EGYPTIAN DENTAL JOURNAL

VOL. 64, 2477:2483, JULY, 2018

I.S.S.N 0070-9484

FIXED PROSTHODONTICS, DENTAL MATERIALS, CONSERVATIVE DENTISTRY AND ENDODONTICS

www.eda-egypt.org • Codex : 37/1807

CARIOGRAM AND CARIES RISK ASSESSMENT FOR ATHLETES

Wajdi Bardisi*, Yasser El-Bouhi** *and* Wahdan M. El-kwatehy***

ABSTRACT

Aims and Objectives: The aims of this study were evaluation and comparison of the caries risk factors in athletes and controls and evaluate the usefulness of cariogram for caries risk assessment in athletes.

Materials and Methods: The present study contains two groups (athletes and controls). Eight dental caries risk factors required for built up of the cariogram were recorded. Diary questionnaire used for recording diet content and frequency as well as fluoride exposure and frequency of tooth brushing, saliva samples were used for recording saliva flow rate and pH, direct interview with the participants was used for recording general health condition and dental examination was used for recording past dental history and dental plaque.

Results: There were significant differences between athletes and controls as regards past dental history, saliva flow rate, pH and frequency of food intake while the differences were not significant between them regarding diet content, tooth brushing, fluoride exposure and dental plaque.

Conclusion: The athletes had high risk for development of dental caries. This high risk may be due to decreased saliva flow rate and pH and increased frequency of food intake. The cariogram model is able to identify caries-related factors in athletes and can help sport dentistry for planning specific preventive program for them.

KEY WORDS: Caries Risk Assessment, Cariogram, Dental caries.

INTRODUCTION

Dental caries is very important dental health problem affecting the human race of both genders in all races, socioeconomic strata and age groups [1]. Dental caries is known to be a multifactorial disease process; host factors (saliva and teeth), the micro flora (cariogenic bacteria), the substrate (diet) and time. These different caries risk factors should be comprehensively studied, tackled, modified so that the dental caries can be prevented [2].

The relationship between sport and oral health problems has been investigated, the previous stud-

* Dental intern in College of Dentistry, Umm Al-Qura University, Saudi Arabia.

** Consultant, Alexandria Dental Research Center, Semouha, Alexandria, Egypt.- Assistant professor, Department of Conservative and Restorative Dentistry, College of Dentistry, Umm Al-Qura University, Saudi Arabia;

*** Assistant professor, Department of Preventive Dentistry, College of Dentistry, Umm Al-Qura University, Saudi Arabia; - Department of Dental Public Health and Preventive Dentistry, Faculty of Dentistry, Mansoura University, Egypt.

ies focused on the risk of trauma. However, athletes may have poor oral health including high levels of dental caries and erosion. According to different sports, the prevalence of dental caries is ranged from 15% to 75% of all athletes [3,4].

Frese et al (2015) carried out a study in Germany to evaluate the effect of training on dental erosion, caries and saliva among athletes who perform 5 or more hours of training per week. Their results showed that, the athletes mean cumulative Basic Erosive Wear Examination score was significantly higher than that of controls [5].

Antoon et al (2016) were studied the effect of exercise on the salivary flow rate, pH, viscosity and composition of saliva among twenty healthy dental students performed an aerobic exercise by cycling for 15 min on cycle-ergometers. The study showed that, there is a temporary increase in the viscosity of saliva immediately after moderate exercise, which is probably caused by an increase of the MUC5B secretion rate (Salivary mucin MUC5B is responsible for the visco-elastic behavior of saliva). On the other hand, there is in significant differences in saliva flow rate and pH [6].

The most of caries susceptibility tests developed is based on the microbiological aspects of dental caries. It is very difficult to measure all the factors responsible for caries using one caries activity test. So, the ideal method to evaluate caries activity in terms of sensitivity, specificity and reliability has not been found [7].

In the past, caries risk assessment was depend on individual risk factor but currently moved to an approach in which all risk factors are assessed based on the putative role they play in the etiology of the dental disease [8,9]. Many studies indicated that, cariogram was more accurate in predicting caries than any single factor and had shown promising results in predicting caries in children [10-12].

