Original Research Article

Title: Stress and its influence on salivary Biomarkers and oral health among medical students.

A Cross sectional Clinico – Biochemical study

Abstract

Aim: To evaluate the perceived stress among first year Medical students', and its influence on Salivary biomarkers and gingival inflammation among medical students'.

Methodology: Cohen's Perceived Stress Scale and a modified self administered questionnaire was given to a convenient sample of 85 study subjects who got admission in private medical college and hospital to assess perceived stress and possible potential factors. Clinical oral examination, (Gingival health) by Modified Quigley Hein plaque Index, Loe and Silness Gingival index, sulcus bleeding index; Also their Unstimulated Pooled saliva samples was collected to estimate salivary bio markers(cortisol level and interleukin 1 beta).

Results: According to Perceived stress score by Cohen, majority were stressed (score more than 13) 85% (n=73), possible potential factors like, 60% of study subjects were not staying in hostel previously, among which, majority (n=44) study subjects were stressed 87.1% of study subjects were having a nuclear family among which majority (75.3%)of study subjects were stressed.

Conclusion: Majority of the first year Medical students showed perceived stress, among which factors like students having experience of hostel stay showed more stress, whereas the perceived stress dint had any effect on salivary biomarkers. Future longitudinal studies are emphasized to monitor salivary biomarkers and its effect on oral health

Key words: Stress, Cortisol, Interleukin one beta, Gingiva

Introduction

Stress is defined as 'pressure or worry caused by problems in somebody's life . It describes external demands (physical or mental) on an individual's physical and psychological wellbeing. The perception of stress, in fact is frequently by one's personal system of beliefs and attitudes. These self-cognitions mediate the perceived stressor and consequent student behavior in turn effecting academic performance (Westerman GH, Grandy TG, Ocanto RA, Erskine CG 1993 and Divaris K, et al.2008)

The stress reaction includes activation of the hypothalamus-pituitary-adrenal cortex (HPA) axis, with release of corticotrophin-releasing hormone from the hypothalamus, and glucocorticoids, including cortisol from the adrenal cortex. In the HPA system, cortisol secretion is regulated by the adrenocorticotropic hormone from the pituitary gland. Salivary cortisol levels are closely correlated to blood cortisol levels and, therefore, reliably reflect HPA activity (Kirschbaum C, Hellhammer DH, 1994).

Medical education stands out as a distinctive educational procedure and is perceived as being stressful, and a high level of stress may have a negative effect on cognitive functioning and learning of students in a medical school. It involves the acquisition of required academic, clinical and interpersonal skills within educational programmes. Such a challenge is unlike anything students have faced before, regardless of their pre-professional background (Chrousos GP,1995).

The potential negative effects of emotional distress on medical students include impairment of functioning in class-room performance and clinical practice, stress-induced disorders and deteriorating performance (Shah M, 2010)

Academic stress appears to affect oral health, shown by more plaque accumulation, and increased amounts of IL 1 BETA, IL-6, IL-10 in GCF and in turn effecting periodontal health and increase cortisol level in saliva (Deinzer R, Forster P, Fuck L, Herforth A, Stiller-Winkler R, Idel H, 1999; Deinzer R, Hilpert D, Bach K, Schawacht M, Herforth A, 2001; Deinzer R, Rattermann S, Mobes O, Herforth A,1998; Johannsen A, Bjurshammar N, Gustafsson A2010; Deinzer R, Kottman W, Forster P, Herforth A, Stiller-Winkler R, Idel H,2000)

Thus keeping in mind several stress related studies which are well established on medical students including cross sectional questionnaires study being done (Shah M ,2010; Murphy RJ, Gray SA, Sterling G, Reeves K, DuCette J,2009; Aboalshamat K, Hou XY, Strodl E 2014; Masry EL R, Ghreiz SM, Helal RM, Audeh AM, Shams T, 2013)and stress studies on oral health especially gingival inflammation and periodontitis (Deinzer R, Forster P, Fuck L, Herforth A, Stiller-Winkler R, Idel H, 1999; Deinzer R, Hilpert D, Bach K, Schawacht M, Herforth A, 2001; Deinzer R, Rattermann S, Mobes O, Herforth A,1998; Johannsen A, Bjurshammar N, Gustafsson A2010) There is paucity in studies among medical students' perceived academic stress and its influence on salivary and inflammatory markers and oral health.. The present study is aimed to further understand the perceived stress among first year MBBS students', may significantly contribute towards gingival inflammation and variations in interleukin 1 beta and cortisol in saliva. Results of the present study may be utilized in planning academic schedule and curricula of professional health sciences institutions and further to develop scientific evidence based modules to effectively manage stress in academic environment. Thus this study aims to evaluate the Perceived Stress and its influence on salivary Biomarkers (Cortisol and interleukin one beta) and oral health among medical students.

