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Obesity and Food away from Home

What Drives the Socioeconomic Gradient in Excess Body Weight?

Christoph Strupat
Gabriela Farfán
Laura Moritz
Mario Negre
Renos Vakis

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Abstract

Rising obesity rates are one of the most challenging public health issues in many emerging economies. The extent to which the nutritional composition of food consumed away from home is behind this rise, and the links with socioeconomic status, is not yet well understood. This paper explores this question by combining a representative restaurant survey that includes detailed information on the nutritional composition of the most widely consumed meals in Metropolitan Lima and a representative household survey with anthropometric measures of adult women. The findings indicate that the nutritional quality in restaurants located in the food environment of the households is significantly associated with higher rates of obesity and overweight. Up to 15 percent of the socioeconomic gradient in obesity is attributable to restaurant food quality, with sodium being the main driver. This highlights the importance of considering the food environment to inform public health policies, particularly for the poor.

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Obesity and Food away from Home: What Drives the Socioeconomic Gradient in Excess Body Weight?

Christoph Strupat,[a] Gabriela Farfán,[b] Laura Moritz,[c] Mario Negre[a,b] and Renos Vakis [b]

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[a] German Development Institute/Deutsches Institut für Entwicklungspolitik.
[b] World Bank.
[c] Leibniz Institute of Agricultural Development in Transition Economies.

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1 Introduction

It is widely acknowledged that obesity is one of the most pressing public health issues in many emerging economies (Abdulai 2010; Alderman et al. 2006; Meng et al. 2009). In these contexts, recent obesity trends mostly derive from the nutrition transition that stems from changes in lifestyle. These are expressed in reduced physical activity and greater food consumption in supermarkets or restaurants, often resulting in unhealthy diets (Popkin et al. 2012). Because of these recent trends, emerging economies often face undernutrition and overnutrition simultaneously, leading to a *dual burden of disease* (Popkin et al. 2012). Chronic diseases, such as type 2 diabetes, cardiovascular diseases, certain cancers and hypertension, are associated with poor diet and cause rising morbidity and mortality rates (Popkin 2006; Rosin 2008; Swinburn et al. 2011). The costs of this emerging obesity epidemic can be substantial and can exceed the costs associated with other chronic diseases putting formal or informal insurance schemes under financial pressure (Bhattacharya and Sood 2011, Strupat and Klohn 2018). Finkelstein et al. (2010) estimate the costs of overweight and obesity in the United States and find that the total annual cost attributable to obesity among full-time employees is $73.1 billion.

Peru is no exception, and its recent economic transition to an upper-middle-income economy has come hand in hand with a steeply upward obesity trend (World Bank 2017). Female obesity rates increased from 15 percent in 1997 to 24 percent in 2016 (Knoema 2017). According to the World Bank (2011), 64 percent of the Peruvian population ages more than 15 were overweight in 2009. The World Health Organization (WHO 2014) estimates that 66 percent of total deaths in 2012 in Peru can be attributed to non-communicable diseases such as cardiovascular diseases, cancers and diabetes. In response to these findings and their negative implications for the country's economic development, the Peruvian government has implemented several interventions. Yet, these are mostly intended to eliminate undernutrition, whereas overnutrition receives less attention (Acosta and Haddad 2014). At the same time, 65 percent of all urban households in Lima that include at least one adult consume food away from home (FAFH) on a daily basis. According to data of the National Household Survey 2013 (Encuesta Nacional de Hogares, ENAHO) and Farfan et al. (2017), Peruvian households spend an average of 27 percent of their food expenditures on eating outside the home. Because the nutrition transition is a rather recent development in Peru and the consumption of FAFH is high across urban areas, gaining a better understanding of the determinants of overweight and obesity is highly relevant.

Even though some cases of obesity and overweight are linked to genetic and metabolic factors, the obesity epidemic itself is related to behavioral determinants and the social and physical environment (Sturm and An 2014; Cannuscio et al. 2014; Katare and Beatty 2018). There is growing agreement among experts that the food environment is a key driver of rising trends in excess body weight (Steeves et al. 2014).[1] Increased

[1] This comprises the types of food sources that are accessible to an individual and to which consumers are exposed in those environments (the availability of healthy and unhealthy foods, food prices and so on).

access to fast-food outlets is linked to a rise in obesity (Powell et al. 2009; Larson et al. 2011; Currie et al. 2010). FAFH tends to be more calorie dense than foods prepared at home. Most consumers may be unaware of the high levels of calories, fat, saturated fat, and sodium found in many menu items and may underestimate actual calorie content (Burton et al. 2006). In particular, low-income and minority neighborhoods have disproportionately lower levels of access to healthier food sources and greater access to less healthy food sources (i.e. food deserts) (Bridle-Fitzpatrick 2015; Gibson 2011). Studies find significant associations between food environment, FAFH and weight gain (for example, see Kim et al. 2014; Seguin et al. 2016; Zeng and Zeng 2018).

Despite the growth of the literature on the effects of the food environment and FAFH, there are still significant research gaps (Steeves et al. 2014). In particular, a more detailed assessment of the food environment with regard to the (micro) nutritional quality of FAFH and the interplay of FAFH and excess body weight is needed for the design of better food environment interventions. The unique data set of this study includes micronutrients of most-consumed meals from a representative restaurant survey allowing us to shed light on this relationship at the population level in urban Peru. Among the different nutrients, we can identify the main drivers of poor nutritional quality and which combination of micronutrients are most likely to contribute to excess body weight when consumed above the recommended intake.

The present study differs from the current literature in three important ways. First, instead of using dietary recall data provided by interviewees on the frequency and quality of FAFH, which is prone to substantial measurement error, the study relies on detailed objective *nutritional information* on the most frequently *consumed menus* in the food environment of individuals. The detailed nutritional information is supplied by a representative sample of 1,605 restaurants in the Lima Metropolitan Area, among which nutrition professionals and experts at the National Institute of Statistics and Informatics collected information on the main menus offered. For each restaurant, nutritional specialists observed the preparation of the most popular menu and recorded and weighted all ingredients. In addition, for a subset of restaurants, the ingredients were taken to the laboratory for further analysis. As a result, we can calculate exact, objective data on the quantity of calories, proteins, fat, carbohydrates, fiber, zinc, iron, beta carotene, vitamin A1, vitamin A, vitamin C and sodium. There appears to be no comparable restaurant study in the developing world.[2]

Second, to make the best use of these nutritional data and to overcome the limitations of current diet quality indicators, we propose a novel index called *Proportional Difference of Relative Nutrient Intake* (PDRNI) index. This index computes the relative difference between the *real intake of nutrients per menu* and the *recommended intake*. The focus is on the restricted nutrients (fat, carbohydrates and sodium) that are most likely to contribute to body overweight if consumed above the recommended intake (Scheidt and Daniel 2004).

Third, in contrast to smaller-scale studies, we can assess the links among nutritional

[2] The trade-off of having such detailed information at the restaurant level comes from not having individual-level consumption data.

quality, specific nutrients of FAFH and individual excess body weight at the population level. This allows us to study the differences in nutritional quality across the food environments of various socioeconomic groups and explore whether these differences contribute to the commonly found socioeconomic gradient in excess body weight.[3] In contrast to other studies that use self-reported body weight measures, this study relies on data of the Demographic and Health survey (DHS), which contain anthropometrics measured by health professionals and are therefore less prone to measurement error.

More specifically, the representative restaurant survey that measures the nutritional composition of the most frequently consumed lunch menus in Metropolitan Lima is combined with the household survey that contains anthropometric measures of women ages 15 to 49 living in Lima.[4] This unique data set allows an assessment of whether there is a link between the nutritional quality of FAFH in the food environment and excess body weight among women in 40 neighborhoods of urban Peru.[5] In addition, the stratification of the restaurant data allows us to examine the differences in nutritional quality between neighborhoods of different socioeconomic groups and whether this explains the socioeconomic gradient in excess body weight.[6]

Based on an ordered logit model, the findings indicate that a lower diet quality of FAFH in restaurants located in the food environment of the household is significantly associated with individual excess body weight. A 10 percent increase in the PDRNI of restricted nutrients is associated with a 7.4 percent increase in the probability of obesity and a 1.7 percent increase in the probability of overweight. This relationship holds after accounting for a number of factors that correlate with body weight, including socioeconomic fixed effects that control for food quality at home and other unobserved factors that correlate with body weight and the nutritional quality of FAFH. In exploiting the importance of specific nutrients, we find that *sodium* in most restaurant menus seems to be responsible for the association between the diet quality of FAFH and excess body weight. This is in line with a number of studies suggesting that dietary sodium intake implicates weight gain (Larsen et al. 2014; Yi and Kansagra 2014).

