Oral health of paralympic athletes: is there enough scientific evidence to support oral health actions for this population? Narrative review

Saúde bucal de atletas paraolímpicos: existem evidências científicas suficientes para fundamentar ações de saúde bucal para essa população? Revisão narrativa

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ABSTRACT
Paralympic athletes are athletes with disabilities who compete in official recreational or collegiate competitions. Like any other group of people, these para-athletes need special attention concerning oral health. Oral health is a hotly debated topic in the literature in general, but what about the oral health of para-athletes, is there enough scientific evidence on oral health to support oral health actions for para-athletes? This narrative review aimed to answer this question. A review of the literature using the PubMed database was performed between March and April 2022. The authors selected original studies in the English language without a limit of date. The search strategy consisted of a combination of terms “Special Olympics” AND “athletes” and “Paralympic athletes” AND “oral health”. 1140 articles were founded, but only 24 matched the inclusion criteria. The studies included oral health data from 185,499 para-athletes. Gingival problems and dental caries were the most cited oral problems. There is a significant need for the preventive and restorative oral health of this population. The studies provide sufficient information to plan specific actions for this population.

Keywords: oral health, paralympic athletes, literature review.

RESUMO
Atletas paralímpicos são atletas com deficiência que competem em competições oficiais recreativas ou colegiais. Como qualquer outro grupo de pessoas, esses para-athletes precisam de atenção em relação à saúde bucal. A saúde bucal é um tema muito debatido...
na literatura em geral, mas no que diz respeito à saúde bucal de para-atletas, há evidências científicas suficientes sobre saúde bucal dessa população para planejar ações de saúde bucal? Esta revisão narrativa teve como objetivo responder a essa pergunta. Uma revisão da literatura utilizando a base de dados PubMed foi realizada entre março e abril de 2022. Os autores selecionaram estudos originais em língua inglesa sem limite de data. A estratégia de busca consistiu da combinação dos termos “Olimpíadas Especiais” E “atletas” E “atletas paraolímpicos” E “saúde bucal”. Foram encontrados 1.140 artigos, mas apenas 24 atenderam aos critérios de inclusão. Os estudos incluíram dados de saúde bucal de 185.499 atletas paraolímpicos. Problemas gengivais e cárie dentária foram os problemas bucais mais citados. Há uma necessidade significativa da saúde bucal preventiva e restauradora dessa população. Os estudos fornecem informações suficientes para planejar ações específicas para essa população.

Palavras-chave: saúde bucal, atletas paraolímpicos, revisão de literatura.

1 INTRODUCTION

The term Paralympic athletes, or Special Olympic Athletes (SOA), refers to athletes with disabilities who compete in official competitions, i.e., are high-performance athletes. In fact, the term Paralympic athletes, used by the International Paralympic Committee, is used for individuals with impairment who compete in recreational, collegiate, and/or official competitions, regardless of competition level (Tweedy & Vanlandewijck, 2011; Tweedy, Beckman & Connick, 2014; Ravensbergen, Mann & Kamper, 2016). In Brazil, Paralympic athletes are recruited from municipal, state or regional events, mostly organized by the Brazilian Paralympics committee, which bring together thousands of athletes with physical or intellectual disabilities. These events, in addition to looking for athletes who can integrate the Paralympic selection of Brazil, are part of a great collective effort to include these people in society, providing them with physical and mental well-being. In this case, athletes who compete in these trials, before being Paralympic athletes, are para-athletes.

Perhaps the most important competition for Paralympic athletes is the Paralympic Games which are held every 4 years, and which bring together the elite of Paralympic sports. In fact, Paralympic Games, and consequently the International Paralympic committee, decisively contributed to change the general population’s perception about disabilities of people around the world accompanying the event (Gold & Gold, 2007). In the Paralympic games it is possible to observe athletes and teams very well prepared physically and mentally and who compete at a high level, with support from healthcare professionals.
Like any other groups of athletes, Paralympic athletes need special attention with regard to general health care in order to perform well in competitions. In this case, oral health also plays a key role since oral and dental discomfort of any kind can harm the athlete's performance during a competition. Oral health is a hotly debated topic in the literature in general, but what about the oral health of Paralympic athletes, is there enough scientific evidence on oral health to support oral health actions for Paralympic athletes? This narrative review aimed to answer this question.

