

Luciana Paula do Carmo FERRUZZI¹ , Letícia Resende DAVI² , Daniela Cristina Braga de LIMA¹ ,
Marcelo TAVARES³ , Alessandra Maia de CASTRO⁴ 

¹ Postgraduate Program in Dentistry, School of Dentistry, Federal University of Uberlândia, Uberlândia, Minas Gerais, Brazil.

² Department of Occlusion, Fixed Prosthesis, and Dental Materials, School of Dentistry, Federal University of Uberlândia, Uberlândia, Minas Gerais, Brazil.

³ Department of Statistics, School of Mathematics, Federal University of Uberlândia, Uberlândia, Minas Gerais, Brazil.

⁴ Department of Pediatric Dentistry, School of Dentistry, Federal University of Uberlândia, Uberlândia, Minas Gerais, Brazil.

Corresponding author:

Alessandra Maia de Castro Prado

Email: alessandramaiacp@ufu.br

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Abstract

Several studies have suggested that athletes with disabilities experience more difficulties having access to oral health care than the population in general. The aim of this study was to estimate the impact of socio-demographic/socio-economic factors, oral hygiene habits and clinical oral health conditions on the OHRQoL – Oral Health-Related Quality of Life (assessed with the Oral Health Impact Profile 14 – OHIP-14) on a sample of athletes with heterogeneous types of disabilities. Altogether, 105 athletes with disabilities were evaluated. Cross-sectional data was collected including interviews to obtain socio-demographic/socio-economic data, the OHIP-14 and clinical oral examinations parameters. The outcome variable was the OHIP-14 severity score. The explanatory variables were sex, age, monthly household income, level of schooling, frequency of toothbrushing and flossing, gingival bleeding, periodontal disease, trauma in incisors, prosthesis wearing and needs, number of sound teeth, DFMT (decayed, filled and missing teeth) index and its isolate components. Mann-Whitney, Kruskal-Wallis and Spearman tests used to compare OHIP-14 severity scores associated with the explanatory variables. The mean OHIP-14 severity score for the sample was 9.32 (SD 8.99) and the most affected domain was Physical Pain (mean 2.63; SD 1.97), followed by Psychological Discomfort (mean 1.81; SD 2.02). Significant differences in mean OHIP-14 scores were found for periodontal disease, need for complete dentures, number of sound teeth, DFMT index and its components. These results suggest that these clinical parameters can be related to impaired OHRQoL for this population.

Keywords: Athletes. Disabled Persons. Epidemiology. Oral Health. Quality of Life.

1. Introduction

Oral health is relevant for one's general health as it has influence on the quality of life and overall well-being. Nevertheless, even elite athletes may experience poor oral health which could lead to effects ranging from physical pain or functional limitations to psychological impacts (Needleman et al. 2015). When it comes to athletes with disabilities, the scenario seems to be worse since studies have suggested that they may have poorer general oral health status which is often attributed to the manifold difficulties they face to attend dental treatment (Zhou et al. 2017).

According to a recent systematic review and meta-analysis, dental caries is a significant global health problem in athletes with intellectual disabilities worldwide (Azeredo et al. 2019). Yet another review showed that athletes with intellectual disabilities were more frequently diagnosed with oral health problems such as missing teeth, gingivitis, filled teeth, sealants, and untreated decays (Al-Shamlan et al. 2019).

People with disabilities may find in adapted sports a means to foster physical rehabilitation, help them overcome psychological challenges and promote social engagement, thus helping in their psychosocial reintegration process. In addition to this, people with disabilities participating in adapted sports activities by itself is sufficient for presenting a positive perception of quality of life (Ciampolini et al. 2017).

Paralympic sports have gained an increasing number of practitioners which can be evidenced by the growing number of athletes participating in paralympic events (International Paralympic Committee 2018).

