



Proposal for a breakfast quality index for Brazilian population: Rationale and application in the Brazilian National Dietary Survey



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ABSTRACT

Breakfast has been related to positive nutrition and health outcomes, but criteria for an optimal composition of this meal are not well established. The aim of this study was to propose a breakfast quality index (BQI) for the Brazilian population, and to describe the relationship between breakfast quality, socio-demographic factors, dietary intake at breakfast and for the total day. BQI was constructed based on individual dietary data of 22,279 breakfast consumers, aged 20+ years from the Brazilian National Dietary Survey, a population-based cross-sectional study. The BQI was comprised of food components (cereals, fruit/vegetables, dairy products), and nutrient criteria (energy, fiber, free sugar, saturated fat, calcium and sodium). Mean, percentage and 95% CIs were estimated for variables according to BQI categories. The mean BQI was 4.2, with 71% of individuals falling into medium BQI category and 6% in high category. Individuals in urban areas, in higher categories of income and education and women had higher BQI means. Consumers with high BQI had higher intake of fruits/vegetables and higher breakfast and total daily intake of energy, carbohydrates, fiber, total sugar, sodium, potassium, phosphorus, thiamin, riboflavin, niacin, folate and vitamins B6, A, C, and D, and lower trans fatty acids compared to those in low and medium BQI groups. Promoting a high-quality breakfast may contribute to a better nutrient intake and achievement of daily requirements.

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1. Introduction

Diet plays an important role in preventing and controlling morbidity and premature mortality resulting from nutritional deficiencies and noncommunicable diseases (World Health Organization [WHO], 2003). In this context, a balanced daily breakfast is an important meal which supplies essential nutrients and helps balance the diet, providing appreciable proportions of daily energy, macronutrient, and micronutrient intakes (Nicklas, Reger, Myers, & O'Neil, 2000; Pinto & Carbajal, 2003; Barr,

DiFrancesco, & Fulgoni, 2013).

There is some evidence suggesting that breakfast frequency and quality may be associated with appetite and glycemic control (Pereira et al., 2011), daily energy intake (Schusdziarra et al., 2011), nutrient intake and diet quality (Barr et al., 2013; Matthys, De Henauw, Bellemans, De Maeyer, & De Backer, 2007; Kant, Andon, Angelopoulos, & Rippe, 2008; Deshmukh-Taskar, Radcliffe, Liu, & Nicklas, 2010; Barr, DiFrancesco, & Fulgoni, 2014; O'Neil, Nicklas, & Fulgoni, 2014). These aspects may influence weight control over time (Albertson et al., 2007; Blondin, Anzman-Frasca, Djang, & Economos, 2016; Timlin & Pereira, 2007), as well as visceral fat levels (Alexander et al., 2009) and changes in risk factors for diseases such as diabetes, hypertension, dyslipidemia and cardiovascular disease (Timlin & Pereira, 2007; Smith et al., 2010; Cahill et al., 2013; Hallström et al., 2013; Odegaard et al., 2013; Yoo et al., 2014; Bi et al., 2015; Wennberg, Gustafsson, Wennberg, & Hammarström, 2015; Kubota, Iso, Sawada, Tsugane, & JPHC Study Group, 2016).

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Despite its clear importance, criteria for an ideal composition of breakfast, including types and amounts of foods, nutrients, and energy are not well established. There is a variety of breakfast quality indexes in the literature, and most of them follow a similar rationale of the diet quality indexes, expressing the overall healthiness of the meal or diet, respectively. In general, these indexes are a summary measure of the diet or meal quality and not a description of their pattern. Therefore, individuals may have a similar score with different contributing components, and thus different dietary patterns (Moeller et al., 2007; Ocké, 2013). Nevertheless, the indexes are constructed based on a specific meal or dietary pattern that is known to be healthy or based on pre-existing dietary guidelines for the population (Ocké, 2013), and usually add points for appropriate foods, but not deduct points for inappropriate food choices. Two well-known examples of dietary quality indexes are the Healthy Eating Index (Guenther, Reedy, & Krebs-Smith, 2008) and the Mediterranean Diet Score (Trichopoulou et al., 1995). The strength of scores of diet quality is that they rely on the body of scientific evidence from studies on health and disease prevention. However, there is insufficient knowledge and consensus on what actually is the healthiest diet (Ocké, 2013). In spite of this, studies evaluating the relationship between health and diet quality demonstrate that higher dietary quality is consistently inversely related to CVD and all-cause mortality (Kant, 2004; Reedy et al., 2014).