2 METHODOLOGY

A review of the literature using the PubMed database (https://www.ncbi.nlm.nih.gov/pubmed) was performed between March and April 2022. The authors selected original studies in the English language without a limit of date. The search strategy consists of terms and keywords of “Special Olympics” + “athletes” and “Paralympic athletes” which were used to identify relevant publications. To identify articles that mention oral health aspects of athletes, the next step was to search for a combination “Special Olympics” AND “athletes” and “Paralympic athletes” AND “oral health”. Data about the main changes involving the oral health of these athletes were recorded in their own forms.

3 RESULTS

In the first phase, the search for titles with the word “Special Olympics” + “athletes” and “Paralympic athletes” resulted in 1140 articles. After reading the titles, 37 articles remained, once most of them involved athletes without any impairment or addressed aspects of the general health of Paralympic athletes. After reading the 37 abstracts, 13 were excluded once were not clear about the results found; offered information about dental programs to Paralympics athletes, but without oral health data. The 24 remaining articles and their main results are shown in Table 1.
Table 1. Summary of the articles involved in this narrative review.

| Author / Title | Objective | Results | Conclusion |
|----------------|-----------|---------|------------|
| 1 Opazo-Garcia et al. Oral health problems in high-performance athletes at 2019 Pan American Games in Lima: a descriptive study. BDJ Open. 2021; 16; 7:21. N=6,680 | To determine the prevalence of the most common oral pathologies in high-performance athletes during the emergency dental care performed at the Lima 2019 Pan American Games. | 1.14% presented as dental emergencies; 90.8% of the athletes seen presented pre-existing oral pathological conditions; periodontal diseases (34%) and dental caries (29%) were the most frequent conditions. | The most prevalent diseases were periodontal disease and dental caries. It is necessary to implement new care strategies for athletes, based on prevention, before and during sports competitions. |
| 2 Fernández et al. Oral health needs of athletes with ID in Southern Europe: Greece, Italy and Spain. Spec Care Dentist. 2021;41(2):187-194. N= Not reported | The aim was to evaluate the oral condition and treatment needs of Special Olympics athletes from Greece, Italy and Spain. | The prevalence of untreated decay was 57.0% in Greece, 48.8% in Italy and 41.7% of the Spanish athletes. The prevalence of signs of gingival disease was 61.1% in Greece, 60.6% in Italy and 66.1% in Spain. While the majority of the athletes were in need of dental treatment. | Oral disease is an unresolved problem in the studied population. Therefore, efforts should be directed to meet their treatment needs and to prevent oral disease. |
| 3 Dagon et al. Prevalence of dental trauma in individuals with special needs participating in local Special Olympics games. Spec Care Dentist. 2019;39(1):34-38. N= 249 | To evaluate the prevalence and severity of dental trauma among Special Olympics athletes with intellectual disabilities who participated in the 2016 Israeli Special Olympics games | The prevalence of dental trauma was 27.3%. Most of the traumas (94%) involved the maxillary incisors. | The main results revealed by this study's findings supports the need for using preventive measures, such as mouth guards, during sport activities |
| 4 Pradhan et al. Oral and aural problems in Australian Special Olympics athletes. Spec Care Dentist. 2019;39(5):478-484. N= 130 | To investigate Associations between oral and aural problems among adults with intellectual disability (ID). | The SO athletes had poor oral health with a high prevalence (56.8%) of gingival signs and unmet dental needs (66.9%) | A larger sample of SO with tooth and septant level data could clarify the association between oral and aural problems in people with ID. |
| 5 Marro et al. Erosive tooth Wear in SO athletes with ID. BMC Oral Health. 2019; 28;19(1):37. N= 232 | To determine the presence and severity of erosive tooth wear (ETW) in athletes with ID. | The prevalence of ETW for young athletes with ID was 51.14%. | Half of the young athletes with ID presented at least one affected surface with ETW. |