Methodology:

First year Medical Students who had got admission in a private medical college and hospital were taken into the study and was conducted in full accordance with the ethical principles of the Institution's Ethical Committee and the World Medical Association Declaration of Helsinki; with clearance from institutional review board

Study purpose and procedures were fully explained to the students, and those who were willing to get involved voluntarily in the study, were involved and written informed consent(http://www.who.int/rpc/research_ethics/InformedConsent-clinicalstudies. 22/4/15)was obtained

This Clinico-biochemical study consisted of a convenient sample of 85 study subjects who got admission in private medical college and hospital. Salivary biomarkers taken in to consideration were cortisol and interleukin 1 beta; gingival inflammation was considered in oral health.

Also the following criteria's were taken into consideration

The specific **inclusion criteria** were as follows:

1. First year Medical Study subjects signing the informed consent form after knowing the purpose, objectives, methodology of the study.
2. Study subjects should demonstrate a willingness to comply with all study procedures and clinical examination and saliva collection schedules.

The specific **exclusion criteria** were as follows:

1. Undergone oral prophylaxis in the past month
2. History of medical treatments like antibiotics, any drugs / medications that may interfere with the study design
3. Any systemic diseases, bleeding disorders and Immunological complications.
4. Subjects with acute infections.
5. Mental depression or on any psychiatric related therapy

The study was composed of the following parts

1. **Questionnaire administration to evaluate stress levels –** Perceived stress was determined with the help of Cohen's Perceived Stress Scale (PSS) questionnaire, which has been used in many studies (Shah M, 2010; Masry EL R, Ghreiz SM, Helal RM, Audeh AM, Shams T 2013)and a modified questionnaire based on previous studies (Shah M, 2010; Murphy RJ, Gray SA, Sterling G, Reeves K, DuCette J 2009;Masry EL R, Ghreiz SM, Helal RM, Audeh AM, Shams T 2013) to asses possible potential stressors of perceived stress.
2. **Clinical oral examination of Oral Health ; Gingiva -** Parameters like- Modified Quigley Hein plaque Index , Loe and Silness Gingival index, Sulcus bleeding index by Muhlemann and son was used to assess gingival inflammation among the study subjects.
3. **Salivary Biochemical estimation** – Unstimulated Pooled saliva samples was collected at 11 am morning as it is the ideal time for saliva collection to estimate cortisol level and interleukin 1 – beta. The same were stored at –80 °C until biomarker concentrations were measured. The procedure for salivary biochemical estimation was according to the instructions of ELISA kit by Krishgnen biosystems.

RESULTS

Among 85 study subjects, who were in age group of 17-19 years, majority were females 61.2%(n=52) followed by 38.8%(n=33) males;51 (60%)study subjects were not staying in hostel previously followed by 34 study subjects who had experience of staying in hostels, 68.2%(n=58) study subjects were having an single parent working followed by 31.8 % (n=27) with both parents working; whereas that majority were staying with nuclear family 87% (n=74) followed by joint family 12.9% (n=11)**(Table 1)**

Perceived stress component was estimated with the help of PSS by Cohen stress scale which showed that majority were stressed (score>13) 85.9% (n=73) followed by 14.1% (n=12) not stressed. Among this majority were females 54.1 %(n=46) followed by males 31.8 %(n=27); 60% of study subjects were not staying in hostel previously, among which , majority (n=44) study subjects were stressed, followed by 40% study subjects stayed in hostels, 29 study subjects were stressed; 68.2% of study subjects were having single parent as working, among which, majority (n=49) study subjects were stressed, followed by 31.8% study subjects having with both parents working, 24 study subjects were stressed;87.1% of study subjects were having a nuclear family among which majority of study subjects (n-73) were stressed, followed by 12.9% study subjects having joint family a total of 9 subjects were stressed**. (Table 2)**