International data on the oral health status of athletes with heterogeneous types of disabilities is really scarce. Most of the literature in this field has been based on the Special Olympics sporting events which are aimed at athletes with intellectual disabilities (Marks et al. 2018). Although these studies offer a useful assessment of this population's oral health status, it is argued that the generalization of their results should be avoided, once their participants may have better access to dental care than the general population of people with disabilities (Marks et al. 2018).

Oral health criteria offer objective measures of oral disorders which are undeniably important to understand a population's health status. Yet, they fail to provide deeper insight into the impact of oral disease on everyday living and quality of life. A number of questionnaires focusing on individuals' self-perception have been developed to assess Oral Health-Related Quality of Life (OHRQoL) and the Oral Health Impact Profile short form (OHIP-14) is a shortened version of the OHIP-49 (Slade 1997). It is a 14-item questionnaire, which was translated to Portuguese, validated for Brazil and presents good psychometric qualities (De Oliveira and Nadanovsky 2005).

Although previous studies have described a moderate relationship between disease and quality of life (Masood et al. 2017), there is an apparent scarcity of articles about OHRQoL in populations of athletes with disabilities, so there is a need for studies which assess the oral health status of this population, considering the heterogeneity of disabilities which is commonly inherent among these individuals, regardless of the sports they practice. So, the aim of the present study was to evaluate if the OHRQoL (assessed by the OHIP-14 severity score) is affected by socio-demographic/socio-economic factors, oral hygiene habits and clinical oral health conditions on a sample of athletes with heterogeneous types of disabilities. The study hypothesis was that none of the socio-demographic/socio-economic factors, the oral hygiene habits and the clinical oral health status would have an impact on the OHRQoL of the athletes.

2. Material and Methods

Study design and sample characteristics

This cross-sectional observational study evaluated athletes with disabilities training in Uberlândia, MG, Brazil, congregated by the Uberlândia's Foundation of Tourism, Sports and Leisure (FUTEL). Exclusion criteria comprised subjects who were not able to answer the questionnaires (either themselves or with the aid of a legal caretaker), those that were not present for examinations during the study and also those who were not able or willing to sign a statement of informed consent. Altogether, 121 athletes were eligible to participate, but 105 took part in the study and a convenience sampling strategy was adopted.

Ethical considerations

The Human Research Ethics Committee of the Federal University of Uberlândia, MG, Brazil, approved the study (protocol process number: 98620818.1.0000.5152). Participants signed a statement of informed consent.

Training exercise and pilot study

Both dentists who took part in the study underwent a training exercise which was theoretical and practical. A professor of the School of Dentistry of the Federal University of Uberlândia conducted the theoretical stage involving the discussion of the criteria used in the clinical examinations. In the clinical stage, 10 patients, who were undergoing treatment at the prior mentioned School of Dentistry, were examined by

the two dentists. Each dentist was responsible for a set of criteria and performed the same examinations in the whole sample throughout the entire study in order to avoid inter-examiner discrepancies.

Subsequently, a pilot study was performed with 10 athletes, not included in the main study. The same athletes were re-evaluated ten days afterwards. The intra-examiner Kappa coefficient was calculated for all the clinical parameters. Kappa values varied from 0.65 to 1.00 and were considered satisfactory, according to the criteria adopted by the Brazilian National Oral Health Survey (Brasil 2010). The necessary adaptations were then made to adjust the data collection tool.

Non-clinical data collection

Every practical stage of this study took place in the athletes' training centers, using natural illumination, since many participants would face difficulties in displacing to the School of Dentistry.

Non-clinical data was collected through face-to-face interviews prior to clinical examinations. The instruments used in the interviews were the Brazilian version of the OHIP-14 and an adapted questionnaire. The OHIP-14 comprises seven conceptual domains: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap, with 2 questions each. It measures the frequency of oral impacts on a five-point Likert type scale: 0 = never; 1 = hardly ever; 2 = occasionally; 3 = fairly often; 4 = very often. In the additive method, used to obtain the total OHIP-14 severity score, the ordinal values for the 14 questions are added (range from 0 to 56). The method performs better than the simple count method but has a similar performance as the weighted standardized method when it comes to discriminating between groups (Allen and Locker 1997). The overall and per domain OHIP-14 severity scores were calculated. Higher scores denote poorer self-reported OHRQoL (De Oliveira and Nadanovsky 2005). Volunteers were instructed to answer the questions considering the previous 12 months.