| 6 Gray et al. Oral health status of athletes with an intellectual disability competing in the SO Great Britain (GB) National Games 2017. Br Dent J. 2019;226(6):423-426. N=692 | To describe the oral health status of athletes with ID competing in the SO, GB National Games, held in Sheffield in August 2017 | 14% had untreated decay, 51.9% had at least one filling and 28.6% had signs of gingivitis. 6.2% reported pain from their mouth and 2.7% were found to require urgent treatment. Overall, 90.3% reported to clean their mouths at least once per day and 0.7% were found to be edentulous. | These results provide valuable baseline data to monitor and review the oral health of SO athletes within Great Britain. |
| 7 Marks et al. Global oral health status of athletes with ID. Clin Oral Investig. 2018; 22(4):1681-1688. N= 149,272 | To identify the oral health status and treatment needs of SO athletes with ID from 181 countries by the assessment of oral health parameters and differences. | Athletes presented higher rates of signs of gingival disease. The prevalence of untreated dental caries also was significantly higher. | The data provided by this study demonstrate that continuous efforts for preventive and restorative oral health care are needed for the oral health of these athletes. |
| 8 Bisser et al. Oral health in 12- to 17-year-old athletes participating in the German SO. Int J Paediatr Dent. 2010;20(6):451-7. N= 160 | To evaluate the oral health in adolescents with ID participating in the German Special Olympics games 2008. | Caries prevalence was 58.1% and the mean DMFT was 2.3. About half of the participants showed signs of gum inflammation. More than 90% of them brushed their teeth by themselves without assistance. | Individuals examined have a poorer oral health than the general population. Specific prevention programmers seeking close cooperation with parents, custodians, and caretakers should be developed. |
| 9 Kragt et al. Oral health among Dutch elite athletes prior to Rio 2016. Phys Sportsmed. 2019;47(2):182-188. N= 116 | Described the first results from such a screening conducted in Dutch elite athletes of the Nederlands Olympics Committee | DMFT-score was 3.0; 43% of the athlete's clinical findings were reported which needed a direct referral to the general dentist. | The most of athletes needed dental treatment. |
| 10 Fernandez et al. Treatment needs and predictive capacity of explanatory variables of oral disease in young athletes with an ID in Europe and Eurasia. Eur J Paediatr Dent. 2016;17(1):9-16. N= 503 | To evaluate the oral condition and treatment needs of young athletes with intellectual disability (ID) from 53 countries of Europe and Eurasia who participated in the SO European Games held in Antwerp, October 2014. | Untreated decay was recorded in 33.4% of the participants and 38.7% of them had signs of gingivitis disease. | There is consistent evidence of persistent need for promotion of oral health, as well as preventive and restorative treatment in young athletes with ID in Europe and Eurasia. |
11 Fernandez Rojas et al. Oral health needs of athletes with ID in Eastern Europe: Poland, Romania and Slovenia. Int Dent J. 2016;66(2):113-9. N=3,545
To evaluate the oral condition and treatment needs of Special Olympics athletes from Poland, Romania and Slovenia
The prevalence of untreated decay was 41% in Poland and 61% in Slovenia, whilst 70% of the Romanian athletes had signs of gingival disease and only 3.8% presented molar fissure sealants. In addition, 47% of Polish athletes were in need of urgent treatment
Exploration of the oral health systems of the countries revealed similar significant co-payments and lack of incentive for dentists to treat patients with special needs. The results demonstrated the need for a structured system in which a special population is a target for oral-health-related education programmers and system-included preventive, restorative and maintenance interventions

12 Fernandez et al. Treatment needs and impact of oral health screening of athletes with ID in Belgium. BMC Oral Health. 2015; 30;15:170. N= 627
The aims of this study were to evaluate treatment needs of participants of SO in Belgium 2013 in comparison with those from 2008 and to assess the impact of screening and referral within the SOSS in a group of athletes who participated in two consecutive events, 2012 and 2013
The prevalence of gingival signs was 44.3 % in 2013, slightly higher than in 2008 (42.4 %). The burden of untreated decay affected 27.1 % of the population showing a net increase in comparison to 2008 (20.9 %).
Continuous efforts for preventive and restorative oral health care are needed for this population.