Pearson Correlation test between **Cohen stress scale scores, potential factors stress scale and Miscellaneous stress scale** with biochemical estimation values and clinical parameters showed Non significant correlation. Whereas Spearman Correlation test between **Interpersonal stress scale scores and** Clinical **skill stress scale scores** with biochemical estimation values and clinical parameters showed Non significant correlation **(Table 3)**

Multiple linear regressions of various biochemical estimation values and clinical parameters with perceived stress scores showed that, Significant inverse relation was found between miscellaneous stress scores only with Gingival index (-0.0089, $p<0.005$), where as Non significant correlation was found between other biochemical estimation values and clinical parameters with perceived stress scores.**(Table 4)**

Gender wise Comparison by t test showed no significant difference between male and female students with respective to Cohen stress scores ($t = -0.0982$, $p >0.05$), Potential factor stress scores ($t= -0.3834$, $p >0.05$), biochemical estimation i.e. Cortisol ($t=-1.7589$, $p >0.05$), IL Beta value ($t= -0.3468$, $p >0.05$), Clinical parameters i.e. Plaque index ($t=0.5858$, $p >0.05$), Gingival index ($t=0.7097$, $p >0.05$), bleeding on probing index ($t=0.4869$, $p >0.05$) at 5% level of significance. **(Table 5)**

Stay wise Comparison by t test showed Significant difference between students staying at hostels and day boarders with their Cohen stress scores ($t = 3.0453$, $p < 0.05$). Also Significant difference was observed between students staying hostels and day boarders with their PIaque scores ($t = -2.2618$, $p < 0.05$) at 5% level of confidence **(Table 6)**

Discussion

While it's been usually believed that stress has an effect on health, which has long been recognized as a cause for concern in both developed and developing countries. It has been described as an unavoidable experience for undergraduate medical trainees. Stressors experienced especially during the undergraduate medical training if not addressed early, may have dire consequences on them as professionals, their patients and the society as a whole. The present study tried to overcome and give a clearer cut and differentiated picture of the perceived stress and its effect on gingival health, salivary interleukin one beta and cortisol among Indian medical students. The present study is aimed to further understand the perceived stress among first year MBBS students', may significantly contribute towards gingival inflammation and variations in interleukin 1 beta and cortisol in saliva.

Around 85 study subjects were involved with the help of convenient sampling. Perceived stress was determined with the help of Cohen's Perceived Stress Scale (PSS) questionnaire, which has been used in many studies (Shah M, 2010; Masry EL R, Ghreiz SM, Helal RM, Audeh AM, Shams T 2013) and a modified questionnaire based on previous studies ((Shah M, 2010; Murphy RJ, Gray SA, Sterling G, Reeves K, DuCette J 2009;Masry EL R, Ghreiz SM, Helal RM, Audeh AM, Shams T 2013) to asses possible potential stressors of perceived stress.

Among 85 study subjects, who were in age group of 17-19 years, majority were females 61.2%(n=52) followed by 38.8%(n=33) males (Table 1).

As the study comprised of perceived stress component, the perceived stress was estimated with the help of PSS, which showed that majority were stressed (i.e having score more than 13) 85% (n=73) followed by 14.1% (n=12) not stressed. Among this majority were females 54.1 %(n=46) followed by males 31.8 %(n=27). The results of the present study are in accordance with most of the other studies (Iqbal S, Gupta S , Venkatarao E,2015; Eva EO etal 2015;) among health professionals. One possible reason could be due to the fact that most of the students are not adequately prepared on what to expect during the medical training and so may not be able to cope effectively when faced with pressures and

expectations of being a medical student, thereby they perceive it as stressed during their academic course.

Around 60% of study subjects were not staying in hostel previously, among which , majority (n=44) study subjects were stressed, followed by 40% study subjects stayed in hostels, 29 study subjects were stressed which is seen in a similar study (GeorgeLS , Balasubramanian A, Paul N, Leelamoni K,2016). Stress among subjects staying in hostel previously might be due to their constant pressure of being staying outside since their college days before professional course, and it has continued after joining medical course. And for study subjects not staying in hostel previously also felt stressed, which might be due to coming out of family for first time.

