

## Impact of oral disease and disorders on Oral Health-Related Quality of Life of Brazilian football athletes: a cross-sectional study

Impacto das doenças e distúrbios bucais na Qualidade de Vida Relacionada à Saúde Bucal de atletas brasileiros de futebol americano: um estudo transversal

Impacto de las enfermedades y trastornos orales en la Calidad de Vida Relacionada con la Salud Bucal de los atletas de fútbol americano brasileños: un estudio transversal

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### **Abstract**

**Introduction:** The athletes who practice sports routinely are exposed to the onset of numerous diseases. **Objective:** To evaluate oral conditions and their impact on oral health-related quality of life (OHRQoL) in Brazilian football athletes using OHIP-14 questionnaire. **Methods:** In this cross-sectional study, after sample calculation, football athletes were recruited in Rio de Janeiro, Brazil. Clinical and non-clinical data were collected. Psychometrics properties from OHIP-14 were assessed and the student's T-test was used to evaluate the associations. **Results:** From 45 football athletes recruited, after applying the eligibility criteria, 34 athletes were included. The most frequent oral conditions observed were dental erosion (85.3%) and malocclusion (85.3%). OHIP-14 had satisfactory properties ( $\alpha$  of Cronbach = 0.80 and test-retest/ICC = 0.90). The mean of impact on OHRQoL was 2.79 ( $\pm$  3.98). There were association of OHIP-14 total score ( $p=0.01$ ) and the physical pain subscale ( $p<0.05$ ) for tooth sensitivity, psychological discomfort subscale for dental caries ( $p=0.01$ ), physical pain subscale ( $p=0.04$ ) and psychological disability ( $p=0.01$ ) for malocclusion. **Conclusions:** The most prevalent oral conditions in athletes were dental erosion and malocclusion. Dental caries, malocclusion and tooth sensitivity were most likely to impact OHRQoL. The OHIP-14 is a satisfactory instrument to detect impact on OHRQoL in Brazilian athletes.

**Keywords:** Oral health; Quality of life; Athletes.

### **Resumo**

**Introdução:** Os atletas que praticam esportes rotineiramente estão expostos ao aparecimento de inúmeras doenças. **Objetivo:** Avaliar as condições bucais e seu impacto na qualidade de vida relacionada à saúde bucal (QVRSB) em atletas brasileiros de futebol americano por meio do questionário OHIP-14. **Métodos:** Neste estudo transversal, após cálculo amostral, foram recrutados atletas de futebol americano no Rio de Janeiro, Brasil. Dados clínicos e não clínicos foram coletados. As propriedades psicométricas do OHIP-14 foram avaliadas e o teste T de Student foi usado para avaliar as associações. **Resultados:** Dos 45 atletas de futebol americano recrutados, após aplicação dos critérios de elegibilidade, foram incluídos 34 atletas. As condições bucais mais frequentes observadas foram erosão dentária (85,3%) e má oclusão (85,3%). O OHIP-14 apresentou propriedades satisfatórias ( $\alpha$  de Cronbach = 0,80 e teste-reteste/ICC = 0,90). A média de impacto na QVRSB foi de 2,79 ( $\pm$  3,98). Houve associação do escore total do OHIP-14 ( $p=0,01$ ) e da subescala dor física ( $p<0,05$ ) para sensibilidade dentária, subescala desconforto psicológico para

cárie ( $p=0,01$ ), subescala dor física ( $p=0,04$ ) e subescala psicológica incapacidade ( $p=0,01$ ) para má oclusão. Conclusões: As condições bucais mais prevalentes em atletas foram erosão dentária e má oclusão. Cárie, má oclusão e sensibilidade dentária foram os mais propensos a impactar a QVRSB. O OHIP-14 é um instrumento satisfatório para detectar impacto na QVRSB em atletas brasileiros.

**Palavras-chave:** Saúde bucal; Qualidade de vida; Atletas.

### Resumen

**Introducción:** Los deportistas que practican deporte de forma habitual están expuestos a la aparición de numerosas enfermedades. **Objetivo:** Evaluar las condiciones orales y su impacto en la calidad de vida relacionada con la salud bucal (OHRQoL) en atletas de fútbol brasileños utilizando el cuestionario OHIP-14. **Métodos:** En este estudio transversal, después del cálculo de la muestra, los atletas de fútbol fueron reclutados en Río de Janeiro, Brasil. Se recogieron datos clínicos y no clínicos. Se evaluaron las propiedades psicométricas de OHIP-14 y se utilizó la prueba T de Student para evaluar las asociaciones. **Resultados:** De 45 deportistas de fútbol reclutados, después de aplicar los criterios de elegibilidad, se incluyeron 34 deportistas. Las condiciones orales más frecuentes observadas fueron la erosión dental (85,3%) y la maloclusión (85,3%). OHIP-14 tuvo propiedades satisfactorias ( $\alpha$  de Cronbach = 0,80 y test-retest/ICC = 0,90). La media de impacto en OHRQoL fue de 2,79 ( $\pm$  3,98). Hubo asociación de la puntuación total del OHIP-14 ( $p=0,01$ ) y la subescala de dolor físico ( $p<0,05$ ) para la sensibilidad dental, la subescala de malestar psicológico para la caries dental ( $p=0,01$ ), la subescala de dolor físico ( $p=0,04$ ) y la subescala de dolor psicológico. incapacidad ( $p=0,01$ ) para maloclusión. **Conclusiones:** Las condiciones bucales más prevalentes en deportistas fueron la erosión dental y la maloclusión. La caries dental, la maloclusión y la sensibilidad dental tenían más probabilidades de afectar la OHRQoL. El OHIP-14 es un instrumento satisfactorio para detectar impacto en OHRQoL en atletas brasileños.