13 Marks et al. Oral cleanliness and gingival health among SO athletes in Europe and Eurasia. Med Oral Patol Oral Cir Bucal. 2015;12(2):591-7. N= 7,754
The aim of the study is to explore the prevalence of gingival signs of inflammation and its relationship to oral cleanliness and age among SO athletes from Europe and Eurasia
48.64% of the athletes presented with gingival signs.
High prevalence of gingival signs among individuals with special needs; over 50% in more than 20 countries. There is a serious need for education and preventive programs for the patients, their parents and caregivers.

14 Trihandini et al. Oral health condition and treatment needs among young athletes with intellectual disabilities in Indonesia. Int J Paediatr Dent. 2013;23(6):408-14. N=not reported
To describe and to evaluate the oral treatment needs of Special Olympics Special Smiles Athletes in Indonesia between 2004 and 2009
More than 70% of athletes had visible untreated decay. Almost 30% had gingival inflammation. Pain in the oral cavity was reported by 28.6%. Athletes who had untreated decay reported 6.67 times more pain compared to those who did not have untreated decay. Athletes living in provinces on Java Island had 1.54 times more untreated decay compared to the athletes who live in provinces in outer Java Island. 21.63% need urgent treatment.
The results suggest that there is an elevated oral treatment need in Indonesian Special Smiles population.

15 Fernandez et al. Oral health findings in athletes with ID at the NYC SO. Spec Care Dentist. 2012;32(5):205-9. N= 664
To collect data about oral health in Special Olympics athletes with intellectual disabilities from New York City.
9% reported oral pain; 8% needed urgent care; 28% had untreated caries, 60% had filled teeth; 32% had signs of gingival disease.
The data showed high preventive and restorative oral health needs.

16 Leroy et al. The oral health status of SO athletes in Belgium. Community Dent Health. 2012;29(1):68-73. N= 687
To describe and evaluate the oral condition and oral treatment needs of the participants of the Special Olympics Special Smiles program organized in Belgium in 2008.
More than 70% had at least one missing tooth. Gingivitis and caries experience were 44% and 22%, respectively. Injury = 12%. Of those athletes with an edentulous mandible, only 53% presented with a removable denture: 73% of athletes missing some maxillary anterior teeth and 30% of those missing all anterior teeth had no prosthetic replacement in the maxilla. Nearly two thirds of athletes were referred for treatment: in 12% of athlete’s dental treatment was considered urgent.
The results suggest that there is a tremendous unmet need for dental treatment.

17 Schulte et al. Oral health in adult athletes with intellectual disabilities in Germany. Gesundheitswesen. 2011;73(5):78-83. N=420
To evaluated oral health of athletes that took place at 2008 summer games of Special Olympics Germany.
More than 70% had at least one missing tooth. Gingivitis and caries experience were 44% and 22%, respectively. Injury = 12%. Of those athletes with an edentulous mandible, only 53% presented with a removable denture: 73% of athletes missing some maxillary anterior teeth and 30% of those missing all anterior teeth had no prosthetic replacement in the maxilla. Nearly two thirds of athletes were referred for treatment: in 12% of athlete’s dental treatment was considered urgent.
Preventive programmes should be developed and applied in cooperation with parents, relatives and caregivers.