Around 68.2% of study subjects were having single parent as working, among which, majority (n=49) study subjects were stressed, followed by 31.8% study subjects having with both parents working, 29 study subjects were stressed . As in the modern era with rising cost of living probably single parent working status observed by their wards makes them things stressful.

Around 87.1% of study subjects were having a nuclear family among which majority of study subjects (n-73) were stressed, followed by 12.9% study subjects having joint family a total of 9 subjects were stressed. This might be due to the poorer interactions with the family members by which they can't share and discuss their problems and relieve stress which is also seen in other studies (Ghazanfar H, Haq I, Bhatti JRA, Hameed S, Shafi MS, Hussain A, Javaid A, Naseem S 2016) where as gender wise distribution showed no differences in stress among male and female which is in according to a similar study (Waqas A, Khan S, Sharif W, Khalid U, Ali A 2015)

Whereas significant difference was observed in perceived stress in students having hostel stay experience, which is seen in other study too (Malviya A, Tiwari S, Meena V, Simhal B, Singh D,2016). This could be due to staying away from home after schooling, separated from family, lack of adjustment of hostel facilities like food and accommodation.

As discussed perceived stress scores were high in students staying in hostels which are in accordance to many studies (GeorgeLS , Balasubramanian A, Paul N, Leelamoni K,2016) and also significant difference was observed between students staying hostels and day boarders with their Plaque scores, which means that PI scores are significantly lesser in hostilities as compared day boarders. This could be due once they have joined medical course and also staying with the same peer group might have played a role in keeping their oral health better, where as salivary cortisol and interleukin 1 beta didn't show any significant

difference. Over all the results suggest that majority of subjects were having perceived stress which shows that there is also need to bring about changes in the quality of evaluation system.

The second part of the study was to know that whether the perceived stress has any effect on salivary cortisol, interleukin one beta and gingival health. But it didn't show any significant association towards the same. Whereas in similar studies, saliva collection done during exams time showed increase in salivary biomarkers for the same (Deinzer R, Forster P, Fuck L, Herforth A, Stiller-Winkler R, Idel H, 1999; Deinzer R, Hilpert D, Bach K, Schawacht M, Herforth A, 2001; Deinzer R, Rattermann S, Mobes O, Herforth A,1998; Mercz CJ, Wolf OT, 2015) In the present study, probably the reason of being not effecting gingival health would be; they might have perceived life as stressed, wherein perceived stress as such might not have affected health aspect. Also saliva collection was done at a point in time when they were free from exams.

One of the limitations of the present study as mentioned previously would be because of the cross sectional study which precludes evaluation of temporal associations and information was collected on self-administered questionnaires; there remains the possibility of information bias. Future this cohort can be longitudinally followed to know the effect of perceived stress on cortisol, interleukin 1 beta and gingival health. Prospective studies are Necessary to study the associations between occurrence of stressors and incidence of stress

CONCLUSION

Majority of the first year MBBS students showed perceived stress, among which factors in students having experience of hostel stay showed more stress, whereas the perceived stress dint had any effect on cortisol, IL1 β and gingival health.

There is need to address these stressors by student advisors, peer education, and planning academic schedule and curricula of professional health sciences and further to develop scientific evidence based modules to effectively manage stress in academic environment. The students should be taught different stress management techniques to improve their ability to cope with a demanding professional course.

Future longitudinal studies are emphasized to monitor cortisol and interleukin 1 β, and its effect if it's there on gingival health.

Ethical Statement

The study was conducted in full accordance with the ethical principles of the Institution's Ethical Committee and the World Medical Association Declaration of Helsinki; with ***clearance from institutional review board***

REFERENCES

1. Abu-Ghazaleh SB, Sonbol HN, Rajab LD. A longitudinal study of psychological stress among undergraduate dental students at the university of Jordon, BMC Medical Education .2016;16(1):1-6

2. Aboalshamat K, Hou XY, Strodl E. Psychological Health of Medical and Dental Students in Saudi Arabia: A Longitudinal Study Public Health Research 2014; 4(5): 179-184
3. Acharya S. Factors Affecting Stress Among Indian Dental Students. J Dent Educ 2003;67(10):1140–48

4. Borjalil S, Mohammadi A, Mojtahedzadeh R, Sources and Severity of Perceived Stress among Iranian Medical Students. Iran Red Crescent Med J. 2015; 17(10): 17767.