After considering a number of individual and environmental determinants of obesity,

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[3] Individuals in neighborhoods with low socioeconomic status tend to exhibit a greater prevalence of overweight and obesity relative to individuals in neighborhoods of higher socioeconomic status.

[4] While data only allow this relationship to be analyzed among women, women are more sensitive to the food environment than men (Hallam et al. 2016; Kuchler et al. 2002).

[5] The neighborhood is the district of residence and the direct food environment of the women. Since detailed information on whether women consume FAFH predominately in their neighborhood or socioeconomic group is not available, what we use is an indicator that is expected to correlate with the quality of the most-frequently consumed menus out of home. Qualitative evidence from local experts supports that people eating in restaurants are mostly from the same socioeconomic group of the restaurant's environment, which is also in line with findings from other urban areas (Cannuscio et al 2014). This is most likely for women from low socioeconomic status (SES) neighborhoods. In neighborhoods of higher socioeconomic status, restaurant clients also tend to be locals who can afford the upper tier eating possibilities, or visitors but from equally wealthy neighborhoods.

[6] The stratification of districts by socioeconomic group is a quantile measure defined by the average expenditure levels of the households in the respective neighborhoods as reported in the National Survey of Family Budgets (ENAPREF) 2009–2010.

we find a strong socioeconomic gradient in obesity. Women living in poor and middle-income neighborhoods have a significantly higher probability of obesity than women in wealthy neighborhoods. Between 10 and 15 percent of this socioeconomic gradient in excess body weight can be attributed to differences in the diet quality of FAFH in the food environment. Interestingly, the same type of menus (for example, chicken with rice and *arroz chaufa*, a fried rice dish) were most frequently consumed across socioeconomic groups, but diet quality differs greatly among the groups. The diet quality of the same menu is, on average, always much lower in neighborhoods of low socioeconomic status compared with high socioeconomic status neighborhoods. When analyzing variation within socioeconomic status, differences in diet quality explain 15 percent of the higher excess body weight in poor neighborhoods, while they explain only 10 percent in more well-off neighborhoods. Hence, women in poorer neighborhoods could benefit slightly more from an improvement in the diet quality of FAFH in their food environment compared with women in more well-off neighborhoods. This result points to the potential value of public health policies that help people, especially in poorer neighborhoods, to make healthier food choices away from home. The rest of the paper is organized as follows. Section 2 introduces the data sets. Section 3 presents the diet quality index defined for the study, while section 4 describes the empirical approach. Section 5 introduces the descriptive and empirical results, and section 6 concludes.

2 Data

The data used in this analysis originate from four sources: (1) the Demographic and Family Health Survey (*Encuesta Demográfica y de Salud Familiar*), which has been published as the continuous demographic and health surveys; (2) the Survey to Measure Nutritional Composition of Meals Most Frequently Consumed away from Home (*Encuesta para Medir la Composición Nutricional de los Principales Alimentos Consumidos Fuera del Hogar*, ENCONUT); (3) ENAHO; and (4) the National Survey of Family Budgets (ENAPREF).

The continuous demographic and health survey is part of the traditional demographic and health survey (DHS), which provides nationally representative information on various aspects of maternal and child health. While the standard demographic and health survey had been carried out in Peru at five-year intervals since 1986, the continuous design replaced it in 2004 and is being conducted annually. This allows health information to be monitored on women of reproductive age (15–49) and their children under age 5. The traditional questionnaire covers fertility, mortality, nutrition, and anthropometric information measured by health professionals, as well as individual and household characteristics. For 2013, the data set contains information on 2,106 non-pregnant women of reproductive age living in 40 districts and neighborhoods in the Lima Metropolitan Area (Lima and Callao).

In 2013, the Peruvian National Institute of Statistics and Informatics (*Instituto Nacional de Estadística e Informática*), with technical support from the National Food and Nutrition Center (*Centro Nacional de Alimentacion y Nutricion* in the Ministry of Health) and the support of the World Bank, conducted a unique, representative restaurant survey in the Lima Metropolitan Area. The objective of the survey was to determine the nutritional composition of the meals most frequently consumed away from home and offered to the public in commercial facilities. Following a stratified random sampling design by socioeconomic strata, ENCONUT collected data on 1,738 restaurants offering menus at lunch time.[7] Each menu included at least two courses, a main dish and a starter, and might also include a dessert or a drink. During the first stage of the survey, the owner, manager, or chef reported on the number of servings of the three most highly consumed meals per day during the work week (Monday to Friday), the preparation and serving times, the price and the ingredients used. The net response rate was 97.6 percent (1,696 restaurants). During the second stage of the survey, restaurants were visited again by nutritional specialists, who observed the preparation of the menu, and weighed, in raw and cooked form, all the ingredients in the menu, including starter, main dish, dessert and drink. On a subset of restaurants, the ingredients of the most highly consumed menus were subsequently taken to the laboratory for further analysis. As a result, detailed information on the calories, proteins, fat, carbohydrates, fiber, zinc, iron, beta carotene, vitamin A1, vitamin A, vitamin C, and sodium are available on each menu. An important advantage of the data is that nutrition professionals observed the preparation of the menus and weighed the ingredients as meals were prepared, minimizing potential measurement errors. To the best of the authors' knowledge, there is no comparable restaurant study in the developing world.

ENAHO, a continuous multi-topic household survey, is the main source of information on the measurement and the monitoring of the living standards of the Peruvian population. Among the wealth of individual information, the survey also collects detailed information on the food consumed away from home by each adult household member. By meal event (breakfast, lunch, dinner or others), the survey collects information on the frequency of consumption, the place of consumption (street vendor, markets, restaurants, or soup kitchens), and the costs of the food. Important for this study, the survey allows inferences at the Lima Metropolitan Area.

Last collected in 2008–2009, ENAPREF is the main source of information on the family consumption basket and, thus, the computation of the consumer price index and the measurement of household consumption in national accounts. The household expenditures reported in the survey are the basis for the stratification of Metropolitan Lima into five socioeconomic strata, which constitutes the basis for the sampling design of the ENCONUT survey.

All data sets cover the same 40 districts and neighborhoods in the Lima Metropolitan Area. Thus, the sample of 2,106 women ages 15 to 49 living in these neighborhoods is combined with information from ENCONUT, ENAHO and ENAPREF at the neighborhood level. For each neighborhood, the average quality of the diet of FAFH, the average menu price and the average number of menu servings are calculated using the information on 1,605 restaurants (ENCONUT).[8] Furthermore, the share of women

[7] A la carte restaurants were disregarded.
[8] While the ENCONUT data set covers 48 districts in the Lima Metropolitan Area, the continuous demographic and health survey covers only 40 districts, which are the ones used in the analysis.

of reproductive age who consume FAFH at lunch and the average household expenditure are calculated based on data of the ENAHO household survey. In addition, information on the socioeconomic strata of each neighborhood from the ENAPREF survey is used to determine typical household expenditures. For ease of interpretation, the five original strata are collapsed into four groups for the analysis by socioeconomic strata.[9]

3 Diet quality index

Several diet quality measures are commonly used in the nutrition literature. To exploit the detailed information available on nutrients in our restaurant survey more effectively, we propose a new index inspired by two existing indexes: the Ratio of Recommended to Restricted Food Components (RRR) and the Mean Adequacy Ratio (MAR). Most indexes in the nutrition literature are based on food groups or a combination of the RRR and the MAR (Drewnowski 2005; Scheidt and Daniel 2004). The underlying approach in both indexes is to examine the daily intake of nutrients relative to a recommended nutrient measure. The main difference between the two is that the RRR divides food components into six recommended nutrients (protein, calcium, iron, vitamin A, vitamin C, and fiber) and five restricted nutrients (energy, saturated fat, cholesterol, sugar, and sodium) (Scheidt and Daniel 2004), whereas the MAR does not differentiate between these two.[10] The RRR can be written as follows:

$$\mathrm{RRR} = \frac{\sum \%\ \mathrm{DV}_{\mathrm{recommended}}/6}{\sum \%\ \mathrm{DV}_{\mathrm{restricted}}/5} \qquad (3.1)$$

The daily value (DV) expresses the share of the real to the required nutrient intake. This value is truncated at a maximum of 100 percent. The interpretation of the RRR is based on a standard of 1.0 (equal to 100 percent) that represents an equal proportion of recommended and restricted nutrients. Values below 1.0 show a higher percentage daily value for restricted values than for recommended values and are therefore an indicator of less nutritious food.