18 Oredugba and Perlman. Oral health condition and treatment needs of SO athletes in Nigeria and to suggest ways of improving access to oral healthcare. Spec Care Dentist. 2010;30(5):211-7. N= 1,286
To determine the oral health condition and treatment needs of SO athletes in Nigeria and to suggest ways of improving access to oral healthcare
The majority cleaned their mouths once daily, 12.2% complained of pain, 21.1% had untreated decay, 6.6% had dental injury, 48.1% had gingival signs suggestive of periodontal disease, 15.8% required urgent treatment, and 43.7% required non-urgent treatment.
SO athletes has poorer than that of the general population in Nigeria.
| No. | Authors and Title | Year | Journal | Summary |
|-----|-------------------|------|---------|---------|
| 19  | Hanke-Herrero et al. Latin-American Special Olympics athletes: evaluation of oral health status | 2010 | Spec Care Dentist. | To evaluate the oral health status and dental needs of the athletes with ID from Latin-American and Caribbean countries. |
|     |                    |      |         | Untreated dental caries was recorded for more than half of the examined athletes. Missing teeth were noted in more than one-third of the athletes. More than half of the participants had signs of gingival disease and half needed preventive mouth guards. |
|     |                    |      |         | The main data supports the certainty of the need for increased dental services for individuals with intellectual disability in the respective countries. |
| 20  | Dellavia et al. Oral health conditions in Italian Special Olympics athletes. | 2009 | Spec Care Dentist. | To evaluate dental and medical conditions during three Italian Special Olympics National Games. |
|     |                    |      |         | Total DMFT was 10.3 (SD 5.8; D=1.3; M=6.1; F=2.8). Decayed and filled teeth were significantly more frequent in athletes who did not have DS compared to those with DS. |
|     |                    |      |         | Athletes with DS and without DS who participated in the Italian SO had a similar oral status, which was better than Italian persons who were institutionalized and who had an ID. |
| 21  | Turner et al. The oral health of people with intellectual disability participating in the UK Special Olympics. | 2008 | J Intellect Disabil Res. | This paper describes the oral health of participants at the 2005 Glasgow Special Olympics. |
|     |                    |      |         | Older SO participants were more likely to have fewer than 21 teeth and to have fillings, untreated decay, gum inflammation and heavy plaque levels. 28% of SO participants had 21 or more teeth, no fillings and no obvious decay. Those from the north, midlands and south regions of England had significantly more chance of good dental health so defined compared with participants from Scotland. Gum inflammation was common. 5% of participants needs urgent treatment for dental or soft tissue problems and 40% to require non-urgent treatment. |
|     |                    |      |         | The study identifies the vulnerability of the older participants to dental problems, and this may indicate greater difficulty maintaining surveillance as individuals age or informal careers become less able or available. |
| 22  | López del Valle et al. Puerto Rican athletes with special health care needs: an evaluation of oral health status | 2007 | J Dent Child (Chic). | To evaluate the oral health status of Special Olympics athletes participating in an event in Villalba, Puerto Rico in 2004. |
|     |                    |      |         | Almost 45% of examined athletes had untreated dental decay; 33% had missing teeth, 60% had gingival signs of periodontal disease, and 16% reported dental pain. |
|     |                    |      |         | Results of clinical examinations indicate a population with ID that is in significant need of preventive and restorative oral health needs. |
| 23  | Reid et al. Prevalence and predictors of untreated caries and oral pain among Special Olympic athletes. | 2003 | Spec Care Dentist. | The authors assessed the prevalence and predictors of untreated caries and oral pain among Special Olympic athletes. |
|     |                    |      |         | The prevalence of oral pain and untreated caries was 13.5% and 30.4%, respectively. Statistically significant independent were observed between untreated caries and oral pain, gingivitis, injury, missing teeth, and home care. |
|     |                    |      |         | Substantial levels of untreated caries and oral pain were prevalent and related to poor oral hygiene and poor oral health. |
| 24  | White et al. Oral health status of special athletes in the San Francisco Bay Area. | 1998 | Calif Dent Assoc. | To assess the oral health status of athletes participating in annual SO events at sites across the country. |
|     |                    |      |         | Child athletes 9-20 years of age had more untreated decay and substantially more missing permanent teeth than 9-20-year-old children represented in the 1986-87 National Institute of Dental Research Survey of U.S. School Children. Prevalence of missing teeth among adult athletes compared favorably with data from the Third National Health and Nutrition Examination Survey and the Behavioral Risk Factor Surveillance System Survey. |
|     |                    |      |         | Approximately one-third of child and adult athletes were determined to need dental care. |

Notes: N= number of subjects involved in the study; ID= Intellectual Disability; SO= Special Olympics. Source: Authors
4 DISCUSSION

This narrative review aimed to investigate if there is sufficient scientific information about Paralympic athletes, or Special Olympics athletes, oral health to support actions for this population. So, we decided to search for articles that emphasized this issue. 1140 articles that match the initial search strategy were founded but after exclusion criteria, only 24 articles were selected. Despite relatively few articles included, the main results and conclusions obtained from each article allow a very broad discussion.