5. Chrousos GP. The hypothalamic-pituitary-adrenal axis and immune-mediated inflammation. N Engl J Med. 1995;332(20):1351– 62.

6. Crego A, Carrillo-Diaz M, Armfield JM, Romero M . Stress and Academic Performance in Dental Students: The Role of Coping Strategies and Examination-Related Self-Efficacy, J Dent Educ. 2016; 80(2):165-172

7. Deinzer R, Forster P, Fuck L, Herforth A, Stiller-Winkler R, Idel H. Increase of crevicular interleukin 1beta under academic stress at experimental gingivitis sites and at sites of perfect oral hygiene. J Clin Periodontol 1999;26:1–8.

8. Deinzer R, Hilpert D, Bach K, Schawacht M, Herforth A. Effects of academic stress on oral hygiene – a potential link between stress and plaque-associated disease? J of Clin Periodontal 2001;28:459-64.

9. Deinzer R, Rattermann S, Mobes O, Herforth A: Increase in gingival inflammation under academic stress, J Clin Periodontol 1998;25:431-33.

10. Deinzer R, Kottman W, Forster P, Herforth A, Stiller-Winkler R, Idel H. After-effects of stress on crevicular interleukin-1beta. J Clin Periodontol 2000;27(1):74–77.

11. Divaris K, et al. The academic environment: the students' perspective. Eur J Dent Educ. 2008;12(Suppl1):120–130.

12. Eva EO, Islam MZ, Mosaddek AS, Rahman MF, Rozario RJ, Iftekhar AF, Ahmed TS,Jahan I, Abubakar AR, Dali WP, Razzaque MS, Habib RB, Haque M. Prevalence of stress among medical students: a comparative study between public and private medical schools in Bangladesh. BMC Res Notes. 2015 ; 8:327

13. Garbee WH Jr, Zucker SB, Selby GR. Perceived sources of stress among dental students. J Am Dent Assoc 1980;100(6):853–57.

14. GeorgeLS , Balasubramanian A, Paul N, Leelamoni K, A study on perceived stress and coping mechanisms among students of a medical school in south india, J. Evid. Based Med. Healthc. 2016; 3(38), 1889-1895

15. Ghazanfar H, Haq I, Bhatti JRA, Hameed S, Shafi MS, Hussain A, Javaid A, Naseem S. Severity of stress in Pakistani medical students, Rawal Medical Journal. 2016;41(1):116-120

16. Gordon NA, Rayner CA, Wilson VJ, Crombie K, Shaikh AB, Yasin-Harnekar S. Perceived stressors of oral hygiene students in the dental environment. African Journal of Health Professions Education. 2016 Mar 26;8(1):20-4.

17. Gupta S, Choudhury S, Das M, Mondol A, Pradhan R. Factors causing stress among students of a medical college in Kolkata, India. Educ Health (Abingdon). 2015; 28(1):92-5

18. Internet http://www.who.int/rpc/research_ethics/InformedConsent-clinicalstudies. 22/4/15

19. Iqbal S, Gupta S , Venkatarao E. Stress, anxiety & depression among medical undergraduate students & their socio-demographic correlates . Indian J Med Res 2015; 141(3):354-357.

20. Johannsen A, Bjurshammar N, Gustafsson A. The influence of academic stress on gingival inflammation. Int J Dent Hyg. 2010;8: 22–27

21. Kötter T, Pohontsch NJ, Voltmer E. Stressors and starting points for health-promoting interventions in medical school from the students' perspective: a qualitative study. Perspect Med Educ 2015;4:128–135.

22. Kirschbaum C, Hellhammer DH. Salivary cortisol in psychoneuroendocrine research: Recent developments and applications, Psychoneuroendocrinology. 1994; 19:313-33.