Following Drewnowski (2005), the MAR is an alternative, but similar diet quality measure. It is defined as the sum of the real and recommended nutrient intake (RNI) per day for various nutrients, *k*, divided by the total amount of nutrients, N, as follows:

$$\mathrm{MAR} = \frac{\sum \%\ \mathrm{RNI}_{\mathrm{k}}}{\mathrm{N}} \qquad (3.2)$$

One important shortcoming of both diet quality indexes is that they do not account for overnutrition by capping values above the ideal value of 1. This truncation leads to a biased picture of diet quality if the focus is on restricted nutrients (saturated fat, cholesterol, sugar, and sodium), which are the key relevant nutrients in terms of

[9] The high and mid-high socioeconomic groups have been collapsed because of the low number of observations in each of the socioeconomic groups.

[10] Recommended nutrients can be readily consumed and require a minimum amount of consumption. Restricted nutrients should ideally only be consumed up to a certain limit. Overconsumption of these nutrients over longer periods may be harmful to health.

excess body weight.

To address this, we build a new index called *Proportional Difference of Relative Nutrient Intake* (PDRNI). This index computes the difference between the real and recommended values of nutrients per menu by subtracting the relative intakes by 1 (recommended nutrient intake, RNI).[11] Following the RRR, we focus on restricted nutrients, and calculate the PDRNI as follows:

$$\mathrm{PDRNI_r} = \frac{\mathrm{intake_r}}{\mathrm{RNI_r}} - 1 \quad (3.3)$$

$$\mathrm{PDRNI_{menu}} = \sum_{r=0}^{Nr} \mathrm{PDRNI_r} \, / \, \mathrm{N_r}, \quad (3.4)$$

where r refers to a restricted nutrient, and N_r is the total amount of restricted nutrients per menu. A positive difference represents the overnutrition of restricted nutrients. To use this index in the analysis, the mean is calculated over the PDRNIs of all menus in the neighborhood of the individual's residence. Thus, the PDRNI shows the average diet quality in restricted nutrients per neighborhood.

4 Empirical approach

To examine the relationship between the diet quality of FAFH supplied in the individual's neighborhood and individual excess body weight, we estimate an ordered logit model using the following body mass index (BMI) categories:[12]

$$\text{normal weight} = \begin{cases} 1 \text{ if BMI} < 25 \\ 0 \text{ otherwise} \end{cases}$$

$$\text{overweight} = \begin{cases} 1 \text{ if } 25 \leq \text{BMI} < 30 \\ 0 \text{ otherwise} \end{cases}$$

$$\text{obesity} = \begin{cases} 1 \text{ if BMI} \geq 30 \\ 0 \text{ otherwise} \end{cases}$$

The observed category is influenced by an unobserved latent variable, y_i^*, which is defined as $y_i^* = x_i'\beta + u_i$. As y_i^* increases, the weight categories shift from normal weight to overweight and to obesity. For the three categories, one may write:

$$y_i = c \; if \; \alpha_{c-1} < y_i^* \leq \alpha_c, c = 0, 1, 2 \quad (4.1)$$

The following ordered logit regression model is estimated:

$$Pr[y_{cid} = 1|x] = \beta_{c0} + \beta_{c1}'X_c + u_{cid} \quad (4.2)$$

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[11] The international RNIs published by the World Health Organization are used as a benchmark (see WHO 2003, 2012, 2015; WHO and FAO 2005). These, combined with adjustments for the South American context, show the recommended calorie intake for Lima and the ratio of carbohydrates, protein and fat for Argentina (INEI 2010; MSAL 2016). In the case here, the recommended value is transformed from recommended quantity per day to recommended quantity per menu. Because ENCONUT only covers meals served during lunch, the recommendations per day are calculated for lunch only. Following Aparicio Camargo and Ávila Tijero (2014) for university canteens in Peru, a lunch meal represents 40 percent of the daily RNI.

[12] The ordered logit model is based on Greene (2008) and Wooldridge (2010).

The dependent variable, y_{id}, indicates the weight status of woman i who lives in neighborhood d. This variable is regressed on a constant, β_{c0}, and determinants of individual BMI commonly found in the literature (Baum and Chou 2011; Rosin 2008). X is a matrix containing the following categories of determinants: *socioeconomic* (age, education, marital status, household expenditures, number of household members), *lifestyle* (smoking, not working, daily television usage), *health* (health status, currently breastfeeding, has health insurance) and *environmental* (average menu price for FAFH in the neighborhood, share of women in the neighborhood who consume FAFH every day).[13] Although the extensive model covers a wide range of determinants of excess body weight, the possibility that some factors (genetic, biological, behavioral) explaining individual BMI are not observable cannot be excluded.

To consider further unobservable *environmental* determinants of excess body weight, the socioeconomic status dummies are included for each neighborhood; these reflect average household expenditures and neighborhood-specific welfare. Equation 4.2 is augmented by including the vector ω_{cd}, which represents the dummy variables associated with each of the four socioeconomic groups, as follows:

$$Pr[y_{cid} = 1|x] = \beta_{c0} + \beta_{c1}'X_c + \beta_{c2}'\omega_{\text{cd}} + u_{cid}, \qquad (4.3)$$

where β_{c2} captures the estimated effects and shows whether there is a socioeconomic gradient in excess body weight across neighborhoods after considering *socioeconomic*, *lifestyle*, *health* and *environmental* determinants of excess body weight. In the last step, the continuous variable, $PDRNI_{cd}$, is included to indicate the *average diet quality per neighborhood* in restricted nutrients (equation 4.4). The coefficient of interest is β_{c3}.

$$Pr[y_{cid} = 1|x] = \beta_{c0} + \beta_{c1}'X_c + \beta_{c2}'\omega_{\text{cd}} + \beta_{c3}PRDNI_{cd} + u_{cid} \qquad (4.4)$$

Thus, we can explore whether the socioeconomic status of the neighborhood is still associated with individual excess body weight after accounting for the impact of the diet quality of FAFH. Conversely, equation 4.4 provides an estimation of the correlation of the diet quality of FAFH and excess body weight after controlling for unobserved effects that are common within socioeconomic groups and influence body weight.

Unfortunately, we do not have information on whether women predominately consume FAFH within their socioeconomic group. What we use is an indicator that is expected to correlate with the quality of the food most frequently consumed away from home. Qualitative evidence provided by local experts supports the notion that people eating in restaurants are mostly from the same socioeconomic group of the restaurant's environment, which is also in line with findings from other urban areas (Cannuscio et al. 2014). This is most likely in the low socioeconomic status

[13] For detailed summary statistics, see the appendix, table A1. Information is also available on chronic diseases, eating patterns and alcohol consumption, but only on women ages 39–49. The model is estimated by restricting the sample to women in this age-group and considering these variables. The results do not change. They are available upon request.

neighborhoods. In neighborhoods of higher socioeconomic status, restaurant clients also tend to be locals who can afford the upper-tier eating possibilities or visitors who are from equally wealthy neighborhoods. Commuters from poorer areas tend to buy not from restaurants, but rather from markets or street vendors that resemble the food options available in their socioeconomic group.

5 Results

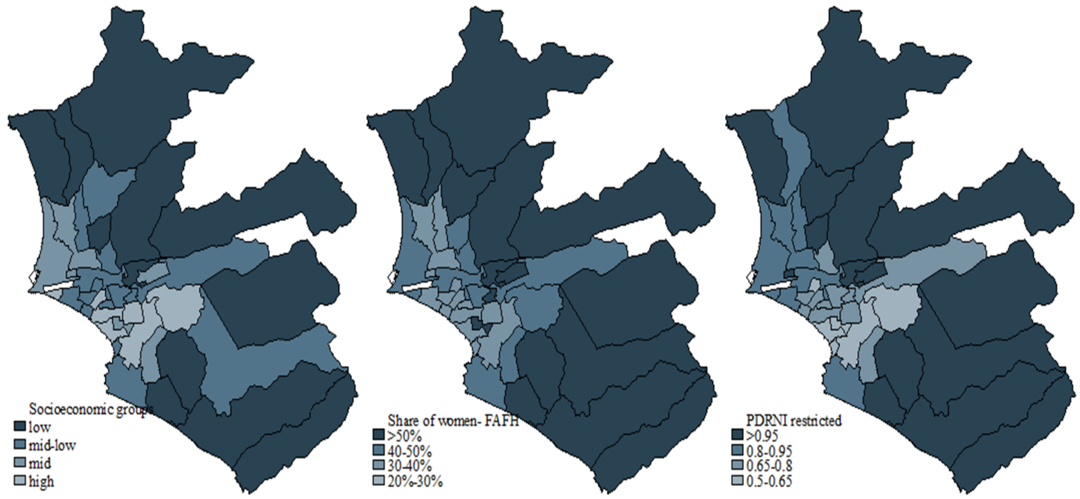
5.1 Descriptive results

Figure 1 shows the geographical distribution of the four socioeconomic groups, the share of women who consume FAFH on a daily basis and the PDRNI of restricted nutrients in 40 neighborhoods of the Lima Metropolitan Area. The first map shows that neighborhoods with a lower socioeconomic background are predominately situated in the north and south, whereas high socioeconomic status neighborhoods are located in the center. A similar distribution can be found for the share of women consuming FAFH on a daily basis.[14] While, on average, 49 percent of all women ages 15–49 consume FAFH on a daily basis (such as in restaurants; see the appendix, table A1), neighborhoods with the highest shares are mainly located in the north and south of the Lima Metropolitan Area. Furthermore, it becomes apparent that most of these neighborhoods show the highest PDRNI of restricted nutrients, while neighborhoods of higher socioeconomic status in the center of Lima exhibit lower PDRNI values. From a simple visual observation, it appears that especially women in neighborhoods of low socioeconomic status consume FAFH and also face a lower nutritional quality of menus in these food environments.

