

Review Article

Deterioration of Oral Health as a Risk Factor for High-Performance Athletes

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Introduction

In Chile in 2010, 600 athletes attended the National Olympic plan and participated in different international competitions. In addition to this, the program of “National sports projection” was implemented, which aims at the development and refinement of the morphological, motors and psychological foundations of athletes to keep them in optimal sports conditions. This program has defined a policy which aims to be highly scientific, with a strictly pedagogical methodology, according to the development and refinement of the morphological, motors and psychological foundations, for getting the appropriate sports form to each stage and level of age, through a healthy and successful system of sports preparation, insert on regional and national realities.

It is therefore expected that high performance athletes have an optimal general health, since it is in direct relation to obtain improved sports performances; however, oral health is likely to be neglected as previous studies have shown [1-3]. Otherwise poor oral health could affect performance directly through pain arising from oral disease conditions but also more subtly from effects such as increased systemic inflammation and psychosocial impacts since in several sports body weight, composition and aesthetics are crucial factors to the athlete [3].

This study, according to our search, is the first that characterizes oral health of elite athletes in Chile, and contributes to improve the current evidence of poor sports performance being related to an impaired oral health.

Keywords: Caries; Periodontal Disease; High-Performance Athletes

Material and Methods

Study of prevalence: To calculate sample size was used a proportion of tooth decay in the population of $p = 0.8225$ with a significance level of 5% ($\alpha = 0.05$) and an estimation error of 3%,

resulting in a sample size of 59, in practice, a group of 64 high performance athletes randomly selected, associated to the CER (Regional Training Center) of Valparaiso Region during the year 2012, of 80 athletes.

The selection criteria were the following: high-performance athletes from beginners to advanced levels who accepted to participate in this research and who signed an informed consent, without orthodontic appliances or systemic disease. Only two athletes were discarded because they were carriers of orthodontic appliances.

They were examined in the clinics of the Faculty of Dentistry of the Andres Bello University, and the following variables were collected: gender, age, sports performance in two levels, according to the current national ranking of athletes at the time of the study, dichotomized in ranking from 1 to 10 as “excellent” and 11 or more as “good”. They were also collected oral variables: dental caries presence, DMF index, Community Periodontal Index of Treatment Needs (CPITN), presence of periodontal disease if the test-taker had cumulatively signs of bleeding, calculus and periodontal pockets, and other dental alterations involving both lesions of oral mucosa and Temporomandibular joint disturbances.

The variables were collected by a single examiner, which was calibrated for the CPITN variable with a gold standard specialist in periodontics, reaching a Kappa index of 1, considered as very good agreement.

For the analysis of data, the qualitative variables are described in relative frequencies and quantitative variables are described using means and medians. For the analysis of two qualitative variables association, measurement OR were calculated with 95% confidence interval. The statistical test applied were Chi Square of Pearson, Pearson Correlation Coefficient and a generalized linear model of binomial family (logistic regression) was adjusted.

This study was carried out under the International Guidelines of Ethical Review of the Epidemiological Studies, document

published by CIOMS (Council for International Organizations of Medical Sciences) [2].

Results

Age of participants ranged between 13-20 years old with a mean age of 17 ± 1.52 . In relation to the gender, 66.1% were men and 33.9% were women.

Only 11.3% of the athletes were free of caries and the mean of the rates of DMF Index , Decayed, Missed, and Filled of the athletes were 3.24 ± 1.97 , 1.32 ± 1.37 , 1.92 ± 1.48 and 0 respectively (table 1).

	DMFT/ dmft	Decayed	Filled
Mean	3,24	1,92	1,32
Upperconfidencelimit	2,72	1,53	0,96
Lowerconfidencelimit	3,75	2,30	1,68
5% trimmed mean	3,17	1,81	1,21
Median	3,00	2,00	1,00
Variance	3,90	2,21	1,87
Std. Dev.	1,98	1,49	1,37
Asymmetry	0,57	1,12	0,97
Kurtosis	0,19	1,32	0,61

Table 1: DMF Decayed and Filled.

