Dentistry Section

Relationship of Perceived Stress and Dental Caries among Pre University Students in Bangalore City

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ABSTRACT

Introduction: Stress can increase the susceptibility to dental caries by four possible mechanisms. Studies show that adolescents tend to more likely develop negative body image, disturbed eating behaviours and high levels of stress. Students report stress, taking and studying for exams being the greatest source of academic stress due to competition and the large amount of content in less time.

Aims and Objectives: The objectives were to analyze the caries experience in relation to perceived stress during preuniversity examination period, to estimate the prevalence of dental caries and to calculate SiC (significant caries index) among preuniversity students in Marathahalli, Bangalore city, India.

Materials and Methods: This cross-sectional, correlational study involved 210 students (Response rate = 65.37%). The questionnaire consisted of demographic details and Perceived Stress Scale (PSS). Dental caries status was evaluated using the WHO (1997) caries diagnostic criteria for decayed, missing, and filled teeth (DMFT: Dynamical mean field theory).

Results: Prevalence of dental caries was 50.48%. Mean DMFT was 1.74 and Sic index was 4.56. The correlation between PSS and caries experience was found to be weak (r=0.389) (p<0.001).

Conclusion: Academic stress appears to affect oral health, shown by higher caries experience in high perceived stress score individuals.

Keywords: Caries experience, DMFT, Perceived stress, Sic index

INTRODUCTION

The most important concept that underlies all attempts to understand the influence of social and physiological factors on general health and oral health is that of stress [1]. Stress had been defined as "an inharmonious fit between the person and the environment, one in which the person's resources are taxed or exceeded, forcing the person to struggle, usually in complex ways, to cope" [2]. If people perceive an event as more than they could deal with and exceed the resources available to them, then only at this point do they perceive stress that could lead to disease.

Several pathologies of the oral cavity have been associated with stress such as periodontal disease, acute necrotizing ulcerative gingivitis, dental caries, recurrent aphthous ulcerations, and upper respiratory infections [3]. Although bacteria are essential for dental caries, several host and environmental factors, including psychosocial stress, may increase susceptibility. In one of the first books on dentistry, Fauchard theorized in 1746 that dental caries may be related to stress [4]. The association between stress and heightened susceptibility to dental caries has been demonstrated in both human [1,5-7] and animal studies [8].

Stress can increase the susceptibility to dental caries by four possible mechanisms:

1. Affecting the immune system and compromising host resistance to cariogenic bacteria [3] partly by increasing serum and salivary catecholamines and corticosteroids. The cortisol level of the body increases during stress producing acid that can be determined using litmus test on the tongue creating a favourable environment for bacteria. A study concluded that children with and without dental caries differ significantly in the mean values of urinary catecholamines [6].

2. By reducing salivary secretion leading to decreased clearance of cariogenic bacteria- Subjective oral dryness and unstimulated salivary flow were significantly associated with perceived stress [9-10].

3. By unhealthy emotional eating habits leading to frequent snacking and more intake of sugar containing diet [6,11].

4. By impaired performance of self-care habits (flossing teeth, brushing teeth) [12] leading to poor oral hygiene creating favourable environment for bacteria.

Also, studies show that adolescents tend to more likely develop negative body image, disturbed eating behaviours and high levels of stress [11]. Students report stress, taking and studying for exams being the greatest source of academic stress due to competition and the large amount of content in less time [13-14].

Hence, this study aims to assess potential relationship between perceived stress and caries experience during their preuniversity examination period in preuniversity students in Marathahalli, Bangalore city, India. The study also has the objective to provide baseline data on the prevalence of dental caries and to calculate significant caries index (SiC), proposed by Bratthall [15], to bring attention to the adolescents with the highest caries scores in preuniversity students in Marathahalli, Bangalore City, India.

