

Correlation of serum cortisol with sleep habits and daytime sleepiness of young adults

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ABSTRACT

Objective: To assess the sleep habits and daytime sleepiness of medical students and to relate these to their serum cortisol.

Study Design: Cross-sectional observational study

Place and Duration: Department of Physiology, Islamic International Medical College Rawalpindi and Railway General Hospital Rawalpindi from 1st March 2010 to 28th February 2011

Methodology: Sixty MBBS students, equally from both genders were randomly selected from first year and final year class. Their age, weight, sleep habits, exercise, nap/week and daytime sleepiness were find out through sleep questionnaire and Epworth sleepiness scale. Blood samples for serum cortisol was taken at 9:00am

Results: Out of 60 students, sleep duration of 13.33% of students was less than 6 hrs. 16.67% of the students were having daytime sleepiness. Daytime sleepiness was more in female students (26.67%). Female students (76.67%) had more than 3 naps/week. Dreams remembering was more in 66.67% in male students as compared to female students (46.67%). Serum cortisol was 307.8 pg/ml in students having daytime sleepiness as compared to students having no daytime sleepiness (248.8 pg/ml. Daytime sleepiness and weight of the students was positively correlated to the serum cortisol levels.

Conclusion: Daytime sleepiness is more in female students resulting in more naps/week as compared to male students. Male students with better sleep at night has more dream remembering as compared to female students. Serum cortisol, a stress marker is raised in students with daytime sleepiness.

Keywords: Medical students, Sleep habits, Daytime sleepiness, Cortisol, Serum cortisol, Epworth scale

How to Cite This:

Bhatti AA, Qureshi ZA, Jawaria, Umar N, Nasir R, Khan UA. Correlation of serum cortisol with sleep habits and daytime sleepiness of young adults. *Isra Med J.* 2019; 11(4): 208-212.

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INTRODUCTION

Sleep is one of the most essential physiological process of life. It has fundamental effects on cognitive performance as well as on physical and mental wellbeing¹. Sleep restores ATP, the energy currency of brain cells². In adults a daily sleep of 7 to 8.5 hours is considered to be effective and restorative³. The sleep awake pattern vary among individuals and this variation can be due to age, profession, physical and mental health, physiological and psychological status of the subjects⁴. University students are vulnerable to sleep disturbances that can be due to academic stress, social stress to perform well in assessments and extracurricular activities⁵.

Medical college is one of the places that has stressful environment. This can be due to numerous factors like broad curriculum, academic needs and frequent and extensive examinations^{6,7}. High level of stress is reported in many worldwide medical colleges like Thailand (61%), Malaysia (42%), United States (57%)⁸, King Saud University (63%)⁹ and King Faisal University (53%)¹⁰. The prevalence of stress in Pakistan medical students is reported to be 60%⁶. The stress can affect the quality and quantity of sleep among medical students. The prevalence of poor sleep habits in medical students is not different than prevalence of stress among these students. In United States 51%¹¹, Lithuania (59%): King Saud University (37%)¹² students

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Received for Publication: February 13, 2019
1st Revision of Manuscript: April 11, 2019
2nd Revision of Manuscript: May 12, 2019
Accepted for Publication: August 06, 2019

have poor sleep habits. About half to three quarters college students may fall asleep during learning activities during the day which can be due to insufficient sleep¹³ It is associated with behavioral changes in students and poor academic progress¹⁴. Daytime sleepiness among the college and universities students in different countries are from as low as 4.1% in Japanese to as high as 42.5% in Brazilian students. Napping in lecture halls which reflects daytime sleepiness is not uncommon among medical students¹⁵. Normal sleep habits maintain the normal circadian rhythm of many hormone¹⁶

