Trait Anxiety and Salivary Cortisol Levels In Female College Students in Assam

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Abstract:
Background:Women undergo various physical and psychological changes throughout their life cycle, compounded by the expectations of different roles from her. One such challenging phase is her college life when various social and environmental changes may lead to stress. A new step toward independent living is exciting and terrifying at the same time. The hormonal changes only complicate things further, as menstruation itself is a stressful phenomenon to most women. Women are known to be more anxiety prone than men and the underlying mechanism may be both physical and environmental. This study tries to explore the the trait anxiety in this vulnerable time and salivary cortisol levels were also assessed as there is indication of cortisol being increased in stress, thus making it possible to study for the correlation of cortisol with anxiety.
Materials and methods: A total of 30 college girls from various streams were selected after taking informed consent and using the STAI manual their trait anxiety was measured. Saliva samples for salivary cortisol were collected at 45 minutes post waking. The anxiety scores were then calculated and the saliva cortisol levels estimated. The data obtained was analysed to see for relation of anxiety scores and cortisol levels.
Results:It was seen that higher anxiety scores were associated with higher cortisol levels and there was significant correlation between anxiety and salivary cortisol level, for the morning surge or peak level of cortisol.
Conclusion: Anxiety is a common problem among college girls and the various factors predisposing them to it need to be explored. Also, morning cortisol levels were correlated to anxiety severity. Further exploration of relation of anxiety with cortisol levels is needed.
Key word: trait anxiety; cortisol; college girls

I. Introduction

A critical determinant of mental health and mental disorders is gender. There are striking differences in the presentation of mental illnesses across the male and female populations even when other variables are similar. Disorders such as depression, anxiety, and unspecified psychological distress are 2–3 times more common in women than in men [1].The National Mental Health Survey of India 2015-16 estimated the lifetime prevalence of neurotic & stress related disorders as 3.7% with phobic anxiety disorders having 1.9% and other anxiety disorders having 1.3% lifetime prevalence. Females had a higher lifetime prevalence (4.5%) than males (2.85%). This gender difference was maintained across the anxiety spectrum from phobic anxiety disorder (M:F= 1.5:2.3) to generalised anxiety disorder (M:F= 0.4:0.8). Depressive disorders also had higher lifetime prevalence among women (5.7%) compared to men (4.8%). [2] The NMHS of Assam estimated the mental morbidity to be at 11.8% lifetime prevalence in men while it was 5.62% in women while taking into account all mental morbidities. However when neurotic and stress related disorders were considered alone, than a female predominance was seen with 0.93% lifetime prevalence in females compared to 0.60% in males. But the pattern varied from the national survey with preponderance of generalised anxiety disorder in women and phobic disorders in men [3].

A woman's body changes from a girl to a mature woman with an active reproductive constitution to the stage when her reproductive capacity ends, at the same time she also transforms from a daughter, a student to a wife, mother, professional to retirement. These changes go hand in hand, neither do the bodily transformations wait for the social roles to catch up, nor do the social demands accommodate her changing bodily needs and shortcomings. [4],[5]

One such stage is that where the college life begins. It is that period in her life where a sudden and dynamic shift takes place. Most women have to leave the security of being with their parents and the comfort of their homes in pursuit of higher education. Some may even have to leave their own cities, towns and villages and go to a completely unfamiliar one. Adjusting to a new place while dealing with a demanding academic schedule are not her only problems. Making new friends, developing romantic relationships, having a completely new social circle are other areas where she may be challenged. Adding to that is the rising cost of education and having to adjust to new living and food habits.

Of the many mental health issues that may arise at this vulnerable time, anxiety is one such problem that they encounter and it may either be a general predisposition to be overtly anxious in situations, i.e. trait anxiety which is stable and enduring, or it may be situation specific only, i.e. state anxiety, which is short lived. Trait anxiety refers to stable and enduring individual differences in anxiety proneness i.e. the tendency to perceive a stressful situation as threatening and respond to such situation with an elevation in the intensity of their state anxiety reactions, which are subjective feelings of tension, nervousness, apprehension, and worry, and arousal of the autonomic nervous system experienced at a given moment of time and temporary [6]. A person with trait anxiety no doubt is likely to develop state anxiety more easily and in lesser stressful conditions. Although anxiety is a natural adaptive reaction, it can become debilitating, impairing one's social and occupational functioning, and even alter body condition (eg, forming gastric ulcers) leading to anxiety disorders which are a group of mentaldisorders that are characterized by exaggerated feelings of anxiety and fear response.

