

Research Article

Sleep disorders and dental caries related to salivary alpha-amylase among dental students

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Abstract: College students experience several sleep problems, which may impact academic performance and health including dental health. The purpose of the study was to assess the effect of sleep disorders on dental caries status related to salivary alpha-amylase among dental students. Methods: A cross-sectional comparative study was done among dental students, aged 22 to 23 years attending the College of Dentistry, Al- Kufa University, 270 students have participated in this study. A questionnaire completed by those students was used to collect information about sleep disorders using Pittsburg sleep quality index. According to Manji et al (1989) criteria, teeth affected by dental caries were recorded. Unstimulated salivary samples were chemically analyzed for the detection of alpha-amylase using Enzyme Linked Immuno-Sorbent Assay. Results: It was found that the prevalence of poor sleep quality among dental students was 58.9% while the prevalence of dental caries in students with good sleep quality (75.68%) was higher than that for students with poor sleep quality (71.07%), also founded decay, missing and filling surfaces and decay level three of caries severity were significantly higher for students who had a good sleep quality. The mean value of salivary alpha-amylase was higher for students who had poor sleep quality yet difference was not significant. Conclusion: Caries experience was significantly higher among students with good sleep quality that was not affected by salivary amylase.

Keywords: Pittsburg sleep quality index, sleep disorder, alpha-amylase, dental caries

Introduction

Sleep disorders in adults often refer to sleep that is less than the recommended 7–8 hours each night^(1,2). Sleep deprivation is frequent among college students, and it can affect academic performance, health, and mood⁽³⁾. The National Sleep Foundation claims that 59% of adults aged 18 to 29 identify as night owls. Previous studies have been conducted on dental students to know the efficiency of sleep and its effect on them^(4,5), the researchers found that sleep loss effect on dental caries attributed that sleep deprivation is linked to lower salivary flow, lower IgA secretion, and higher salivary amylase activity⁽⁶⁾. Short sleep has also been linked to increased salivary interleukin-6 production, according to epidemiological evidence⁽⁷⁾ with high colony numbers of *Streptococcus mutans*⁽⁸⁾ also the relationship between late bedtimes and dental cavities in deciduous and permanent teeth was found^(9,10).

Studies have also shown the effect of sleep disturbances on salivary alpha-amylase, as they found an increase in salivary alpha-amylase activity following acute sleep restriction⁽¹¹⁾ and total sleep deprivation⁽¹²⁾. Elevated salivary alpha-amylase levels have been linked to driver stress during regular sleep-wake situations^(13,14) and slower reaction times⁽¹⁵⁾. Salivary amylase plays a very important role into digestion of starch⁽¹⁶⁾, and also plays role in bacterial clearance due to its binding activity to certain streptococci in the oral cavity in addition to its role in binding and adhesion of certain types of bacteria on the tooth surfaces⁽¹⁷⁾. Amylase is also involved in the production of pellicle that has developed on tooth surface. It inhibits the growth of certain bacteria directly and binds to lipopolysaccharide, a bacterial surface structure, and bacterial toxin, both of which cause tissue-damaging inflammatory reactions in many cases⁽¹⁸⁾. There has

been no previous Iraqi investigation on the impact of the sleeping disorder on dental caries among dental students; therefore, this research was carried out in connection to salivary amylase.

Materials and Methods

This study was a cross-sectional comparative study. Before data collection ethical approval was obtained from the Ethics Committee, College of Dentistry, University of Baghdad to perform this study. Official permission was obtained from the general direction of the College of Dentistry, University of Al – Kufa to interview the dental students.