23. Liu M , Gu K, Wong TKS, Luo MZ, ChanMY Perceived stress among Macao nursing students in the clinical learning environment. International journal of Nursing Sciences 2015; 2; 128-133

24. Masry EL R, Ghreiz SM, Helal RM, Audeh AM, Shams T. Perceived Stress and Burnout among Medical Students during the Clinical Period of Their Education, Ibnosina J Med BS 2013,5(4):179-188

25. Malviya A, Tiwari S, Meena V, Simhal B, Singh D . Stress among post graduate medical students in central india: A cross section study using perceived stress scale, Global Journal For Research Analysis. 2016; 5(3):368-370

26. Mercz CJ, Wolf OT. Examination of cortisol and state anxiety at an academic setting with and without oral presentation Stress. 2015;18(1):138-42.

27. Murphy RJ, Gray SA, Sterling G, Reeves K, DuCette J, A Comparative Study of Professional Student Stress, J Dent Educ 2009; 73(3):328–37.

28. McGregor B A, Murphy K M, Albano DL, Ceballos R M, Stress, cortisol, and B-lymphocytes: A novel approach to understanding academic stress and immune function. Stress.2016;19(2):185-191

29. Northover C, Thapar A, Langley K, Fairchild G, Van Goozen S, Cortisol levels at baseline and under stress in adolescent males with attention-deficit hyperactivity disorder, with or without comorbid conduct disorder. Psychiatry Res.2016; 242:130-136

30. Ng V , Koh D, Mok BY, Chia SE, Lim LP Salivary Biomarkers Associated with Academic Assessment Stress Among Dental Undergraduates. J Dent Educ 2003;67(10):1091–94.

31. Oku AO, Owoaje ET, Oku OO, Ikpeme BM. Prevalence of stress, stressors and coping strategies among medical students in a Nigerian medical school. Afr J Med Health Sci 2015;14:29-34

32. Polychronopoulou A, Divaris K. Dental students' perceived sources of stress: a multi-country study. J Dent Educ 2009;73(5):631–39.

33. Qamar K, Khan NS, Kiani MRB. Factors associated with stress among medical students; J Pak Med Assoc 65: 753; 2015.

34. Ravi Shankar TL, Ain TS, Gowar O. Effect of academic stress on plaque and gingival health among dental students of Moradabad. India J In Acad Periodontol 2014; 16(4):115-20

35. Shah M. The potential negative effects of emotional distress on medical students include impairment of functioning in class-room performance and clinical practice, stress-induced disorders and deteriorating performance, BMC Medical Education 2010; 10:2-8

36. Seraphim AP, Chiba FY, Pereira RF, Mattera MS, Moimaz SA, Sumida DH. Relationship among Periodontal Disease, Insulin Resistance, Salivary Cortisol, and Stress Levels during Pregnancy. Brazilian dental journal. 2016 Apr;27(2):123-7.
37. Slavish DC, Graham-Engeland JE, Smyth JM, Engeland CG. Salivary markers of inflammation in response to acute stress. Brain Behav Immun. 2015; 44:253-69. . Review.

38. Suzuki N, Nakanishi K, Yoneda M, HirofujiT, Hanioka T, Relationship between salivary stress biomarker levels and cigarette smoking in healthy young adults: an exploratory analysis, Tobacco Induced Diseases,2016;14(1):1-7

39. Waqas A, Khan S, Sharif W, Khalid U, Ali A. Association of academic stress with sleeping difficulties in medical students of a Pakistani medical school: a cross sectional survey. Peer J 2015 ;(12):3:840-51.

40. Westerman GH, Grandy TG, Ocanto RA, Erskine CG. Perceived sources of stress in the dental school environment. J Dent Educ 1993; 57:225-31.