[14] The average household expenditures per year for the four socioeconomic groups are based on calculations using data of the ENAHO survey. Neighborhoods of low, mid-low, mid- and high socioeconomic status exhibit average per capita household expenditures of S/. 7,500, S/. 9,000, S/. 11,500 and S/. 20,500 (see the appendix, figure A1). Since the socioeconomic strata was based on quintiles of the household expenditure distribution, we estimated first the five socioeconomic status groups and then collapsed into the four that are used in this study.

Figure 1: Geographical distribution of socioeconomic status, share of women who consume FAFH on a daily basis and restricted PDRNI

Socioeconomic groups **Share of women, daily FAFH** **Diet quality of FAFH**

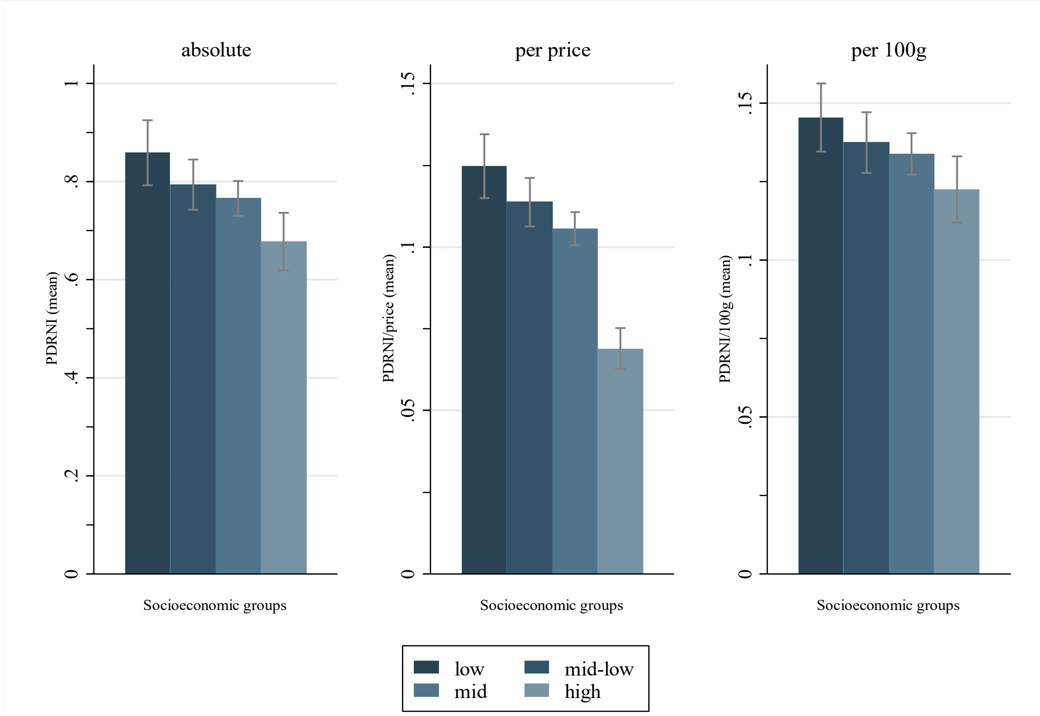


Source: Estimates based on ENCONUT 2013, ENAHO 2013.
Note: The diet quality index, expressed in the Proportional Difference of Relative Nutrient Intake (PDRNI) index on the restricted nutrients, measures the distance to the ideal intake. The further away the value is from zero (ideal value), the less nutritious is the average menu offered in restaurants in the nutrients considered. The restricted nutrients are carbohydrates, fat and sodium. Data are weighted.

Figure 2 displays a similar relationship between the PDRNI of restricted nutrients and the socioeconomic status of the neighborhoods. Neighborhoods with low socioeconomic status have the highest PDRNI, while high socioeconomic status neighborhoods have the smallest values, indicating that restaurants in neighborhoods with high socioeconomic status serve food of better diet quality relative to their counterparts in the low socioeconomic status neighborhoods. This pattern holds if the price and the weight of the respective menus are included. The variation across socioeconomic groups is greater in diet quality per local currency unit (the nuevo sol). This is because of higher average meal prices in the high socioeconomic status neighborhoods.

An examination of the three most highly consumed menus among the socioeconomic groups reveals that there are almost no differences in the menu types across the groups. Among all socioeconomic groups, chicken with rice was the most frequently consumed menu item (see the appendix, table A2). The PDRNI of restricted nutrients of the same menu is much higher in neighborhoods of low socioeconomic status relative to neighborhoods of high status. This points to the fact that the same menus must be prepared differently across the four socioeconomic groups.

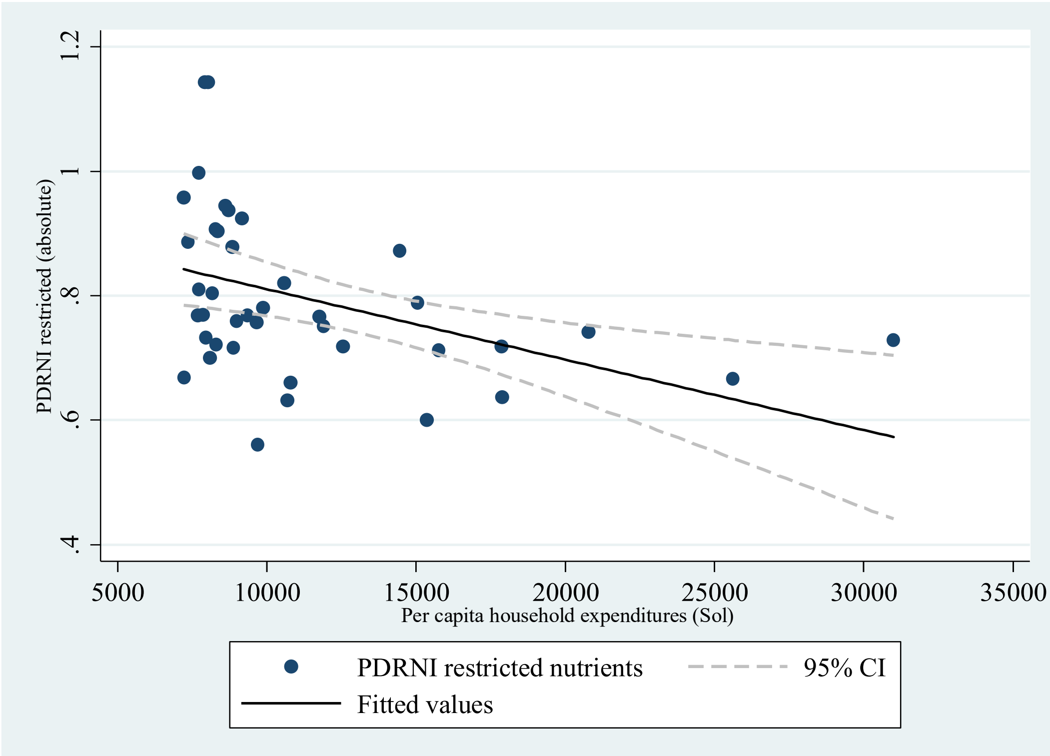
Figure 2: Diet quality in restricted nutrients, by socioeconomic neighborhood



Source: Estimates based on data of ENCONUT 2013.
Note: The diet quality index, expressed in the Proportional Difference of Relative Nutrient Intake (PDRNI) index on the restricted nutrients, measures the distance to the ideal intake. The further away the value is from zero (ideal value), the less nutritious is the average menu offered in restaurants in the nutrients considered. The restricted nutrients are carbohydrates, fat and sodium. Data are weighted.

