

ASSESSMENT OF THE ASSOCIATION BETWEEN OVERWEIGHT/OBESITY AND TRAUMATIC DENTAL INJURY AMONG BRAZILIAN SCHOOLCHILDREN

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ABSTRACT

The aim of this study was to evaluate the association between overweight/obesity and the occurrence of traumatic dental injury among schoolchildren aged 7 to 14 years. A cross-sectional study was carried out involving 590 students at public schools in the city of Campina Grande, Brazil. The classification proposed by O'Brien (1994) was used for the diagnosis of traumatic dental injury. Overweight/obesity was determined based on the body mass index. Clinical examinations were performed by two examiners who had undergone a calibration exercise (Kappa statistics of 0.87 and 0.90 for intra-examiner and inter-examiner, respectively). Data analysis involved the chi-square test and Fisher's exact test with a 5% level of significance. Traumatic dental injury was less prevalent among the

schoolchildren with overweight/obesity than those without this condition (8.7% and 13.3%, respectively). When the sample was stratified by gender and age, traumatic dental injury was also more prevalent among schoolchildren without overweight/obesity. When the sample was stratified based on ethnicity, prevalence rates were similar between those with and without overweight/obesity. In the overall sample, no significant association was found between overweight/obesity and traumatic dental injury ($p = 0.253$). Overweight/obesity among schoolchildren aged 7 to 14 years was not associated with traumatic dental injury in this study. The analysis of physical activity may be important to gain a better understanding of this finding.

Keywords: Tooth Injuries; Dentition, permanent; Obesity.

ASSOCIAÇÃO ENTRE SOBREPESO/OBESIDADE E TRAUMA DENTÁRIO EM ESCOLARES BRASILEIROS

RESUMO

O objetivo do presente estudo foi avaliar a associação entre o sobrepeso/obesidade e a ocorrência do trauma dentário entre escolares de 7 a 14 anos de idade. Caracterizou-se como um estudo transversal realizado com 590 escolares de escolas públicas de Campina Grande, Brasil. Utilizou-se como critério de diagnóstico para traumatismo dentário a classificação proposta por O'Brien (1994) e para sobrepeso/obesidade o índice IMC. Os exames clínicos foram feitos por dois examinadores previamente calibrados (Kappa intra e inter de 0,87 e 0,90, respectivamente). Os testes estatísticos utilizados foram Qui-quadrado e exato de Fisher (significância de 5%). Os indivíduos sem sobrepeso/obesidade apresentaram mais lesões de trauma dentário que aqueles

com sobrepeso/obesidade (13,3% vs 8,7%). Quando estratificada a amostra em relação ao sexo, idade e grupo étnico, o traumatismo dentário foi mais prevalente entre crianças/adolescentes sem sobrepeso/obesidade, com exceção do grupo étnico, que apresentaram prevalências similares. No grupo total não foi observada associação entre sobrepeso/obesidade e trauma dentário ($p=0,253$). A presença de sobrepeso/obesidade em escolares de 7 a 14 anos não foi associada ao traumatismo dentário. A análise da atividade física pode ser um fator importante para melhor elucidar a temática.

Palavras-chaves: Traumatismos Dentários; Dentição Permanente; Obesidade.

INTRODUCTION

Traumatic dental injury is considered a public health problem^{1,2} and one of the main reasons for urgent dental care. It can also have a negative impact on quality of life³⁻⁶. The literature reports high prevalence rates of traumatic dental injury among schoolchildren (Table 1, with references.^{1,7-20}). Studies indicate that accentuated overjet, inadequate lip seal and overweight/obesity are predisposing factors to

this condition. However, divergent results are found regarding the association with overweight/obesity²⁰⁻²⁴ and no in-depth analysis has yet been carried out on this subject.

The prevalence of childhood obesity has been on the rise in both Brazil and around the world in recent decades, with rates ranging from 11.4% to 28.7%^{21,25-29}. This increased prevalence has motivated a number of studies in the field of dentistry.