A survey conducted by the APA (American Psychological Association) found that anxiety was the leading concern among college students (41.6%) which was followed by depression (36.4%) and then relationship problems (35.8%). The American College Health Association Fall 2018 National College Health Assessment found that 63% of college students in the US had overwhelming anxiety symptoms in the past year and reported 23% students were diagnosed as having an anxiety disorder or treated by a mental health professional for anxiety the same year.[7] In a study of gender differences in anxiety disorders and anxiety symptoms in adolescents, it was found that among current and recovered cases, female participants reported experiencing a significantly higher degree of anxiety symptomatology than male participants [8]. Similarly, other studies have also confirmed that women with anxiety disorders appear to report a significantly higher severity level of the cognitive and somatic symptoms of anxiety, compared to men. [9]. Studies conducted in Indian college students also have found similar results of both anxiety and depression symptoms occurring more in girls compared to boys [10] . Inconsistent findings were, however, obtained by Deb, Chatterjee &Walsh (2010) in their study of 460 adolescents in different schools and colleges in Calcutta, where they found that boys had significantly higher anxiety than the girls.[11]

Anxiety is closely related to stress, so much so that many a times they become synonymous, and cortisol is one such hormone that has been shown to react to stressful external or internal stimuli. Schlotz et al., 2004, had observed in their study that individuals who tend to anticipate on upcoming situations with ineffective cognitions or coping styles, e.g. more hopelessness, might exhibit higher morning cortisol levels [12]. Mantella et al 2008, in their study of generalised anxiety disorder on elderly individuals had found higher basal cortisol levels particularly on the morning hours, and similarly higher basal cortisol levels were also found in studies by Schweizer et al 1986, Pomara N et al 2005, Tafet G E et al 2005 in their studies of anxiety disorders and the HPA axis, where the mean age was lesser. Most of these studies had also concluded that the higher cortisol levels were more dependent on state anxiety rather than trait anxiety by various challenge tests or clinical interventions [13-16]. While most studies on anxiety explore it at a disorder level, this study attempts to explore it at the symptom level, i.e. trait level of anxiety inherent to the person's personality and general predisposition. It also tries to explore how this trait anxiety relates to salivary cortisol in the female college students.

II. Materials And Methods

This study was conducted in LGB Regional Institute of Mental Health, Tezpur, a town in the North-Eastern part of India. This institute is a tertiary care institute providing mental health facility to the whole of North-East region in India. It was a clinical study conducted from 1/2/2019 to 30/7/2019.

Study population:30 college girls from various colleges situated in Tezpur pursuing their graduation in various streams participated in this study. They were explained about the study and informed consent was taken.

Inclusion criteria:
Females aged 18 to 25 years
Pursuing their graduation in any of the colleges situated in Tezpur.
With regular 21 to 35 days menstrual cycles.
Willing to participate in the study and giving written informed consent.

Exclusion criteria:
Females with irregular menstrual cycles
Females with any major medical, surgical or gynaecological disorder
Currently taking oral contraceptives
Females who had undergone any dental interventions in last one month
Females who have any current oral condition like bleeding gums, mouth ulcers etc.
Females with history suggestive of any infection in past one month.
Not willing to give consent

Tools for study:
1. Socio-demographic profile
Describes patient's data in terms of age, religion, type of family, domicile, nature of current residence, socio-economic status, and current branch of study.

2. State – Trait Anxiety Inventory for Adults (Form Y1 and Y2)
The *State-Trait Anxiety Inventory* (STAI) is a copyrighted tool was published by Spielberger et al., in 1970 that has been used widely in research and also in clinical practice. The S-Anxiety scale (STAI Form Y-1) for state anxiety comprises of twenty statements that score how respondents feel "*right now*, at this moment." The T-Anxiety scale (STAI Form Y-2) consists of twenty statements that assess how people *generally* feel. The STAI is a self administered tool and can be given individually or to groups. It has no time limit. College students require about six minutes to fill the S-Anxiety or the T-Anxiety scale, and about ten minutes to complete both. When used for repeated administrations for the S- anxiety scale, then five or less minutes are required. Each STAI item is scored on a scale of 1 to 4. A scoring key is used to score the scales by hand. A fourth- or fifth-grade reading level is required to fill the forms. Normative data for Form Y of STAI are available for working adults, military recruits, college students, and high school students. The minimum score is 20 and maximum score is 80.
Form Y2 was given to the participants for assessment of trait anxiety.

