	2008	2003	2008
Underweight	3.45	3.83	4.24	4.72	3.69	3.050	2.300	2.15	3.34	3.79	3.67	3.79
Normal Weight	81.87	78.22	82.38	77.83	76.97	71.860	77.550	70.51	76.98	72.96	80.07	75.12
Overweight	12.51	14.93	11.20	14.11	15.80	18.85	16.170	20.17	16.11	18.54	13.45	16.56
Obese	2.16	3.02	2.17	3.34	3.53	6.23	3.98	7.17	3.57	4.71	2.8	4.53
Total	29,761											

Table 2 - Individual and Family Characteristics of Children Ages 10-16: Brazil, 2003-04 & 2008-09

	All	Siblings
Age	13.29	13.31
Sd	1.94	1.91
Years of Education	5.13	4.92
Sd	2.33	2.33
Mother education (mean)	5.86	5.28
Sd	4.29	4.15
Father education (mean)	5.32	4.77
Sd	4.33	4.19
Per capita household income	492.34	379.16
Sd	930.84	623.91
Attends school? (% yes)	95.62	95.39
Right Grade for Age? (% yes)	45.28	39.50
Works? (% yes)	13.50	15.08
Parental Obesity		
None is Overweight/Obese	26.34	28.34
Only Father Overweight/Obese	22.47	21.14
Only Mother Overweight/Obese	22.37	23.53
Both Parents Overweight/Obese	28.81	26.99
N	29,761	17,488

Table 3 - BMI Group per Individual and Household Characteristics of Children Ages 10-16: Brazil, 2003-04 & 2008-09

	ALL				SIBLINGS			
	Underw.	Norm. Weig.	Overw.	Obese	Underw.	Norm. Weig.	Overw.	Obese
Gender (% girls)	48.31	48.18	46.46	43.32	47.63	48.00	48.61	41.54
Age	13.33	13.35	13.02	12.89	13.29	13.35	13.08	13.03
Sd	1.97	1.93	1.93	2.00	1.94	1.91	1.91	2.07
Years of Education	4.84	5.14	5.13	5.17	4.65	4.93	4.89	5.02
Sd	2.38	2.33	2.30	2.23	2.35	2.33	2.34	2.25
Mother education (mean)	5.36	5.69	6.61	7.02	4.92	5.13	6.01	6.89
Sd	4.11	4.26	4.36	4.44	3.96	4.10	4.30	4.47
Father education (mean)	4.98	5.13	6.04	6.60	4.54	4.60	5.52	6.54
Sd	4.17	4.28	4.47	4.37	4.03	4.12	4.45	4.47
per capita household income	381.98	463.45	627.47	665.98	309.12	360.30	478.75	559.21
Sd	632.54	890.56	1172.73	827.45	586.50	607.58	704.00	669.27
Attends school? (% yes)	96.42	95.63	95.34	95.74	96.82	95.54	94.30	94.19
Right Class? (% yes)	38.18	45.00	53.44	58.42	34.83	39.47	46.82	55.17
Works? (% yes)	11.03	14.22	11.22	10.01	12.52	15.72	12.27	13.26
Race								
White	35.86	37.76	42.99	44.45	32.23	32.93	37.64	35.63
Black or Brown	63.64	61.48	55.82	53.79	67.25	66.21	60.71	62.02
Parental Obesity								
None is Overweight or Obese	45.55	28.40	15.28	8.33	45.43	30.12	16.10	9.62
Only Father Overweight or Obese	21.11	22.79	22.10	18.78	20.91	21.38	20.77	16.34
Only Mother Overweight or Obese	21.30	23.12	19.74	18.40	21.98	24.23	20.66	18.60
Both Overweight or Obese	12.05	25.70	42.88	54.49	11.68	24.26	42.47	55.44
Mother works?	58.00	58.96	58.12	61.13	59.61	59.10	57.23	61.19
Poor? (% yes)	33.91	30.77	20.24	13.11	41.36	39.36	28.49	17.37
20% Richest?	9.97	14.06	19.80	24.01	6.83	9.46	14.98	20.08
N	1,505	23,955	3,579	722	914	14,461	1,790	323

Table 4 – Coefficients of Logit Models of Child and Adolescent BMI: Brazil, 2003-04 & 2008-09

	Model 1	Model 2	Model 3	Model 4
Parents' Obese? (None Omitted)				
Only Father Overweight or Obese	1.923***	1.901***	1.713***	1.716***
	(0.1066)	(0.1056)	(0.0963)	(0.0965)
Only Mother Overweight or Obese	1.790***	1.791***	1.834***	1.839***
	(0.1013)	(0.1013)	(0.1042)	(0.1045)
Both Overweight or Obese	3.789***	3.747***	3.495***	3.509***
	(0.1899)	(0.1882)	(0.1767)	(0.1776)
Sex (male omitted)	0.880***	0.878***	0.880***	0.882***
	(0.0305)	(0.0305)	(0.0307)	(0.0310)
Age in years	0.895***	0.895***	0.891***	0.889***
	(0.0079)	(0.0079)	(0.0079)	(0.0081)
Region (north omitted)				
Northeast	0.941	0.944	0.982	0.988
	(0.0494)	(0.0496)	(0.0520)	(0.0523)
Southeast	1.468***	1.443***	1.300***	1.301***
	(0.0838)	(0.0826)	(0.0754)	(0.0754)
South	1.518***	1.478***	1.318***	1.323***
	(0.0974)	(0.0954)	(0.0863)	(0.0866)
Midwest	1.379***	1.367***	1.275***	1.278***
	(0.0852)	(0.0846)	(0.0796)	(0.0798)
Junk Food in the Household? (no omitted)		1.147***	1.042	1.042
		(0.0408)	(0.0380)	(0.0381)
Log of per capita household income			1.218***	1.221***
			(0.0291)	(0.0292)
Mother education (mean)			1.011	1.011*
			(0.0057)	(0.0057)
Father education			1.004	1.005
			(0.0057)	(0.0057)
Works? (no omitted)				0.935
				(0.0571)
Attends school? (no omitted)				0.675***
				(0.0605)
N	29,761	29,761	29,761	29,761