The sample of the present study included the dental students of fourth and fifth grades aged 22-23 years from the College of Dentistry, University of Al – Kufa, n=270 (98 males, 172 females) participate in this study. A Pittsburgh sleep quality index (PSQI) questionnaire by Buysse et al. in 1989⁽¹⁹⁾ was used to assess sleep disorders as sleep quality is measured both quantitatively and subjectively. Through this questionnaire, the efficiency of sleep was known. The sleep latency, sleep length, habitual sleep efficiency, sleep disruptions, the utilization of sleep medicine, and daytime dysfunction are among the 19 self-rated items and seven clinically determined areas of sleep issues in the previous month included in the PSQI. On a scale of 0 to 3, each of these domains is equally weighted. The total seven component scores were added to provide a global PSQI score that ranges from 0 to 21. A PSQI score of more than 5 indicates poor sleep quality⁽¹⁹⁾. The reliability of this index was measured in the present study and founded to be equal to 0.67 Cronbach's alpha..

The decayed, missing, filled index (DMFs) was used to record the dental caries according to Manji et al⁽²⁰⁾, this index criteria allow for the recording of caries lesions on permanent teeth based on their severity (D1: brown color lesion in enamel only, D2: minor loss of the enamel surface, D3: carious lesion included the enamel and dentin only without pulpal involvement and D4: carious lesion with cavitation and possibility or definite pulpal involvement), M: Missing was recorded for teeth that has been extracted as a result of caries and F: Filling was recorded when one or more than one permanent restoration. Plane mouth dental mirrors and probes were used for clinical evaluations. To make comparisons regarding salivary alpha-amylase. Unstimulated saliva was pooled⁽²¹⁾ from subsamples (45 students with good sleep quality and 44 with poor sleep quality), the students advice to keep clam and relax, then instruct them to minimize movement and accumulate the saliva in the floor of mouth and then spit it out into the sterile disposable cap, the participants expectorated the saliva into the sterile container once every 30 second for 5 minutes, the samples were then immediately placed on ice to minimize bacterial degradation of salivary protein until subsequent processing⁽²²⁾, then samples were subsequently transferred to a lab for centrifugation and analysis. Salivary alpha-amylase ELISA Kit was used to measure the concentration in mg/dl using an Assay for Enzyme-Linked Immuno-Sorbent (ELISA) equipment. The manufacturer's instructions were followed for the reagent preparation concept, technique assay, and result calculation (Assay: Blank well tacked as zero, the absorbance (OD) of each well was measured one by one under 450 nm wavelength, which was conducted within 10 minutes after having added stop solution, according to standards concentrations and corresponding optical density (OD) values, the linear regression equation of the standard curve was calculated. This formula was used to convert OD values of samples to concentration of corresponding samples.

Statistical analysis

The Statistical Package for Social Research was used to conduct the statistical analysis (SPSS-22, Chicago, Illinois, USA) using frequency, percentage for qualitative variable, the mean and standard error for quantitative variable, Chi square for data distribution, Independent two sample T-test, and Pearson's correlation used as inferential statistics, the level of significance is at or lower than 0.05.

Results

The results of the present study illustrated the prevalence of poor sleep quality was found among dental students to be 58.9%. Concerning dentition status, the result showed that the prevalence of dental caries for the total sample was found to be 73%. For students with good sleep quality the prevalence was (75.68%) higher than this for students with poor sleep quality (71.07%). Results in Table 1 shows that the DMFS for students had good sleep quality is significantly higher than that for students with poor sleep quality, the same result was found concerning each component of DMFS but the differences were not significant. Concerning caries severity, Table 2 illustrates the mean value of the D₃ level of caries severity was significantly higher among students who had good sleep quality than those who had poor sleep quality. The same result was found concerning all other levels of caries severity however the differences were not significant.

Table1: Descriptive and inferential statistical analysis of caries experience (DMFS and its components) by sleep quality scale among dental students.

Caries experience	Pittsburg sleep quality index				T-test	P value
	good		poor			
	Mean	±SE	Mean	±SE		
DS	2.739	0.300	2.088	0.215	1.762	0.07
MS	0.532	0.190	0.440	0.157	0.371	0.71
FS	2.369	0.352	1.654	0.211	1.744	0.08
DMFS	5.640	0.540	4.182	0.365	2.234*	0.02
DMFT	3.874	0.314	3.164	0.237	1.806	0.07

D: decayed, M: missed, F: filled, S: surface, T: tooth

*significant P<0.05

Table 2: Descriptive and inferential statistical analysis of caries severity (D_{S1-4}) by sleep quality scale among dental students.

