Oral Health Survey among Adolescents Undergoing Obesity Treatment

Gabriela Ferreira (GABRIELA_LACET@HOTMAIL.COM)
Universidade Do Porto https://orcid.org/0000-0001-8595-4978
Sângela Maria da Silva Pereira
Universidade Federal do Maranhao
Inês Ferreira
Universidade do Porto Faculdade de Medicina Dentaria
Henedina Antunes
Universidade do Minho Escola de Medicina
Irene Pina Vaz
Universidade do Porto Faculdade de Medicina Dentaria

Research article

Keywords: Pediatric Obesity, Dental Caries, Periodontal Disease, Pediatric nutrition

Posted Date: June 1st, 2020

DOI: https://doi.org/10.21203/rs.3.rs-28435/v1

Abstract

Background: Besides the bad nutritional habits, it has been studied that systemic changes induced by obesity may have repercussions on oral environment. This study evaluated the oral health status of obese adolescents undergoing follow-up at a tertiary hospital in Portugal.

Methods: Ninety subjects were classified as obese or severe obese according to the World Health Organization references. Caries experience and periodontal condition were determined by the DMFT index (decayed, missing and filled teeth) and Community Periodontal Index (CPI), respectively. The data for the ages 12 and 15 were compared using Wilcoxon test for one sample to the National Prevalence Study of Oral Diseases (NPSOD), performed in Portugal and published in 2008 and 2015.

Results: A mean BMI of 29.4 (± 4.1) was observed, and 64.4% (n = 58) of the subjects were diagnosed with severe obesity. The DMFT of obese adolescents was similar to that of the Portuguese population. At 12 years of age, obese individuals were found to have fewer missing teeth (p = 0.001) and more sealed teeth than those of the same age in Portugal in 2008 (p = 0.012) and 2015 (p = 0.001). At age 15, obese adolescents had fewer decayed teeth (p = 0.017) than individuals of the same age in Portugal (NPSOD, 2008).

Conclusions: Obese children and adolescents presented an oral health status similar to that of the Portuguese population at the same age according to the majority of the criteria. These findings can be explained by the health care provided with repeated recommendations for oral hygiene.

Background

The prevalence of obesity increased dramatically over the last two or three decades in industrialized countries [1]. Obesity has not only esthetic implications, but it is considered to be a serious chronic disease with multifactorial etiology [2], which has been frequently associated with other conditions, such as diabetes mellitus [3], asthma [4], hypertension [5], dental caries [6, 7] and periodontal disease [2, 8].

Obese children and adolescents have been commonly reported to have a poor oral health status, suggesting an association between periodontal disease, dental caries and obesity in different age groups [9, 10]. Dental caries is an oral disease affecting the population worldwide which has common etiological factors to obesity. Previously, a positive association was reported between the number of decayed, missing and filled teeth (DMFT) and excessive body weight [6, 7]. Furthermore, periodontal disease is a chronic oral inflammatory disease that has also been frequently associated with obesity. Changes in the levels of systemic inflammatory markers in obese individuals may explain such an association, as well as psychosocial factors that influence the oral hygiene habits of these individuals, which directly affect their periodontal health [2, 8].

In Portugal, the prevalence of overweight and obesity at the age of 13 was 13% and 22% among females and males, respectively. At the age of 15, the prevalence rates were as high as 15% in females and 19% in males [11]. According to the reports of the National Prevalence Study of Oral Diseases (NPSOD) carried out in Portugal, in 2008, the mean DMFT of individuals at the age of 12 and 15 were 1.48 and 3.04, respectively, as compared to 1.18 among 12-year-olds in 2015. Nevertheless, there are no documented studies in the literature evaluating the prevalence of dental caries and periodontal disease in relation to obesity in Portugal. Thus, this cross-sectional

study was carried out to evaluate the oral health status of obese adolescents treated in a Portuguese tertiary hospital.

Methods

This was a cross-sectional study with obese adolescents treated at the Pediatric Gastroenterology, Hepatology and Nutrition Unit of a tertiary hospital in northern Portugal. A total of 90 subjects aged 12 to 15 years were evaluated. Individuals with a delay in psychomotor development that impeded oral evaluation were excluded from the sample.