As with the socioeconomic groups, a similar pattern can be found in the relationship between the absolute PDRNI of restricted nutrients and the average per capita household expenditures in the 40 neighborhoods in the Lima Metropolitan Area (figure 3). Neighborhoods with low levels of average per capita household expenditures exhibit higher PDRNI values, indicating a lower diet quality of menus sold at restaurant in these neighborhoods. The higher the average household expenditure, the lower the PDRNI of restricted nutrients and the better the diet quality. It seems that poor neighborhoods show the highest variation in the diet quality of FAFH and, on average, the unhealthiest food environment; the situation is the reverse among the rich counterparts, among whom is the most nutritious environment.

Figure 3: Diet quality (restricted nutrients) and average per capita household expenditures across neighborhoods

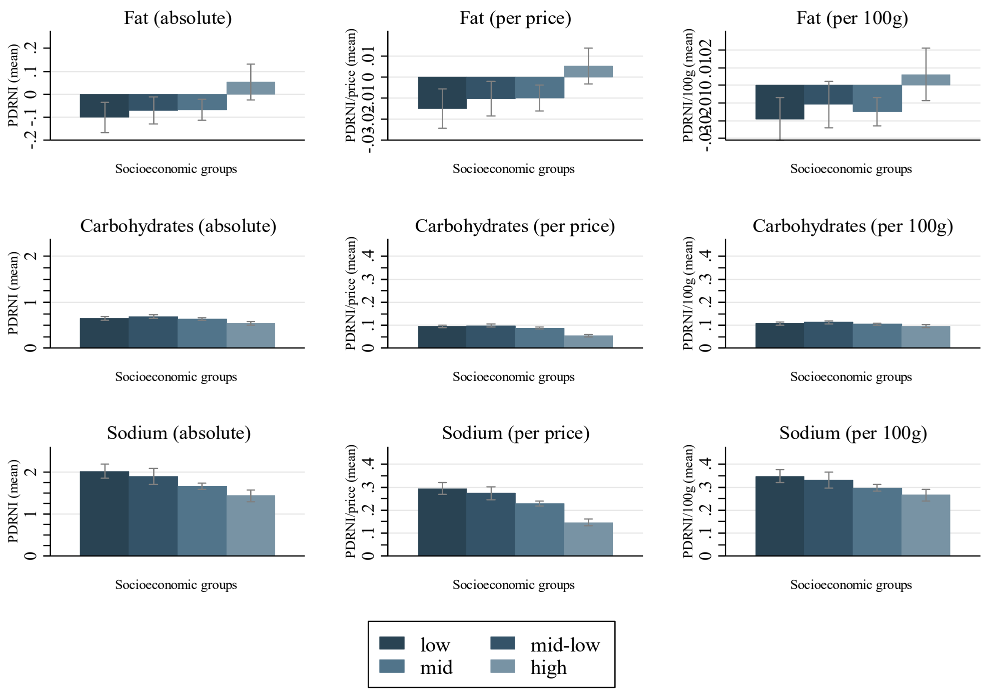


Source: Data of ENCONUT 2013; ENAHO 2013.
Note: Data are weighted.

Because the restricted nutrients consist of fat, carbohydrates and sodium, figure 4 depicts the PDRNI separately for these nutrients to identify which of them contributes most to a less healthy diet. Sodium and carbohydrates are shown to be mostly responsible for the overall positive PDRNI of restricted nutrients. While the average fat intake of FAFH is close to the recommended intake, the mean intake of carbohydrates per menu supplied in restaurants is 65 percent above the recommended intake. The PDRNI for sodium is even larger, with a mean intake of 165 percent above the recommended intake. [15] Menus with a high quantity of carbohydrates and sodium that are consumed in neighborhoods of low and mid-socioeconomic status seem to be responsible for this finding.

[15] The quantities of each nutrient are tested to determine if they differ across the four socioeconomic groups; statistically significant differences are found only in the case of sodium.

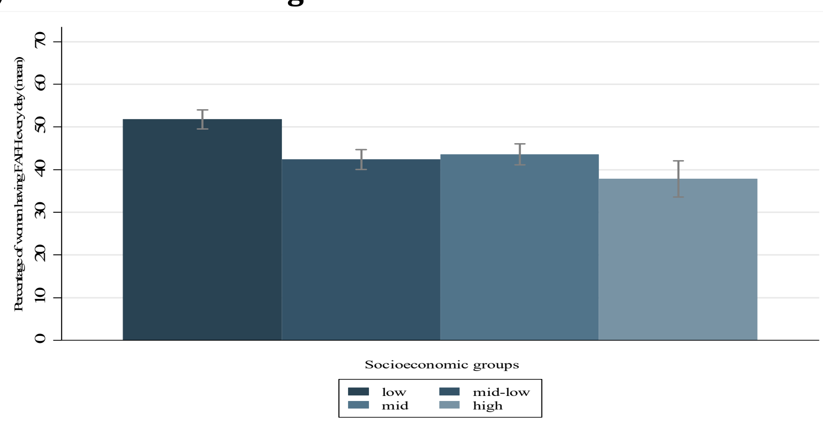
Figure 4: Diet quality (restricted nutrients separately), by socioeconomic neighborhood



Source: Estimates based on data of ENCONUT 2013.
Note: The diet quality index, expressed in the Proportional Difference of Relative Nutrient Intake (PDRNI) index on the restricted nutrients, measures the distance to the ideal intake. The further away the value is from zero (ideal value), the less nutritious is the average menu offered in restaurants in the nutrients considered. Data are weighted.

In order to understand the potential relevance of the diet quality of nearby restaurants, figure 5 displays the share of women ages 15–49 who consume FAFH on a daily basis. It appears that nearly half of all women living in neighborhoods of low socioeconomic background consume FAFH every day, while the share is smaller in mid–socioeconomic status (43 percent) and high socioeconomic status (38 percent) neighborhoods.

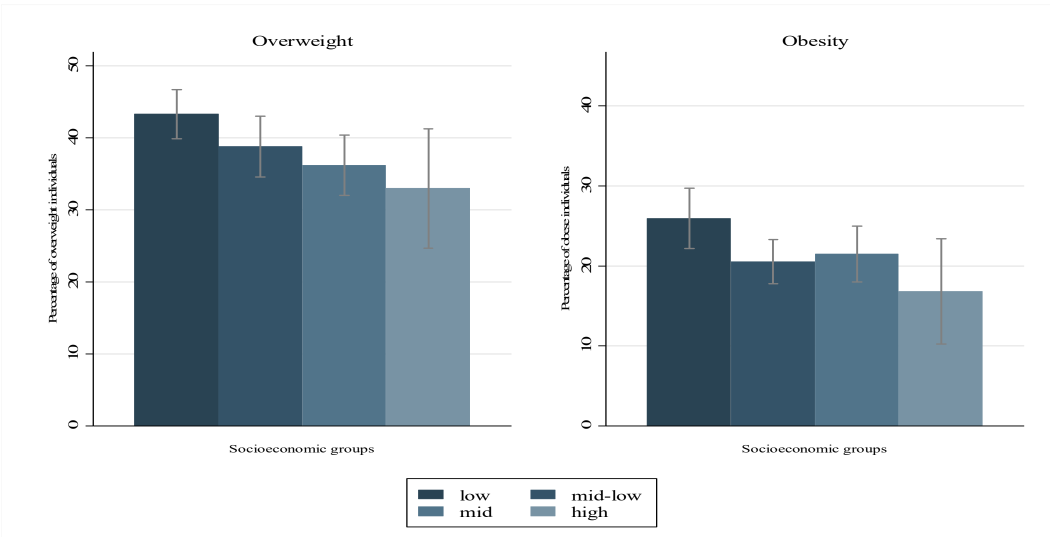
Figure 5: Percentage of women (age 15–49) who consume FAFH every day, by socioeconomic neighborhood



Source: Estimates based on data of ENAHO 2013. *Note*: Data are weighted.

Because women in low socioeconomic neighborhoods consume FAFH more frequently, figure 6 shows the share of overweight and obese women (ages 15–49) in the four socioeconomic groups. The higher the socioeconomic status of the neighborhood, the smaller the share of overweight women, though the standard deviations in the high socioeconomic status group are quite high. While 42 percent of women in neighborhoods with low socioeconomic status are overweight, the proportion decreases monotonically to 32 percent in neighborhoods with high socioeconomic status.

Figure 6: Percentage of overweight and obese women (ages 15–49), by socioeconomic neighborhoods



Source: Estimates based on data of the continuous demographic and health survey 2013.
Note: Overweight is defined as $25 \leq BMI < 30$, and obesity as $BMI \geq 30$. Data are weighted.

