Archives of Oral Biology 81 (2017) 69–73

Contents lists available at ScienceDirect

Archives of Oral Biology

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

Research Paper

Influence of masticatory function, dental caries and socioeconomic status on the body mass index of preschool children

Maria Eliza Soares[a,*], Maria Letícia Ramos-Jorge[a,*], Bruna Mota de Alencar[a], Simone Gomes Oliveira[a], Luciano José Pereira[b], Joana Ramos-Jorge[c]

[a] Department of Pediatric Dentistry and Orthodontics, School of Dentistry, Universidade Federal dos Vales do Jequitinhonha e Mucuri, Diamantina, Brazil
[b] Department of Physiology and Pharmacology, School of Medicine, Universidade Federal de Lavras, Lavras, Brazil
[c] Department of Pediatric Dentistry and Orthodontics, School of Dentistry, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil

ARTICLE INFO

Keywords:
Pediatric obesity
Mastication
Dental caries
Socioeconomic factors
Body mass index

ABSTRACT

Objective: The objective of this study was to determine the influence of masticatory function, dental caries and socioeconomic status on the body mass index (BMI) of preschool children.
Methods: A cross-sectional study was conducted with a sample of 285 children aged three to five years allocated to three groups based on the BMI: underweight, ideal weight and overweight/obesity. Socioeconomic status was determined based on the responses of parents/caregivers to a specific form. Cavitated lesions were diagnosed using the criteria of the International Caries Detection and Assessment System. Masticatory function was assessed based on masticatory performance (MP) and the swallowing threshold (ST), which were evaluated based on the results of a test food. Data analysis involved the employment of the Kruskal-Wallis, Mann-Whitney and chi-square tests as well as simple and multiple linear regression analyses.
Results: In the final multiple regression model, BMI was influenced by monthly household income (β = 0.234; 95%CI: 1.014 to 1.647), number of cavitated teeth (β = −0.180; 95%CI: −0.293 to −0.054) and X50 of the ST (β = 0.304; 95%CI: 0.213–0.498).
Conclusion: Children whose food test resulted in large particles and those from families with a higher monthly income had a higher BMI. Children with a greater number of teeth with cavitated dental caries had a lower BMI.

1. Introduction

Childhood obesity is considered one of the most common adverse health conditions among children. On the global scale, nearly 43 million children less than five years of age are overweight (de Onis, Blossner, & Borghi, 2010). A recent study conducted in Brazil reports a 14.1% prevalence rate of childhood obesity (Aiello, Marques de Mello, Souza Nunes, Soares da Silva, & Nunes, 2015). Since this condition may be a precursor to diseases such as diabetes, there has been growing interest in exploring factors associated with childhood obesity (de Morais Tureli, de Souza Barbosa, & Gavião, 2010).

Studies investigating the association between socioeconomic status and childhood obesity offer conflicting results (Bloomquist & Bergstrom, 2007; Rolland-Cachera, Deheeger, & Bellisle, 1999). However, these is a consensus that the prevalence of childhood obesity has increased in recent years, even in populations with a low socioeconomic level (Abreu et al., 2014; Guedes, Rocha, Silva, Carvalhal, & Coelho, 2011). There has also been a decline in the prevalence of malnutrition among economically disadvantaged populations (Fernandes, Gallo, & Advíncula, 2006). The palatability and low cost of energy dense foods, such as carbohydrates and fats, may explain these findings (Drewnowski & Specter, 2004).

In addition to social, environmental and genetic aspects, studies have shown that obese individuals tend to swallow larger particles of food (Consolação Soares et al., 2017; de Morais Tureli et al., 2010). Thus, a poorer masticatory function has been associated with a higher body mass index (BMI) among schoolchildren (de Morais Tureli et al., 2010). It is also possible that individuals with poor mastication function alter their diet by avoiding foods that are difficult to chew (Friedlander, Weinreb, Friedlander, & Yagiela, 2007).

Several studies have investigated the association between dental caries and BMI (Granville-Garcia, de Menezes, de Lira, Ferreira, & Leite-Cavalcanti, 2008; Vazquez-Nava et al., 2010). A systematic review with meta-analysis suggests such an association (Hayden et al., 2013), but important confounding factors were not controlled in the primary studies. It is plausible that the association between these two conditions

* Corresponding authors at: Department of Pediatric Dentistry and Orthodontics/School of Dentistry/Universidade Federal dos Vales do Jequitinhonha e Mucuri. Rua da Glória, 187, 39.100-000, Diamantina, MG, Brazil.
E-mail addresses: lisadtna@yahoo.com.br (M.E. Soares), mlramosjorge@gmail.com (M.L. Ramos-Jorge).

http://dx.doi.org/10.1016/j.archoralbio.2017.04.032
Received 24 September 2016; Received in revised form 11 April 2017; Accepted 28 April 2017

is bidirectional. A BMI outside the ideal range may be a risk factor for dental caries, but may also be considered an outcome of dental caries. A study showed that obese children tend to consume foods that are rich in fermentable carbohydrates with greater frequency (Cinar & Murtomaa, 2011). Moreover, depression and low self-esteem are often related to overweight and obesity and can exert an indirect influence on the adoption of inadequate oral health behaviors, thereby increasing the chance for the development of dental caries (Davison & Birch, 2001). Considering BMI as an outcome of dental caries, Papas et al. (1989) state that caries can affect one's diet, nutrition and preferences for certain foods. This direction of the association can occur due to chewing problems, as dental caries tends to worsen masticatory function (Consolação Soares et al., 2017; de Morais Tureli et al., 2010).