Information on oral hygiene habits, region of residence, parental education and dental history were collected through a questionnaire.

Anthropometric measurements

Both the World Health Organization (WHO) and the Center for Disease Control and Prevention (CDC) recommend the use of percentiles for obesity classification (Obese: BMI ≥ 95th percentile). The WHO also advocates the classification according to standard deviations (Obese: BMI > 2SD). A new criterion has been recommended for the classification of severe obesity, since this degree of obesity presents a higher risk of comorbidities and may reflect a different treatment plan for the patient. While there has been no consensus for this classification, in our study we used the 99th percentile as a cut-off point for classification of severe obesity in accordance with previous reports in the literature [12, 13].

The anthropometric data of the study participants were collected by experienced nurses, according to a standardized protocol. The weight was measured in kilograms in a digital weight scale (SECA model 763) and the height was measured in centimeters (SECA model 763). These measurements were used to calculate the BMI (kg/m^2).

The classification of obesity in percentiles was performed according to the World Health Organization (WHO) growth and nutrition references [14]. The BMI percentiles for age depends on graphs adjusted for sex and age for those aged 5 to 19 years. According to these charts, "obesity" and "severe obesity" were defined as 95th percentile ≤ BMI < 99th percentile, and BMI ≥ 99th percentile, respectively.

Determination of oral health status

The WHO recommends the DMFT index (number of decayed, missing and filled teeth) to evaluate caries activity and experience, which impacts the oral health condition of an individual. Nevertheless, it is worth noting that there are alternative ways of detecting and quantitating dental caries. For instance, the ICDAS II (International Caries Detection and Assessment System) criteria is a more complete classification than the DMFT as it considers early demineralization lesions of the dental enamel. Adversely, this method has a strong limitation of execution in a nonclinical environment, such as in the case of fieldwork. Therefore, since the examinations in our study were performed in a hospital setting and not in a dental office, and because of the ease of comparison of data with other studies, we used the DMFT index as a criterion for determining caries activity and experience.

An intra-oral examination was performed under artificial lighting by a single investigator previously trained and calibrated. The clinical examination measured the individuals' caries experience and activity through the DMFT index as well as their periodontal condition through the Community Periodontal Index (CPI) according to the WHO instructions for conducting epidemiological studies [15].

The examination was performed under field conditions. Each participant was seated on a high backrest chair; the examiner was positioned in front of the chair and used a plane mouth mirror and a metallic periodontal probe. The examiner first recorded the individual's DMFT. The lesions were recorded as present when a cavity was detected through manual inspection. The DMFT was dichotomized into a caries-free subgroup (DMFT = 0) and caries-experienced subgroup (DMFT ≥ 1). The presence of sealed teeth was also recorded during the clinical examination.

The CPI was assessed by examination of bleeding on probing, recorded with the CPI probe suggested for this examination. The probing was performed on six index teeth (16, 11, 26, 36, 31, 46) and recorded according to the codes: 0 (healthy) or 1 (bleeding). The CPI was categorized as healthy gingiva (CPI = 0) or as with at least one tooth with bleeding (CPI ≥ 1).

Lastly, an evaluation of the oral mucosa was performed to identify possible inflammatory, proliferative or fungal lesions in the oral cavity of the study participants.

Statistical analysis

The data were analyzed descriptively and inferentially using the SPSS 20.0 statistical software. Caries activity and/or caries experience and the presence of sealed teeth were compared using the Wilcoxon test for one sample against the results obtained in the NPSOD, which was carried out by the General Directorate of Health in Portugal and published in the years 2008 [16] and 2015 [17].

The 2015 NSPOD study used the ICDAS II for examination and presentation of the results. For the purpose of comparison with our findings with obese individuals, we used the category $D_{56}MF$, which is considered to be equivalent to the DMFT index.