Periodontal damage was registered through the CPITN resulting 18 (29%) code 0, considered healthy; 14 (22.6%) code I, bleeding on probing; 27 (43.5%) code II, presence of calculus; 3 (4.8%) code III, probing depths between 3.5 - 5.5 mm; and 0 (0%) code IV; depths of probing greater than 5.5 mm.

Athletic performance and oral health

When relating sports performance with presence of caries, periodontal health and oral alterations, only the last two revealed statistically significant differences, as shown in table 2, which also informs that Odds Ratio increases with increasing severity of the CPITN.

	Good Performance (Fr.)	Excelent Performance (Fr.)	P Value	OR [95% CI]
Current Presence of Dental Caries				
Presence of caries	1	6	0,234	4,0 [0,4 - 35,5]
Absence of caries	22	33		
Presence of Bleeding				

Withbleeding	23	21	0,000	2,0 [1,5 - 2,8]
Withoutbleeding	0	18		
Presence of Calculus				
Withpresence	19	12	0,000	10,6 [2,9 - 38,2]
Withoutpresence	4	27		
CPITN				
Code 1	0	18	0,000	1,0 [Reference]
Code 2	4	10		15,8 [0,7 - 324,3]
Code 3	16	11		53,0 [2,8 - 972,7]
Code 4	3	0		259,0 [4,3 - 15364,9]
Oral Alterations				
Withalterations	22	9	0,000	73,3 [8,6 - 622]
Withoutalterations	1	30		

Table 2: Association between oral risk factors and sports performance.

Oral health and injuries

When relating injuries of athletes with caries, periodontal health and oral alterations, only the latter two revealed statistically significant differences, as shown in table 3.

	With injuries (Fr.)	Without injuries (Fr.)	P Value	OR [95% CI]
Current Presence of Dental Caries				
Presence of Caries	3	4	0,415	2,3 [0,5 - 11,5]
Absence of Caries	35	20		
Presence of Bleeding				
Withbleeding	35	9	0,000	19,4 [4,6 - 82,1]
Withoutbleeding	3	15		
Presence of calculus				
Withpresence	28	3	0,000	19,6 [4,8 - 80,2]
Withoutpresence	10	21		
CPITN				

Code 1	3	15	0,000	1,0 [Reference]
Code 2	7	7		5,0 [0,9 - 25,3]
Code 3	25	2		62,5 [9,3 - 417,9]
Code 4	3	0		31,0 [1,2 - 747]
Oral Alterations				
Withalterations	30	1	0,000	86,3 [10,1 - 739,4]
Withoutalterations	8	23		

Table 3: Association between oral health risk factors and injuries.

In the final logistic regression model, CPITN and other buccodental alterations resulted as risk factors for lower sports performance, as shown in table 4.

	OR	STD. ERR	Z	P> z	P-value	0,000
					R ²	48,58%
					95% Confidence interval	
Gender	0,56	0,49	- 0,66	0,52	0,10	3,16
CPITN	3,64	2,41	1,95	0,05*	0,99	13,35
Presence of Caries	0,63	1,27	-0,23	0,82	0,01	32,7
DMFT	0,95	0,25	-0,16	0,87	0,56	1,6
Oral Alterations	29,22	35,14	2,81	0,00*	2,76	308,62
Cons	0,03	0,07	-1,47	0,14	0,00	3,19

Table 4: Logistic regression (response variable: excellent performance = 0; good performance = 1).

Discussion

In 2007, Soto et al., [4] reported a 62.5% in children aged 12, ostensibly less than our study, although comparable to that obtained in 1999 by Urbana, cited by Soto [4] to the same age which reached 84.34%. This could indicate that the measures taken in the country to reduce the prevalence of caries are being favorable; however, this advance appears not being observed in high performance athletes, who still maintain a similar prevalence to that of 15 years ago. This high level of tooth decay could be explained since most of the high-performance athletes belonged to educational establishments characterized by a low socio-economic level, some of them also come from rural areas, and according to Soto et al., [4] rurality and poverty are systematically associated to higher levels of oral disease.

Our findings coincide with Needleman et al. who describes that the state of oral health of elite athletes in dental revisions

made in major championships is on a lower average than population [5-7].