Cortisol is one of the hormone effected by changes in sleep habits¹⁷. Sleep deprivation increases the serum cortisol level and can affect mental health. Sleep restriction therapies not only improve insomnia but also decrease serum cortisol levels to normal as shown by a study carried out in shift workers. Serum cortisol is one of the marker of stress and is raised in stressed individuals¹⁸. It is reported that sleep deprived students may have malfunctioning of hypothalamic-pituitary-adrenal¹⁹ that can result in bipolar disorders²⁰ One of the study carried out in medical students at Karachi, depicted that female students are “poor sleepers” with excessive daytime sleepiness as compared to male students but there is gap that relation of serum cortisol with sleep was not studied²¹. Sleep habits and daytime sleepiness is vastly studied in young adults but to our knowledge no study has been published yet which show the relation of serum cortisol with sleep habits and daytime sleepiness in medical students. We conducted this study with an objective to find out sleep habits and daytime sleepiness of medical students and to relate these to their serum cortisol.

METHODOLOGY

This cross-sectional observational study, has carried out in Islamic International Medical College Rawalpindi and IIMC-T Railway General Hospital Rawalpindi and its duration was 1 year (1st March 2010- 28th February 2011). Approval was taken from Ethical review board of Riphah International University. Sixty MBBS students were included in the study by random sampling. Thirty students were from first year MBBS and thirty from final year MBBS. It was made sure that both gender get equal representation in study sampling. Students of first year and final year MBBS, 18-24 years, healthy, with well-developed secondary sexual characteristics like beard, moustaches were included in the study. Students having symptoms of acute or chronic medical illness, presence of abnormal chest signs or skeletal deformity, being on medical treatment, any diagnosed hormonal disease, acute stress such as death of relative or forthcoming professional examinations, psychiatric illness, bleeding tendency, history of fainting, taking medicines like sedative, anticonvulsants, antidepressants, anxiolytics, antihistaminic and steroids were excluded from the study. Females with history of any gynaecological problems like irregular menstrual cycle, dysfunctional uterine bleeding, hirsutism, acne or gynaecological surgery were not included in the study.

Age sex, weight, height, pulse, blood pressure, temperature of the students were documented. BMI of the students was calculated. For the sleep habits, usual sleep questionnaire was used. This questionnaire had queries of daily sleep habits like, time to go to bed, time of rise in early morning, number of naps/day etc. Exercise habits of the students were also noted down. The Questionnaires for daytime sleepiness (Epworth sleepiness scale) and sleep habits were adapted from previous studies²². Epworth sleepiness scale measures the probability of falling asleep in different situations. It was scored by ranking the chance of falling asleep as 0, 1, 2, and 3 depicting, no chance of falling asleep, slight chance of falling asleep, moderate and high chance of falling asleep respectively. The situations were, sitting and reading, watching TV, sitting inactive in a public place etc. almost 8 such situations. At the end added up score was calculated which showed the daytime sleepiness of the students. A score of less than six was normal, score between 7 and 9 was ranked as limited daytime sleepiness, score of more than 10 was considered sleepy. For the sleep habits, usual sleep questionnaire was used. This questionnaire had queries of daily sleep habits like, time to go to bed, time of rise in early morning, number of naps/day etc. The students were given a description how to fill questionnaires and about blood sampling and the purpose of the study. The informed and written consent was taken from the students. Fifteen students were entertained at one time to fill the questionnaires and blood sampling. To assess the serum cortisol, 3 ml of blood was taken from antecubital vein after taking aseptic techniques at 9:00 am. It was immediately taken to laboratory where ELFA technique (Enzyme Linked Fluorescent Assay, VIDAS® Cortisol S) was used to measure serum cortisol.

Data Analysis: All the data were presented as Mean± SD for each group Data was analyzed by using Graph pad Prism software version 6 (GraphPad. Inc., La Jollay, CA, USA) (www.graphpad.com). For comparison of two groups student's t-test was used and for comparison of more than two groups one-way ANOVA was used. The significance level was adjusted at $p < 0.05$ and confidence interval was taken as 95%.