Understanding factors associated with BMI can contribute to the prevention of childhood obesity and malnutrition. The objective of this study was to evaluate the influence of masticatory function, dental caries and socioeconomic status on the BMI of preschool children.

2. Methods

2.1. Sample and study design

A cross-sectional study was conducted with a sample of male and female preschool children aged three to five years in the city of Diamantina, Brazil. The sample size was calculated using the formula for the comparison of two means and the parameters determined during a pilot study, which was conducted with 30 children allocated to three groups based on the BMI: underweight, ideal weight and overweight/obesity. Considering a standard deviation of 2.33 (referring to the BMI), a one-point difference to be detected among groups, an 80% statistical power and 5% standard error, a minimum sample of 83 children was determined for each group. Sixteen children (20%) were added to each group to compensate for possible dropouts, totaling 297 children. The results of the pilot study demonstrated that no changes in the methods were needed.

Convenience sampling was performed for the recruitment of children from daycare centers and preschools in the city. The weight and height of each child were measured for the determination of the BMI, which was the basis for the allocation of the children to the different groups. Individuals with systemic or neurological disorders, such as Down's syndrome or cerebral palsy, those who took medications that could directly or indirectly affect muscle activity, such an antidepressants, muscle relaxants or sedatives, and individuals who wore orthodontic appliances were excluded from the study. Individuals with the common cold or influenza on the day scheduled for the examination were evaluated after the signs and symptoms had ceased. Only children in the primary dentition phase were included.

2.2. Anthropometric evaluation

Weight was measured with the child positioned with the feet together and shoulders erect on a calibrated digital scale (G-Tech Glass G4FB, Accumed Produtos Médico Hospitalares Ltda, Rio de Janeiro, Brazil) with a precision of 100 g (g). The children stood barefoot on the scale in their school uniforms and 200 g were subtracted from the total body mass due to the weight of the clothing. Height was measured using a portable stadiometer with a sliding vertical bar (WCS, Cardiomed, Curitiba, Brazil). The children were positioned with their backs to the stadiometer and the Frankfurt plane parallel to the floor. The sliding bar was positioned at the highest part of the top of the head (Brasil, 2004). BMI was calculated as weight (kg) divided by height (m) squared (kg/m^2) (World Health Organization, 2006). The values were plotted on a growth curve established by the World Health Organization (WHO) based on age and sex. Children with a BMI higher than the 96th percentile were considered obese, those between the 85th and 96th percentiles were considered overweight, those between the third and 85th percentile were considered to be within the ideal range and those with a BMI below the third percentile were considered underweight (World Health Organization, 2006). In the present study, children with overweight and obesity were included in a single group.

2.3. Socioeconomic form

A specific form addressing the child's sex and age as well as mother's schooling and monthly household income was sent to the parents/caregivers of the children to be filled out (Ramos-Jorge et al., 2015).

2.4. Clinical oral examination

Cavitated lesions were diagnosed using the criteria of the International Caries Detection and Assessment System (Pitts, 2004). The clinical examination was performed by a single dentist who had undergone a training exercise. After theoretical training, 15 children aged three to five years were examined and submitted to a second examination after one week. Inter-examiner (in relation to the gold standard) and intra-examiner agreement were determined using the Kappa statistic (K > 0.80). Following brushing of the teeth supervised by the dentist, the oral examinations were performed at the preschool with the aid of a head lamp (PETZL, Tikka XP, Crolles, France), mouth mirror (PRISMA, São Paulo, SP, Brazil), WHO probe (Golgran Ind. e Com. Ltda, São Paulo, SP, Brazil) and gauze to dry the teeth. During the examination, the child remained lying on a portable cot.

2.5. Evaluation of masticatory function

Masticatory function was determined based on masticatory performance (MP) and the swallowing threshold (ST). For such, the Optocal test food was used (Slagter, Bosman, & Van der Bilt, 1993), the components of which are condensation silicone (Optosil, Heraeuz Kulzer, Hanau, Germany) at a proportion of 58.3%, toothpaste (Colgate-Palmolive Ltda., São Paulo, Brazil) at a proportion of 7.5%, common dental plaster (Polidental, Cotia, Brazil) at a proportion of 10.2%, powdered alginate (Jeltrate Plus, Dentisply, Milford, USA) at a proportion of 12.5%, solid petroleum jelly at a proportion of 11.5%, catalyzing paste (20.8 mg/g) and three drops of peppermint essence. The material was blended and inserted into molds to form cubes measuring 5.6 mm^3. The cubes were stored in an electric oven at 60 °C for 16 h to ensure complete polymerization. Portions of 17 cubes measuring approximately 3 cm^3 and weighing 3.2 g were separated and stored in plastic recipients until testing (de Morais Tureli et al., 2010).

2.5.1. Masticatory performance

MP was evaluated based on the median size of the shredded particles after a given number of chewing cycles. After a training exercise to familiarize each child with the taste and consistency of the material (de Morais Tureli et al., 2010), a trained examiner instructed the children to chew the 17 cubes. The examiner informed the children that they would be told when to expel the material. After 20 chewing cycles counted by the examiner, the material was expelled into a collector with a lid. The child's mouth was rinsed with filtered water for the removal of all particles, which were also expelled into the collector. Any particles that remained in the oral cavity were removed with pincers and placed in the collector. The time for each child to perform 20 chewing cycles was recorded with the aid of a stopwatch.

2.5.2. Swallowing threshold

After the evaluation of MP, an evaluation of the ST was performed with 17 cubes of Optocal. Each child was instructed to chew until feeling the desire to swallow, upon which time he/she was to stop chewing and signal to the examiner so that he/she could expel the material. The examiner visually quantified the number of chewing