Little attention has been directed towards using cariogram for identifying the caries risk factors and caries risk assessment in athletes. So the present study was conducted to clarify the usefulness of cariogram for caries risk assessment in athletes.

AIM OF THE WORK

The present study was carried out to:

1- Determine the caries risk factors in athletes.

2- Compare between caries risk factors in athletes and controls.

3- Evaluate the usefulness of cariogram in caries risk assessment in athletes.

MATERIALS AND METHODS

Study design and subjects

The present study was a comparative case control study conducted in Makkah, Kingdom of Saudi Arabia from February to June, 2017. This study compare between two groups, the target population was athletes practicing different sports at Star Track Fitness Center, Makkah, KSA. By calculation of the sample size at confidence interval 95% and confidence level of 5%, the estimated sample was (52) which increased to (55) athletes. Group I (containing 55 athletes) matched with Group II (containing 55 non athletes). All participants were 18 - 40 years old non smoker males, free from any systemic diseases. Athletes were practice sport for at least 2 years ago. Athletes and controls were matched for age and socioeconomic status regarding educational level, occupation and income. The verbal informed consents were obtained from all participants at the beginning of the study. The study was carried out after obtaining ethical approval from institutional Review Board, College of Dentistry, Umm Al-Qura University no. #39-17#.

Dental examination

Dental examination was carried out by well trained calibrated examiner using visual examination with mirrors and probes at a fitness center, the participant was set on an ordinary chair and a good

source of artificial light was used. The dental caries experience was recorded according to World Health Organization criteria 1997 using DMFS Index [13]. Radiographs were not obtained. Dental plaque was scored according to Silness and Löe Plaque Index [14].

Saliva collection and pH measurement

Stimulated whole saliva was collected to determine the salivary flow rate and pH. The participants were informed about the saliva collection process, they instructed about saliva collection technique which was Spitting method, Subjects were instructed not to eat for one hour prior to the sampling, the subjects were allowed to sit on the chair and relax for a few minutes, then chew the non flavored gum for 5 minutes, each participant expectorated in disposable tube each 30 seconds to collect saliva and asked to avoid swallowing. After the collection, the amount of saliva was measured and flow rate (ml/min) was determined for each saliva sample. Salivary pH values were measured using a hand – held pH meter, 0.5 ml of each saliva sample was placed onto the pH-sensitive electrode to measure the pH value within 30 seconds.

Dietary information and fluoride exposure

Dietary information was collected from a weekly dietary questionnaire completed by each participant. All types and amount of the foods consumed for one week, frequency of main meals, drinks and snacks, types of fluoride used and the frequency of tooth brushing/day were included in the questionnaire and also recorded for one week.

Risk assessment according to cariogram

To complete the required information in the Cariogram program, Eight component factors were included as described in Table 1. Clinical judgment which is based on the opinion of the researcher was set to 1 for all the patients to avoid bias,. The normal past dental history for this age group considered when dental caries experience = 6-8 surfaces.

The Cariogram scoring of the past dental history was based on whether the subject had a dental caries experience below, within or above the age group range. Related diseases were obtained from direct interview with the participants. Salivary factors, dietary information, dental plaque scores, fluoride exposure scored as shown in table 1.

The cariogram was created by a well trained investigator who did not conduct the examinations, the data were entered into the cariogram software. Once information is entered into the program, a pie chart is automatically generated that shows a green area of the chart indicating the "actual chance to avoid new cavities".

Statistical analysis

Data were analyzed using SPSS software (statistical package for social sciences) version 22. Data were presented as mean ± standard deviation, unpaired independent student t test was used for comparison between the two groups, $P < 0.05$ was considered to be statistically significant [15].

RESULTS

The scores of caries risk factors are presented in table (2), on comparison between athletes and controls indicated that, there were statistically significant differences between them as regards DMFS scores (p=0.018), saliva flow rate (p=0.000), pH (p=0.011) and diet frequency (p=0.031). On the other hand, there were statistically no significant differences between them as regards diet contents (p=0.785), dental plaque scores (p = 0.793) and tooth brushing and fluoride exposure (p= 0.699).