The adapted questionnaire included questions about sex, age, monthly household income, level of schooling and oral hygiene habits. Age was divided into three categories: 15-30, 31-45 and 46+ years. Monthly household income was categorized into four groups considering the Brazilian minimum wage (1 BMW current value of US\$ 269.00): up to 1 BMW, from > 1 to 3 BMW, from > 3 to 5 BMW and > 5 BMW. Level of schooling was assessed in number of years and grouped as follows: up to 8, from 9 to 12 and more than 12. Toothbrushing was dichotomized into once a day or twice/more daily. Dental flossing was divided into irregularly (if the individual flossed a few days per week/month) or regularly (if the individual flossed every day).

Clinical data collection

Clinical examinations were performed to collect the volunteer's oral findings using adapted guidelines from the World Health Organization (WHO) - Oral Health Surveys Basic Methods (WHO 2013).

The periodontal condition was evaluated employing the Community Periodontal Index (CPI) and Clinical Attachment Loss (CAL). After gentle probing, gingival bleeding was observed and registered as present or absent. The distance in millimeters from the free gingival margin to the base of the pocket/sulcus was defined as the pocket depth (PD). The distance between epithelial attachment and the cement-enamel junction was used to estimate CAL. The occurrence of periodontitis was determined by the combination of $PD \geq 4$ mm and $CAL \geq 4$ mm in at least one measured site (Peres et al. 2007). Traumatism for upper and lower incisors was assessed and dichotomized as absent or present. Dental prosthesis use was categorized as follows: does not wear, wears fixed dental prosthesis, wears removable dental prosthesis and wears complete dentures. Dental prosthesis needs were classified as follows: no need, needs to replace one tooth, needs to replace more than one tooth and needs complete dentures. Decayed-filled-missing teeth in permanent dentition (DFMT) index and its components were determined, as well as the number of sound teeth.

Data management and statistical analysis

The outcome variable was the OHIP-14 severity score. The explanatory variables were sex, age, monthly household income, level of schooling, frequency of toothbrushing and flossing, gingival bleeding, periodontal disease, trauma in incisors, prosthesis wearing and needs, number of sound teeth, DFMT index and its isolate components (decayed, filled and missing teeth). Mann-Whitney and Kruskal-Wallis tests were

used to compare OHIP-14 severity scores associated with these variables. Descriptive analysis of the data was performed and the mean OHIP-14 severity score values, standard deviation, median and interquartile range were calculated in association with the explanatory variables. Spearman correlation coefficients were calculated to assess the correlation between number of sound teeth, DFMT index, its isolate components and the OHIP-14 severity scores. A 5% level of significance was adopted.

3. Results

A total of 105 athletes with disabilities took part in this study. The average age of the participants was 33 (SD 12) years (range 15 to 71 years). Sixty athletes practiced athletics, 24 powerlifting, 11 were swimmers and 10 played boccia. Seven athletes needed the help of a caretaker to perform their daily activities.

Among the participants, 82 (78.1%) had a predominant physical impairment, 17 (16.2%) had visual impairments and 8 (7.6%) had intellectual impairments predominantly. The athletes with physical impairments included: 48 with limitations of the lower limbs, 6 with limitations of the upper limbs, 12 with limitations of both the lower and upper limbs and 12 with hemiplegia (limitations on one side of the body of the lower and upper limbs). The etiology of the impairments comprehended: poliomyelitis, myelomeningocele, hydrocephalus, hypoxia at birth, dwarfism, arthrogyrosis, cerebral palsy, autism, glaucoma, congenital toxoplasmosis, stroke, cerebral aneurysm, meningitis, Arnold Chiari syndrome, traffic accident, gunshot trauma and injury from shallow water diving.