Results

A total of 59 (65.6%) males and 31 females with a mean age of 13.4 (± 1.0) years were examined. The study participants' mean BMI was found to be 29.4 (± 4.1), and 64.4% (n = 58) of them were diagnosed with severe obesity. Most of the sample resided in urban areas (n = 59, 65.6%). With regard to parental schooling, 58.4% (n = 52) of the mothers had only elementary education. In the previous year, 71.1% (n = 64) of the children/adolescents had visited the dentist. The mean toothbrushing frequency was 1.5 (± 0.7) times daily and 85.6% (n = 77) of the sample reported not making use of dental floss. As to the treatment for obesity, 38 (42.7%) adolescents were being followed up for over 2 years.

With regard to caries experience, 57.8% (n = 52) of the total sample had DMFT ≥ 1, with a mean DMFT of 2.0 (± 2.4). Among the DMFT components, there was a higher prevalence of filled teeth, with an average of 1.3 (± 1.8) filled teeth per individual. The mean number of sealed teeth was 4.5 (± 4.4). As for periodontal health, the overall prevalence of bleeding on probing (CPI ≥ 1) was 71.1% (n = 64). The study participants had no oral mucosal lesions.

Previously, the NPSOD evaluated the variables DMFT index and sealed teeth in individuals within age groups comparable to those of the present study, that is, 12 and 15 years of age in the 2008 study report, and 12 years of age in the 2015 report. In our study, the sample size of obese participants was n = 18 at age 12, and n = 15 at age 15.

As shown in Table 1, there were no significant differences between the median DMFT in the obese group as compared to the 2008 NPSOD report for age 12 (p = 0.180) and 15 (p = 0.689), and 2015 NPSOD report for age 12 (0.180). At age 15, obese subjects had significantly fewer decayed teeth (p = 0.017) than individuals of the same age in Portugal according to the 2008 NPSOD study report. At 12 years of age, obese children had significantly fewer missing teeth (p = 0.001) and more sealed teeth than children of the same age in Portugal in 2008 (p = 0.012) and 2015 (p = 0.001).

Table 1
Median DMFT index (decayed, missing and filled teeth) and number of sealed teeth among obese adolescents as compared to the 2008 and 2015 NPSOD reports on Portuguese adolescents aged 12 and 15 years.

	2008 NPSOD						**2015 NPSOD**		
Variable	**12 years old**			**15 years old**			**12 years old**		
	NPSOD	**Obese individuals (n = 18)**	**p-value**	**NPSOD**	**Obese individuals (n = 15)**	**p-value**	**NPSOD**	**Obese individuals (n = 18)**	**p-value**
DMFT	1.48	1.00	0.180	3.04	3.00	0.689	1.18	1.00	0.180
Decayed Teeth	0.75	0.00	0.122	1.56	0.00	0.017	0.27	0.00	0.369
Missing Teeth	0.08	0.00	0.001	0.34	0.00	0.057	0.06	0.00	0.001
Filled Teeth	0.65	1.00	0.441	1.14	2.00	0.097	0.74	1.00	0.441
Sealed Teeth*	4.2	5.00	0.012	4.4	5.00	0.196	3.61	5.00	0.001
Wilcoxon test									

Table 2

Percentage of healthy subjects, presence of fissure sealant and oral hygiene habits among obese individuals (from our study) and a Portuguese population aged 12 and 15 years included in the 2008 and 2015 NPSOD reports.

Variable	12 years old		15 years old		
	2008 NPSOD	2015 NPSOD	Obese individuals (n = 18)	2008 NPSOD	Obese individuals (n = 15)
Caries free (DMFT = 0)	44.0%	53.0%	38.9%	28.0%	26.7%
Healthy gingiva (CPI = 0)	29.0%	51.7%	33.3%	22.0%	21.4%
Fissure sealant	38.0%	55.2%	72.2%	20.0%	86.7%
Tooth brushing 2x or more per day	67.0%	69.6%	50.0%	69.0%	80.0%
Dental floss user	9.7%	5.9%	11.1%	7.8%	33.3%

Table 2 shows the percent number of caries-free individuals (DMFT = 0) and healthy gingiva (CPI = 0), as well as the presence of sealants, the use of dental floss and the number of individuals who reported brushing their teeth twice or more on a daily basis.