3. Saliva cortisol ELISA kit:
Diametra Saliva Cortisol ELISA kit DCM020-11 was used for analysis of the saliva samples. It is based on the principle that cortisol (antigen) in the sample competes with the antigenic cortisol conjugated with horseradish peroxidase (HRP) for binding to the limited no. of antibodies of anticortisol coated on the microplate (solid phase). The reference range given by the manufacturer are 3-10 ng/ml for A.M. sample and 0.6-2.5 ng/ml for P.M. sample. It is sensitive upto 0.12 ng/ml at 95% confidence limit.
Collection and processing of samples: samples were collected at 45 minutes after waking up. Free flowing saliva was collected in sterile vials and centrifuged within half hour of collection and stored at -40 degrees till final estimation. The stored frozen saliva samples were then thawed to room temperature for assessment using saliva cortisol kit for salivary cortisol. Competitive immunoenzymatic colorimetric method for quantitative determination of cortisol concentration in saliva was used.
The values were then calculated to obtain the salivary cortisol levels in each sample.
Statistical analysis: Statistical Package for the Social science (SPSS), version 2.0 was used. All continuous variables were checked for normal distributions by means of the Kolmogorov-Smirnov test. Data were presented as arithmetic means and standard deviations (mean ± SD) for parametric variables. For non-parametric variables, data were presented as medians, quartiles and percentages. Pearson's correlation was used to see for correlation between anxiety scores and cortisol levels, and paired t tests were used to see for variation in the values of anxiety and cortisol in the two time periods i.e. premenstrual and postmenstrual phases. Chi square test was done to see for association of anxiety with sociodemographic and menstrual variables.
Ethical consideration: The study was started only after approval of Ethics Committee. Before the start of the process all the individual who were selected for the study were explained about the subject matter of the study. After they were clear about this, consent was taken from them and they were also ensured that the information sought from them would be kept confidential. Subjects were given the right to withdraw from the study at any stage.

III. Result

Sociodemographic characteristics: [table 1] The mean age of the study sample was 20.73+/-1.31 years with minimum age being 19 years and maximum age was 24 years, maximum students were from the semi urban domicile making up for 56.7% of the sample, 90% of the sample were from nuclear families and only 10% were from joint families, the socioeconomic status maximum sample (56.7%) were of the upper middle category and rest were upper class (20%) and middle class (23.3%), two third of the sample (66.7%) were

Hindu. The rest one third were Muslim (26.6%) and Christian (6.7%), majority of the students lived away from their homes and families (88.3%), in hostels and as paying guests, 46.6% each were in the Arts and Science branch and 6.6% were in the commerce branch.

Table 1: sociodemographic variables

Variable N=30	Categories	Values
Mean age (in years)		20.73 +/- 1.31
Domicile (%)	Rural	7 (23.3%)
	Semi urban	17 (56.7%)
	Urban	6 (20%)
Family type (%)	Nuclear	27 (90%)
	Joint	3 (10%)
Socio economic status (%)	Upper	6 (20%)
	Upper middle	17 (56.7%)
	Middle	7 (23.3%)
Religion (%)	Hindu	20 (66.7%)
	Muslim	8 (26.6%)
	Christian	2 (6.7 %)
Current residence (%)	With family	5 (16.7%)
	Hostel/PG	25 (83.3%)
Branch	Arts	14 (46.6%)
	Commerce	2 (6.6%)
	Science	14 (46.6%)

Trait anxiety scores: [table 2] the mean trait anxiety raw score was 46.3667+/-10.49. The raw scores as obtained by applying the STAI questionnaire were converted to percentiles of the normative values for college girls as given in the STAI manual. Scores above the 75th percentile were taken as high and scores below 75th percentile as low for the purpose of the study [table 3]. More than half the study sample had high anxiety at the trait level.