There is a similar pattern in the prevalence of obesity. The prevalence rate is 25 percent in in the low socioeconomic status neighborhoods and falls to 17 percent in the high socioeconomic status neighborhoods. Thus, there is descriptive evidence of a socioeconomic gradient in overweight and obesity. Especially women in neighborhoods of low socioeconomic status that more frequently consume FAFH (see figure 5) exhibit the highest prevalence of overweight and obesity, in line with the low nutritional quality of diets in the restaurants in these neighborhoods (see figure 2). However, it may be that this pattern is merely an outcome of other underlying factors. The following section examines if this is the case and estimate the strength of these relationships once important underlying factors are accounted for, such as the lifestyle and health characteristics of the respondents and other food environment characteristics that may partly explain the associations.

5.2 Empirical results

Following equations 4.2, 4.3 and 4.4 of the empirical approach, the ordered logit model is applied with the dependent variables overweight and obesity.[16] Table 1

[16] The category normal weight serves as a reference category.

presents the average marginal effects in the case of obesity (see the appendix, table A2, for the results on overweight). The first column shows a model with all control variables covering common determinants of excess body weight. The second column shows a model that adds the socioeconomic status of the neighborhoods, while the model in the third column adds the PDRNI. The results in the first column show that the relationship of several of the control variables with obesity is statistically significant. Age, marriage, smoking and television usage are positively related, while education and health insurance membership are negatively related with obesity. In particular, the estimates of educational attainment show that women with higher education are 7 percentage points less likely to be obese than women with primary education.

To assess whether the socioeconomic status of the individual's neighborhood is related to obesity, the socioeconomic group dummies of the neighborhoods are included (see column 2). The estimates of the socioeconomic status dummies show that women living in poor neighborhoods are associated with a 14 percentage point greater probability to obesity relative to women in high socioeconomic status neighborhoods. This positive relationship becomes smaller in mid-low and mid socioeconomic status neighborhoods and provides evidence of a socioeconomic gradient in obesity across neighborhoods even after one has considered individual determinants such as individual educational attainment or lifestyle factors.[17]

In column 3, the diet quality index of FAFH is added to explore how much of the socioeconomic gradient in obesity across neighborhoods is attributable to restaurant food quality. This reveals that a 10 percent increase in the PDRNI of restricted nutrients is associated with a 1.7 percentage point rise in the probability of obesity. This point estimate is statistically different from zero and corresponds to a relative increase of 7.4 percent in obesity. It seems that the neighborhood's diet quality of FAFH is strongly associated with obesity levels. If the estimates of the socioeconomic status dummies between the second and the third models are compared, between 10 and 15 percent of the association between socioeconomic status and obesity are found to be attributable to restaurant food quality in the neighborhood.[18] Diet quality explains a higher share of this association in poor neighborhoods, but a lower share in more well-off neighborhoods. It seems that the socioeconomic gradient in obesity is also a consequence of the differences in diet quality of FAFH across socioeconomic groups. Potentially, women in poorer neighborhoods would benefit slightly more from an improvement in the diet quality of FAFH with regard to obesity relative to women in more well-off neighborhoods.

[17] We test whether the estimates of the socioeconomic groups are different. The two-sided-test of significance rejects the zero hypothesis at the 5%-level comparing the low and mid-low and low and mid socioeconomic status dummies. There is no statistically significant difference between the mid-low and mid-socioeconomic status groups.

[18] The differences in the estimate of the socioeconomic status dummies are statistically significant at the 10 percent level.

Table 1: Diet quality and obesity, *ordered logit model, average marginal effects*

Variables	(1) BMI category obesity	(2) BMI category obesity	(3) BMI category obesity	Relative difference (2)–(3) p-values in brackets
Low socioeconomic status (1/0) (neighborhood)		0.137***	0.117***	*−14.60%*
		(0.0413)	(0.0333)	*[0.061]*
Mid-low socioeconomic status (1/0) (neighborhood)		0.0682*	0.0588*	*−13.80%*
		(0.0402)	(0.0330)	*[0.070]*
Mid socioeconomic status /1/0) (neighborhood)		0.0678*	0.0608*	*−10.30%*
		(0.0365)	(0.0317)	*[0.068]*
PDRNI restricted (neighborhood)			*0.170***	
			(0.0709)	
Socioeconomic characteristics				
Secondary education (1/0)	−0.0343*	−0.0335	−0.0300	
	(0.0203)	(0.0265)	(0.0260)	
Higher education (1/0) [*reference: primary education*]	−0.0671*	−0.0626*	−0.0616*	
	(0.0350)	(0.0351)	(0.0348)	
2nd quantile household wealth index (1/0)	0.0295	0.0189	0.0183	
	(0.0272)	(0.0272)	(0.0272)	
3rd quantile household wealth index (1/0)	0.0132	−0.000127	−0.00112	
	(0.0305)	(0.0288)	(0.0290)	
4th quantile household wealth index (1/0)	−0.0523	−0.0189	−0.0216	
	(0.0296)	(0.0289)	(0.0290)	
Age 20–29 [*Ref. cat. Age 15-19*]	0.116***	0.116***	0.115***	
	(0.0240)	(0.0238)	(0.0237)	
Age 30–39	0.227***	0.224***	0.223***	
	(0.0306)	(0.0286)	(0.0295)	
Age 40–49	0.281***	0.283***	0.282***	
	(0.0268)	(0.0252)	(0.0261)	
Single (1/0) [*reference: divorced, widowed*]	−0.0320	−0.0325	−0.0325	
	(0.0217)	(0.0215)	(0.0210)	
Married (1/0)	0.0634**	0.0636**	0.0618**	
	(0.0258)	(0.0264)	(0.0261)	
Number of household members	0.00740	0.00747*	0.00698	
	(0.00459)	(0.00454)	(0.00442)	
Lifestyle				
Smoking (1/0)	0.0668**	0.0632*	0.0616*	
	(0.0325)	(0.0325)	(0.0321)	
Daily television usage (1/0)	0.0219*	0.0221*	0.0236**	
	(0.0118)	(0.0116)	(0.0115)	
Not working (1/0)	0.00782	0.00828	0.00757	
	(0.0191)	(0.0186)	(0.0187)	
Health				
Sick last two weeks (1/0)	0.0162	0.0158	0.0192	
	(0.0264)	(0.0267)	(0.0268)	
Currently breastfeeding (1/0)	0.00669	0.0119	0.0104	
	(0.0260)	(0.0263)	(0.0265)	
Contributory health insurance (1/0) [*reference: no insurance*]	−0.0496***	−0.0489***	−0.0520***	
	(0.0149)	(0.0160)	(0.0161)	
Non-contributory health insurance (1/0)	−0.0252	−0.0278*	−0.0285*	
	(0.0166)	(0.0158)	(0.0158)	
Environment				
Share of women daily FAFH (neighborhood)	0.110	0.0953	0.0776	
	(0.168)	(0.242)	(0.235)	
Average menu price (neighborhood)	−0.00379	−0.0181	−0.0249**	
	(0.00983)	(0.0113)	(0.0103)	
N	2,106	2,106	2,106	
Pseudo R2	0.087	0.092	0.096	

Note: The variable *PDRNI restricted* is the diet quality index that measures the proportional difference of relative nutrient intake (PDRNI). A one-unit increase expresses a higher distance to the ideal value and thus implies a less nutritious diet. * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses are clustered by district.

A similar pattern can be found in the prevalence of overweight (see the appendix, table A3). A 10 percent increase in the PDRNI of restricted nutrients is found to be associated with a 0.52 percentage point greater probability of overweight, which corresponds to a relative increase of 1.7 percent. From 9 to 14 percent of the association between socioeconomic status and overweight is attributable to restaurant food quality in the neighborhood.

Table 2 divides the PDRNI of restricted nutrients into the three components and shows estimates of the average marginal effects of carbohydrates, fat and sodium separately. The results indicate that sodium is the most relevant in explaining the risk of overweight and obesity within the group of restricted nutrients, as it is the only association that results statistically significant. This is in line with the descriptive results showing that sodium is mostly responsible for the overall positive PDRNI of restricted nutrients. While the average fat intake of FAFH is close to the recommended intake, the mean intake of sodium far exceeds the recommend intake. Sodium intake is often positively associated with the consumption of energy-rich sugar-sweetened beverages, increasing higher total daily energy intake and contributing to weight gain. These results are in line with a number of studies suggesting that dietary sodium intake implicates a weight gain (Larsen et al. 2014; Yi and Kansagra 2014).