**Palabras clave:** Salud bucal; Calidad de vida; Atletas.

## 1. Introduction

Sports have an important position in society not only because of their popularity, but also because of their health benefits (Maffulli et al., 2011; O'Donovan et al., 2010). Physical injury is a common risk factor in sports participation and, it should be pointed out, as inevitable in athlete training and competition (Maffulli et al., 2011). The injuries adversely affect the athletes, especially the area of physical and social well-being (Moreira et al., 2014). The inability of an athlete to remain active in sports, especially in demanding sports, may be a greater risk factor to the reduction health-related quality of life (HRQoL) (Simon & Docherty, 2014). High performance standards are required for athletes, and they demand that individuals be completely healthy (D'ercole et al., 2016). The athlete's oral health is directly related to his or her well-being and physical performance (Needleman et al., 2013).

According to the World Health Organization (WHO), an ideal health assessment would include a measure of the person's physical health, a measure of physical, social, and psychological functioning and a measure of quality of life (The WHOQOL Group, 1998). To treat only signs and symptoms of the disease would not allow the individual to make a full recovery of health. So, in order to fully contemplate the WHO concept of health, it is extremely important to research and evaluate the use of socio-dental indicators (quality of life instruments) validated in the language and in the population to complement the information obtained by the clinical indicators (Antunes et al., 2018).

Among the most common oral disorders in athletes in the literature are bruxism (Gay-Escoda et al., 2011), dental caries (Bryant et al., 2011; Gay-Escoda et al., 2011; Needleman et al., 2013; Márquez-Hidalgo et al., 2020; Opazo-García et al., 2021), dental erosion (Needleman et al., 2013; Bryant et al., 2011; Frese et al., 2015), dental trauma (Gay-Escoda et al., 2011; Cohenca et al., 2007), malocclusion (Gay-Escoda et al., 2011) and, periodontal disease (Needleman et al., 2013; Gay-Escoda et al., 2011; Márquez-Hidalgo et al., 2020; Opazo-García et al., 2021). However, as far as we know, there are some reports in the literature those evaluated in Dutch/UK elite and professional athletes on how oral conditions can influence the Oral Health-Related Quality of Life (OHRQoL) of athletes using respectively Oral Health Impact Profile-14 (OHIP-14) and Oral Impacts on Daily Performance (OIDP) (Gallagher et al., 2018; Kragt et al., 2018). So, the objective of this study was to evaluate the oral conditions and their impact on OHRQoL in a group of Brazilian football athletes using OHIP-14. The

hypothesis is that the OHIP-14 will be effective in detecting the poor oral condition of Brazilian athletes associated with a negative influence on their quality of life.

## **2. Methodology**

### **Ethical aspects**

This research was approved by the Local Ethical Committee, Fluminense Federal University (protocol nº 2.175.625). Written informed consent was obtained from athletes and parents of underage athletes. After oral exam, when some necessities were detected, the athletes were referred to the clinics of a public university.

### **Type of study and sampling**

This cross-sectional study was conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) (Von Elm et al., 2008). The sample was recruited from a football team in Rio de Janeiro, Brazil. The primary variable considered for calculating sample size was dental caries, according to the systematic review by Ashley et al. (2015), which considered the most prevalent oral condition in athletes. So, considering 10% error, 95% confidence interval, 0.4% (design effect = 0.5) to compensate for a possible cluster effect and increased by 10% to compensate for any withdrawals, the minimum sample size was 30 subjects (Sullivan & Dean, 2003).

The subjects included in the sample were invited to participate in the study according to the following inclusion criteria: athletes over 14 years of age those were training at least six months in the team; those who had signed the informed consent; and those who were fluently in Brazilian Portuguese language. Confounding factors to detect the OHRQoL (athletes with special needs, syndromes, systemic disorders, orthodontic appliance users, who were in dental treatment; those who missed the clinical examination visit; and who have incompletely answered the questionnaires) were excluded.