RESULTS

The results of serum cortisol levels estimated by ELFA technique, sleep habits by sleep questionnaire and daytime sleepiness by Epworth sleepiness scale were shown in tables and figures. Table-I showed that the mean cortisol of all students was 273.45 nmol/l (171-536 nmol/L). 16.67% (n=10) students were feeling sleepy. Sleep duration of 13.33% (n=8) was less than six hours. Most of the students (65% n=39) were using alarm for early morning awakening. Pearson correlation between serum cortisol levels and different parameters was performed which showed positive correlation of serum cortisol with the weight and daytime sleepiness with the value of 0.2683 and 0.2797 respectively.

Table-I: Demographic data and sleep habits of medical student (N=60)

Parameters		Values	Pearson correlation	p value
Total serum Cortisol (Mean ±SD) nmol/L		273.45±75.45		
Age (yrs.) (Mean ±SD)		0.082	0.082	0.5334
Weight (kg.) (Mean ±SD)		63.28±11.19	0.2683	0.0382*
BMI	Normal 18.5-23	0.6551		
	Overweight 23-28	0.2797		
	Obese >28	6 (10%)		
Day time Sleepiness	Normal ES 0 to 6	27 (45%)	0.2797	0.0304*
	Limited ES 7 to 9	23 (38.33%)		
	Sleepy >10	10 (16.67%)		
Sleep Duration	<6hrs	8 (13.33%)	0.6551	0.619
	6-8 hrs	40 (66.67%)		
	>8 hrs	12 (20%)		
Exercise	Yes	23 (38.33%)	-0.01482	0.9105
	No	37 (61.67%)		
Naps/week	No Naps	12 (20%)	0.02525	0.8481
	<3 Naps/week	10 (16.67%)		
	>3 Naps/week	38 (63.33%)		
Awakening	Alarm	39 (65%)	0.09599	0.4656
	Natural	21 (35%)		
Dream remembering	No	26 (43.33%)	0.03133	0.8122
	Yes	34 (56.67%)		

Fig-1 shows statistically significant raised serum cortisol in students who were having daytime sleepiness (307.8 nmol/l ±43.1) as compared to normal (248.8 nmol/l ±43.1).

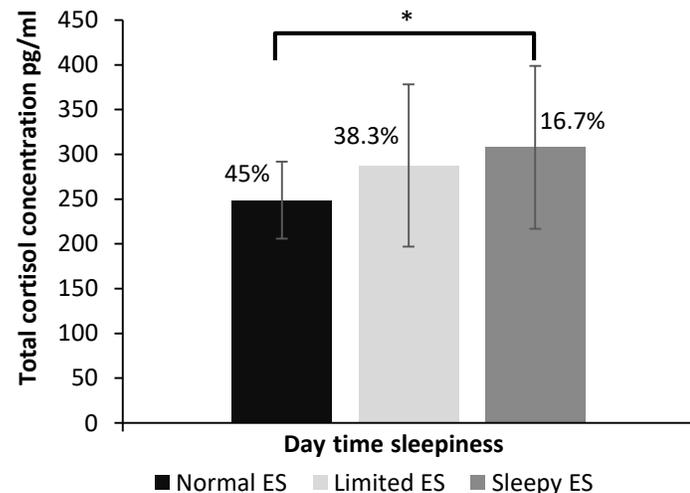


Fig-1: Comparison of serum cortisol and daytime sleepiness in medical students (Unpaired t-test, Mann Whitney U test; ES=Epworth's sleepiness score; *p<0.05) (N=60)

Table-II shows that serum cortisol level were lower in females (268.2 nmol/l ±74.72, n=30) as compared to males (278.7 nmol/l ±77.09, n=30). Obesity is more in male students (13.33% n=4) as compared to female students (6.67% n=2). Female students (66.67% n=20) have more daytime sleepiness as compared to male students (43.34% n=13). More female students have less duration of sleep (16.67% n=10) as compared to male students

(10% n=3). Female students (73.33% n=21) use alarm for awakening as compared to male students (56.67% n=17). Female students have more number of naps/week (76.67% n=23) as compared to males (50% n=15).