MATERIALS AND METHODS

This cross-sectional study involved 210 students during their preuniversity examination period from the only two existing preuniversity colleges in Marathahalli, Bangalore from May 2014 to June 2014. The sites were chosen, because they provided adequate and convenient samples that fitted the budget and time limitations of the study. Based on the results of the pilot study on 30 participants, the sample size was calculated for oral health parameter assessed, i.e., for decayed, missing, and filled teeth. Sample size was calculated using the formula

$$\text{Sample size} = \frac{Z^2 \times (p) \times (1-p)}{c^2}$$

Z = Z value (1.96 for 95% confidence interval)

P = % of picking a choice, expressed as decimal (80% expressed as 0.8)

C = confidence interval, expressed as decimal

So, the sample size was $\dfrac{(1.96)^2 \times 0.8 \times 0.2}{(0.056)^2}$

Class	Gender		Total
	Male	Female	
1st PUC	63	57	120(57.14%)
2nd PUC	37	53	90(42.86%)
Total	100(47.62%)	110(52.38%)	210(100%)

[Table/Fig-1]: Distribution of sample according to gender and class of study

Gender	Mean	Std dev	Class	Mean	Std dev
Male	27.47	7.15	1st PUC	27.18	7.15
Female	27.05	6.86	2nd PUC	27.34	6.80
p- value = 0.661			p- value = 0.862		

[Table/Fig-2]: Comparison of perceived stress score according to gender and class of study

Class	Gender		Total
	Male	Female	
1st PUC	27	28	55(45.83%)
2nd PUC	18	33	51(56.67%)
Total	45(45%)	61(55.45%)	106(50.48%)

[Table/Fig-3]: Prevalence of DMFT between males and females and class of study

Gender	Mean	Std dev	Class	Mean	Std dev
Male	1.47	2.30	1st PUC	1.47	2.22
Female	1.96	2.61	2nd PUC	2.08	2.75
p- value = 0.107, Z = -1.612			p- value = 0.139, Z = -1.480		

[Table/Fig-4]: Comparison of DMFT scores according of gender and class of study

Category	R	p-Value
Overall	0.389	<0.001*
Males	0.579	<0.001*
Females	0.242	0.011*
1st PUC	0.413	<0.001*
2nd PUC	0.372	<0.001*

[Table/Fig-5]: Distribution of sample according to gender and class of study
*denotes significant correlation

Factor	Factor1	Factor2	Factor3	Factor4	Factor5
Loadings	q1	q4	q5	q6	q8
	q2	q7	q10	q9	
	q3	q13			
	q11				
	q12				
	q14				
% Variance xplained	18.00	11.80	10.90	10.00	9.50
Rename	Work load	Managing work	Achievement	Personal problems	Failures

[Table/Fig-6]: PSS Factor analysis

Predictor	B	Std Error of β	p-Value	R²
Constant	-2.025	0.6364	0.002	0.151
Perceived Stress Score	0.138	0.0226	<0.001*	

[Table/Fig-7]: Regression results table
*denotes a significant factor

Sample size = 196 which was rounded off to minimum 200 participants.

A questionnaire and oral examination was used to collect the data. The questionnaire consisted of demographic details and Perceived Stress Scale (PSS) [16]. PSS, by Cohen is a 14-item scale designed to measure the degree to which life situations were appraised as stressful by the individual within the last month. Each item was rated on a 5-point answer scale ranging from 0: "never" to 4: "very often". We used the 14-item PSS version due to its notable good psychometric properties and the evidence of its validity [16].

Oral examination to assess dental caries status was evaluated using the WHO caries diagnostic criteria for decayed, missing, and filled teeth (DMFT) by a single calibrated examiner using a plane mouth mirror and CPI probe under natural light (Type 3). Training and calibration exercises were undertaken before commencement.

Those who agreed to participate in the study were asked to sign the consent form. The subject providing positive history of any systemic disease was excluded from the study. Subjects were then given self-administered questionnaires. Instructions were given and the investigator stood by to answer questions. Upon completion of the questionnaire, the oral examination was carried out. Response rate was 65.37% (total-335 students and participants-219). Nine students were excluded from analysis. Hence, results of this study were based on 210 subjects.