The OHIP-14 severity score ranged from 0 to 41.0 (median 6.0; mean 9.32; SD 8.99). The distribution of the scores was skewed and 45.71% of the participants had scores between 0 and 5. As shown in Figure 1, the analyses per domain revealed that physical pain was the most affected one (mean 2.63; SD 1.97), followed by psychological discomfort (mean 1.81; SD 2.02).

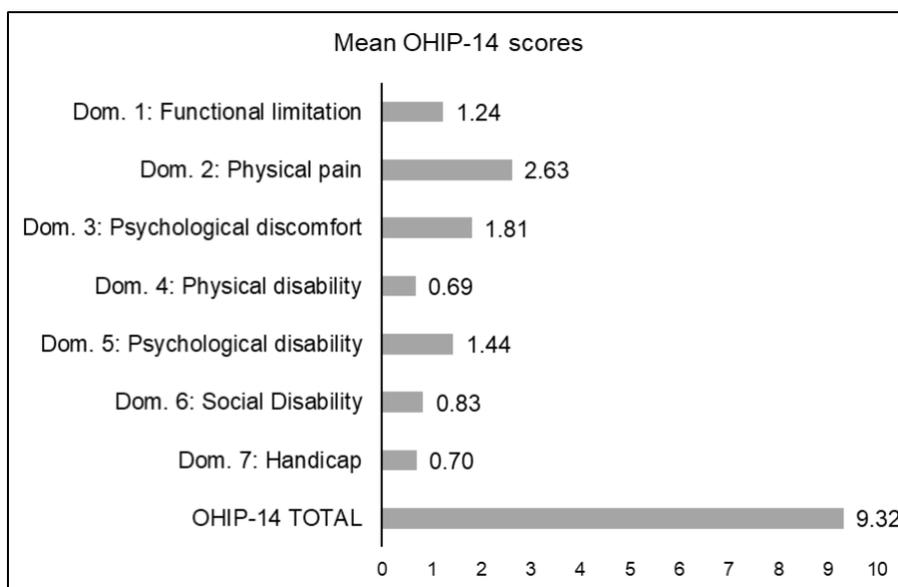


Figure 1. Mean scores for total OHIP-14 and by domain.

The socio-demographic/socio-economic characteristics of the sample are presented in Table 1. Most individuals were males (60.9%), mostly young (46.7% were between 15-30 years old), 63.8% studied between 9 and 12 years, and 49.5% had a monthly household income which varied from 1 to 3 Brazilian minimum wages.

Most participants (93.3%) reported that they brushed their teeth twice or more daily and 67.6% declared that they floss daily (Table 1).

Gingival bleeding was observed in 82.9% of the volunteers. Periodontal disease was prevalent in 33.3% of the sample. Twenty-five (23.8%) volunteers have experienced some kind of dental trauma in incisors. Most volunteers (86.7%) do not wear any kind of prosthesis, however 39 volunteers (37.1%) need some type of prosthesis (Table 1).

Significant differences in mean OHIP-14 scores were found for periodontal disease and need for prosthesis.

Table 1. Descriptive analyses of the characteristics of athletes with disabilities in Uberlândia, MG – Brazil. Mean, standard deviation, median, interquartile range and p-value for total OHIP-14 scores, related to the study variables (n= 105).