Caries severity	Pittsburg sleep quality index				T test	P value
	good		poor			
	Mean	±SE	Mean	±SE		
D₁	1.000	0.135	0.937	0.126	0.340	0.73
D₂	1.018	0.146	0.874	0.130	0.736	0.46
D₃	0.234	0.082	0.063	0.029	1.971*	0.02
D₄	0.486	0.182	0.214	0.091	1.340	0.18

D: decayed

*significant P<0.05

The result of the present study illustrated that the mean value of alpha-amylase was non significantly lower among students with good than poor sleep quality. While the results in Table 4 showed that among students with good sleep quality the correlations between dental alpha-amylase and DMFS , DMFT and MS were significant in a negative direction another result founded concerning students with poor sleep quality as the type the correlations were significant in positive direction for DMFS ,DMFT and FS.

Table 3: Descriptive statistical analysis of salivary amylase (mg/dl) by sleep quality scale among dental students.

	Pittsburgh Sleep Quality Index				T-test	P value
	good		poor			
	Mean	±SE	Mean	±SE		
salivary amylase	376.055	11.623	385.424	17.201	0.453	0.65

Table 4: Correlation between salivary amylase (mg/dl) and caries experience by Pittsburgh Sleep Quality Index.

		Amylase	
		r	P value
good	DS	-0.190	0.21
	MS	-0.468*	0.001
	FS	-0.176	0.24
	DMFS	-0.456*	0.002
	DMFT	-0.319*	0.03
poor	DS	0.294	0.05
	MS	0.062	0.68
	FS	0.379*	0.01
	DMFS	0.406*	0.006
	DMFT	0.322*	0.03

D: decayed, M: missed, F: filled, S: surface, T: tooth

*significant P≤0.05

Discussion

Sleep disorders have become common among students (23). This study deals with students of the fourth and fifth grades of the Faculty of Dentistry because they are exposed to tension and anxiety about exams, especially the fatigue generated because of work overload in the clinic, which may affect the efficiency of their sleep (24). In Iraq this is the first study to investigate the relationship between sleep quality and dental caries among dental students. Concerning sleep quality status the results of current study showed that the occurrence of dental caries among students with good sleep quality was (75.68%) higher than this for students with poor sleep quality (71.07%).

Although dental caries is considered a multifactorial disease the data of the present study found that that the mean of DMFS and D₃ were significantly higher among students with good sleep quality than those with poor sleep quality. This results could be explained by many factors include:

It was found that insomnia which was associated with decreased appetite (25), loss of appetite, defined as the reduced desire to eat, may vary due to psychobiological changes and environmental factors such as very high temperature cause loss of appetite (26). Sleep disturbance might negatively affect daily life with both psychological and physical consequences, such as daytime tiredness (27). The consequences of tiredness might lead to disrupted food routines and a potential risk of meals being postponed until a later time. That can in turn lead to decreased food intake (especially the cariogenic food) this lead to a decrease in dental caries, as found AM et al, 2013 positive relation between food consumption and caries (28). Also it was found in present study that the students who had poor sleep quality had higher levels of salivary alpha amylase which plays an important role in reducing dental caries (29), compared to those who had good sleep quality.

However this result disagree with other studies that link late bed times and dental caries (9,10), as they link between short sleep and high levels of *Streptococcus mutans* colony counts (8). Also disagree with the result of Yuen et al. in 2014 (30) who found that flossing and mouth rinsing were significantly more frequent in subjects with less PSQI..

The salivary alpha-amylase was found in the present study to be non-significantly higher among students with poor sleep quality this goes in accordance with previous studies (11,12). It was found that poor sleep quality was associated with psychological problems (31,32) and this leads to an increase salivary alpha amylase, due to salivary alpha amylase has its release regulated by the sympathetic autonomic nervous system (33), and has importance in the psychobiology of stress. The levels of salivary alpha amylase in humans increase under various conditions of physical and psychological stress before any other clinical

signs can be perceived. Therefore, the salivary alpha amylase may act as effective biomarker, which can be used alternatively noninvasive way to evaluate psychological stress.