A DMFT index of 3,24 is found in our sample, there were no missing teeth, as compared to described in players of Barcelona football club [7], with a mean age of 21 years ($\pm 1,6$), where it was reported a DMFT 5,70, decayed 2,2, missed 0,6 and filled 2,9, showing an impaired oral health in both groups, which could be partially explained by the international origin of the players, since a relevant contingent comes from developing countries and because they are exposed to risk factors that favor the development of oral diseases like the exposition to a diet rich in carbohydrates [5,6], with high frequency, and probably they have not been educated in a healthy diet from the point of view of oral health. In addition, there is abundant evidence that adolescents usually neglect their habits of oral care [8,9]. The sugar-rich diet is due in part to sports drinks or isotonic drinks, highly consumed by elite athletes or people who practice sports [5-7]. These are made from varied electrolytes concentrations associated with carbohydrates, which have acid pH, lower than 5,5, critical point for the dental enamel. This acidic pH of sports drinks cause tooth erosion, transforming the enamel on a surface less mineralized, porous and prone to the appearance of dental caries, particularly if consumption is long and repetitive [5-7].

When relating the index of Damage by Caries (DMFT) with sports performance, we obtain as a result those athletes who had excellent performance, had a media of damage by caries lower than athletes with good and very good performance. However, these differences cannot be statistically significant; this could be attributed to the reduced sample obtained.

Periodontal damage was present in 71% of the athletes of high performance, similar results to those reported in Chile by Soto et al. (2007) [4], with 66,9%, and in Spain by Cosme Gay (2010) [10], with 68% in adolescents. The lower percentage of athletes who presented codes III and IV CPITN index is attributable to their ages mean, because most of them were teenagers, in contrast with the population where there is ample evidence of high percentages of III and IV codes [11,12].

When relating periodontal damage with athletic performance, our study yields evidence of a relationship between these variables, because athletes who present disease or periodontal damage obtained disparate sports performances, while those without periodontal damage had excellent performance. The mechanism of action of how pathological oral states could influence sports performance, initially expressed as tiredness to the effort and muscle fatigue, would be produced by microorganisms that are installed in the oral system and would induce the body defense systems to produce different types of inflammatory mediators. These mediators

may be located at different levels, which could cause a decrease in the speed of contraction - relaxation response of the muscle with fibrillar tone loss, which would translate into a decrease in sports performance [13,14].

We use the CPITN index in our study, widely used in research, oriented to determine the need for treatment and not the severity of illness. For future studies would be recommended to estimate the severity of the disease considering the level of clinical attachment, which would clearly identify if the patient has or had periodontal disease.

The predictive model gives evidence that the deterioration in oral health explains a relevant percentage of the sports performance through dental variables, giving foundation to the fact that the dental management of athletes is relevant to enhance sports marks. The most interpretative variable was “oral alterations”, but its explanatory role is conditioned by the interaction with the other variables in the model.

After having noted the deterioration of the oral health of high- performance athletes, we suggest that sport medicine teams should be complemented with an oral health program for the management of emergency, first aid care, rehabilitation and prevention, promoting general health and sports performance. This program, among others, should capacitate the trainers in oral health care, and on the other hand, is justified because the traditional care is expensive, requires time for the clinical attention and transfer, which can cause absenteeism to sports training.

It is proposed to future research to collect additional variables, such as oral hygiene index, history of dental trauma, mouth breathing, training overload, competitions overload, psychological stability, genetic markers, time spent on training and family stability; these variables could complement models that explain better athletic performance. As well, we proposed making a multicenter study in the future that provides higher levels of evidence to these findings.

Our study concludes that high-performance athletes have deteriorated oral health and provides evidence those buccodental diseases decreases athletic performance. Therefore, the contribution of the dentist to the sports medicine team could be essential to maximize sports marks. Furthermore, it is necessary to develop buccodental programs for athletes as a way to decrease inequalities and improve overall health quality.

Within the limitations of our study, while it is true that our study took a random representative sample of high-performance athletes, it was made from a particular region of Chile that has a small number of this type of athletes. The explanatory variable “oral alterations” comprises multiple pathologies such as mucosal

alterations, Temporomandibular joint disorders, dental trauma and malocclusions which could be confounding. Consequently we recommend for following studies that each pathology should be collected separately.

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