Discussion

In our observational study, we investigated the oral health condition and obesity in children and adolescents aged 12 to 15 years. Overall, there was a high frequency of gingival bleeding on probing and caries experience among obese individuals, which is in agreement with the results presented in the reports of the 2008 NSPOD and in its last update published in 2015.

No significant differences in DMFT for any of the age groups were observed when compared to the 2008 NSPOD study. However, fewer teeth were lost ($p = 0.001$) at age 12 in obese adolescents, which was counterbalanced by a higher number of sealed teeth ($p = 0.012$) detected in this population. The same occurred in relation to the 2015 study report. Furthermore, at age 15, obese adolescents had fewer decayed teeth ($p = 0.017$), but no analytical comparison to the 2015 NSPOD data was possible as this nation-wide study did not encompass 15-year-old subjects.

The association between obesity and dental caries has been previously studied, considering that both conditions have common etiological factors such as excessive sugar intake. Recent studies have suggested that obese children are at increased risk for dental caries and have identified an association between the two conditions in childhood [6, 7].

The present study found no differences in the dental caries experience between the obese population and the Portuguese population of the same age group, suggesting that the increase in BMI is not necessarily associated with an increase in the prevalence of caries, which is in agreement with previous studies [18–20]. Alves, Susin [18] carried out a cross-sectional study and found no association between obesity and caries in a sample of 12-year-old

children from public and private schools in southern Brazil. In addition, the largest cross-sectional study [19] with Kuwaiti children revealed no significant association between caries and obesity, but rather an inverse relationship between obesity and dental caries. Likewise, no significant association between caries and weight gain was observed among children and adolescents in the United States based on the NHANES IV (National Health and Nutrition Examination Survey) data [20].

The studies reporting a decrease in caries experience and increased obesity have concluded that the relationship between overweight and dental caries in children is much more complex and cannot be explained solely by carbohydrate intake [18–20]. These results corroborate our findings, where obese adolescents aged 15 years presented significantly ($p = 0.017$) fewer decayed teeth than those of the same age in the 2008 NSPOD study [16]. Of note, the obese participants in our study underwent treatment for obesity as well as medical and nutritional follow-up, which may explain the fact that they presented fewer decayed teeth.

Here, the obese children and adolescents had a higher percentage of sealed teeth as compared to the data published in the reports of the national studies for both 12 and 15 age groups. This can be considered an indicator of improvement of the oral health services provided to the Portuguese population, implied in greater coverage of the service and greater investment in the prevention of oral diseases, namely through the National Program for the Promotion of Oral Health (NPPOH), established since 2005.

The relationship between obesity and oral health in childhood remains inconclusive. While in adults there is a clear association between obesity and periodontal disease, in children and adolescents no consensus has been reached [21, 22]. This association is due to the fact that periodontal disease is an inflammatory condition dependent on host, pathogens and environmental factors, and also due to the possible influence of the oral condition on the serum levels of inflammatory mediators, since obese subjects present alterations in the levels of systemic inflammatory markers. Moreover, the literature points out that a systemic inflammatory condition may interfere with the oral inflammatory condition [23]. Recently, Modeer, Blomberg [24] in a cross-sectional study with obese and normal-weight adolescents observed that the former had a higher incidence of bleeding on probing and higher levels of inflammatory markers measured in the gingival crevicular fluid than normal weight subjects.

Our results indicated that obese children had a high prevalence of bleeding on probing (71.1%), but because there was no control group with normal-weight children submitted to the same conditions, the analysis of the relationship between obesity and periodontal status was not practicable. The high frequency of bleeding may also be related to the low frequency of daily brushing and/or to the absence of other oral hygiene care products, such dental floss, by most individuals in the sample.

Reeves, Rees [25] investigated the correlation between obesity and periodontal disease in a group of American adolescents. The authors concluded that the onset of periodontitis may be associated with an increased waist circumference and weight gain in individuals aged 17 to 21 years; in contrast, the association was no longer seen between the age 13 and 16. Considering these findings, further studies are needed to clarify the association, if any, between obesity and periodontal disease in children.