The majority of the breakfast quality indexes are developed for children and adolescents, based on core food groups outlined in national dietary guidelines (O'Sullivan et al., 2009; Morales, Aguilar, Vega, & Para, 2011; O'Dea & Wagstaff, 2011; Hallström et al., 2012; Fugas, Berta, Walz, Fortino, & Martinelli, 2013; Monteagudo et al., 2013) and very few include nutrient criteria (Monteagudo et al., 2013). O'Neil, Byrd-Bredbenner, Hayes, Jana, Klinger, & Stephenson-Martin (2014) proposed some nutrient criteria to define a quality breakfast based on the 2010 Dietary Guidelines for Americans and the US School Breakfast program guidelines while also taking into consideration the nutrients of concern in the US population. Another study of 12,316 adults from NHANES evaluated breakfast quality according to energy density (ED) and food group combinations reported for breakfast (Kant et al., 2008). Findings suggest that a lower ED of breakfast was associated with a lower overall dietary ED and a higher micronutrient and fiber intake and lower body weight.

In Brazil, one study of adolescents proposed that the standard breakfast should contain food sources of calcium and energy (Gambardella, Frutuoso, & Franchi, 1999). The calcium should come from milk and dairy products, which also provide a source of zinc and protein, and the energy source should come from breads and biscuits with a topping such as jam, honey, margarine, butter, mayonnaise, cheese or cold cuts. Another study with Brazilian university students (Alves & Boog, 2007), adapted from Gambardella et al. (1999) criteria, proposed that breakfast could be classified as: *standard* (calcium and energy sources as outlined above); *full* (calcium and energy sources plus foods rich in vitamins and minerals, such as fruits and vegetables); or *partial* (any other food not included in the full or standard breakfast described). The Dietary Guidelines for the Brazilian population do not recommend amounts of foods or nutrients specifically at breakfast, however they give examples of quality breakfast meals according to Brazilian habits and recommend the consumption of natural or minimally processed foods, such as fruits, coffee and milk, and culinary preparations based on cereals or tubers, such as cassava (Brasil, 2014).

Although there is some evidence suggesting a relationship between breakfast quality, nutrition and health outcomes, there is no available tool to evaluate the quality of this meal in Brazilian

population. In this context, the aim of the present study was to propose a breakfast quality index for the Brazilian population, and to describe the relationship between breakfast quality, socio-demographic factors, and dietary intake at breakfast and for the total day.

2. Methods

2.1. Study sample

The present paper analyses data from the first Brazilian National Dietary Survey (BNDS), a dietary intake assessment study at the individual level conducted as a part of the Brazilian Household Budget Survey (HBS), a large cross-sectional population-based study performed from March 2008 to March 2009 (Pereira, Souza, Duffey, Sichieri, & Popkin, 2015).

The BNDS collected dietary data from a representative sample of 34,003 Brazilian individuals aged ≥ 10 years randomly selected from about 25% of the 55,970 households evaluated in the HBS (Souza, Yokoo, Sichieri, & Pereira, 2015). In brief, the HBS used a two-stage cluster sampling design. In the first stage, the census tracts (primary sample units) were randomly selected from each stratum of census tracts. In the second stage, permanent private households (second sample units) were randomly selected without replacement within census tracts (Pereira et al., 2015).

For the present study, only adults, aged ≥ 20 years, with complete data (dietary intake, socioeconomic, anthropometric and demographic data), not pregnant or lactating, and consumers of breakfast were considered eligible ($n = 22,279$).

This study was conducted in accordance with the Federal Law number 5534 from November 14th, 1968 which guarantees confidentiality of the gathered information by all Brazilian census and surveys. All ethical considerations are in conformity with the Brazilian Resolution Number 196/96 on research involving human subjects.

2.2. Socioeconomic, demographic and anthropometric data

Trained interviewers collected individuals' information on age, sex, region, household area (urban/rural), per capita family income and education by a structured questionnaire administered at home. Anthropometric data (body weight and height) were measured in triplicate using calibrated digital scales, with a capacity of 150 kg (kg) and graduation of 100 g, and portable wall-mounted stadiometers, of extension up to 200 cm with an accuracy of 0.1 cm, following standardized procedures and an average of the three readings was recorded. Details of the procedures can be found in a previous publication (IBGE, 2010). Body mass index (BMI) was calculated dividing weight (kg) by height (m^2).

2.3. Dietary data collection

Dietary data were collected by two non-consecutive food records completed by each individual over 20 years of age in the households. Respondents were instructed by trained interviewers to register all consumed foods and beverages in household measures as well as to report the meal time, place of consumption (i.e. at home or away-from-home) and cooking methods. To guide the estimation of the food portions, manuals with instructions and photos of household measures were provided to individuals. After completion of the food records, the interviewers returned to households for quality control, i.e., for identifying and correcting reporting errors, missing details of description about portion sizes, cooking methods and brand names, besides inquiring if there was any food or beverage consumption during time intervals greater

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