### **Data collection**

#### *Sample characterization and OHRQoL assessment*

Data such age, sex, ethnicity (self-reported), economic information (economic classification in A, B, C, D, E in which the higher economic condition correspond to classification A and lower economic conditions correspond to classification E, according to Brazilian economic classification) (ABEP, 2015) were collected. For statistical analyses, the variables were dichotomized.

Initially, a pre-test study was conducted using the OHRQoL questionnaire evaluation. A convenience sample (athletes considered as exclusion, for example those during orthodontic treatment) was recruited (n=5). The test-retest reliability analysis requires that individual conditions remain stable between the two administrations of the questionnaire. So, a second questionnaire, two weeks later, was completed subsequent to asking athletes if their oral condition had no change since recruitment.

The assessment of the OHRQoL was performed through the validated Brazilian version of the Oral Health Impact Profile (OHIP-14) (Almeida et al., 2004) questionnaire in a face-to-face interview. One dental assistant, who was blind to the clinical oral examinations, carried out interviews. The interviewer was trained in the reading and intonation of each question and the answer options for the questionnaire. The OHIP-14 is constructed with 14 questions (overall) distributed in 7 domains (subscales) with 2 questions each: functional limitation, physical pain, psychological discomfort, physical limitation, psychological limitation, social limitation and disability. Response categories of OHIP-14 are coded on a five-point scale: 0=Never; 1=Almost never; 2=Sometimes; 3=Almost always; 4=Always. The final value of the OHIP-14 questionnaire is

obtained by summing the values of the 14 responses. The result for each individual may vary from 0 to 56, and the higher values will indicate poorer oral health and lower satisfaction index related to the individual's OHRQoL.

#### *Clinical data: Oral health evaluation*

Some data on dental history were obtained in the interview, using multiple choice questions. It was assessed tooth sensitivity, diet, toothbrushing, toothpaste use, intrinsic factors that could be related to dental erosion (e.g. vomiting, regurgitation, gastroesophageal problem, bulimia, anorexia, xerostomia, radiotherapy and hemodialysis), teeth grinding and dental tightening.

The clinical examination was performed in a dental clinic using a spatula, gauze, probe, mirror, disposable gloves, and illumination. A single pre-trained and calibrated pre-work examiner evaluated the following oral conditions: dental caries (DMFT index) (WHO, 2013); periodontal disease (Community periodontal index) (WHO, 2013); dental erosion (Basic Erosive Wear Examination) (Bartlett et al., 2008); dental trauma (Traumatic dental injury index) (WHO, 2013); malocclusion (DAI index) (Jenny e Cons, 1996); and bruxism (American Academy of Sleep Medicine) (AASM, 2005). For statistical analyses, all variables were dichotomized. The training exercise was performed using images of different clinical situations and the calibration was carried out with an oral examination of 20 athletes (from a previous study) on two separate occasions, with a 2-week interval between sessions. Intra- and inter-examiner reliability was assessed. Inter-examiner reliability ranged from 0.80 (95% CI 0.80–0.95) to 1.00 and intra-examiner reliability was Kappa =1.00.

### **Data analysis and management**

#### *Statistical analysis*

The data were tabulated in Excel and statistical analysis was performed using the Statistical Package for Social Sciences (version 16.0; SPSS Inc., Chicago, IL, USA) considering  $p < 0.05$ .

The psychometric properties of the socio-dental indicator were evaluated, since the original validation of the Brazilian version did not include athletes. So, internal consistency reliability was assessed by means of Cronbach's Alpha, and test-retest reliability by means of the intraclass correlation coefficient (ICC).

Relative frequencies were obtained from oral health and OHRQoL analysis describing, respectively, the prevalence of oral conditions and their impact on oral health.

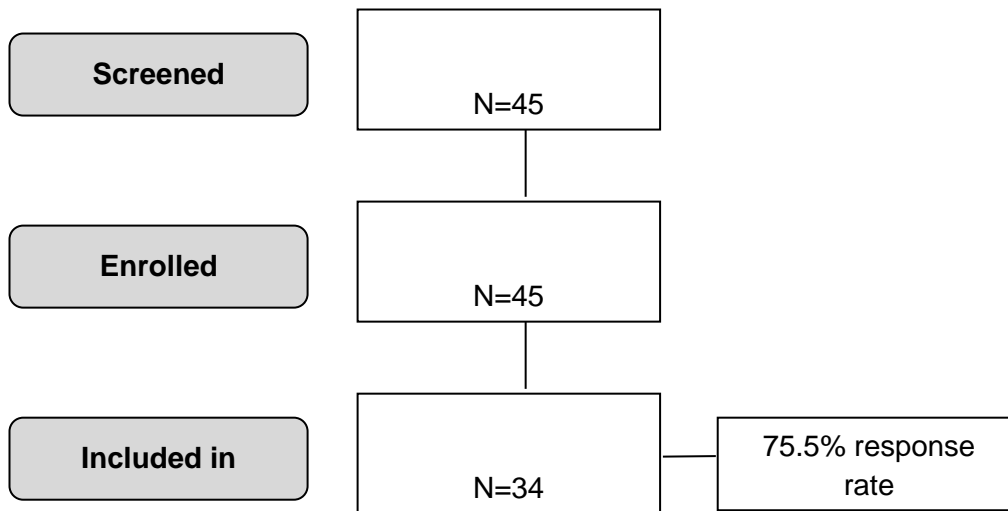
The OHIP-14 index scores were calculated using the additive method. Since an ordinal scale is used in these questionnaires, normality of the sample was initially assessed using the Kolmogorov-Smirnov test. The normality was confirmed so mean comparisons were obtained for items in overall and subscale scores using parametric tests (student's t test).