Table 2: mean trait anxiety scores

STAI scores	Mean	Std. Deviation
Trait anxiety score	46.3667	10.49625

Table 3: high and low trait anxiety percentage

N=30	High anxiety (Above 75th)	Low anxiety (Below 75th)
Trait anxiety	16 (53.3%)	14 (46.7%)

Salivary cortisol levels: the mean cortisol level at 45 minutes post waking was 7.0910 ng/dl with a standard deviation of 0.9985, which was similar to levels for females of the particular age demographic.
Pearson's correlation was applied to find correlation between anxiety scores and the saliva cortisol levels. [table 4]

Table 4: correlation of cortisol with trait anxiety

Variables	Correlation (r)	P- Value
Trait anxiety with morning salivary cortisol.	**0.440**	**0.015**

$P<0.05$ indicates that there is significant correlation between trait anxiety and morning cortisol level.
Relation of anxiety with sociodemographic variables
Chi square test was applied to check the relation of sociodemographic variables with trait anxiety [table 5] and no significant association ($p<0.05$) was observed for domicile (p=0.204), family type (p=0.586), socioeconomic status (p=1.000), religion (p=0.709), branch of study (p=0.282) and current residence (p=0.336).

Table 5: p-value of trait anxiety with various sociodemographic variables

Variables	Categories	Number	p-value
Domicile (%)	Rural	7 (23.3%)	0.204*
	Semi urban + urban	23 (76.7%)	
Family type (%)	Nuclear	27 (90%)	0.586*

	Joint	3 (10%)	
Socio economic status (%)	Upper + upper middle	23 (76.7%)	1.000*
	Middle	7 (23.3%)	
Religion (%)	Hindu	20 (66.7%)	0.709*
	Muslim + Christian	10 (33.3%)	
Branch	Arts + commerce	16 (53.33%)	0.282
	Science	14 (46.67%)	
Current residence (%)	With family	5 (16.7%)	0.336*
	Hostel/PG	25 (83.3%)	

*using Fisher's exact test

IV. Discussion

The mean of the raw scores indicates that there is high level of trait anxiety in the given population

The study of trait anxiety revealed that more than half the sample (53.3%) had high level of trait anxiety which is higher than the percentage reported by the American Psychological Association survey of anxiety being prevalent in 41.6% of college students but lower than another study by the American College Health Association Fall 2018 National College Health Assessment, which reported that 63% of college students had overwhelming anxiety symptoms. These discrepancies may partly be answered by the fact that our current study is only of females who overall present higher symptoms as reported by both Indian and foreign studies. Another reason for the discrepancies may be the use of different tools and cut offs to determine the presence, absence or severity of anxiety.

The mean cortisol levels in the morning sample was 7.09+/-0.99 ng/dl. These values were in keeping with the expected values for salivary cortisol in 18 to 25 year old females. Pearson's correlation was applied to test the correlation between the anxiety scores and the cortisol levels. Significant correlation ($p < 0.05$) was found between trait anxiety score with morning cortisol level. The above results indicate that higher cortisol levels were correlated with higher anxiety levels. Schlotz et al., 2004, had observed in their study that individuals who tend to anticipate upcoming situations with ineffective cognitions or coping styles, e.g. more hopelessness, might exhibit higher morning cortisol levels. This might explain the higher morning cortisol levels in the high trait as well as state anxiety. Mantella et al 2008, in their study of GAD on elderly individuals had found higher basal cortisol levels particularly on the morning hours, and similarly higher basal cortisol levels were also found in studies by Schweizer et al 1986, Pomara N et al 2005, Tafet G E et al 2005 in their studies of anxiety disorders and the HPA axis, which runs parallel to this study results but it is difficult to generalise it as the age sample group is younger as well as though they rank high on anxiety symptoms they cannot be termed GAD without further clinical assessment. Most of these studies had also concluded that the higher cortisol levels were more dependent on state anxiety rather than trait anxiety by various challenge tests or clinical interventions. But this study had assessed trait anxiety directly and the association cannot be ignored as even state anxiety can be dependent on the trait anxiety of the person. When tested for the relation of sociodemographic variables with trait anxiety using chi square test then it was seen that it was not significantly associated ($p > 0.05$) with domicile ($p = 0.204$), current residence ($p = 0.336$), socioeconomic status ($p = 1.000$), type of family ($p = 0.586$), religion ($p = 0.709$) or branch of study ($p = 0.282$). This may be due to the fact that for college going girls more than the residence, domicile, socioeconomic status etc. the adjustment to the changes that are encountered hold more importance, like building of new friendships, first steps towards an independent living, exploring their identity, academic pressures, and development of romantic relationships. So the sociodemographic factors may take a backseat during this period. It is a unique stage in a woman's life where a whole new perspective is gained about herself and the society that is influenced by both the environment she has grown up in as well as the environment she currently inhabits. Conflicting ideologies of the two environments may make her curious, anxious and drive her towards forming her own opinions and make her adapt to and solve problems as per her own unique adjustment, thereby pushing her towards forming her identity.