Table 1: Prevalence studies on traumatic dental injury in the literature.

| Authors/Year | Location | Age group | Sample | Prevalence (%) |
|--|-------------------------|-----------|--------|----------------|
| Al-Majed, Murray, Maguire (2001) ⁷ | Riad (Saudi Arabia) | 12-14 | 862 | 34.0 |
| Alonge, Naredran, Williamson (2001) ⁸ | Harris County (USA) | 12 | 1039 | 2.4 |
| Marcenes, Murray (2001) ⁹ | London (United Kingdom) | 14 | 2242 | 23.7 |
| Marcenes, Zobot, Traebert (2001) ¹⁰ | Blumenau (Brazil) | 12 | 652 | 58.6 |
| Tapias et al. (2003) ¹¹ | Mostoles (Spain) | 10 | 470 | 17.4 |
| Traebert et al. (2004) ¹ | Biguaçu (Brazil) | 11 | 724 | 10.4 |
| Soriano, Caldas Jr, Góes (2004) ¹² | Recife (Brazil) | 12 | 116 | 23.3 |
| Fakhruddin et al. (2008) ¹³ | Ontario (Canada) | 12-14 | 2422 | 11.4 |
| Pedroni, Barcellos, Miotto (2009) ¹⁴ | Vitória (Brazil) | 7-15 | 383 | 31.8 |
| Naidoo, Sheiham, Tsakos (2009) ¹⁵ | South Africa | 11-13 | 1665 | 6.4 |
| Cavalcanti et al. (2009) ¹⁶ | Campina Grande (Brazil) | 7-12 | 448 | 21.0 |
| Navabazam, Farahani (2010) ¹⁷ | Yazd (Iran) | 9-14 | 1440 | 27.5 |
| Díaz et al. (2010) ¹⁸ | Temuco (Chile) | 1-15 | 359 | 37.9 |
| Silveira, Bona, Arruda (2010) ¹⁹ | Blumenau (Brazil) | 12 | 145 | 29.7 |
| Damé-Teixeira et al. (2013) ²⁰ | Porto Alegre (Brazil) | 12 | 1528 | 34.7 |

The aim of this study was to investigate a possible association between overweight/obesity and the occurrence of traumatic dental injury among schoolchildren aged 7 to 14 years.

METHODS

Sample characteristics

A cross-sectional study was carried out involving male and female school children aged 7 to 14 years at public schools in the city of Campina Grande, Brazil. The participants were selected from a population of 15,946 schoolchildren in the same age group.

Two-stage sampling was performed to ensure representativeness: schools were first randomly selected from each administrative district of the city and schoolchildren were then randomly selected from each school. The sample size was calculated based on a 21.0% prevalence rate of traumatic dental injury, a 5% margin of error and a 95% confidence interval. A correction factor of 2.0 was applied to compensate for the design effect, leading to a minimum sample of 502 schoolchildren, to which 20% was added to compensate for possible losses. Thus, the sample size was determined to be 602 schoolchildren.

Eligibility criteria

Inclusion criteria were agreement to undergo the clinical examination and a statement of informed consent

signed by a parent or guardian. Exclusion criteria were deviations from normality, missing teeth due to dental caries, extensive carious lesions on the upper central incisors and the use of an orthodontic appliance.

Pilot study

A pilot study was conducted to test the methodology. The children in the pilot study ($n = 41$) were not included in the main sample. The results revealed no misunderstandings regarding the questionnaire or need for changes to the method.

Training and calibration exercise

The theoretical phase involved a discussion of the diagnostic criteria for traumatic dental injury and an analysis of photographs. A specialist in this field served as the gold standard in the theoretical reference and instructed two researchers on how to perform the examination. The clinical phase was carried out at a randomly selected school that was not part of the main sample. Each researcher examined 50 schoolchildren for the determination of inter-examiner agreement. Thirty schoolchildren were examined a second time after a seven-day period for the determination of intra-examiner agreement. Kappa coefficients were 0.87 and 0.90 for intra-examiner and inter-examiner agreement, respectively, demonstrating that the examiners were capable of conducting the epidemiological study.

Data acquisition

Examinations were performed at school during normal classroom hours by the two examiners who had undergone the training and calibration exercise. The criteria proposed in the Children's Dental Health Survey of the United Kingdom³⁰ were used for the diagnosis of traumatic dental injury. Both natural and artificial (classroom lighting) light was used during the examinations. The teeth were first cleaned and dried with gauze. A N° 5 mouth mirror (PRISMA®, São Paulo, SP, Brazil) was used for the examination. The examiners used individual protection equipment against cross-infection and all materials had been sterilized.

Body mass index (BMI) was calculated by weight in kilograms divided by the square of height in meters (Kg/m²). The determination of overweight/obesity was based on the criteria established by the World Health Organization (2007) for child and adolescent growth and calculated using the AnthroPlus program³¹. Individuals with a BMI equal to or greater than the 85th percentile were classified with overweight/obesity. Individuals with a BMI greater than the 15th percentile and less than the 85th percentile were classified without overweight/obesity.

Statistical analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS for Windows, ver-

sion 18.0, SPSS Inc, Chicago, IL, USA). The chi-square test and Fisher's exact test were employed to test the association between overweight/obesity and traumatic dental injury. The level of significance was set at 5% ($p < 0.05$).