Variables		OHIP-14 scores					
Sociodemographic factors		n (%)	Mean	SD	Median	Interquar- tile Range	(P-value)
Gender	Female	41 (39.1%)	8.292	7.724	5.000	12.000	0.689
	Male	64 (60.9%)	9.984	9.716	6.000	13.750	
Age Group (years)	15 to 30	49 (46.7%)	7.735	7.979	5.000	11.500	0.445
	31 to 45	36 (32.3%)	10.667	10.466	6.000	14.750	
	46+	20 (19.1%)	10.800	8.218	8.500	14.750	
Socioeconomic factors							
Monthly household income	1 BMW	31 (29.5%)	9.742	8.571	6.000	12.000	0.791
	> 1 to 3 BMW	52 (49.5%)	9.538	9.314	6.000	15.750	
	> 3 to 5 BMW	13 (12.4%)	9.692	11.003	6.000	13.000	
	> 5 BMW	9 (8.6%)	6.111	5.255	5.000	10.000	
Level of Schooling (in years)	Up to 8	19 (18.1%)	9.684	7.660	6.000	15.000	0.657
	9 to 12	67 (63.8%)	9.433	9.124	6.000	13.000	
	> 12	18 (17.1%)	8.779	10.367	5.500	11.750	
Oral Hygiene Habits							
Toothbrushing	1X a day	7 (6.7%)	13.857	11.437	14.000	18.000	0.236
	2X or + daily	98 (93.3%)	9.999	8.773	6.000	11.500	
Dental flossing	Irregularly	34 (32.4%)	11.470	9.561	9.000	16.250	0.088
	Regularly	71 (67.6%)	8.296	8.583	5.000	10.000	
Variables		OHIP-14 scores					
Clinical Oral Health Parameters		n (%)	Mean	SD	Median	Interquar- tile Range	(P-value)
Gingival bleeding	Absent	18 (17.1%)	7.353	8.170	4.000	10.000	0.234
	Present	87 (82.9%)	9.816	9.126	6.000	13.000	
Periodontal disease	Absent	70 (66.7%)	7.843	7.945	5.000	10.500	0.025*
	Prevalent	35 (33.3%)	12.286	10.274	9.000	16.000	
Trauma (incisors)	Absent	80 (76.2%)	9.313	9.449	6.000	12.500	0.539
	Present	25 (23.8%)	9.360	7.505	6.000	12.000	
Wearing Dental prosthesis	Do not wear	91 (86.7%)	9.022	8.777	6.000	12.000	0.066
	Fixed	7 (6.7%)	13.143	8.726	11.000	18.000	
	Removable	5 (4.7%)	13.200	12.729	13.000	23.500	
	Complete denture	2 (1.9%)	10.000	14.142	10.000	–	
Need for dental prosthesis	No need	66 (62.9%)	7.682	7.494	5.000	11.000	0.031*
	Replace 1 tooth	11 (10.0%)	8.636	7.447	10.000	15.000	
	Replace > 1 tooth	25 (24.0%)	12.080	11.202	9.000	18.000	
	Complete denture	3 (2.9%)	25.000	6.245	23.000	–	

*Statistically significant difference (p-value < 0.05). Mann-Whitney for dichotomous variables and Kruskal-Wallis for the other variables with more than two categories.

Spearman correlation coefficients were used to assess the association between the number of sound teeth, DFMT index and its components and the OHIP-14 severity scores and were not strong (Table 2). All scores of DFMT were correlated significantly with OHIP-14.

Table 2. Spearman correlation between OHIP-14 and sound teeth, DFMT index, decayed, filled, missing teeth and p-value.

Variables	Correlation coefficient	p-value
OHIP-14 X Sound teeth	-0.295	0.002*
OHIP-14 X DFMT index	0.329	0.001*
OHIP-14 X Decayed teeth	0.192	0.050*
OHIP-14 X Filled teeth	0.222	0.023*
OHIP-14 X Missing teeth	0.267	0.006*

*Statistically significant difference (p-value < 0.05 – Spearman).

Table 3 shows that the number of sound teeth (mean 18.94; SD 7.81) decreased in older age groups. The mean DFMT was 9.92 (SD 7.91) and the ‘filled teeth’ component was predominant (mean 6.86; SD 6.25) followed by ‘missing teeth’ (mean 1.99; SD 4.65) and ‘decayed teeth’ (mean 1.08; SD 1.75). Tooth loss and filled teeth increased in older age groups.

Table 3. Means (SD) for sound teeth, DFMT, decayed, filled, missing teeth by age categories (in years) and for the total sample (n= 105).

