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Research report

Degree of food processing of household acquisition patterns in a Brazilian urban area is related to food buying preferences and perceived food environment ☆

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ABSTRACT

Objective: This cross-sectional study examined the association between local food environment and consumers' acquisition of ultra-processed food. *Methods:* Households were randomly selected from 36 census tracts in Santos City, Brazil. Mothers, of varying economic status, who had children ages 10 or younger (n = 538) were interviewed concerning: their household food acquisition of 31 groups of food and beverages, perceptions of local food environment, food sources destinations, means of transportation used, and socioeconomic status. Food acquisition patterns were classified based on the degree of industrial food processing. Logistic regression models were fitted to assess the association between consumer behaviors and acquisition patterns. *Results:* The large variety of fresh produce available in supermarkets was significantly related to lower odds of ultra-processed food purchases. After adjusting for sociodemographic characteristics, higher odds for minimally-processed food acquisition were associated with: frequent use of specialized markets to purchase fruits and vegetables (OR 1.89, 95% CI 1.01–2.34), the habit of walking to buy food (OR 1.58, 95% CI 1.08–2.30), and perceived availability of fresh produce in participants' neighborhood (OR 1.58, 95% CI 1.08–2.30). Acquisition of ultra-processed food was positively associated with the use of taxis as principal means of transportation to food sources (OR 2.35, 95% CI 1.08–5.13), and negatively associated with perceived availability of a variety of fruits and vegetables in the neighborhood (OR 0.57, 95% CI 0.37–0.88). *Conclusion:* The results suggest that interventions aiming to promote acquisition of less processed food in settings similar to Santos, may be most effective if they focus on increasing the number of specialized fresh food markets in local neighborhood areas, improve residents' awareness of these markets' availability, and provide appropriate transportation.

Introduction

Obesity and diet-related chronic diseases have emerged as global challenges of the 21th century, fueled by rapid and intense urbanization, and subsequent changes in food environments and food choices (Huang, Drewnowski, Kumanyika, & Glass, 2009; Larson & Story, 2009; Ludwig, 2011; Townshend & Lake, 2009). Globalization, free trade, economic growth and urbanization are macro-level factors that increased utilization of new food production technologies, and influenced the types of foods available in neighborhoods worldwide (Monteiro, Levy, Claro, de Castro, & Cannon, 2011; Monteiro, Moubarac, Cannon, Ng, & Popkin, 2013; Pérez-Cueto et al., 2010; Townshend & Lake, 2009).

Although the availability of healthy foods is a significant influence on food choice (Hawkes, 2009; Larson & Story, 2009; Murakami, Sasaki, Takahashi, & Uenishi, 2009; Walker, Block, & Kawachi, 2012), the consumer decisions are also motivated by other factors, including: perceived barriers to obtaining healthy food (such as distance to food sources), quality of food sold, prices, and store attributes such as store size, food safety, cleanliness, customer service, and brands sold (Blitstein, Snider, & Evans, 2012; Gittelsohn & Sharma, 2009; Krukowski, McSweeney, Sparks, & West, 2012; Larson & Story, 2009; Macdonald, Ellaway, Ball, & Macintyre, 2011; Morland & Evenson, 2009; Thornton, Pearce, Macdonald, Lamb, & Ellaway, 2012; Walker et al., 2012). These factors may interact with community

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characteristics such as the socioeconomic status (SES) of its residents, and racial and ethnic composition (D'Angelo, Suratkar, Song, Stauffer, & Gittelsohn, 2011; Dennisuk et al., 2011; Jaime, Duran, Sarti, & Lock, 2011; Macdonald, Cummins, & Macintyre, 2007).

Food processing is theorized to be a shaping force in the global food system. It dominates the food supply of both developed and developing countries, and influences the availability of food products in local stores (Macdonald et al., 2007; Monteiro et al., 2011). Ultra-processed foods are very palatable, flavorful, satisfying, inexpensive and ready-to-eat products that tend to have a long shelf-life (Davis et al., 2011; Monteiro et al., 2011). Accordingly, ultra-processed foods are hypothesized to be the major dietary driver of obesity and non-communicable diet-related chronic diseases, due to use of ingredients such as hydrogenated oils, fats, flours, starches, sugar, additives, and industrial processing methods such as frying, smoking, and canning (Davis et al., 2011; Ludwig, 2011; Monteiro et al., 2011, 2013; Moubarac et al., 2013).

In developed countries, many studies have examined the influence of the food environments and food purchases on dietary and health outcomes (Caspi, Soresen, Subramanian, & Kawachi, 2012; D'Angelo et al., 2011; Glanz, 2009; Glanz, Bader, & Iyer, 2012; Hawkes, 2009; Krukowski et al., 2012; Larson & Story, 2009; Macdonald et al., 2011; Morland & Evenson, 2009; Murakami et al., 2009; Pérez-Cueto et al., 2010; Walker et al., 2012). Little is known about the food environment and food acquisition patterns in Brazil (Duran, Diez-Roux, Latorre, & Jaime, 2013; Jaime et al., 2011; Martins et al., 2013; Velásquez-Melendez, Mendes, & Padez, 2013). Therefore, we investigated the association between participants' food-related behaviors, perceptions about the local food environment, food acquisition patterns, degree of food processing, and characteristics of food sources in urban areas of varying socioeconomic status, in Santos City, Brazil.