Ethical considerations

This study received approval from the State University of Paraíba (Brazil) under process number 05700133000-08 and was carried out in compliance with Resolution 196/96 of the Brazilian National Board of Health and the 1975 Declaration of Helsinki.

RESULTS

This study involved 602 schoolchildren, seven of whom refused to participate and five of whom were excluded due to extensive caries on the anterior teeth (1.9% of the total sample). Among the 590 schoolchildren examined, 275 (46.6%) were male and 315 (53.4%) were female. The majority of participants were up to ten years of age (67.8%) and non-Caucasian (81.7%). The prevalence of traumatic dental injury in the permanent anterior teeth was 12.7% ($n = 74$) and the prevalence of overweight/obesity was 13.6% (Table 2).

Traumatic dental injury was less prevalent among the individuals with overweight/obesity than among those without this condition (8.7% vs. 13.3%). No significant association was found between overweight/obesity and traumatic dental injury ($p = 0.253$) (Table 3). When the sample was stratified based on gender among individuals with overweight/obesity, the prevalence of traumatic dental injury was greater among males than females (13.5% and 4.7%, respectively). However, the statistical tests revealed no association between traumatic dental injury and either gender or overweight/obesity in the sample studied (Table 3).

While traumatic dental injury among individuals with overweight/obesity was more prevalent in the 11-to-14-year-old age group than in those up to 10 years of age (14.3% and 5.8%, respectively), age was not significantly associated with traumatic dental injury in the sample. Moreover, no statistically significant difference was found between children with and without overweight/obesity when the sample was stratified based on ethnicity (Table 3).

Table 2: Characterization of the sample.

| Variable | n | % |
|--------------------------------|------------|--------------|
| Sex | | |
| Male | 275 | 46.6 |
| Female | 315 | 53.4 |
| Age group | | |
| Up to 10 years | 400 | 67.8 |
| 11 to 14 years | 190 | 32.2 |
| Ethnicity | | |
| Caucasian | 108 | 18.3 |
| Non-Caucasian | 482 | 81.7 |
| Traumatic dental injury | | |
| Present | 75 | 12.7 |
| Absent | 515 | 87.3 |
| Overweight/obesity | | |
| Present | 80 | 13.6 |
| Absent | 510 | 86.4 |
| TOTAL | 590 | 100.0 |

Table 3: Occurrence of traumatic dental injury according to weight classification and stratified by gender, age and ethnicity.

| | | Traumatic dental injury | | | | | | | |
|----------------|----------------------------|-------------------------|------|-----|------|-------|-------|-------------|---------------------|
| | | Yes | | No | | Total | | p-value | PR (95% CI) |
| Variable | Overweight/obesity | n | % | n | % | n | % | | |
| Male | With overweight/obesity | 5 | 13.5 | 32 | 86.5 | 37 | 100.0 | p * = 0.534 | 1.00 |
| | Without overweight/obesity | 42 | 17.6 | 196 | 82.4 | 238 | 100.0 | | |
| Female | With overweight/obesity | 2 | 4.7 | 41 | 95.3 | 43 | 100.0 | p † = 0.396 | 1.00 |
| | Without overweight/obesity | 26 | 9.6 | 246 | 90.4 | 272 | 100.0 | | |
| Up to 10 years | With overweight/obesity | 3 | 5.8 | 49 | 94.2 | 52 | 100.0 | p * = 0.602 | 1.00 |
| | Without overweight/obesity | 33 | 9.5 | 315 | 90.5 | 348 | 100.0 | | |
| 11 to 14 years | With overweight/obesity | 4 | 14.3 | 24 | 85.7 | 28 | 100.0 | p † = 0.376 | 1.00 |
| | Without overweight/obesity | 35 | 21.6 | 127 | 78.4 | 162 | 100.0 | | |
| Caucasian | With overweight/obesity | 1 | 7.1 | 13 | 92.9 | 14 | 100.0 | p * = 1.000 | 1.12 (0.14 to 8.62) |
| | Without overweight/obesity | 6 | 6.4 | 88 | 93.6 | 94 | 100.0 | | |
| Non-Caucasian | With overweight/obesity | 6 | 9.1 | 60 | 90.9 | 66 | 100.0 | p * = 0.208 | 1.00 |
| | Without overweight/obesity | 62 | 14.9 | 354 | 85.1 | 416 | 100.0 | | |
| Total group | With overweight/obesity | 07 | 8.7 | 73 | 91.3 | 80 | 100.0 | p * = 0.253 | 1.00 |
| | Without overweight/obesity | 68 | 13.3 | 442 | 86.7 | 510 | 100.0 | | |

*Pearson's chi-square test
†Fisher's exact test

DISCUSSION

Traumatic dental injury and childhood obesity have piqued the interest of the scientific community in recent years, as both conditions affect a significant portion of the population, have an impact on quality of life and involve high healthcare costs^{4,6,32,33}.