Table (3), graph (1 and 2) shows the different sectors of cariogram. There were statistically significant difference between athletes and control group as regards the green sector (P=0.014) and red sector (P=0.031) while there were no significant difference between them as regards dark blue sector (P=0.103), faint blue sector (P=0.097) and yellow sector (P=0.165).

Table (1) Input variables and scores used to complete the Cariogram.

Scare	Variable	Instrument	Sector
Circumstance	Caries experience	DMFS of the population by age	0: No caries experience 1: Lower than the age group range 2: Within the age group range 3: Higher than the age group range
	Related Diseases	Face to face interview	0: No caries related disease 1: Related disease - Mild degree 2: Related disease - Severe degree
Diet	Diet content	Weeldy diet diary	0: Very low amount of sugar 1: Low amount of sugar 2: Moderate amount of sugar 3: High amount of sugar
	Diet Frequency	Weeldy diet diary	0: 0 to 3 daily intakes 1: 4 to 5 daily intakes 2: 6 to 7 daily intakes 3: More than 7 daily intakes
Bacteria	Plaque Quantity	Silness-Loe plaque index	0: No plaque accumulation 1: Mild plaque accumulation 2: Moderate plaque accumulation 3: Heavy plaque accumulation
Susceptibility	Fluoride program	Oral health questionnaire	0: Complete fluoride program 1: Irregular complete fluoride program 2: Only dentifrices 3: No fluoride supplements
	Salivary Secretion	Stimulated saliva Test	0: > 1.1 mL/min 1: 09 -1.1 mL/min 2: 0.5 -0.9 mL/min 3: <0.5 mL/min
	Buffering capacity	pH meter	0: pH > 6.8 1: 5.6 < pH>6.8 2: pH< 5.6

Table (2) shows the comparison between different caries risk factors in athletes and controls

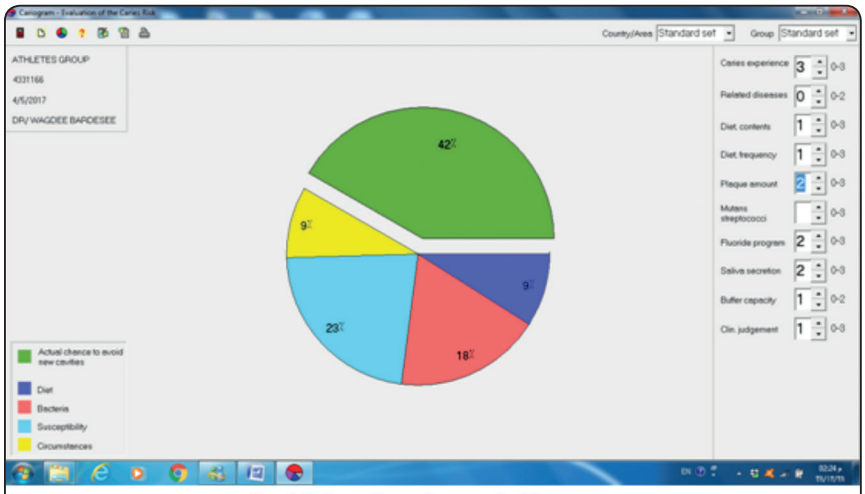
Groups Variable	Athletes group (mean ± SD)	Control group (mean ± SD)	Comparison (t test)
Age	29.3 ± 112	29.7 ± 10.3	t= 0.107 (p =0.912)
DMFS	21.0 ± 15.15	9.53 ± 9.38	t= 2.518 (p= 0.018)
S.F.R (ml/min)	1.65 ± 0.48	2.75± 0.81	t= 4.539 (p= 0.000)
pH	5.83 ± 0.40	6.34± 0.50	t= 2.743 (p=0.011)
Diet frequency	3.60 ± 0.91	2.80± 1.01	t= 2.274 (p= 0.031)
Diet content	1.27 ± 0.70	1.33 ± 0.62	t= 0.276 (p=0.785)
Dental plaque	1.80 ± 0.68	1.73 ± 0.70	t= 0.265 (p= 0.793)
Tooth brushing and fluoride	1.87 ± 0.35	1.80± 0.56	t= 0.390 (p= 0.699)

DMFS = Decayed, Missed due to caries and Filled permanent tooth Surface, S.F.R = Salive Flow Rate, SD = standard deviation, p = value of significance. t= independent t test at CI = 95% and level of significance at p ≤ 0.05.