The relationship of OHIP-14 overall to subscales with variable associations (ethnicity, economic classification, educational level, dental sensitivity, bruxism, dental tightening, dental caries, periodontal disease, dental erosion, traumatic dental injury and malocclusion) was assessed using the student's t-test.

### **3. Results**

Initially, 45 individuals were originally contacted, but after applying the eligibility criteria, a total of 34 athletes were examined and interviewed (positive joined rate, 75,5%) (Figure 1). The main reason for exclusion were those athletes who missed the clinical examination visit (n=5) or those who used orthodontic appliances (n=6).

**Figure 1:** Strobe diagram depicting participant flow.



Source: Authors.

The psychometric properties of the socio-dental indicator (OHIP-14 instrument) in this sample were evaluated and presented a satisfactory reliability with 0.80 for Cronbach's alpha and 0.90 in test-retest.

The characterization of the athletes who were interviewed and their oral health is presented in Table 1. The most prevalent oral conditions were dental erosion (85.3%) and malocclusion (85.3%).

**Table 1:** Characterization and Dental Condition of Athletes (n=34).

<b>Sample Characterization</b>	
Mean age (SD)	22.35(4.72)
<b>Ethnicity (%)</b>	
Caucasian	30(88.2)
Afrodescendant	4(11.8)
<b>Socioeconomic classification (%)</b>	
A,B	13(38.2)
C,D,E	21(61.8)
<b>Educational level (%)</b>	
< 9 years of education	6(17.6)
≥ 9 years of education	28(82.4)
<b>Oral Health Status</b>	
<b>Dental sensitivity (%)</b>	
Yes	18(52.9)
No	16(47.1)
<b>Bruxism (%)</b>	
Yes	10(29.4)
No	24(70.6)
<b>Dental tightening (%)</b>	
Yes	16(47.1)
No	18(52.9)
<b>Dental caries (%)</b>	
Absent	8(23.5)
Present	26(76.5)
<b>Periodontal disease (%)</b>	
Absent	18(52.9)
Present	16(47.1)

<b>Dental erosion (%)</b>	
Yes	29(85.3)
No	5(14.7)
<b>Dental trauma (%)</b>	
Yes	14(41.2)
No	20(58.8)
<b>Malocclusion (%)</b>	
Yes	29(85.3)
No	5(14.7)

Footnote: Values were reported as mean and standard deviation (SD). Source: Authors.

The mean of impact on OHRQoL from total scale was 2.79 ( $\pm$  3.98). The subscale more affected by the oral status was physical pain 1.12 ( $\pm$  1.55) (Table 2). This subscale also presented the higher prevalence in each question (35.3% “had painful” and 29.4% “found it uncomfortable to eat any foods”) and presented the higher means of impact (0,53  $\pm$  0,82 for “had painful” and 0.59  $\pm$  1.08 for “found it uncomfortable to eat any foods”). The question “Have you been self-conscious because of your teeth or mouth?” also presented the higher prevalence (35.3%) and means (0.56  $\pm$  0.82) (Table 3).

**Table 2:** OHRQoL mean and standard deviation of athletes. Description of OHIP-14 in total scale and subscales.

<b>OHIP-14 (variations)</b>	<b>Mean (SD)</b>
Total scale (0-56)	2.79(3.98)
Subscales	
Functional limitation (0-8)	0.06(0.34)
Physical pain (0-8)	1.12(1.55)
Psychological discomfort (0-8)	0.76(1.30)
Physical disability (0-8)	0.15(0.43)
Psychological disability (0-8)	0.56(1.23)
Social disability (0-8)	0.09(0.38)
Handicap (0-8)	0.06(0.24)

Footnote: Values were reported as mean and standard deviation (SD). Source: Authors.