In this study, the prevalence of traumatic dental injury was 12.7% among schoolchildren aged 7 to 14 years. This is in agreement with findings described in both Brazilian^{1,6,34,35} and international^{5,11,36} studies, which report rates ranging from 10 to 18%. However, other studies report rates as high as 34.7%²⁰ and even 66.6%¹⁸. The divergence may be explained by cultural differences as well as differences in the diagnostic criteria, type of sample and age group analyzed^{34,37}.

The prevalence of overweight/obesity was 13.6%, which is similar to figures reported in studies carried out in Brazil (13.3 to 15.7%)²⁵⁻²⁷. Although this rate is lower than the national average (36.4%)³⁸, it is sixfold higher than the target rate of 2.3% established by the World Health Organization³⁹. Studies report a number of factors associated with the increase in the prevalence of overweight/obesity,

such as changes in child behavior in recent decades, especially with regard to dietary habits and a reduction in physical activity^{27,32}.

Excess weight can lead to alterations in the joints of the feet and their relationship to the ankle, which can affect postural control strategies and the alignment of other joints of the lower limbs and trunk. Over time, excessive shortening or lengthening may occur, which, along with the forward lean of the pelvis, lead to internal rotation of the hip and the emergence of valgus knees and fallen arches^{28,40}. Due to these mechanisms of postural adaptation, reports of falls (29.41%) and imbalance (67.64%) are frequent among obese schoolchildren aged 6 to 12 years²⁸.

Analyses addressing the influence of obesity on the occurrence of traumatic dental injury remain scarce and the findings are conflicting. A study carried out in 2006 assessed this association in preschoolers and found that children with overweight/obesity had a 2.5-fold greater chance of having traumatic dental injury than children within the ideal weight range⁴¹. Similar findings are reported in an investigation carried out in Italy with schoolchildren aged 6 to 11 years²¹ and a study conducted in Brazil involving 13-

year-olds²². According to the authors cited, obesity in children is a risk factor for traumatic dental injury because obese children are less agile than those who are within the ideal weight range, which may make them more prone to accidents^{21,22}. However, overweight/obesity did not prove to be a risk factor for the occurrence of traumatic dental injury among the schoolchildren analyzed in our study ($p = 0.253$), which is in agreement with findings described in other Brazilian studies as well as other papers published in the international literature^{11,20,23,34,37,42}.

When the sample is stratified by gender, age and ethnic background, traumatic dental injury was more prevalent among the schoolchildren without overweight/obesity, except those of Caucasian ethnicity, among whom prevalence rates were similar (7.1% vs. 6.4%). Previous studies have also found no association between gender and the occurrence of traumatic dental injury among individuals with overweight/obesity^{34,37}. With regard to age and ethnic background, a search of the literature revealed no study that stratified the sample based on these variables in the analysis of an association between traumatic dental injury and overweight/obesity. In our study, however, the occurrence of traumatic dental injury proved to be independent of overweight/obesity in the stratified analysis.

The divergent results in the literature on this subject suggest that other factors, such as physical activity, merit further investigation. Falls stemming

from physical activities are considered a predisposing factor for the occurrence of traumatic dental injury. As children/adolescents with overweight/obesity lead a sedentary lifestyle^{43,44}, they are consequently less prone to accidents of this nature in comparison to children/adolescents within the ideal weight range^{11,18,36,45,46}. Case-control studies and longitudinal investigations are needed to assess the influence of different degrees of physical activity on the occurrence of traumatic dental injury.

It is important to highlight the methodological differences among studies regarding the diagnosis of overweight/obesity. In this study, schoolchildren with a BMI equal to or greater than the 85th percentile were classified as overweight/obese, which is similar to the criterion used in a previous study¹¹. However, other studies either used different cutoff points^{21,23} or failed to report the cutoff point employed^{20,22,42}. Some studies applied a different classification system, such as that proposed by the National Center for Health Statistics^{34,37}. The different cutoff points may contribute to the contradictory findings reported in studies of this nature and underscore the need to analyze the data with caution. Moreover, all studies addressing this issue have had a cross-sectional design, which does not allow the determination of cause and effect. As a change in nutritional status from ideal weight to excess weight or vice versa is faster among schoolchildren than in other phases of life, prevalence bias is a factor to consider in these studies.

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