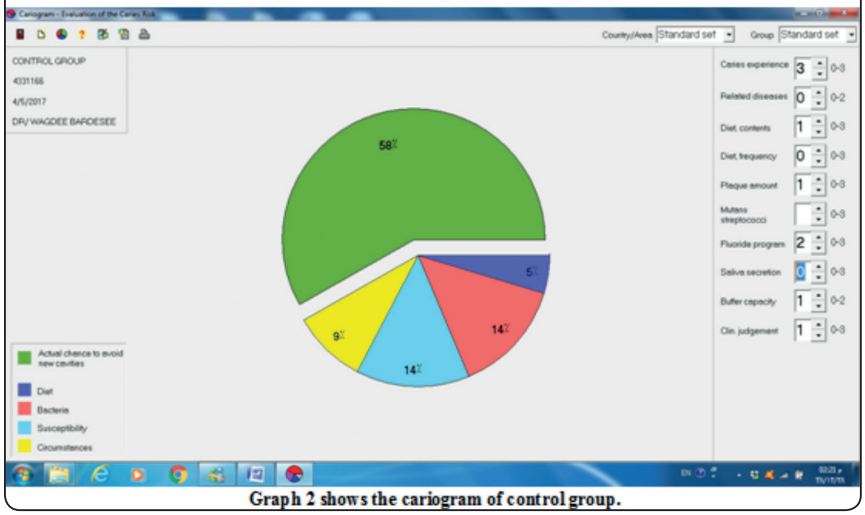
TABLE (3): Comparison between the different sectors of the cariogram in athletes and control group

The sector / Groups	Green (Mean ± SD)	Dark blue (Mean ± SD)	Red (Mean ± SD)	Faint blue (Mean ± SD)	Yellow (Mean ± SD)
Athletes	41.53±16.87	8.73±5.82	18.87±5.50	22.60±14.28	8.33±2.69
Control	58.07±17.51	5.90±2.92	14.67±4.61	14.57±11.19	6.67±3.64
t test (p value)	2.634(0.014)	1.685(0.103)	2.267(0.031)	1.715(0.097)	1.426(0.165)

SD = Standard Deviation, p= value of significance, t= independent t test at CI = 95% and level of significance at p ≤ 0.05.



Graph I shows the cariogram of athletes group.



Graph 2 shows the cariogram of control group.

DISCUSSION

The most common dental practice usually depend on individual caries risk factor during risk assessment but, as dental caries is a multifactorial disease, more than one factor can predict future caries [16], also health care providers need a helpful tool to assess risk before caries is present, for these reasons the present study was used cariogram as risk assessment tool in athletes to help in early caries risk detection and guides the dental health care providers in their decision making process involved in effective prevention and management of dental caries [17,18].

The increased caries risk in athletes may be due to increased past dental history (21.20 vs 9.53), decreased saliva flow rate (1.65 vs 2.75), increase the acidity of saliva (5.83 vs 6.29) and increased diet frequency (3.60 vs 2.80) in athletes group than control group (Table 2). The results of the present study was in agreement with the results of the previous studies which examined the relationship between dental erosion wear and caries in athletes and develop the hypothesis of high dental caries and erosive wear among them to their low level of saliva pH [5,19,20].

Although there are no significant differences between athletes and control group as regards dark blue, faint blue and yellow sectors, the green sector (chance to avoid future caries) is bigger in control group than athletes and the difference was statistically significant (Table 3). These findings indicating the importance of cariogram in caries risk assessment instead of individual risk factor assessment. Also, these results confirm and support the ability of cariogram in accurately estimating future caries for athletes. Hence a cariogram can be said to be a useful tool for caries prediction for them. These findings are in conformity with other studies reported in the literature [21-24].

Cariogram may be utilized as a powerful tool in identifying the risk for dental caries in athletes and can also help the policy makers of sport dentistry to plan for the future prevention of dental caries based on the caries risk prediction.