The results of our study contribute to reinforce the fact that medical or nutritional follow-up of obese patients is also an opportunity for recommendations regarding hygiene and oral care [26]. While there seems to be no direct causal relationship between obesity and poor oral condition, it is known that oral diseases have etiological factors similar to those of obesity and that other aspects can be considered as conditioning factors, such as low self-

esteem. For a detailed investigation of the relationship between these morbidities, further studies should be carried out with a sample of obese patients who are not under medical supervision and with a control group of normal-weight children. It would also be beneficial to investigate a sample of adults who have a long history of obesity, since childhood obesity is considered a risk factor for the disease development in adulthood.

Conclusions

Obese adolescents monitored in a tertiary hospital in Portugal had a satisfactory average of sealed teeth, which can be used as an indicator of good access to dental care. When compared to non-obese adolescents from Portugal (secondary data), they did not present an inferior oral health condition as expected, which leads us to conclude that there is no causal relationship between obesity and the oral health condition and that preventive practices are effective in preventing poor oral condition in high-risk groups.

Abbreviations

DMFT index
decayed, missing and filled teeth index
CPI
Community Periodontal Index
NPSOD
National Prevalence Study of Oral Diseases
WHO
World Health Organization
CDC
Center for Disease Control and Prevention
BMI
Body Mass Index
ICDAS
International Caries Detection and Assessment System
NHANES
National Health and Nutrition Examination Survey - USA
NPPOH
National Program for the Promotion of Oral Health - Portugal

Declarations

Ethics approval and consent to participate

All procedures performed in this study were in accordance with the ethical standards of the Ethics Committee for Health from Hospital de Braga, Braga, Portugal (Reference number: CESHB 055/2016) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

All risks to individuals were minimized, either by training and qualification of the investigator responsible for the clinical examination, by the use of appropriate material as well as the respect of the confidentiality of the data collected. Each participant gave a voluntary and informed consent after explanation of the objectives of the study,

data collection method, risks and benefits. Informed consent was signed by the subjects and their parents or legal guardians.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

Funding

No funding

Authors' contributions

Conceived and designed the study: GLSF, HA, IPV. Performed the clinical examination: GLSF. Participated in the data collection: GLSF, SMSP, IF. Analyzed the data: GLSF, SMSP, IPV. Wrote the manuscript: GLSF, SMSP, IF, HA, IPV.

Acknowledgements

The authors thank the team of the Pediatric Gastroenterology, Hepatology and Nutrition Unit of the Hospital de Braga for their collaboration with the study, especially Dr. Filipa Neiva.

References

1. Wang Y, Lobstein T. Worldwide trends in childhood overweight and obesity. Int J Pediatr Obes. 2006;1:11–25.
2. Sfasciotti GL, Marini R, Pacifici A, Ierardo G, Pacifici L, Polimeni A. Childhood overweight-obesity and periodontal diseases: is there a real correlation? Ann Stomatol (Roma). 2016;7:65–72.
3. o Hartaigh B, Jiang CQ, Bosch JA, Zhang WS, Cheng KK, Lam TH, et al. Independent and combined associations of abdominal obesity and seated resting heart rate with type 2 diabetes among older Chinese: the Guangzhou Biobank Cohort Study. Diabetes Metab Res Rev. 2011;27:298–306.
4. Jensen ME, Wood LG, Gibson PG. Obesity and childhood asthma - mechanisms and manifestations. Curr Opin Allergy Clin Immunol. 2012;12:186–92.
5. Rodilla E, Costa JA, Martin J, González C, Pascual JM, Redon J. Impact of abdominal obesity and ambulatory blood pressure in the diagnosis of left ventricular hypertrophy in never treated hypertensives. Med Clin. 2014;142:235–42.
6. Fadel HT, Pliaki A, Gronowitz E, Mårild S, Ramberg P, Dahlèn G, et al. Clinical and biological indicators of dental caries and periodontal disease in adolescents with or without obesity. Clin Oral Investig. 2014;18:359–68.
7. Gerdin EW, Angbratt M, Aronsson K, et al. Dental caries and body mass index by socio-economic status in Swedish children. Community Dent Oral Epidemiol. 2008;36:459–65.