Table - II: Serum cortisol and daytime sleepiness/ sleep habits of medical students by gender (N=60)

Gender	Male (n=30)	Female (n=30)
Total serum Cortisol level	278.7±77.09	268.2±74.72
Age (years)	21.23±1.98	20.8±2.02
Weight (Kilogram)	67.47±12.20	59.1±8.34
BMI	Normal 18.5-23	60% (18)
	Overweight 23-28	26.67% (8)
	Obese >28	13.33% (4)
Day time Sleepiness	Normal ES 0 to 6	56.67% (17)
	Limited ES 7 to 9	36.67% (11)
	Sleepy ES 10 and above	6.67% (2)
Sleep Duration	<6hrs	10% (2)
	6-8 hrs	63.33% (19)
	>8 hrs	26.67% (8)
Exercise	Yes	53.33% (16)
	No	46.67% (14)
Naps/week	No Naps	30% (9)
	<3 Naps/week	20% (6)
	>3 Naps/week	50% (15)
Awakening	Alarm	56.67% (17)
	Natural	43.33% (13)
Dream remembering	No	33.33% (10)
	Yes	66.67% (20)

DISCUSSION

Medicine is one of the most stressful professional education. Students are under continuous stress to perform well in frequent evaluations of the broad and extensive curriculum⁶. This stress, besides having many other consequences results in sleep disorders in medical students²³. Though disturbed sleep is present globally in medical students, it has been depicted in a study carried out in Pakistan that medical students have more disturbed sleep than their non-medical counterparts²⁴.

Our study showed that medical students have less duration of sleep (<6hrs) and this problem is more in female students as compared to male students²⁵. This can be explained by social and cultural values in Indo-Pak region where females has to participate and help in domestic works to their mothers more as compared to male students. They have to wake up early for these works²⁶. Due to less duration of sleep at night, female students take more naps/week as compared to male students.

The subjects having an average duration of sleep have better health, satisfaction with life, less feelings of tension, depression, anger, fatigue and confusion.¹⁴ Interestingly almost 50% of the female students were overweight in our study, showing the relation of normal sleep duration and better health. This study also showed that most of the students have more than normal BMI. Raised BMI is also linked with lack of exercise which is depicted in this study. It has been proved in literature that sleep disturbances not only impair cognitive performance of individuals but also impairs the capacity for exercise and increases the risk of exercise induced injuries²⁷.

Almost more than half students in our study had daytime sleepiness that can be explained by less duration of sleep at night. Daytime sleepiness was more in females as compared to male students. It is quite similar to the results of other studies carried out in Sudan¹³, Malaysia¹⁵ and Karachi²⁸ which also show more daytime sleepiness in female students.

Sleep has significant effects in homeostasis of different hormones. Cortisol hormone, mainly released from the zona fasciculate of adrenal gland is one of the important marker of stress and it is usually at higher level in circulation of stressed individuals¹⁹. Less sleep duration is linked with higher levels of serum cortisol and daytime sleepiness is positively correlated with the release of serum cortisol in students in our study. By managing the sleep duration of individual the cortisol level can be brought to normal and adverse effects of continuous raised cortisol can be prevented¹⁸.

This study concludes that the medical students have decreased quantity of sleep at night which results daytime sleepiness in these students. The serum cortisol level is raised in those students who are overweight, who have poor sleep quality and have daytime sleepiness.

CONCLUSION

Daytime sleepiness is more in female students resulting in more naps/week as compared to male students. Male students with better sleep at night has more dream remembering as compared

to female students. Serum cortisol, a stress marker is raised in students with daytime sleepiness.

Recommendations: Students with poor sleep quality should be trained to improve their sleep to keep serum cortisol level normal. The outcome of this training can be assess by re conducting the study.

CONTRIBUTION OF AUTHORS

Bhatti AA: Designed research methodology, Data collection, Manuscript writing.

Qureshi ZA: Data interpretation, Manuscript final reading

Jawaria: Literature review, Introduction writing

Umar N: Literature search, Statistical analysis

Nasir R: Data interpretation, Results writing

Khan UA: Conceived idea, Manuscript approval.

Disclaimer: None.

Conflict of Interest: None.

Source of Funding: None.

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