**Table 3:** Prevalence values and mean score by item of the OHIP-14 questionnaire (n=34)

Items	Dimensions	Prevalence (%)	Mean (SD)
<b>Functional limitation</b>			
1.	Have you had trouble pronouncing any words because of problems with your teeth or mouth?	1(2.9)	0.03(0.17)
2.	Have you felt that your sense of taste has worsened because of problems with your teeth or mouth?	1(2.9)	0.03(0.17)
<b>Physical pain</b>			
3.	Have you had painful aching in your mouth?	12(35.3)	0.53(0.82)
4.	Have you found it uncomfortable to eat any foods because of problems with your teeth or mouth?	10(29.4)	0.59(1.08)
<b>Psychological discomfort</b>			
5.	Have you been self-conscious because of your teeth or mouth?	12(35.3)	0.56(0.82)
6.	Have you felt tense because of problems with your teeth or mouth?	4(11.8)	0.20(0.73)
<b>Physical disability</b>			
7.	Has your diet been unsatisfactory because of problems with your teeth or mouth?	2(5.9)	0.09(0.38)
8.	Have you had to interrupt meals because of problems with your teeth or mouth?	2(5.9)	0.06(0.24)
<b>Psychological disability</b>			
9.	Have you found it difficult to relax because of problems with your teeth or mouth?	5(14.7)	0.23(0.65)
10.	Have you been a bit embarrassed because of problems with your teeth or mouth?	5(14.7)	0.32(0.88)
<b>Social disability</b>			
11.	Have you been a bit irritable with other people because of problems with your teeth or mouth?	1(2.9)	0.03(0.17)
12.	Have you had difficulty doing your usual jobs because of problems with your teeth or mouth?	2(5.9)	0.06(0.24)
<b>Handicap</b>			
13.	Have you felt that life in general was less satisfying because of problems with your teeth or mouth?	2(5.9)	0.06(0.24)
14.	Have you been totally unable to function because of problems with your teeth or mouth?	0(0)	0(0)

Footnote: SD = standard deviation. Source: Authors.

When evaluating the association of the OHIP-14 total score and its domains (mean  $\pm$  SD) with independent variables among athletes, there was a statistical relationship between the total score ( $p=0.01$ ) and the physical pain subscale ( $p<0.05$ ) for sensitivity, psychological discomfort subscale for caries ( $p=0.01$ ), physical pain subscale ( $p=0.04$ ) and psychological disability ( $p=0.01$ ) for malocclusion (Table 4).



**Table 4:** Association of the OHIP-14 total score and its domains (mean  $\pm$  SD) with independent variables among athletes (n=34).

Variables	Functional limitation	Physical pain	Psychological discomfort	Physical disability	Psychological disability	Social disability	Handicap	OHIP-14 Total Score
<b>Ethnicity</b>								
Caucasian	0.07(0.36)	1.17(1.58)	0.70(1.29)	1.17(0.46)	0.60(1.30)	0.03(0.18)	0.03(0.18)	2.77(3.96)
Afrodescendant	0	0.75(1.50)	1.25(1.50)	0	0.25(0.50)	0.50(1.00)	0.25(0.50)	3.00(4.76)
P value	0.72	0.62	0.44	0.48	0.60	0.42	0.45	0.91
<b>Economic classification</b>								
A,B	0	1.08(1.32)	0.23(0.44)	0.08(0.28)	0.23(0.60)	0	0	1.61(2.10)
C,D,E	0.09(0.44)	1.14(1.71)	1.09(1.55)	0.19(0.51)	0.76(1.48)	0.14(0.48)	0.09(0.30)	3.52(4.70)
P value	0.44	0.90	<b>0.02</b>	0.47	0.15	0.19	0.16	0.12
<b>Educational level</b>								
< 9 years of education	0.33(0.82)	2.83(2.40)	1.00(1.26)	0.33(0.82)	0.83(1.33)	1.17(0.41)	0	5.50(6.35)
$\geq$ 9 years of education	0	0.75(1.04)	0.71(1.33)	0.11(0.31)	0.50(1.23)	0.07(0.38)	0.07(0.26)	2.21(3.15)
P value	0.36	0.09	0.63	0.53	0.56	0.58	0.51	0.07
<b>Dental sensitivity</b>								
Yes	1.11(0.47)	1.83(1.79)	1.11(1.60)	2.22(0.55)	0.83(1.58)	1.17(0.51)	1.11(0.32)	4.39(4.88)
No	0	0.31(0.60)	0.37(0.72)	0.06(0.25)	0.25(0.58)	0	0	1.00(1.21)
P value	0.35	<0.05	0.09	0.28	0.16	0.19	0.16	<b>0.01</b>
<b>Bruxism</b>								
Yes	0	1.30(1.16)	1.20(1.93)	0.10(0.32)	0.50(1.27)	0.20(0.63)	0.10(0.32)	3.40(4.17)
No	0.83(0.41)	1.04(1.71)	0.58(0.93)	0.17(0.48)	0.58(1.25)	0.04(0.20)	0.04(0.20)	2.54(3.97)
P value	0.53	0.66	0.21	0.69	0.86	0.46	0.52	0.57
<b>Dental tightening</b>								
Yes	0	1.50(1.46)	1.00(1.63)	0.06(0.25)	0.56(1.09)	0.12(0.50)	0.06(0.25)	3.31(3.66)
No	0.11(0.47)	0.78(1.59)	0.55(0.92)	0.22(0.55)	0.55(1.38)	0.05(0.23)	0.05(0.23)	2.33(4.30)
P value	0.35	0.18	0.33	0.28	0.99	0.60	0.93	0.48
<b>Dental caries</b>								
Yes	0	0.87(1.12)	0.12(0.35)	0.12(0.35)	0.25(0.71)	0	0	1.37(1.50)
No	0.08(0.39)	1.19(1.67)	0.96(1.43)	0.15(0.46)	0.65(1.35)	0.11(0.43)	0.08(0.27)	3.23(4.41)
P value	0.59	0.62	<b>0.01</b>	0.87	0.43	0.46	0.43	0.25
<b>Periodontal disease</b>								
Yes	0	1.07(1.38)	0.57(0.94)	0.07(0.27)	0.28(0.61)	0.14(0.53)	0.07(0.27)	2.21(3.02)
No	0.11(0.47)	1.22(1.77)	1.00(1.57)	0.22(0.55)	0.83(1.58)	0.05(0.23)	0.05(0.23)	3.50(4.73)
P value	0.39	0.79	0.37	0.35	0.19	0.54	0.86	0.38
<b>Dental erosion</b>								
Yes	0.07(0.37)	1.00(1.53)	0.76(1.35)	0.17(0.47)	0.62(1.32)	0.10(0.41)	0.07(0.26)	2.79(4.26)
No	0	1.80(1.64)	0.80(1.09)	0	0.20(0.45)	0	0	2.80(1.92)
P value	0.68	0.29	0.95	0.42	0.49	0.58	0.56	0.10
<b>Dental trauma</b>								
Yes	0	0.78(0.97)	1.00(1.62)	0.07(0.27)	0.64(1.64)	0	0.07(0.27)	2.57(3.59)
No	0.10(0.45)	1.35(1.84)	0.60(1.05)	0.20(0.52)	0.50(0.89)	0.15(0.49)	0.05(0.22)	2.95(4.32)