Note: * p < 0.05. ** p < 0.01; *** p < 0.001. Standard error in brackets.

Table 5 – Results from Quantile Regression Models of Child and Adolescent BMI Percentiles: Brazil, 2003-04 & 2008-09

	3^{th} Perc Underweight	50^{th} Perc Normal weight	85^{th} Perc Overweight	95^{th} Perc Obese
Parents' Obese? (None Omitted)				
Only Father Overweight or Obese	0.499***	0.486***	0.838***	1.199***
	(0.0764)	(0.0554)	(0.1002)	(0.2445)
Only Mother Overweight or Obese	0.536***	0.626***	0.815***	1.834***
	(0.0617)	(0.0454)	(0.0822)	(0.1897)
Both Overweight or Obese	1.137***	1.403***	2.259***	3.616***
	(0.0674)	(0.0586)	(0.0820)	(0.2874)
Works? (No omitted)	0.298*	0.124*	-0.224*	-0.700**
	(0.1191)	(0.0609)	(0.0960)	(0.2540)
Sex (male omitted)	0.079	0.340***	0.365***	0.244
	(0.0538)	(0.0321)	(0.0458)	(0.2058)
Age in years	0.513***	0.593***	0.518***	0.499***
	(0.0108)	(0.0107)	(0.0165)	(0.0524)
Attends school? (No omitted)	0.002	-0.577***	-0.837***	-0.668
	(0.2126)	(0.1291)	(0.0974)	(0.4193)
Log of per capita household income	0.109**	0.208***	0.367***	0.578***
	(0.0409)	(0.0305)	(0.0407)	(0.1397)
Mother education (mean)	0.011	0.029***	0.032***	0.032
	(0.0081)	(0.0073)	(0.0073)	(0.0338)
Region (North omitted)				
Northeast	-0.038	-0.303***	-0.228*	-0.354
	(0.1089)	(0.0469)	(0.0907)	(0.2187)
Southeast	0.012	0.009	0.356*	0.794*
	(0.1066)	(0.0779)	(0.1401)	(0.3681)
South	0.305**	0.253**	0.506***	0.674
	(0.1098)	(0.0792)	(0.1451)	(0.3947)
Midwest	0.034	0.190**	0.299*	0.635*
	(0.1234)	(0.0727)	(0.1206)	(0.3139)
Constant	6.859***	9.647***	12.802***	15.891***
	(0.3310)	(0.2421)	(0.3185)	(1.0963)
N		29,761		

Note: * p < 0.05. ** p < 0.01; *** p < 0.001. Standard error in brackets.

Table 5 - Logistic and Siblings Fixed-Effects Models: Brazil, 2003-04 & 2008-09

Dependent variable: BMI_dummy2	Logistic All children			Siblings Fixed-Effects	
Works? (No omitted)	0.720***	0.798**	0.899	1.056	1.372*
	(0.0561)	(0.0643)	(0.0747)	(0.1327)	(0.1835)
Attends school? (No omitted)	0.744**	0.639***	0.637***	0.728	0.646*
	(0.0809)	(0.0714)	(0.0731)	(0.1222)	(0.1131)
Sex (male omitted)		0.911	0.957		1.078
		(0.0437)	(0.0468)		(0.0702)
Age in years		0.890***	0.950*		0.952
		(0.0172)	(0.0192)		(0.0329)
Years of Education		1.056***	0.948***		0.945*
		(0.0148)	(0.0150)		(0.0239)
Older brother? (No omitted)		1.018	1.021		0.965
		(0.0629)	(0.0646)		(0.0902)
Region (North omitted)					
Northeast			0.869*		
			(0.0592)		
Southeast			1.116		
			(0.0886)		
South			1.324**		
			(0.1227)		
Midwest			1.118		
			(0.0929)		
Junk Food in the Household? (no omitted)			1.060		
			(0.0534)		
Log of per capita household income			1.189***		
			(0.0407)		
Mother education (mean)			1.018*		
			(0.0081)		
Father education			1.014		
			(0.0080)		
Parents Obese? (None Omitted)					
Only Father Overweight or Obese			1.522***		
			(0.1175)		
Only Mother Overweight or Obese			1.640***		
			(0.1244)		
Both Overweight or Obese			3.104***		
			(0.2118)		
N	16,337	16,337	16,337	4,154	4,154

Note: * $p < 0.05$. ** $p < 0.01$; *** $p < 0.001$. Standard error in brackets.

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