RESULTS

The age of the population ranged from 15 to 18 years with the mean age of 16.8 years, 47.62% (100) of the study subjects were male and 52.38% (110) were females, 57.14% (120) study subjects were from 1st PUC and 42.86% (90) from 2nd PUC [Table/Fig-1]. Males recorded a slightly higher mean perceived stress score (27.47 ± 7.15) compared to females (27.05 ± 6.86) but the difference was not statistically significant (p>0.05) [Table/Fig-2]. Second PUC students (27.34 + 6.80) recorded a slightly higher mean perceived

stress score compared to 1st PUC students (27.18 + 7.15) but the difference was not statistically significant (p>0.05) [Table/Fig-2].

Prevalence of dental caries in the study sample was 50.48% (106). Males had 45% whereas females had 55.45% of caries experience. Prevalence of dental caries experience was 45.83% (55) in 1st PUC students and 56.67% in 2nd PUC students and differences were found significant [Table/Fig-3]. Females (1.96 ± 0.61) recorded a slightly higher mean DMFT score compared to males (1.47 ± 2.30) but the difference was not statistically significant (p>0.05) [Table/Fig-4]. Second PUC students (2.08 ± 2.75) recorded a slightly higher mean DMFT score compared to 1st PUC students (1.47 ± 2.22) but the difference was not statistically significant (p>0.05) [Table/Fig-4]. Mean DMFT of the study sample is 1.74 ± 10.28. SiC index score for sample is 4.56.

Overall, the correlation between perceived stress score and DMFT scores in the sample was found to be weak (r=0.389) but highly significant (p<0.001). The correlation between perceived stress score and DMFT scores in males was found to be moderate (r=0.579) and highly significant (p<0.001).The correlation between perceived stress score and DMFT scores in females was found to be very weak (r=0.242) but statistically significant (p<0.05). The correlation between perceived stress score and DMFT scores in 1st PUC students was found to be moderate (r=0.416) and statistically significant (p<0.001). The correlation between perceived stress score and DMFT scores in 2nd PUC students was found to be weak (r=0.372) but statistically significant (p<0.001) [Table/Fig-5].

An exploratory factor analysis was deployed to compare the relationships among the PSS items. The Cronbach's alpha for the perceived stress responses was 0.76. A principal component analysis was performed in which the factors were extracted and rotated by the Varimax method yielding 5 factors which together accounted for 60.2% of the response variance.

The factors extracted from the data were renamed. Six items loaded highly on the first factor which explained 18.0% (Items 1,2,3,11,12 and 14) of the variance which has been renamed as "Work load". The second factor accounted for 11.8% of the variance and three

items highly loaded on it (Items 4,7 and 13) and has been renamed as "Managing work". Item 5 and 10 load into factor 3 which has been renamed as "Achievement". Item 6 and 9 load into factor 4 and has been renamed as "Personal problems". Item 8 loads into factor 5 and has been renamed as "Failures" [Table/Fig-6]. Examination of the highest loadings for each item indicated that items that were positively phrased loaded on the first factor and negatively phrased statements loaded on the second factor. Accordingly, scores for the PSS were obtained by summing responses with the negative items reversed. The PSS scores ranged from 13 to 50.

The regression equation was DMFT score = -2.025 + 0.138 Perceived Stress.

This study observed that Perceived stress score was a significant factor influencing DMFT score (p<0.001). R^2=0.151 implies that Perceived Stress Score explains up to 15.1% of the variation in DMFT. For every unit change in perceived stress score, there will be an increase in DMFT score [Table/Fig-7].

DISCUSSION

The study subjects were based on convenience sampling. A significant issue to consider is whether the findings of this study are generalizable to other populations. To discuss external validity (generalizability), we have to base our rating on the representativeness of the accessible population with the target population and adequacy of the response rate. Sample was by no means representative of the whole population.