P value	0.41	0.26	0.39	0.40	0.75	0.19	0.80	0.79
<b>Malocclusion</b>								
Yes	0.07(0.37)	1.24(1.64)	0.86(1.38)	0.17(0.47)	0.65(1.32)	0.10(0.41)	0.07(0.26)	3.17(4.19)
No	-	0.40(0.55)	0.20(0.45)	-	0	0	0	0.60(0.89)
P value	0.68	<b>0.04</b>	0.30	0.42	<b>0.01</b>	0.58	0.56	0.19

**Footnote:** For values reported as mean and standard deviation (SD), the Student's t test was used. **Source:** Authors.

#### 4. Discussion

The athletes who practice sports routinely are exposed to the onset of numerous diseases. Several factors, including levels of exposure and competition, may leave this incidence higher or lower (D'ercole et al., 2016). A literature review concluded that oral diseases can negatively impact sports performance, either directly or indirectly, and that well-treated oral health can contribute to physical development, improved systemic health, well-being, quality of life, and consequently a better yield (Carvalho et al., 2020). The symptoms of poor self-reported oral health by athletes (e.g. pain, reduced well-being and quality of life, and increased systemic inflammation) may have a direct relationship, and negatively affect athletic performance (Needleman et al., 2015). Oral diseases and associated negative performance impacts are common in UK elite and professional athletes. To the best of our knowledge, no study was conducted in Brazilian population showing how oral conditions may be related to OHRQoL of athletes, justifying this study.

The first hypothesis of this study was confirmed: a high frequency of poor oral condition was observed. The oral condition with more frequency was malocclusion, dental erosion and dental caries. In previous studies, the most common oral conditions found in Olympic athletes were dental caries, dental erosion and periodontal disease (Needleman et al., 2013).

In soccer players, the most common oral health problems were related to dental caries, gingivitis, malocclusion and dental trauma (Gay-Escoda et al., 2011). In a study with triathletes, the association of sport and dental erosion was demonstrated (Frese et al., 2015). A higher prevalence of dental caries in athletes who trained a lot of time during a week was also found (Frese et al., 2015). Studies have shown that dental caries was the most prevalent lesion followed by dental erosion (Bryant et al., 2011; Kragt et al., 2018; Needleman et al., 2013), contrary to the present study, where dental erosion was more frequent than dental caries. With the reduction of intraoral pH, dental erosion occurs, favoring the development of the lesions. The frequency of dental caries and dental erosion may be related to the athlete's diet, for example, a higher intake of fermentable carbohydrates and acid drinks, and a decreased protective role of saliva during training (Bryant et al., 2011).