Table 2: Restricted nutrients and BMI categories

ordered logit model, average marginal effects

Variables	(1) BMI category: obesity	(2) BMI category: overweight
PDRNI carbohydrates	0.028	0.093
	(0.027)	(0.087)
PDRNI fat	0.025	0.007
	(0.086)	(0.027)
PDRNI sodium	0.056*	0.017**
	(0.030)	(0.008)
N	2,106	2,106
Control variables	Yes	Yes
Socioeconomic status of the neighborhood	Yes	Yes

Note: For the control variables, see table 1. The variable *PDRNI restricted* is the diet quality index that measures the proportional difference of relative nutrient intake (PDRNI). A one-unit increase expresses a higher distance to the ideal value and thus implies a less nutritious diet.

* p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses are clustered by district.

To explore potential differences between women living in neighborhoods with different socioeconomic status, we estimate the model for each subsample. The average marginal effects of the PDRNI in the four socioeconomic groups are shown in table 3. We find a relationship between the prevalence of obesity among women living in low socioeconomic neighborhoods and the diet quality of FAFH. A 10 percent increase in the PDRNI of restricted nutrients is associated with a 3.7 percentage point greater probability of obesity. This corresponds to a substantial relative increase of 17 percent in obesity. Among women living in mid- or high socioeconomic neighborhoods, there is no relationship between PDRNI and the probability of obesity. A similar pattern is found for overweight. While overweight seems to be relatively independent of the diet quality of FAFH in neighborhoods with mid- and high socioeconomic status, both factors are related in poor neighborhoods. So, it seems that, after one controls for a number of determinants of excess body weight, the low diet quality of FAFH is found to be substantially associated with high obesity and overweight among women who live in poorer neighborhoods.

Table 3: Socioeconomic status specific effects: diet quality and BMI categories *ordered logit model, average marginal effects*

	Low socioeconomic status	**Mid–low socioeconomic status**	**Mid socioeconomic status**	**High socioeconomic status**
Obesity				
PDRNI restricted	0.366***	0.028	-0.034	0.023
	(0.068)	(0.096)	(0.148)	(0.183)
Overweight				
PDRNI restricted	0.048***	0.009	-0.011	0.014
	(0.013)	(0.033)	(0.052)	(0.133)
N	804	535	533	234
Control variables	Yes	Yes	Yes	Yes

Note: For the control variables, see table 1. The variable *PDRNI restricted* is the diet quality index that measures the proportional difference of relative nutrient intake (PDRNI). A one-unit increase expresses a higher distance to the ideal value and thus implies a less nutritious diet. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses are clustered by district.

6 Conclusion

Rising obesity rates are one of the most undervalued public health issues in many emerging economies. High rates of excess body weight have detrimental health effects and generate a burden on health systems. A unique representative restaurant survey that includes objective measures of the micronutrients in the most widely consumed meals in Metropolitan Lima allows us to shed light on the relationship between the nutritional quality of FAFH and individual excess body weight among the population in urban Peru. Eating away from home is a frequent occurrence across socioeconomic groups in Peru and represents over a quarter of household food expenditures. We build a new diet quality index, the PDRNI, to account for overnutrition in specific micronutrients that are most relevant in terms of excess body weight. The index overcomes shortcomings of other diet quality indexes.

The findings indicate that lower diet quality in FAFH in restaurants located in the individual's food environment is significantly associated with excess body weight. This relationship holds after accounting for a number of factors that correlate with body weight, including socioeconomic fixed effects which control for unobserved factors that correlate with body weight and the nutritional quality of FAFH. Among the various nutrients, the main drivers of poor nutritional quality appear to be sodium, especially in poorer areas. Sodium intake is positively associated with the consumption of energy-rich sugar-sweetened beverages, increasing higher total daily energy intake and contributing to weight gain.

Furthermore, the lower quality of readily available food is found to explain part of the socioeconomic gradient observed in obesity and overweight. The analysis shows that the same gradient is observed in the nutritional quality of similar menus in the food environment, whereby quality decreases, alongside socioeconomic status. This pattern remains if one includes the price and the weight of the respective menus. After controlling for a number of determinants of individual body weight, one finds that the association between excess body weight and socioeconomic status falls by 10 to 15 percent if one considers restaurant diet quality in the neighborhood. This is in line with studies that show that the neighborhood has an independent effect on long-term health outcomes (Ludwig et al. 2012) and that such neighborhood effects can outweigh that of individual income (Bilger and Carrieri 2013).

Due to data limitations, the study abstracts from the analysis of at-home food quality, which could also be correlated with socioeconomic status. It could be argued, for instance, that if differences in at-home food quality across SES are larger than differences in FAFH, then the increasing incidence of FAFH consumption could be actually helping close the SES gradient. While we cannot address the food-at-home/FAFH diet quality trade-offs directly – and therefore test this hypothesis, we believe that the relevance of our results remains. On the one hand, average differences in at-home food quality are controlled for in the analysis through the SES dummies. On the other hand, the fact that FAFH has been identified as a major contributor to the recent rise in obesity rates (Kim et al. 2014; Seguin et al. 2016; Zeng and Zeng 2018), suggests that a more detailed assessment of the food environment with regard to the nutritional quality of FAFH is needed for the design of better food environment interventions. Furthermore, as the incidence of FAFH consumption grows it becomes increasingly critical to address differences in quality of FAFH across socioeconomic groups.

Overall, these findings point to a potentially important entry point for policy action when thinking on addressing rising obesity rates. The modern food environment, with its low-cost, energy dense, mass-prepared food and greater portion sizes is likely to contribute to a higher prevalence and severity of obesity. High excess of sodium intake seems particularly worrisome. Whether effective policies could come from regulation or transparency on the supply side, or guidelines and awareness promotion on the demand side, or any combination of the two, is open to future research. But the results suggest that looking into the role that FAFH quality and the existing gradient with socioeconomic status play in health outcomes merits more attention.

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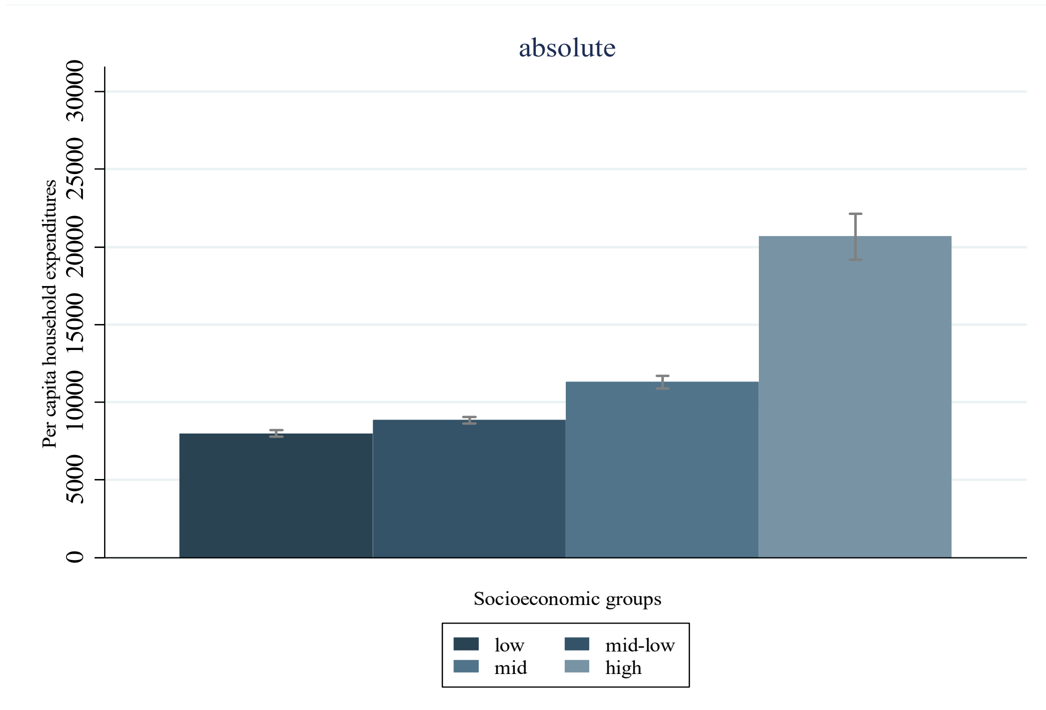
Appendix

Figure A1: Average annual household expenditure, by socioeconomic group



Source: ENAHO 2013.