Response rate was 65.37% of the total sample available and non-response was related to being absent in class on the day of clinical examinations or lack of time to participate in study during the examination period. However, internal validity is not directly affected by the type of sampling. This research could still provide valuable insights about the relation between stress and caries experience.

Psychosocial factors have been suggested by several studies to play a possible role in dental caries [1,17] though the data to support these contentions are sparse. In present study, findings from the analysis demonstrated the correlation between perceived stress score and DMFT scores in the overall sample to be weak (+0.389) but statistically significant.

A similar cross-sectional study was conducted in a refugee camp in Tanzania, with an aim to analyze the caries experience in relation to perceived stress on a sample of 194 persons, aged 11 to 39 years. They found a consistent association between caries experience and perceived stress [1].

More recently, a study [17] investigated the relationship between distress and tooth loss using PSS. They concluded that behaviour and psychological stress only modestly attenuated socio-economic inequality in retention of < 20 teeth, providing evidence to support a mediating role of stress coping.

Animal studies also seem to support this relationship. For example, in a study [12] of rats inoculated orally with cariogenic germs those with increased stress had increased severity and incidence of dental caries.

However, one study [18] on 89 patients in age from 17 to 68 years investigated the relationship of mental stress and oral health and concluded that there was no relationship between DMF score and mental stress. In another descriptive study, Hubbard and Workman [4] could not find a clear relationship between stress family events and dental caries in infants.

Discrepancies in results may be due to several factors such as the differences in the variables controlled for, the kinds of stress dimensions investigated, stress level, and the sensitivity of psychometric instruments employed. Other factors are likely to include differences in sampling strategies, study design, age range, criteria for study eligibility and varying case-definitions for dental caries. In addition to those issues just described, participants may

under-report or over-report their perceived stress for a number of reasons.

Only 15.1% of the variance in caries experience in the sample was explained by perceived stress accounted in this study clearly suggesting that there are important factors other than those examined in this study that may account for the remaining variance, for example, there was no information collected on bacterial activity.

Summing up, the findings in this study were in accord with other studies that reported significant relationships between stress and caries experience [1,12,17]. This is despite the difference in the psychometric instruments used and the diversity of the stress variables examined. Nevertheless, there are a small number of studies [4,18] that failed to find a significant association between perceived stress and caries experience.

Although dental caries has been the most commonly investigated oral disease, most studies focus on children, and studies on caries among adolescents and young adults are scarce. Present study showed 50.48% overall caries prevalence, whilst the DMFT index was 1.74±10.28. The SiC index was 4.56. Similar to our study, a survey in Mexican adolescents and adults showed caries prevalence 74.4%, DMFT index 4.04±3.90 and Sic index 8.64 [19].

Another study on adolescents aged 15 to 18 years in Brazil had caries prevalence of 84.5% with DMFT index 5.48±4.22. The Sic index score was 9.71±2.85 [7].

There are several limitations that are worthy of discussion. The major weakness of this study is its cross-sectional design, which does not give us information about temporality of stress exposure. Patient's stress responses may reflect recent symptoms, while dental caries is a chronic and cumulative disease. Also, disease activity and dietary habits were not measured in this study, one cannot be positive about the temporal precedence in the relationship between stress and dental caries so cannot establish causality. Another major limitation is the convenience nature of the sample. Also, stress scales are self-reported rather than direct observation instruments. When this type of instrument is used in research, one should bear in mind that the respondents may supply incorrect information.