Another hypothesis tested was the possible association between oral conditions and their impact on OHRQoL of football players. Despite the low OHRQoL impact means this hypothesis was confirmed, and demonstrated association to dental caries, malocclusion and tooth sensitivity.

Dimension with highest OHIP scores was physical pain. As there was a high prevalence of dental caries, the pain reported by the players may have been due to this. However, the high frequency of tooth sensitivity, depending on the degree of enamel wear, may be related to dental erosion (Mjör, 2009). With exposure of the dentin, the least resistant part of the tooth, the chance of dental caries appears (Mjör, 2009), especially if the athlete does not have good oral hygiene and consumes a diet rich in carbohydrates.

A factor that may affect the results of this study may be related to the socioeconomic classification of most players. The majority comprehend moderate to low economic classes (C, D, and E). It can be related to little or no oral health orientation, both in prevention and dental treatment itself. Therefore, the need for greater public awareness regarding the prevention and promotion of oral health in sport is emphasized.

Comparison of this study with other studies is difficult, since there are few studies evaluating the OHRQoL in athletes. Elite athletes and UK professionals had negative performance related impacts (Gallagher et al., 2018). In elite Dutch athletes, those who performed more than 20 hours of training per week have significantly lower OHRQoL than athletes who trained less than 20 hours per week (Kragt et al., 2018). In a systematic review, injuries and quality of life (QoL) were compared in the athletes and the conclusion was that most of the studies demonstrated a negative association between injuries and the domains of QoL, mainly in physical and social aspects (Moreira et al., 2014). This is the first study in Brazil that evaluated the association of oral conditions and the impact on OHRQoL in athletes. Within the sample size limitation, based on the proposed methodology, the results of this study are considered positive. Brazil is a country genuinely geared towards sports

and has many difficulties when it comes to oral health, which makes this assessment in other sports important. Thus, this study can be considered a considerable preliminary study showing the conformation of the validity of OHIP-14 in athletes, supporting other studies.

Generalizing these results, it can be concluded that poor oral conditions are frequent in athletes and are related to OHRQoL. So, it can leave consequences on sport activities, which can force athletes to take a long time off from training and competitions. This long time off might cause a huge financial loss for the athlete's team and it can affect his career, because with the lack of training comes the lack of physical conditioning. So, this study could potentially help clinicians understand the magnitude of the benefits associated with the treatment or prevention of such conditions in athletes.

## 5. Conclusion

The most prevalent oral conditions in athletes were dental erosion and malocclusion. Dental caries, malocclusion and tooth sensitivity were most likely to impact OHRQoL. The OHIP-14 is a satisfactory instrument to detect impact on OHRQoL in Brazilian athletes.

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## Conflict of Interest

None of the authors declare competing financial interests.

## Authors' Contributions

All authors were involved in the design and conduct of the study. TC and AJM performed the clinical consultations and the application of the questionnaires. LSA and PS recruited the athletes and applied the inclusion and exclusion criteria. LAAA analyzed and interpreted the data. All authors were involved in drafting and revising the manuscript for intellectual content, and all approved the final version of the manuscript. All authors have had full access to the data (including statistical reports and tables) and can take responsibility for the integrity of the data and the accuracy of the data analysis.

## References

- Almeida, A. M.; Loureiro, C. A.; & Araújo, V. E. (2004). Um estudo transcultural de valores de saúde bucal utilizando o instrumento OHIP-14 (Oral Health Impact Profile) na forma simplificada – Parte I: Adaptação cultural e lingüística. *UFES Rev Odontol*, 6, 6-15.
- American Academy of Sleep Medicine (AASM). (2005). International classification of sleep disorders: diagnostic and coding manual. Westchester, IL: American Academy of Sleep Medicine, pp 182-185.
- Antunes, L. A. A.; Ornellas, G. O.; Fraga, R. S.; & Antunes, L. S. (2018). Oral health outcomes: the association of clinical and socio-dental indicators to evaluate dental caries in preschool children. *Cien Saude Colet*, 23, 491-500.
- Ashley, P.; Di Iorio, A.; Cole, E.; Tanday, A.; & Needleman, I. (2015). Oral health of elite athletes and association with performance: a systematic review. *Br J Sports Med*, 49, 14-19.
- Associação Brasileira de Empresas de Pesquisa (ABEP) Novo Critério de Classificação Econômica Brasil. (2015). Available from: <http://www.abep.org>
- Bartlett, D.; Ganss, C.; & Lussi, A. (2008). Basic Erosive Wear Examination (BEWE): a new scoring system for scientific and clinical needs. *Clin Oral Investig*, 12Suppl1, S65-8.