Figure A2: Average menu price and diet quality in neighborhoods

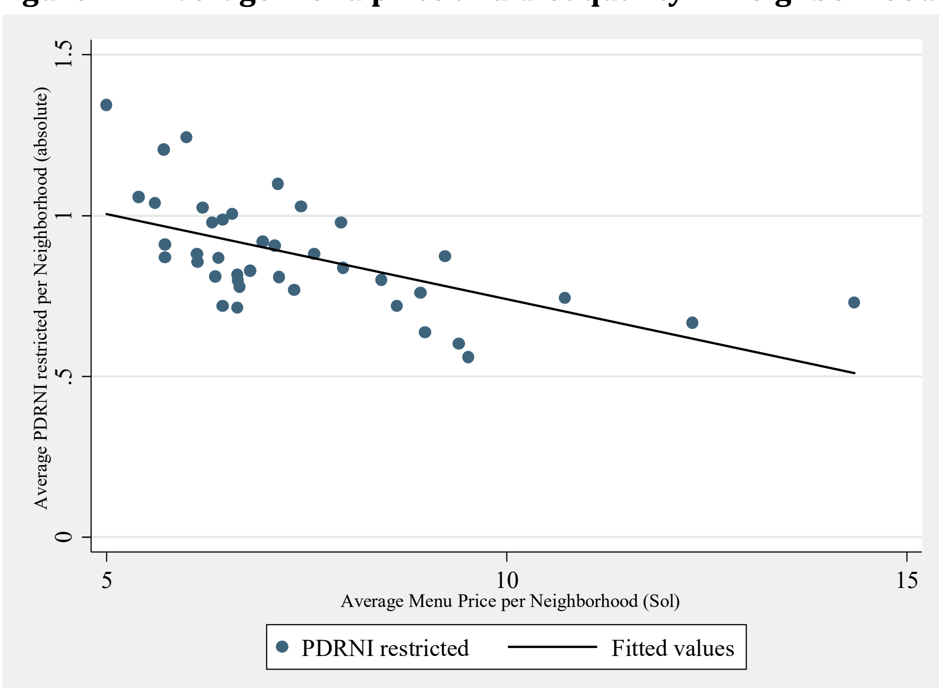


Table A1: Summary statistics

Variable	*Mean*	*Std. Dev.*	*Min.*	*Max.*
Dependent variables				
Overweight	0.37	0.48	0	1
Obesity	0.22	0.41	0	1
Neighborhood variables				
PDRNI restricted nutrients	0.84	0.11	0.56	1.14
PDRNI carbohydrates	0.65	0.10	0.41	0.94
PDRNI fat	−0.07	0.11	−0.31	0.31
PDRNI sodium	1.65	0.31	1.26	3.332
Menu price	6.75	0.98	5.00	13.35
Share of women, daily FAFH	48.96	6.05	27.27	64.28
Low socioeconomic status	0.43	0.49	0	1
Mid-low socioeconomic status	0.25	0.43	0	1
Mid socioeconomic status	0.25	0.43		
High socioeconomic status	0.06	0.24	0	1
Socioeconomic characteristics				
Age	31.21	10.02	15	49
Secondary education	0.71	0.45	0	1
Higher education	0.21	0.41	0	1
Single	0.37	0.48	0	1
Married	0.49	0.50	0	1
Number of household members	4.96	2.01	1	13
1st quantile household wealth index	0.17	0.25	0	1
2nd quantile household wealth index	0.21	0.21	0	1
3rd quantile household wealth index	0.31	0.46	0	1
4th quantile household wealth index	0.31	0.49		
Lifestyle				
Smoking	0.08	0.27	0	1
Daily television usage	0.82	0.38	0	1
Not working	0.22	0.41	0	1
Health				
Sick last two weeks	0.25	0.43	0	1
Currently breastfeeding	0.11	0.31	0	1
Contributory health insurance	0.39	0.49	0	1
Non-contributory health insurance	0.17	0.38	0	1
Number of observations	2,106			

Note: The variable PDRNI restricted is the diet quality index that measures the proportional difference of relative nutrient intake (PDRNI). A one-unit increase expresses a higher distance to the ideal value and thus implies a less nutritious diet. The socioeconomic status of the neighborhood is taken from the ENAPREF. It is a quantile measure and is built on expenditure averages across residents within the districts. Sampling weights have been considered.

Table A2: The three most highly consumed menus, by socioeconomic group

Consumption Ranking	*Socioeconomic status*	*Name of menu*	*Absolute PDRNI*
1	Low	Chicken with rice	0.7308
2	Low	Arroz chaufa	0.9912
3	Low	Stew with chicken and rice	0.8812
1	Mid-low	Chicken with rice	0.6666
2	Mid-low	Arroz chaufa	0.9233
3	Mid-low	Stew with chicken and rice	0.8423
1	Mid	Chicken with rice	0.6118
2	Mid	Stew with chicken and rice	0.7075
3	Mid	Arroz chaufa	0.8312
1	High	Chicken with rice	0.5151
2	High	Arroz chaufa	0.7043
3	High	Sautéed pork loin with rice	0.8236

Note: The variable PDRNI restricted is the diet quality index that measures the proportional difference of relative nutrient intake (PDRNI). A one-unit increase expresses a higher distance to the ideal value and thus implies a less nutritious diet.

Table A3: Diet quality and overweight

ordered logit model, average marginal effects

Dependent variable	*(1) BMI category overweight*	*(2) BMI category overweight*	*(3) BMI category overweight*	*Relative difference (2)–(3)*
Low socioeconomic status (1/0)		0.0389***	0.0352***	*−9.50%*
		(0.0135)	(0.0117)	*(0.60)*
Mid-low socioeconomic status (1/0)		0.0209	0.0180*	*−13.90%*
		(0.0131)	(0.0108)	*(0.061)*
Mid socioeconomic status /1/0)		0.0204*	0.0186*	*−8.80%*
		(0.0118)	(0.0101)	*(0.064)*
PDRNI restricted (neighborhood)			*0.0520****	
			(0.0194)	
Socioeconomic characteristics				
Secondary education (1/0) [*reference category: primary edu.*]	−0.0106**	−0.0118	−0.0112	
	(0.00500)	(0.00851)	(0.00844)	
Higher education (1/0) [*reference: primary education*]	−0.0207*	−0.0192*	−0.0189*	
	(0.0119)	(0.0113)	(0.0113)	
2nd quantile household wealth index (1/0)	0.00909	0.00579	0.00559	
	(0.00857)	(0.00854)	(0.00860)	
3rd quantile household wealth index (1/0)	0.00408	−3.89e−05	−0.000343	
	(0.00951)	(0.00883)	(0.00888)	
4th quantile household wealth index (1/0)	−0.00161	−0.00578	−0.00660	
	(0.00911)	(0.00877)	(0.00863)	
Age 20–29 [*reference: ages 15–19*]	0.0358***	0.0356***	0.0352***	
	(0.00743)	(0.00767)	(0.00669)	
Age 30–39 [*reference: ages 15–19*]	0.0699***	0.0687***	0.0684***	
	(0.0118)	(0.0124)	(0.0109)	
Age 40–49 [*reference: ages 15–19*]	0.0865***	0.0866***	0.0864***	
	(0.0135)	(0.0120)	(0.0103)	
Single (1/0) [*reference: divorced, widowed*]	−0.00986	−0.00997	−0.00995*	
	(0.00627)	(0.00612)	(0.00589)	
Married (1/0) [*reference: divorced, widowed*]	0.0195**	0.0195**	0.0189**	
	(0.00921)	(0.00894)	(0.00916)	
Number of household members	0.00228	0.00229	0.00214	
	(0.00139)	(0.00147)	(0.00140)	
Lifestyle				
Smoking (1/0)	0.0206**	0.0194**	0.0189**	
	(0.00904)	(0.00952)	(0.00914)	
Daily television usage (1/0)	0.00676*	0.00677*	0.00723**	
	(0.00363)	(0.00365)	(0.00354)	
Not working (1/0)	0.00241	0.00254	0.00232	
	(0.00594)	(0.00575)	(0.00574)	
Health status				
Sick last two weeks (1/0)	0.00498	0.00485	0.00589	
	(0.00813)	(0.00796)	(0.00803)	
Currently breastfeeding (1/0)	0.00206	0.00364	0.00320	
	(0.00808)	(0.00824)	(0.00823)	
Contributory health insurance (1/0)	−0.0153***	−0.0150***	−0.0159***	
	(0.00491)	(0.00496)	(0.00521)	
Non-contributory health insurance (1/0)	−0.00777	−0.00853	−0.00872*	
	(0.00569)	(0.00519)	(0.00524)	
Environment				
Share of women daily FAFH (neighborhood)	0.0337	0.0292	0.0238	
	(0.0486)	(0.0755)	(0.0733)	
Average menu price (neighborhood)	−0.00117	−0.00555	−0.00764**	
	(0.00301)	(0.00370)	(0.00347)	
N	2,106	2,106	2,106	
Pseudo R2	0.087	0.092	0.096	