CONCLUSION

The PSS scores of the study cohort during their preuniversity examination period ranged from 13 to 50. Prevalence of caries in the study sample was 50.48%. Mean DMFT score was 1.74+10.28 and Sic score was 4.56. Overall, this study showed a statistically significant correlation between perceived stress and caries experience. Therefore, the clinical implication should be to inform individuals about stress as a possible risk factor for dental caries and to introduce additional preventive strategies in these individuals. Also, at the same time we need to further develop a high-risk approach towards our adolescent population as well as take strict measures to prevent a delayed caries development in them. Future research needs to integrate macro-social determinants into a unifying explanation, along with both psychosocial and biological determinants, and establish an evidence-based theoretical framework to help develop their causal link.

REFERENCES

[1]   Honkala E, Maidi D, Kolmakow S. Dental caries and stress among south African political refugees. *Quintessence Int.* 1992; 23:579-83.
[2]   Lazarus RS, Folkman S. Stress, Appraisal and Coping. New York: Springer, 1984.
[3]   Bosch JA, Brand HS, Ligtenberg AJM, Bermond B, Hoogstraten J, Nieuw Amerongen AV. Psychological stress as a determinant of protein levels and salivary-induced aggregation of streptococcus gordonii in human whole saliva. *Psychosom Med*. 1996;58:374-82.
[4]   Hubbard JR, Workman EA. Handbook of stress medicine an organ system approach. Boca Raton, New York: *CRC Press,* 1998.
[5]   Beck JD, Kohout FJ, Hunt RJ, Heckert DA. Root caries: physical, medical and psychosocial correlates in an elderly population. *Gerodontics*. 1987;3(6):242-47.

[6]   Vanderas AP, Manetas C, Papagiannoulis L. Urinary catecholamine levels in children with and without dental caries. *J Dent Res.* 1995;74(10):1671-78.

[7]   Hugo FN, Campos G, Ccahuana-Vásquez RA, Cypriano S, Sousa ML. Polarisation of dental caries among individuals aged 15 to 18 years. *J Appl Oral Sci.* 2007;15(4):253-58.

[8]   Myrin Borysenko, Samuel Turesky, Joan Z. Borysenko: stress and dental caries in the rat. *Journal of Behavioral Medicine.* 1980;3(3):233-43.

[9]   Bergdahl M, Bergdahl J. Low unstimulated salivary flow and subjective oral dryness: association with medication, anxiety, depression, and stress. *J Dent Res.* 2000;79(9); 1652-58.

[10] Hugo FN, Hilgert JB, Corso S, Padilha DM, Bozzetti MC, Bandeira DR, et al. Association of chronic stress, depression symptoms and cortisol with low saliva flow in a sample of south-Brazilians aged 50 years and older. *Gerodontology.* 2008;25:18-25.

[11] Sanlier N, Ogretir AD. The relationship between stress and eating behaviors among turkish adolescence. *World Applied Sciences Journal.* 2008;4(2):233-37.

[12] Megan Oaten, Ken Cheng. Academic examination stress impairs self–control. *Journal of Social and Clinical Psychology.* 2005;24(2):254-79.

[13] Frazer GH, Kohn JP. An academic stress scale: identification and rated importance of academic stressor. *Psychological Reports.* 1986;59(2):415-26.

[14] Abouserie R. Sources and levels of stress in relation to locus of control and self esteem in university students. *Educational Psychology.* 1994;14(3):323-30.

[15] Bratthall D. Introducing the significant caries index together with a proposal for a new global oral health goal for 12-year-olds. *Int Dent J.* 2000;50:378-84.

[16] Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav.* 1983;24(4):385-96.

[17] Sanders AE, Slade GD, Turrell G, Spencer AJ, Marcenes W. Does psychological stress mediate social deprivation in tooth loss? *J Dent Res.* 2007;86(12):1166-70.

[18] Davis CH, C. Jenkins D. Mental stress and oral diseases. *J Dent Res.*1962;41(5):1045-49.

[19] Cortés JO, Solís CE, Rodriguez JP, Cruz JA, Cerda E, Marín N, Loyola AP. Dental caries experience, prevalence and severity in Mexican Adolescents and young adults. *Rev salud pública.* 2009;11(1):82-91.

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