- Bryant, S.; McLaughlin, K.; Morgaine, K.; & Drummond, B. (2011). Elite athletes and oral health. *Int J Sports Med*, 32, 720-724.
- Carvalho, P. E.; Lima Júnior, C. M. A.; Dantas, K. B. A.; Souza, D. M.; Oliveira, C. C. C.; & Dantas, E. H. M. (2020). Oral health in physical performance of athletes. *Research, Society and Development*, 9, e784998129.
- Cohenca, N.; Roges, R. A.; & Roges, R. (2007). The incidence and severity of dental trauma in intercollegiate athletes. *J Am Dent Assoc*, 138, 1121-1126.
- D'ercole, S.; Tieri, M.; Martinelli, D.; & Tripodi, D. (2016). The effect of swimming on oral health status: competitive versus non-competitive athletes. *J Appl Oral Sci*, 24, 107-113.
- Frese, C.; Frese, F.; Kuhlmann, S.; Saure, D.; Reljic, D.; & Staehle, H.J. et al. (2015). Effect of endurance training on dental erosion, caries, and saliva. *Scand J Med Sci Sports*, 25, e319-326.
- Gallagher, J.; Ashley, P.; Petrie, A.; & Needleman, I. (2018). Oral health and performance impacts in elite and professional athletes. *Community Dent Oral Epidemiol*, 46, 563-568.
- Gay-Escoda, C.; Vieira-Duarte-Pereira, D. M.; Ardèvol, J.; Pruna, R.; Fernandez, J.; & Valmaseda-Castellón, E. (2011). Study of the effect of oral health on physical condition of professional soccer players of the Football Club Barcelona. *Med Oral Patol Oral Cir Bucal*, 16, e436-439.
- Jenny, J. & Cons, N. C. (1996). Establishing malocclusion severity levels on the Dental Aesthetic Index (DAI) scale. *Aust Dent J*, 41, 43-46.
- Kragt, L.; Moen, M. H.; Van Den Hoogenband, C. R.; & Wolvius, E. B. (2018). Oral health among Dutch elite athletes prior to Rio 2016. *Phys Sportsmed*, 8, 1-7.
- Maffulli, N.; Longo, U. G.; Gougoulis, N.; Caine, D.; Denaro, V. (2011). Sport injuries: A review of outcomes. *Br Med Bull*, 97, 47-80.
- Márquez-Hidalgo, J.; Zamora-Campos, D.; Acurio-Benavente, P.; Kinoshita-Rivas, H.; López-Rodríguez, G.; Moreno-Sekula, K.; et al. (2020). Relationship between the quality of life and oral health in athletes at a Peruvian university. *Gen Dent*, 68, 73-77.
- Mjör, I.A. (2009). Dentin Permeability: The Basis for Understanding Pulp Reactions and Adhesive Technology. *Braz Dent J*, 20(1), 3-16.
- Moreira, N. B.; Vagetti, G. C.; de Oliveira, V.; & Campos, W. (2014). Association between injury and quality of life in athletes: A systematic review, 1980-2013. *Apunts Med Esport*, 49, 123-138.
- Needleman, I.; Ashley, P.; Fine, P.; Haddad, F.; Loosemore, M.; de Medici, A.; et al. (2015). Oral health and elite sport performance. *Br J Sports Med*, 49, 3-6.
- Needleman, I.; Ashley, P.; Petrie, A.; Fortune, F.; Turner, W.; Jones, J. et al. (2013). Oral health and impact on performance of athletes participating in the London 2012 Olympic Games: a cross-sectional study. *Br J Sports Med*, 47, 1054-1058.
- O'Donovan, G.; Blazeovich, A.J.; Boreham, C.; Cooper, A.R.; Crank, H.; Ekelund, U. et al. (2010). The ABC of Physical Activity for Health: A consensus statement from the British Association of Sport and Exercise Sciences. *J Sports Sci*, 28, 573-591.
- Opazo-García, C.; Moya-Salazar, J.; Chicoma-Flores, K.; & Contreras-Pulache, H. (2021). Oral health problems in high-performance athletes at 2019 Pan American Games in Lima: a descriptive study. *BDJ Open*, 16, 21.
- Simon, J. E.; & Docherty, C.L. (2014). Current health related quality of life is lower in former Division I collegiate athletes than in non-collegiate athletes. *Am J Sports Med*, 42, 423-429.
- Sullivan, K. M.; & Dean, A. G. Open Source Statistics for Public Health. Available from: <https://www.openepi.com/SampleSize/SSPropor.htm>
- The WHOQOL Group. (1998). The World Health Organization Quality of Life Assessment (WHOQoL): development and general psychometric properties. *Soc Sci Med*, 46, 1569-1585.
- Von Elm, E.; Altman, D. G.; Egger, M.; Pocock, S. J.; Gøtzsche, P. C.; & Vandenbroucke, J. P. (2008). for the STROBE Initiative.. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *J Clin Epidemiol*, 61, 344-349.
- World Health Organization (WHO). (2013). Oral Health Surveys: Basics Methods. Geneva: World Health Organization.