Material and methods

Setting

The Nutritional Environment Assessment in Santos City, Brazil (AMBNUT) was conducted in 2010 in 36 census tracts among different urban areas of the city. Santos is the main city in the metropolitan coastal region of Sao Paulo and has the biggest seaport in Latin America. The city comprises a land area of 281 km^2, with a total population of 420,000 and population density of 15,000 habitants/km^2 (IBGE, 2010). In Santos, approximately 35% of children younger than six, 39% of children ages 6–10, and 52.2% of mothers were classified as overweight and obese (Cremm et al., 2012). For this reason, a cross-sectional design was used to evaluate environmental influences on dietary intake and nutritional status of mothers, and their children, if the children were ages 10 or younger. This study was approved by the Ethics and Research Committee of the Federal University of Sao Paulo (Protocol n. CEP 0275/09 and 0276/09).

Sampling

Families were recruited using stratified random sampling of 36 census tracts. After the selection of census tracts, sectors were randomly selected, and eligible households were identified. Households were chosen first from the most northwest point of the block, and the enrollment continued until the whole block was passed in a clockwise direction. To be eligible for this study, participants needed to be: (1) mothers of children between one to ten years of age, and (2) resident of the household. Women were excluded from this study if they had any health conditions that could affect their nutritional status (e.g. pregnancy, being diagnosed as HIV positive or neoplasm, and having undergone a bariatric surgery procedure). The response rate was 70.3%. The final sample consisted of an average of 16 household interviews per census tract (n = 538).

The study sample size was calculated based on data from the Brazilian Consumer Expenditure Survey 2002–2003 (IBGE, 2004). A sample size of 200 households was determined sufficient to estimate the following parameters: the relative proportion of calories found in food groups with the greatest availability in the Brazilian southeast urban area (36.4% cereals and derivatives food group), a 5% margin of error, a 95% confidence interval and a non response rate of 10%. However, because we had a greater number of interview results available, we used all of the interviews collected through AMBNUT (n = 530), excluding those that had incomplete or inconsistent food acquisition data (n = 8).

Data collection

The data were collected between January and December 2010, using face-to-face interviews with eligible mothers who have consented to participate in the study. The interviews lasted an average of 105 minutes. During the interview we ascertained: (1) household socioeconomic and demographic characteristics, (2) household food acquisition patterns and proximity of food stores to women's homes and workplaces, (3) food sources from which participants purchased fruits, vegetables and meats, as well as reasons participants chose to buy food at each type of food source, (4) means of transportations participants commonly use to travel to food sources, (5) women's perception about the variety and freshness of fruits and vegetables, and (6) women's perception about availability of healthy food in participants' neighborhoods.

Data collectors were trained intensively. Training consisted of instruction on participant enrollment and consenting procedures, interview techniques, and food survey and anthropometric measurement techniques. During in-class practice, data collectors practiced using role-playing, and received feedback from the principal investigator.

Measures

Food acquisition patterns

We assessed household food and beverage acquisition using an instrument adapted from the Brazilian National Center for Geography and Statistics study of household food acquisition (IBGE, 2004). The adapted instrument is a questionnaire with questions about 31 product groups of food, including: refined grains, whole grains, breakfast cereals, white breads, whole-grain breads, flour, pasta, ready-to-eat meals, chips and snacks, fruits and vegetables (fresh), tubers, legumes, dairy products, processed meat (beef, pork, chicken, fish), unprocessed meat (beef, pork, chicken, fish, eggs), oilseeds, sweets (candy, chewing gum, chocolate), cookies, vegetable oils and fats, sugar, soda, juice powder, alcoholic beverages (distilled and fermented).

During the interview, participants reported whether they acquired these products in the past 30 days. Then, they were asked to provide details about the quantity purchased by specifying product weight, size, unit of measure, and product brands whenever applicable. If the participants were not able to report the exact amount of foods they purchased in the last month, we collected information on the weekly and/or daily acquisition, and subsequently used this information to estimate the food acquisition in the 30 days.

The questionnaire was validated through the comparison of the acquisition of food groups with the results of these groups' intake, assessed with use of 24-h recalls obtained in a small sample (n = 30) during the pilot tests phase. The intake of each food group was divided by the number of dwellers in the household, obtaining a *per capita* estimation and values were compared to the acquisition data calculating Spearman Correlation Coefficient. Values ranged from 0.44 to 0.97 ($p < 0.05$). Internal consistency was assessed using the whole sample calculating Cronbach's alpha (0.67).