V. Conclusion

This study shows that there is high prevalence of trait anxiety among female college students and that it is significantly correlated to salivary cortisol levels. However based on the limited sample size and measuring anxiety as a sustained symptom rather than a disorder, further exploration is merited.

References

[1]. Grant BF, Weissman MM. Gender and the prevalence of psychiatric disorders. In: Narrow WE, First MB, Sirovatka PJ, Regier DA, editors. Age and gender considerations in psychiatric diagnosis: A research agenda for DSM-V. Washington, DC: American Psychiatric Association; 2007. pp. 31–46

[2]. National Mental Health Survey of India 2015–2016

[3]. National Mental Health Survey of India 2015–2016- Assam State Report

[4]. Takeda Y. Understanding the Life Stages of Women to Enhance Your Practice. JMAJ 53(5): 273–278, 2010

[5]. Hare-Mustin RT, Marecek J. The meaning of difference. Gender theory, postmodernism and psychology. Am Psychol. 1988;43:455–64. [Google Scholar]

[6]. American Psychiatric Association (2013). Diagnostic and Statistical Manual of Mental Disorders (Fifth ed.). Arlington, VA: American Psychiatric Publishing. p. 189. ISBN 978-0-89042-555-8.

[7]. American Psychological Association. College students' mental health is a growing concern, survey finds. Upfront. June 2013, Vol 44, No. 6. Print version: page 13

[8]. Statistics on anxiety and mental health concerns from American College Health Association (2018, Spring). Reference Group Data Report. https://www.acha.org/documents/ncha/NCHA-II_Spring_2018_Reference_Group_Data_Report

[9]. Elements Behavioral Health. (2017, March 27).Anxiety Statistics on College Campuses: What You Need to Know. https://www.elementsbehavioralhealth.com/anxiety-disorders-2/anxiety-statistics-college-campuses-need-know/https://www.jedfoundation.org/depresion-and-anxiety-among-college-students/

[10]. Preeti Sharma1, Mustafa Nadeem Kirmani2. Exploring Depression & Anxiety among College Going Students. International Journal of Science and Research (IJSR) ISSN

[11]. Deb,Sibnat., Chatterjee, P. &Walsh, K (2010).Anxiety among high school students in India: Comparisons across gender, school type, social strata and perceptions of quality time with parents. Australian Journal of Educational & Developmental Psychology, 10, 18 – 31

[12]. Schlotz, W., Hellhammer, J., Schulz, P., & Stone, A. A. (2004). Perceived work overload and chronic worrying predict weekend–weekday differences in the cortisol awakening response. *Psychosomatic medicine*, 66(2), 207-214.

[13]. Mantella, R. C., Butters, M. A., Amico, J. A., Mazumdar, S., Rollman, B. L., Begley, A. E., ...&Lenze, E. J. (2008). Salivary cortisol is associated with diagnosis and severity of late-life generalized anxiety disorder. *Psychoneuroendocrinology*, 33(6), 773-781.

[14]. Furlan, P. M., DeMartinis, N., Schweizer, E., Rickels, K., &Lucki, I. (2001). Abnormal salivary cortisol levels in social phobic patients in response to acute psychological but not physical stress. *Biological Psychiatry*, 50(4), 254-259.

[15]. Pomara, N., Willoughby, L. M., Sidtis, J. J., Cooper, T. B., & Greenblatt, D. J. (2005). Cortisol response to diazepam: its relationship to age, dose, duration of treatment, and presence of generalized anxiety disorder. *Psychopharmacology*, 178(1), 1-8.

[16]. Tafet, G. E., Idoyaga-Vargas, V. P., Abulafia, D. P., Calandria, J. M., Roffman, S. S., Chiovetta, A., &Shinitzky, M. (2001). Correlation between cortisol level and serotonin uptake in patients with chronic stress and depression. *Cognitive, Affective, &Behavioral Neuroscience*, 1(4), 388-393.