Age	Sound Teeth	DFMT	Decayed	Filled	Missing
15-30	24.12 (5.0)	4.37 (4.6)	0.92 (1.6)	3.37 (0.3)	0.08 (4.2)
31- 45	16.75 (7.2)	12.33 (7.1)	0.94 (1.1)	8.56 (6.3)	2.83 (6.2)
> 46	10.20 (4.1)	19.20 (4.0)	1.70 (2.8)	12.35 (4.8)	5.15 (5.6)
Total	18.94 (7.8)	9.92 (7.9)	1.08 (1.8)	6.86 (4.7)	1.99 (6.3)

4. Discussion

According to Al-Shamlan et al. (2019), studies that evaluate athletes with special needs commonly use convenience sampling, which is justified by the risk of presenting a relatively small number of participants, and their wide age range is also an attempt to tackle this risk. The authors normally related this to the difficulties of intellectually disabled athletes in cooperating with the examiners, but this is not in accordance with this study, since oral examinations were performed without difficulties due to the athletes’ behaviour.

Another systematic review about the prevalence of dental caries in athletes with disabilities showed that eight of the included studies were considered to have a moderate risk of bias, and eight were considered to have high risk of bias (Azeredo et al. 2019), showing that the bias is present in other studies with this public.

The present study evaluated the impact of socio-demographic/ socio-economic factors, oral hygiene habits, clinical oral health parameters on OHRQoL in a sample of athletes with disabilities in Uberlândia, MG, Brazil. Contrary to the hypothesis of the study, some of the explanatory variables analyzed had a significant impact on the OHRQoL and so DFMT.

To the extent of our knowledge, this is the first study to assess OHRQoL and the variables related to it in a group of athletes with multiple disabilities. For Couto et al. (2018), OHIP-14 might be regarded as a useful tool in terms of understanding the overall impact of intellectual disabled patients’ self-perception of their oral health status in their daily activities and quality of life.

Heterogeneity of the study samples may interfere with comparisons of OHRQoL data. Besides, the concept of health and disease, the nature and magnitude of their impacts, may vary between populations according to their cultural backgrounds (Allison 1999). The mean OHIP-14 score (9.32) for this study was higher than the one obtained (4.45) in a study conducted with workers in education in Brazil (Guerra 2014). However, it was lower than the mean (12.7) obtained for a sample of 71 hemophiliac patients in another study carried out in Turkey (Baskirt et al. 2009) but it was quite similar to the study of adults with mild intellectual disabilities (9.98) in Portugal (Couto et al. 2018)

The domains with the highest means were physical pain and psychological discomfort (Fig. 1), which is in agreement with the results found in a study with adults with mild intellectual disabilities, whose most

affected domains were the same (Couto et al. 2018) and other studies reported similar results (Guerra 2014; Marks 2018). A systematic review, which aimed at evaluating the impact of periodontal disease on quality of life, also showed that physical pain was the most affected domain, followed by psychological discomfort, in 4 of the 9 selected studies that adopted OHIP-14 (Ferreira et al. 2016). According to Locker (2000), pain may cause physical or psychological discomfort, or even social disability, defined as restraint or failure in the ability to perform some daily tasks.

None of the social-demographic/socio-economic factors evaluated had a positive association with the OHIP-14 scores. Nevertheless, in a study that aimed at identifying the determinants of OHRQoL among older people, higher age and level of schooling were significantly correlated with better OHIP-14 scores (Martínez-Mesa, 2014).

Mean OHIP-14 scores were higher but not statistically significant for those who reported brushing their teeth twice or more daily and using dental floss regularly. Nonetheless, in a study which aimed at comparing the OHRQoL between a sample of patients with spinal cord injury and healthy controls, irregular toothbrushing was a significant variable related to poorer OHRQoL (Pakpour et al. 2016).

Although dental trauma is the most common sport-related dental implication, the 25 athletes which had suffered trauma in incisors did not report much worse OHIP-14 scores. This result is quite surprising since dental trauma is often associated with serious consequences related to the aesthetic, functional, economic and psychological aspects (Soares et al. 2014).