First, these 24 articles include data about the oral health of 185,499 Paralympic athletes. Undoubtedly, this is a significant number of participants. One study recruited 149,272 participants from 181 countries around the world and showed that the most prevalent diseases were gingival disease and dental caries and the obtained data demonstrate that continuous efforts for oral health care are needed for this population (Marks et al, 2018). Gingival problems were mentioned in all articles, except for three that focus on untreated decay (White et al, 1998; Kragt et al, 2019) and erosive tooth wear (Marro et al, 2019).

Perhaps the main reason for the higher prevalence of gingival problems that include gingival disease, gingivitis, and periodontal disease is the individual’s lack of ability to perform his brushing. Gingival problems were frequently described in many of the articles used in this review (Lopez del Valle et al, 2007; Oredugba & Perlman, 2010; Schulte et al, 2011; Fernandez et al, 2012; Leroy et al, 2012; Marks et al, 2015; Fernandez et al, 2015; Fernandez et al, 2016; Mark et al, 2018; Pradhan et al, 2019; Gray et al, 2019; Opazo-Gracia et al, 2021) and its prevalence varied between 28% (Gray et al, 2019) and 70% (Fernandez Rojas et al, 2016). It seems that this great variation is due to a lack of standardization of the criteria used for gingival and periodontal evaluation, but, in fact, among the analyzed articles, gingival problems are the most cited.

Dental caries was the second most cited oral problem in the articles. In at least four studies, the prevalence of dental caries was greater than 50% in the evaluated individuals. Trihandini et al (2013) observed active caries in 70% of individuals, followed by Fernandez Rojas et al (2016) whose prevalence was 61%, and Hanke-Herrero et al (2010) and Bissar et al. (2010) who state that more than half of the para-athletes evaluated had active carious lesions. On the other hand, the study by Gray et al (2019) states that only 14% of the evaluated para-athletes had active and untreated carious lesions, even though there was not much difference in time between the studies.
Active caries or untreated decay lesions were mentioned in the studies by White et al (1998), Reid et al (2003), Hanke-Herrero et al (2010), Trihandini et al (2013), Fernandez Rojas et al (2016), Marks et al (2018), Fernandez et al (2016), Gray et al (2019) and Fernández et al (2021). Perhaps the worst observed outcome is pain once, in any situation, the pain worsens the quality of life of individuals. Pain was mentioned in several studies (Reid et al, 2003; Lopez del Valle et al, 2007; Oredugba & Perlman, 2010; Fernandez et al, 2012; Trihandini et al, 2013; Gray et al, 2019) which reveals a real need for urgent dental treatment.

Eleven articles are explicit in their conclusion saying that more actions are needed to improve the oral health of Paralympic athletes (López del Valle et al, 2007; Hanke-Herrero et al, 2010; Schulte et al, 2011; Leroy et al, 2012; Trihandini et al, 2013; Marks et al, 2015; Fernandez et al, 2015; Fernandez et al, 2016; Bissar et al, 2010; Marks et al, 2018; Fernández et al, 2021). According to these authors, there is a significant need for the preventive and restorative oral health of this population and continuous efforts in this sense are indispensable, not only during sporting events (Opazo-Garcia et al, 2021; Dragon et al, 2019; Fernandez et al, 2021; Marks et al, 2018; Fernandez et al, 2016; Schulte et al, 2011; Trihandini et al, 2013). Besides that, prevention programmers should involve parents, custodians, and caretakers should be developed (Turner et al, 2008; Marks et al, 2015). Finally, the consulted literature does allow us to draw an epidemiological profile of Paralympic athletes and plan direct actions to improve the oral health of this population. Interestingly, regarding the population of Brazilian para-athletes, data are still scarce.

5 CONCLUSION

According to the consulted literature, there is sufficient scientific evidence that describes the oral health condition of Paralympic athletes and this evidence allows the elaboration of action plans directly related to this population.
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