8. Scorzetti L, Marcattili D, Pasini M, Mattei A, Marchetti E, Marzo G. Association between obesity and periodontal disease in children. Eur J Paediatr Dent. 2013;14:181–4.
9. Martínez FDG, Anaya MVM, Amador LRT. Relación entre obesidad y caries dental en niños. Rev Cubana Estomatol. 2014;51:93–106.
10. Moura-Grec PG, Marsicano JA, Carvalho CA, Sales-Peres SHC. Obesity and periodontitis: systematic review and meta-analysis. Cien Saude Colet. 2014;19:1763–72.
11. Currie C, Zanotti C, Morgan A, Currie D, de Looze M, Roberts C, et al. Social determinants of health and well-being among young people: Health Behaviour in School-Aged Children (HBSC) study: international report from the 2009/2010 survey. Copenhagen: WHO Regional Office for Europe; 2012.
12. Valerio G, Maffeis C, Balsamo A, Del Giudice EM, Brufani C, Grugni G, et al. Severe obesity and cardiometabolic risk in children: comparison from two international classification systems. PloS one. 2013;8:e83793.
13. Skelton JA, Cook SR, Auinger P, Klein JD, Barlow SE. Prevalence and trends of severe obesity among US children and adolescents. Acad Pediatr. 2009;9:322–9.
14. WHO. BMI-for-age (5–19 years) 2007 [Available from: http://www.who.int/growthref/who2007_bmi_for_age/en/index.html.
15. WHO. Oral health surveys: basic methods: World Health Organization; 2013.
16. Amann GPV, Cádima CF. Estudo Nacional de Prevalência das Doenças Orais. Lisboa: Direcção-Geral da Saúde; 2008.
17. Calado R, Ferreira CS, Nogueira P, Melo P. III Estudo Nacional de Prevalência das Doenças Orais. Lisboa: Direcção-Geral da Saúde; 2015.
18. Alves LS, Susin C, Dame-Teixeira N, Maltz M. Overweight and obesity are not associated with dental caries among 12-year-old South Brazilian schoolchildren. Community Dent Oral Epidemiol. 2013;41:224–31.
19. Goodson JM, Tavares M, Wang X, Niederman R, Cugini M, Hasturk H, et al. Obesity and dental decay: inference on the role of dietary sugar. PloS one. 2013;8:e74461.
20. Kopycka-Kedzierawski DT, Auinger P, Billings RJ, Weitzman M. Caries status and overweight in 2- to 18-year-old US children: findings from national surveys. Community Dent Oral Epidemiol. 2008;36(2):157–67.
21. Saito T, Shimazaki Y, Sakamoto M. Obesity and periodontitis. N Engl J Med. 1998;339:482–3.
22. Shimazaki Y, Egami Y, Matsubara T, Koike G, Akifusa S, Jingu S, et al. Relationship between obesity and physical fitness and periodontitis. J Periodontol. 2010;81:1124–31.
23. Amar S, Leeman S. Periodontal innate immune mechanisms relevant to obesity. Mol Oral Microbiol. 2013;28:331–41.
24. Modeer T, Blomberg C, Wondimu B, Lindberg TY, Marcus C. Association between obesity and periodontal risk indicators in adolescents. Int J Pediatr Obes. 2011;6:e264-70.
25. Reeves AF, Rees JM, Schiff M, Hujoel P. Total body weight and waist circumference associated with chronic periodontitis among adolescents in the United States. Arch Pediatr Adolesc Med. 2006;160:894–9.
26. Hadjipanayis A, Grossman Z, Del Torso S, Michailidou K, Van Esso D, Cauwels R. Oral health training, knowledge, attitudes and practices of primary care paediatricians: a European survey. Eur J Pediatr. 2018. doi:10.1007/s00431-018-3108-z.