



Heterogeneity of income and lifestyle determinants of body weight among adult women in Mexico, 2006

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ABSTRACT

In Mexico, the combined prevalence of overweight and obesity among Mexican women increased from 64% in 2000 to 72% in 2006. In this paper, we report our findings on the relation of women's body mass index (BMI) with income and lifestyles choices using data from a cross-sectional survey conducted in 2006. The two following approaches were executed. First, we estimated a two-stage least-squares regression to control for the potential endogeneity of income stratified by urban or rural residency. The second approach was aimed at exploring whether the determinants of weight varied among different weight levels using latent class models. Our findings from the two-stage least-squares regression show a positive non-significant association between income and BMI in the overall and urban samples but a significant positive relationship among rural women. Our results suggest that one unit increase in income is associated with 4.1% increase in body weight in rural areas. Estimates from the latent class model (LCM) show a positive but marginally significant association between income and BMI in the overall sample only in the class where there is a greater likelihood that women have normal weight or overweight compared to the class with a higher probability of being obese, but we also found a large association in rural areas for both classes. Lifestyle choices were associated with BMI. Results from the two-stage least-squares regressions reveal that more hours sitting per day and a higher percentage of expenditures in sugary beverages were associated with higher BMI levels. In the LCM, for women who eventually belong to the higher body weight class, lifestyles seem to matter more.

Findings from this research suggest that policies to tackle the obesity epidemic among adult women should be different for women living in urban and rural areas and women with different weight levels.

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Introduction

Mexico is experiencing a dramatic increase in obesity, particularly among women. Among the adult population, the combined prevalence of overweight (defined as a body mass index (BMI) between 25 and 30) and obesity (BMI greater than 30) increased from 62.1% in 2000 (Olaiz, Rojas, et al., 2003) to 70% in 2006 (Olaiz, Rivera-Dommarco, et al., 2006). The prevalence of overweight is only slightly lower among women (37.5%) compared to men (42.5%). However, obesity is present in 34.5% of adult women compared to 24.2% of men.

The overall objective of this paper is to study the relationship between household income and lifestyle choices with body weight

and to see how these relationships vary by urban/rural residence and by high/low body weight.

Research suggests that the obesity epidemic worldwide is the result of large changes in lifestyles related to food consumption and physical activity (Popkin & Gordon-Larsen, 2004). In low- and middle-income countries, urbanization and economic development have led to major shifts in lifestyles: diets are shifting toward an increased consumption of saturated fats, sugar, and refined foods, and working and leisure activities have become more sedentary (Popkin, 1999; Uauy, Albala, et al., 2001). Daily working and recreational activities are requiring less physical activity in contrast with increased availability of high-energy dense food worldwide (Peters, Wyatt, et al., 2002). A study in Mexico has shown that among adolescents and adults, about 21% of total energy intake comes from energy-containing beverages (mainly whole milk, carbonated and noncarbonated sugar-sweetened beverages, fruit juices, and water combinations) with higher per capita intake levels in urban areas (Barquera, Hernandez-Barrera,

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et al., 2008). Several reviews have shown that consumption of sugar-sweetened beverages is associated with higher energy intake and weight gain (Malik, Schulze, et al., 2006).

The literature also shows that in middle and high-income countries there is a negative association between income (or other socioeconomic variables such as education and occupation) and body weight (McLaren, 2007; Sobal & Stunkard, 1989) and a positive association in low income countries (Monteiro, Conde, et al., 2004). The theory behind these findings is that technologically less developed countries with greater share of income spent on food have a positive relationship between income and body weight while developed countries with an income level relatively high with respect to their food prices would have a negative relationship between income and body weight (Philipson & Posner, 1999). However, in middle-income countries such as Mexico, results from studies on the association between income and weight are mixed. In their systematic review, Monteiro et al. found a positive association between income and body weight in Brazil (in men and women), a positive relationship in a sample of women in Russia and no effects in India (Monteiro et al., 2004). In a different study in Brazil, Monteiro et al. find a positive effect of income among women from least developed region but a null association in the more developed region (Monteiro, 2001). In Mexico, Fernald et al. found a positive association between body weight and education, occupation, quality of housing conditions, household assets, and subjective social status among a representative sample of poor communities in rural areas (Fernald, 2007). Interestingly, the study also reported that consumption of alcoholic and sugar beverages increased with SES, suggesting that rapid changes in lifestyles and access to more industrialized foods is associated with wealth and increased prevalence of overweight and obesity even in rural areas.