Tables

Table 1: Distribution of study subjects according to Gender, type of their previous stay, working status of parents and Family type

	Frequency(Out of 85)	Percent (%)
Females	52	61.2
Males	33	38.8
Not Staying at Hostel	51	60.0
Staying at Hostel	34	40.0
Both Parent Working	27	31.8
Single Parent Working	58	68.2
Subject from Joint Family	11	12.9
Subject from Nuclear Family	74	87.1

Table 2 Cohen Stress scale scores with respect to gender, previous hostel stay, Parent working status and type of family

Gender	< 13(Not stressed)	>=13(Stressed)
Female Count	6(7.1%)	46(54.1%)
Male Count	6(7.1%)	27(31.8%)
Total Count	12(14.1%)	73(85.9%)
Type of Previous stay		

Staying at Hostel	7(8.2%)	44(51.8%)
Not Staying at Hostel	5(5.9)	29(34.1%)
Total Count	12(14.1%)	73(85.9%)
Type of parents working status		
Both	3(3.5%)	24(28.2%)
Single	9(10.6%)	49(57.6%)
Total Count	12(14.1%)	73(85.9%)
Type of family		
Joint	2(2.4%)	9(10.6%)
Nuclear	10(11.8%)	64(75.3%)
Total Count	12(14.1%)	73(85.9%)

Table 3: Correlation between Various Perceived stress scale scores with biochemical estimation values and clinical parameters

Parameters	**Pearson Correlation between Cohen stress scores with**		
	r-value	t-value	p-value
Cortisol value pg/ml	-0.1210	-1.0625	0.2914
IL Beta value	-0.0934	-0.8178	0.4160
Plaque Index	-0.1415	-1.2465	0.2164
Gingival Index	-0.1443	-1.2717	0.2074
Bleeding on probing	-0.1647	-1.4554	0.1497
Parameters	**Pearson Correlation between potential factor stress scale scores with**		
	r-value	t-value	p-value
Cortisol value pg/ml	-0.1168	-0.1168	-0.1168

IL Beta value	-0.1605	-0.1605	-0.1605
Plaque Index	-0.0829	-0.0829	-0.0829
Gingival Index	-0.1525	-0.1525	-0.1525
Bleeding on probing	-0.0788	-0.0788	-0.0788
Parameters	**Pearson Correlation between Academics stress scores with**		
	r-value	t-value	p-value
Cortisol value pg/ml	-0.1498	-0.1498	-0.1498
IL Beta value	-0.1693	-0.1693	-0.1693
Plaque Index	-0.0585	-0.0585	-0.0585
Gingival Index	-0.1036	-0.1036	-0.1036
Bleeding on probing	-0.0659	-0.0659	-0.0659
Parameters	**Spearman Correlation between Inter personal relations stress scores with**		
	r-value	t-value	p-value
Cortisol value pg/ml	0.0242	0.0242	0.0242
IL Beta value	-0.0568	-0.0568	-0.0568
Plaque Index	0.0359	0.0359	0.0359
Gingival Index	0.0190	0.0190	0.0190
Bleeding on probing	0.0861	0.0861	0.0861
Parameters	**Spearman Correlation between clinical skill stress scores with**		
	r-value	t-value	p-value
Cortisol value pg/ml	-0.1303	-1.1453	0.2557
IL Beta value	-0.1044	-0.9152	0.3630
Plaque Index	0.0059	0.0512	0.9593
Gingival Index	-0.0298	-0.2599	0.7957
Bleeding on probing	0.0378	0.3298	0.7424

Table 4: Multiple linear regression analysis of various biochemical estimation values and clinical parameters with perceived stress scores.

Dependent variables	Independent variables	Estimates	SE	t-value	p-level
	Intercept	26.4098	4.2756	6.1769	0.0000