CONCLUSION

The athletes are in high risk for development of dental caries, this high risk may be due to decreased saliva flow rate and pH and increased frequency of food intake. The cariogram model is very helpful for health care worker to identify caries-related factors in athletes.

REFERENCES

1. Bagramian RA, Godoy FC, Volpe AR. The global increase in dental caries. A pending public health crisis. Am J Dent. 2009;21:3–8.
2. Park K. 18th ed. India: M/S Banarsidas Bhanot; Preventive and Social Medicine, 2005.
3. Needleman I, Ashley P, Petrie A, et al. Oral health and impact on performance of athletes participating in the London 2012 Olympic Games—a cross sectional study. Br J Sports Med. 2013;47:1054–1058.
4. Ashley P, Di Iorio A, Cole E, et al. Oral health of elite athletes and association with performance: a systematic review. Br J Sports Med. 2015; 49:14–19.
5. Frese C, Frese F, Kuhlmann S, et al. Effect of endurance training on dental erosion, caries and saliva. Scand J Med Sci Sports 2015; 25(3): 319–326.
6. Newbrun E. Ch. 8. 3rd ed. Chicago: Quintessence Publishing Company; Caries activity tests. Cariology;1989; 273–293.
7. Antoon J, Ligtenberg M., Erwin S, et al.; The effect of exercise on salivary viscosity. Diagnostics; 2016, 6(40):e1-e6.
8. American Dental Association. Caries diagnosis and risk assessment. A review of preventive strategies and management. J Am Dent Assoc. 1995; 126 Suppl:1S-24S.
9. Petersson GH, Twetman S, Bratthall D. Evaluation of a computer program for caries risk assessment in school children. Caries Res. 2002; 36(5):327-340.
10. Petersson GH. Assessing caries risk using the cariogram model. Swed Dent J Suppl. 2003;(158):1- 65.

11. Holgerson PL, Twetman S, Stecksen-Blicks C. Validation of an age-modified caries risk assessment program (cariogram) in preschool children. Acta Odontol Scand. 2009;67(2):106-12.

12. Campus G, Cagetti MG, Sale S, et al. Cariogram validity in schoolchildren: a two-year follow-up study. Caries Res. 2012; 46(1):16-22.

13- World Health Organization; Oral health surveys – basic methods. 4th ed. Geneva: World Health Organization; 1997.

14- Silness J. and Löe H.; Periodontal disease in pregnancy II; correlation between oral hygiene and periodontal condition. Acta Odont Scan, 1964; 22:121–135.

15- Bulman JS. and Osbron JO.; Statistics in Dentistry. Br Dent Assoc. 1989; 6:149.

16- Burt BA.; Concepts of risk in dental public health. Community Dent Oral Epidemiol. 2005;33(4):240-247.

17- Twetman S, Fontana M.; Patient caries risk assessment. Monogr Oral Sci. 2009;148:839-843.

18. Karabekiroglu S, Ünlü N. Effectiveness of Different Preventive Programs in Cariogram Parameters of Young Adults at High Caries Risk: Clinical Study. Int J Dent 2017; 1-10.

19. Mulic A, Tveit A, Songe D, et al. Dental erosive wear and salivary flow rate in physically active young adults. Mulic et al. BMC Oral Health; 2012, 12:8.

20. Shimazaki Y, Fu B, Yonemoto K, et al. Stimulated salivary flow rate and oral health status. J Oral Sci. 2017;59 (1):55-62.

21. Giacaman RA, Miranda Reyes P, Bravo Leön V.; Caries risk assessment in Chilean adolescents and adults and its association with caries experience. Braz Oral Res. 2013; 27(1):7-13.

22. Cabral R, Hilgert L, Faber J, Leal S.; Caries risk assessment in schoolchildren - a form based on cariogram® software. J Appl Oral Sci. 2014;22(5):397-402.

23. Kemparaj U, Chavan S, and Shetty NL; Caries risk assessment among school children in Davangere City using cariogram. Int J Prev Med. 2014; 5(5): 664–671.

24. Petersson1 G, Akerman S, Isberg P, Ericson D.; Comparison of risk assessment based on clinical judgment and cariogram in addition to patient perceived treatment need. BMC Oral Health; 2017; 17(13): e1-e9.