Studies on the association between income and lifestyles choices with body weight in Mexico are limited. Moreover, while a number of studies have examined the determinants of overweight and obesity in other developing countries, none have analyzed the differential effect of income and lifestyles by urbanicity considering the great differences that still persist in the economic development of rural and urban populations. Also, no studies have analyzed differences in the relationship between income and lifestyles with body weight between populations with more and less weight. In other words little is known about the heterogeneity of factors associated with body weight.

To estimate the relationship between income and lifestyle choices with body weight and the heterogeneity of these relationships by urbanicity and weigh level in Mexico, two approaches were executed. First, we estimated a two-stage least-squares regression to control for the potential endogeneity of income. Secondly, we explored whether the determinants of weight vary among different weight levels using latent class models (LCM). Both models were stratified by urban/rural residence.

The paper is organized as follows. The first and second parts describe the conceptual framework and the empirical methods. The third section describes the data and variables used in the empirical model. The fourth part shows our empirical results and the last section presents the discussion of the findings.

Conceptual framework

We use the theoretical frameworks developed by Philipson and colleagues (Lakdawalla & Philipson, 2009; Philipson & Posner, 1999) to understand the relationship between income and lifestyles with women's body weight in Mexico. Their theory suggests that technological change reduced food prices and therefore the cost of calories. They also propose that with technological advances occupational activities have become less physically demanding. To

compensate for more sedentary occupations people have to pay to spend calories during their leisure time.

Their models assume that an individual's utility function depends on food consumption, other consumption and weight with an income restriction consisting of food prices and other type of consumption. The model presumes a positive relationship between food consumption and other consumption with individual's utility but a non-monotonic relationship with weight. Assuming that individuals have an "ideal weight"; people would gain weight below but lose weight when they are above their "ideal weight". Income and prices will influence weight through the demand of calories. Prices increase the cost of calories and income lowers it by reducing the value of other consumption goods. The model implies a negative relationship between prices and weight and a direct relationship between income and weight.

According to Lakdawalla and Philipson income can increase weight through a higher consumption of calories or reductions in physical activity when an increase in earnings raises the number of hours spent in sedentary working activities (Lakdawalla & Philipson, 2009). As proposed by these authors, poor people are at risk of being overweight or obese because as their income increases they tend to demand other type of goods that could contribute to reduce their physical activity or to increase their calorie consumption (watch TV, consume high-energy dense foods, etc.). There is evidence in Mexico that the level of consumption of sugary beverages and high-energy dense food is considerably greater among the poorest population groups compared to the wealthiest (Cahuana, 2011). Assuming consumption of other energy-dense foods would have the same pattern among the poorest population in Mexico and income elasticity of consumption are larger in rural areas, we hypothesize that increases in income can raise the demand of goods that may contribute to reduce physical activity or to increase the consumption of high-energy dense food or beverages leading to weight gains. In other words, marginal increments in income will raise weight among women living in rural areas.

Philipson and Lakdawalla models assume that people limit or expand their food consumption based on how far/close they are from their "ideal weight". If urban dwellers were more concerned about their weight compared to their rural counterparts (as we would expect considering their higher level of wellbeing and information available), we would expect a negative relationship between income and weight in urban areas. However, if increases in income result from earned income, i.e. from jobs requiring less physical activity, we would see a positive effect between income and weight. These two competing effects could lead to an ambiguous relationship between income and weight in urban areas depending on which effect dominates.

Finally, as working activities become more sedentary with technological changes, to counterbalance the reduction in calories spent at work people have to spend more calories during their leisure time. As suggested by Philipson and colleagues, we expect to see a relationship between lifestyles and weight in Mexico: hours spent in physical activity would have a negative effect on weight.

Empirical estimation

Two-stage least-squares regression

In the association between income and weight, income could be endogenous because of reverse causality or omitted factors (Schmeiser, 2008). Weight may be correlated with lower wages if there happens to be discrimination in the labor market where women who weigh more are penalized with lower wages or if women of low weight have low productivity resulting in lower

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