Food Policy 72 (2017) 112–120

Contents lists available at ScienceDirect

Food Policy

journal homepage: www.elsevier.com/locate/foodpol

Validating the usage of household food acquisition surveys to assess the consumption of ultra-processed foods: Evidence from Brazil

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ARTICLE INFO

Keywords:
Food consumption
Ultra-processed food
Indicators
Surveys

ABSTRACT

Our ability to research dietary changes over time and their effects on health is limited by challenges in accurately measuring food consumption. In countries where dietary surveys are scarce and rarely nationally representative, household budget surveys may serve as a useful alternative for assessing food consumption. The objective of this study was to evaluate how well household acquisition data reflects the actual intake of ultra-processed foods, using data from the 2008 to 2009 Brazilian Household Budget Survey. The food acquisition module was conducted for all households selected for the survey (n = 55,970) and a subsample corresponding to 25% of the households (n = 13,569) was randomly selected for the individual food intake module, which was conducted for all individuals aged 10 years or older (n = 34,003). Ultra-processed foods were defined as formulations made by the food industry mostly or entirely from substances extracted from foods or obtained with the further processing of constituents of foods or through chemical synthesis, with little if any whole food. Examples included candies, cookies, chips, sugar-sweetened beverages, and ready-to-eat dishes. Our results showed an important agreement between the estimates of ultra-processed food consumption obtained from household acquisition data and individual intake inside-the-home data, particularly for the relative (% of total energy) consumption of these foods. Our study thus indicates that household budget surveys are quite promising for tracking population-level changes in the consumption of ultra-processed foods. The trend toward increased consumption of food away from home in other low- and middle-income countries indicates that future household budget surveys should include the collection of these data.

1. Introduction

Sources of data on individual food intake in low- and middle-income countries are scarce, inaccurate, and rarely nationally representative. At the same time, household budget surveys are broadly available and are periodically conducted to monitor the cost of living at a national level in a large number of countries; these data could be used to track changes in food consumption patterns (FAO, 2008). However, to date, several limitations have constrained their utility for assessing dietary consumption. Household-based surveys do not provide information on food actually eaten by household members or on intra-family distribution of food consumption. In addition, food acquisition surveys do not account for waste from cooking, spoilage, leftovers, or meals not eaten at home. Furthermore, analyses of a limited number of countries and food groups have suggested that household budget survey estimates can significantly differ from individual dietary consumption (Becker, 2001; Claro et al., 2010; Naska et al., 2001; Sekula et al., 2005).

In Brazil, national trends of food consumption have been regularly evaluated since the mid-1970s using data collected by national household budget surveys. In 2008–2009, the Brazilian Institute of Geography and Statistics included in its national household budget survey a module to assess individual food intake in a subsample of the

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[1] M.L.C. Louzada was funded by the São Paulo Research Foundation (2015/25168-7).

http://dx.doi.org/10.1016/j.foodpol.2017.08.017

Available online 05 September 2017

studied households. This has enabled the evaluation of the accuracy of household acquisition data relative to actual intake.

The consumption of ultra-processed foods (associated with poor health outcomes) is of particular interest in countries undergoing the nutrition transition, such as Brazil (Monteiro et al., 2016). Consequently, methods of tracking the consumption of these foods are needed, and household budget surveys pose a viable option for collecting these data, as well as for collecting frequent data at a national level for a large number of countries. The objective of this study was therefore to compare the estimates of ultra-processed food consumption obtained from household food acquisition relative to individual food intake surveys.

2. Background: the share of ultra-processed foods as an indicator of diet quality

Although food processing is increasingly considered the centerpiece of the global food system and the key factor explaining the relationship between food intake and health conditions, dietary assessments usually ignore it, limiting our ability to monitor changes in dietary patterns across the world (FAO, 2015).

In today's world, it makes little sense to divide food into the categories of "processed" or "unprocessed", as nearly all food consumed today is processed in some way. Additionally, many types of processing are harmless, beneficial, or even essential and play a central role in human evolution. Accurate assessment of the effects of industrial food processing on health requires proper understanding of the extent and purpose of each type of processing and their effect on food.

2.1. Food classification according to the extent and purpose of industrial food processing

Towards this end, a group of researchers proposed a new classification of foods known as NOVA which gives primary importance to the characteristics of food processing. Food processing, as understood by NOVA classification, involves physical, biological and chemical processes that occur after the separation of the food from nature and before it is prepared to be eaten. Therefore, the procedures used in culinary preparation taking place in houses or commercial/institutional restaurants, including disposal of non-edible parts, fractioning, cooking, seasoning and mixing with other foods, are not taken into account by NOVA classification.