A recent systematic review reported that 25 of the 34 selected cross-sectional studies (most of which employed the OHIP-14) demonstrated that periodontal disease was associated with negative impact on quality of life (Ferreira et al. 2017). This result was corroborated by our study. It also states that the greater severity of the disease leads to larger negative impact, since periodontal disease may cause a series of clinical signs and symptoms, such as bleeding, tooth mobility, receding gums, bad breath, toothache and even implications for the systemic health (Seymour 2007). However gingival bleeding, which may be considered one of the first signs of unhealthy periodontium, did not significantly impact the mean OHIP-14 scores, which agrees with the results obtained in another study (Martínez-Mesa 2014).

Wearing dentures was not related significantly to worse OHRQoL, unlike a study (Martínez-Mesa 2014) in which wearing dentures was a variable related to poorer OHRQoL. In a German population-based study which investigated the association between denture status and OHRQoL, it was reported that wearing removable prosthesis was also a strong variable related to impaired OHRQoL (John et al. 2004). The quality of the prostheses, especially when there is poor retention and adjustment, may be one of the reasons for the association between dentures and lower OHRQoL, once unfitting devices can cause traumatic ulcers and stomatitis (Andrade 2012; Gil-Montoya 2015).

According to Couto et al. (2018), the need of dental prosthesis was significantly associated with OHIP-14, since 32.9% of 240 adults with mild intellectual disabilities who had 20 or fewer teeth had an impact in OHRQoL. In this study, 36.9% need some kind of dental prosthesis and it was also statistically significant. Those authors pointed out other concerns about the use of a complete prosthesis such as the risk of swallowing or the difficulty to actually tolerate the use of a denture.

The global prevalence of dental caries was 36.5% in a study with athletes with intellectual disabilities (95% CI = 30.6 to 42.7) with high heterogeneity between studies (Azeredo et al. 2019). Another review (Azeredo et al. 2020) aimed to realize a meta-analysis to calculate a worldwide prevalence of dental caries in athletes without disabilities and showed that there was a high prevalence of dental caries (46.25%). In the present study, 12.3% of the athletes had never had dental caries experience and at the moment of the examination 50.4% presented dental caries. It must be emphasized that only clinical examination was accomplished, since it was not possible to complement the diagnosis with X-ray exam. So, considering the impact of oral health in quality of life and in performance, risk factors for the development of dental caries in athletes should be studied more rigorously (Azeredo et al. 2020).

The number of sound teeth, the DFMT index and its components had a weak but statistically significant association with the OHRQoL. Pain originating from decayed teeth may have deeper impact and its consequences may extend further to cause physical, psychological and social damages to the individual (Johansson and Östberg 2015). However, a study with an elderly sample of individuals from Brazil reported

that the presence of decayed teeth had no impact on OHRQoL assessed with the Geriatric Oral Health Assessment Index (GOHAI) questionnaire (Andrade 2012).

However, this study has important limitations that should be reported. One of these is the convenience sample, which does not guarantee its representativity. Nevertheless, it should be considered that it is possible to make some important inferences about oral health indicators of this sample, in spite of the sampling strategy that was adopted. Another limitation is the cross-sectional design, which did not allow the identification of individuals' OHRQoL perception before a dental treatment and after. So, other multicentric studies are necessary to investigate the OHRQoL of athletes with disabilities in different places. In addition, heterogeneity seems to be an intrinsic characteristic of this population, from the cause and circumstances of the disabilities to the effects they produce. This limitation poses yet another challenge when it comes to avoid bias by means of using stricter exclusion criteria and, at the same time, assuring a sample with a considerable number of participants.

Comprehending which health determinants have the strongest association with welfare may facilitate identifying priorities for preventive measures and choices of treatment. The present findings may assist in the establishment of specific public oral health policies directed at this population, taking into consideration their accessibility needs, as well as other particularities of their health status.

5. Conclusions

In conclusion, the present study demonstrated that some of the most prevalent oral health problems, namely tooth decay, tooth loss and periodontal disease, assessed with indices traditionally used in oral research, were associated with impaired OHRQoL.

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