Concerning the relation between salivary alpha-amylase and dental decay result of this study found significant negative relation that proves the protective effect of salivary alpha-amylase ⁽¹⁶⁾, this is agreed with a previous Iraqi study which found the same results concerning the relation between salivary alpha-amylase and dental caries ⁽²⁹⁾. While another study ⁽³⁴⁾, disproved any significant correlation. meanwhile, an opposite result was found for the poor sleep quality students as salivary alpha-amylase go significantly in a positive direction perhaps due to poor sleep quality and their impact on oral health ⁽³⁵⁾. The limitation of this study included small sample size was due to limited time duration for sample collection which was affected by student's exams and time constraints due to commitment to clinics.

Conclusion

Caries experience was significantly higher among students with good sleep quality that was not affected by salivary amylase.

Conflict of interest

The authors have no conflict of interest to declare.

Author contributions

AAA and BSD; study conception and design. AAA; data collection. AAA and BSD; Methodology, statistical analysis and interpretation of results. AAA; original draft manuscript preparation. AAA and BSD; Writing - review & editing. Supervision; BSD. Both authors reviewed the results and approved the final version of the manuscript to be published. As for SR, some modifications and notes have been added.

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Ethical approval

All of the individuals were given thorough information about the study and the procedures involved, and their informed consent was acquired on a form approved by the ethics committee of the University of Baghdad / College of dentistry.

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اضطرابات النوم و تسوس الاسنان المرتبطة باميليز الفا اللعابي بين طلاب طب الاسنان

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المستخلص

: خلفية: يعاني طلاب الكلية من عدد من مشاكل النوم ، والتي قد تؤثر على الأداء الأكاديمي والصحة بما في ذلك صحة الأسنان. كان الغرض من الدراسة هو تقييم تأثير اضطرابات النوم على حالة تسوس الاسنان المتعلقة بالأميليز اللعابي. الطريقة: تم إجراء دراسة مقطعية على طلاب طب الأسنان الذين تتراوح أعمارهم بين 22 و 23 سنة من الملتحقين بكلية طب الاسنان في جامعة الكوفة. شارك في هذه الدراسة 270 طالب وطالبة. تم ملء استبيان من قبل هؤلاء الطلاب تم استخدامه لجمع المعلومات المتعلقة باضطرابات النوم مؤشر جودة النوم في بيتسبرج (PSQI). تم تسجيل تسوس الأسنان وفقاً لـ (Manji et al) في عام 1989 ، تم تحليل عينات اللعاب غير المحفزة كيميائياً للكشف عن (α -amylase) باستخدام فحص مناعي مرتبط بالإنزيم. النتائج: تبين من خلال الدراسة أن حدوث تسوس الأسنان لدى الطلاب الذين يتمتعون بنوم جيد (75.68%) أعلى من الطلاب الذين يعانون من قلة كفاءه النوم (71.07%) ، ووجدوا أيضاً أن (DMFS) أعلى بالنسبة للطلاب الذين يتمتعون بنوعية نوم جيدة من أولئك الذين يعانون من ضعف نوعية النوم ولكن لا يوجد فرق معنوي إلا في المستوى D3 والنتيجة هي اختلاف كبير. ولكن متوسط قيمة ألفا أميليز اللعابي أعلى للطلاب الذين يعانون من ضعف جودة النوم أفضل من أولئك الذين يتمتعون بنوعية نوم جيدة ولكن الاختلاف ليس كبيراً. الخلاصة: تسوس الأسنان (DMFS) شدة التسوس) أعلى بالنسبة للطلاب الذين يتمتعون بنوعية نوم جيدة مقارنة بأولئك الذين يعانون من ضعف نوعية النوم ، على عكس مستوى ألفا أميليز المرتفع بين الطلاب الذين يعانون من قلة جودة النوم من أولئك الذين يتمتعون بنوم جيد.