Cortisol value pg/ml	Cohen stress scores	-0.0379	0.3089	-0.1228	0.9026
	Academics stress	-0.4127	0.4604	-0.8964	0.3730
	Inter personal relations stress	1.1631	0.9294	1.2515	0.2148
	Miscleneous stress	-0.0637	0.4335	-0.1468	0.8837
	Clinical skills stress	-0.5202	0.5428	-0.9584	0.3411
	R= .21868079 R^2= .04782129				
	F(5,72)=.72321 p<0.60819 Std.Error of estimate: 11.281				
IL Beta value	Intercept	24.0001	5.3104	4.5195	0.0001
	Cohen stress scores	0.2267	0.3836	0.5910	0.5564
	Academics stress	-0.5332	0.5718	-0.9324	0.3542
	Inter personal relations stress	0.5865	1.1543	0.5081	0.6129
	Miscleneous stress	-0.5418	0.5384	-1.0063	0.3176
	Clinical skills stress	-0.1263	0.6741	-0.1874	0.8519
	R= .20959130 R^2= .04392851				
	F(5,72)=.66164 p<.65369 Std.Error of estimate: 14.011				
P.I	Intercept	0.3444	0.0542	6.3514	0.0001
	Cohen stress scores	-0.0043	0.0039	-1.1092	0.2710
	Academics stress	0.0042	0.0058	0.7241	0.4713
	Inter personal relations stress	0.0102	0.0118	0.8685	0.3880
	Miscleneous stress	-0.0071	0.0055	-1.2841	0.2032
	Clinical skills stress	0.0033	0.0069	0.4829	0.6306
	R= .24136348 R^2= .05825633				
	F(5,72)=.89079 p<.49195 Std.Error of estimate: .14308				
G.I	Intercept	0.1896	0.0348	5.4494	0.0000
	Cohen stress scores	-0.0008	0.0025	-0.3173	0.7519
	Academics stress	0.0011	0.0037	0.2854	0.7762
	Inter personal relations stress	0.0106	0.0076	1.4023	0.1651
	Miscleneous stress	-0.0089	0.0035	-2.5192	**0.0140***
	Clinical skills stress	0.0022	0.0044	0.4992	0.6192
	R= .33049083 R^2= .10922419				
	F(5,72)=1.7657 p<.13084 Std.Error of estimate: .09178				
	Intercept	0.2661	0.0554	4.8045	0.0001

B.O.P	Cohen stress scores	-0.0048	0.0040	-1.2077	0.2311
	Academics stress	0.0032	0.0060	0.5301	0.5977
	Inter personal relations stress	0.0192	0.0120	1.5958	0.1149
	Miscleneous stress	-0.0103	0.0056	-1.8365	0.0704
	Clinical skills stress	0.0055	0.0070	0.7808	0.4375
	R= .32552175 R^2= .10596441				
	F(5,72)=1.7067 p<.14402 Std.Error of estimate: .14610				

Table 5: Gender wise Comparison of male and females with various variables by t test

Variables	Male		Female		t-value	p-value
	Mean	Std.Dev.	Mean	Std.Dev.		
Cohen stress scores	19.25	6.68	19.39	5.93	-0.0982	0.9220
Total stress	19.69	10.54	20.67	11.60	-0.3834	0.7025
Academics stress	7.69	4.40	7.39	4.21	0.2998	0.7651
Inter personal relations stress	1.75	1.85	2.04	1.86	-0.6868	0.4943
Miscleneous stress	6.91	3.97	7.83	4.60	-0.9176	0.3617
Clinical skills stress	3.34	2.84	3.46	3.17	-0.1613	0.8722
Cortisol value pg/ml	19.97	9.18	24.43	12.14	-1.7589	0.0826
IL Beta value	20.39	12.49	21.50	14.85	-0.3468	0.7297
P.I	0.26	0.12	0.28	0.16	-0.5858	0.5597
G.I	0.13	0.10	0.15	0.09	-0.7097	0.4801

B.O.P	0.17	0.15	0.18	0.15	-0.4869	0.6277

Table 6: Stay wise Comparison of study subjects with various variables by t test

Variables	Hostellers		Non-hostellers (Day boarders)		t-value	p-value
	Mean	Std.Dev.	Mean	Std.Dev.		
Cohen stress scores	21.84	6.43	17.68	5.53	3.0453	**0.0032***
Total stress	22.94	12.43	18.51	9.91	1.7431	0.0854
Academics stress	8.45	4.72	6.89	3.86	1.5941	0.1151
Inter personal relations stress	1.81	1.89	2.00	1.84	-0.4498	0.6541
Miscleneous stress	8.97	4.75	6.45	3.79	2.5961	0.0113
Clinical skills stress	3.68	3.39	3.23	2.77	0.6327	0.5288
Cortisol value pg/ml	22.23	11.90	22.85	10.80	-0.2403	0.8108
IL Beta value	21.48	14.72	20.76	13.41	0.2217	0.8251
P.I	0.23	0.09	0.30	0.16	-2.2618	**0.0266***
G.I	0.13	0.10	0.15	0.09	-1.1617	0.2490
B.O.P	0.14	0.15	0.20	0.15	-1.6914	0.0948