The rationale and the food groups articulated by the new classification were first described in 2010 (Monteiro et al., 2010) and further developed in the following years (Ministry of Health, 2014; Monteiro et al., 2016). Table 1 provides a detailed list of examples of the four NOVA food groups: (1) unprocessed or minimally processed foods, (2) processed culinary ingredients, (3) processed foods, and (4) ultra-processed foods.

Unprocessed foods include the edible parts of plants (seeds, fruits, leaves, stems, roots) and animals (muscles, viscera, eggs, milk) as well as mushrooms, algae, and water after its separation from nature. Minimally processed foods are perishable foods submitted to processes that do not add new substances to the foods, such as drying, dehydration, milling, fractioning, roasting, pasteurization, refrigeration/freezing, vacuum packaging, and non-alcoholic fermentation. Most of the processes involved in minimal processing aim to extend the life of unprocessed food, enabling its storage for longer use. Other purposes include facilitating or diversifying the preparation of cooked food (such as removing inedible parts, fractioning, and grinding or milling of food) or modifying its flavor (such as roasting coffee beans or tea leaves and fermenting milk to produce yogurt).

Processed culinary ingredients include substances extracted directly from the first group of foods or from nature which are usually consumed as items of culinary preparations. The processes involved in the extraction of these substances include pressing, grinding, milling, spray drying, and refining. These processes aim to manufacture products used for seasoning and cooking unprocessed or minimally processed foods and, in general, to make culinary preparations based on these foods. In food intake surveys, the culinary ingredients are rarely recorded as isolated items, but they appear as part of dishes and preparations of unprocessed or minimally processed foods.

Processed foods include products made with the addition of salt or sugar and sometimes oils, fats, vinegar, or other Group 2 substances to Group 1 foods. They usually have two or at most three ingredients. The processes used in the manufacturing of these products include salting, sugaring, smoking/curing, canning and bottling, pickling, jellying, coagulation, and fermentation, in the case of bread and cheese. The underlying purpose of the manufacture of processed foods is to increase the duration of unprocessed or minimally processed food or to modify its palatability, similar to the purpose of processes used to make Group 1 foods. Processed foods are directly derived from food and are usually recognized as versions of the original foods.

Ultra-processed foods are industrial products that are made entirely or mostly of substances that have been extracted from foods or nature and used as common culinary ingredients (oils, fats, sugar, and salt), derived from food constituents (hydrogenated fats, modified starches), or synthesized in a laboratory based on organic materials such as oil and coal (colorants, flavorings, flavor enhancers, and other additives used to give the products attractive sensory properties). Manufacturing techniques include extruding, moulding, and preprocessing by deep frying or baking. They are completely different from other foods, and mostly contain little or no whole food. A high number of ingredients (usually five or more) and the presence of ingredients that are not used in culinary preparations (hydrogenated fat, interesterified oils, fructose syrup, protein isolates, bulking agents, thickeners, emulsifiers, colorants, flavor enhancers, and several other types of additives) identify ultra-processed foods.

A growing body of studies supports the use of the dietary share of ultra-processed foods, expressed as a percentage of total calories, as a reliable indicator of diet quality and a predictor of health conditions (Crovetto et al., 2014; Louzada et al., 2015a,b,c; Monteiro et al., 2010; Monteiro et al., 2011; Moubarac et al., 2013; Rauber et al., 2015). This indicator is independent of differences in total energy intake, can be estimated from different dietary data sources, and allows for flexibility in the evaluation of culturally-specific foods. In addition, it indicates the extent to which traditional food systems and dietary patterns are being displaced. Consequently, it serves as an interesting alternative for monitoring dietary patterns across the world.

Many characteristics related to ultra-processed food composition, presentation and consumption patterns make them potential risk factors for obesity, diabetes, and other diet-related chronic diseases. Ultra-processed foods have an unfavorable nutrient profile and negatively impact dietary quality. This has been documented in several countries by studies using data collected by household food purchases surveys (Crovetto et al., 2014; Monteiro et al., 2011; Moubarac et al., 2013), individual food intake surveys (Barcelos et al., 2014; Bielemann et al., 2015; Louzada et al., 2015b,c), and analyses of supermarket products (Luiten et al., 2015). Analyses of 24-h food records from a representative sample of Brazilian adolescents and adults demonstrated that the energy density of the diet and the relative content of free sugar, total fats, saturated fats, and trans fats increase significantly with an increase in the consumption of ultra-processed foods (% of total energy), while the opposite occurs for protein, fiber, and potassium (Louzada et al., 2015b). The inferiority of ultra-processed foods was also evident in the assessment of micronutrient content in the Brazilian diet. The consumption of ultra-processed foods (% of total energy) was inversely and significantly associated with the content of vitamins B12, vitamin D, vitamin E, niacin, pyridoxine, copper, iron, phosphorus, magnesium, selenium and zinc. The opposite situation was observed only for calcium, thiamin and riboflavin (Louzada et al., 2015c). Another study evaluated US household barcoded purchasing data using a