Original Article

Association between the behavior of eating disordered and sleep disturbance in Shahid Beheshti University of Medical Students

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Abstract

Background: Recent studies have shown that sleep difficulties could be related to abnormal eating patterns. Apparently, eating and sleeping behaviors both affect human lives. Dysregulation of these behaviors lead to distress and negative health and psychological outcomes. The present study aimed to investigate the association between disordered eating behaviors and sleep disturbance among medical students.

Methods: This was a cross-sectional study which was conducted at Shahid Beheshti University of medical sciences. The eating disorder behaviors were assessed based on the Eating Attitudes Test-40 questionnaire and Sleep disturbances were assessed by two items related to difficulties initiating sleep (DIS) and maintaining sleep (DMS). Each individual correlation was used to calculate variable associations. Linear multiple regression analysis was performed to identify variables contributing to an explanation of sleep difficulties.

Results: In total, 172 people participated in this study. It was observed that bulimic behaviors (BB) and social pressure to eat (SPE) were the dimensions that significantly explained difficulties maintaining sleep (r=0.207, $P<0.001$ and r=0.286, $P<0.001$, respectively) and overall sleep disturbances (r=0.355, $P=0.001$ and r=0.225, $P=0.003$, respectively). Negative correlation between body mass index (BMI) and difficulties maintaining sleep (DMS) (r=-0.069, $P=0.527$) was not remarked which was found in males.

Conclusion: It was ultimately attained that age and sex could be accounted as confounder variables in the association between sleep disturbance and eating behaviors. The results indicated that a normal eating behavior has a positive relation with the quality of sleep.

Introduction

Eating and sleeping behaviors both affect human manner. Dysregulation of these behaviors leads to distress and negative health and psychological outcomes (1). Considering that, food and sleep are among desirable aspects of life style; in addition, there is a correlation between health and lifestyle. Therefore, it is reasonable to pay attention to sleep and eating patterns (2).

Proper nutrition is among critical aspects of maintaining the health of individuals, families, and the society. Distinctly, by using proper food; life fullness, efficiency of activities, satisfaction, joy, and the power of solving life problems, as well as the health of new generations could occur by having a healthy life style (3, 4). Food patterns differ in different societies, races, and cultures; thus, a person's nutrition pattern shows a society nutrition status and also there is a direct relation between the economic status of a country and the nutrition of each society (5).

Sleep is a complicated physiological and behavioral process in which an individual temporarily enters an unconscious state regarding their environment and relative unresponsiveness (6).

Each individual spends a third of the life sleeping. The quality and quantity of sleep affects a social relations and sleep disorders in which negatively affect everyday function, ability, and health (7, 8). Promptly, sleep disorders are among the group of syndromes which present with disturbance of quality, quantity or time of sleep, and behavioral or physiological disturbance which occur during sleep (9). One-third of the adult populations suffer from sleep and circadian rhythm disorders; furthermore, 5% of the population suffer from daily snooze period (10).

In fact, half of the nocturnal awakenings have been reported to be associated with food intake and the calorie intake of 300 kcal (11). Global eating disorders, particularly bulimic behaviors and social pressure for eating were associated with increased difficulties initiating and maintaining sleep among college students (12). Also, it has been proven that nutritional factors may have an indispensable role in the pathogenesis of sleep disorders by their effects on gastrointestinal and brain connections (13). Although there is an affirmation that sleep and eating behaviors are strongly related (14-17), to the best of our knowledge, there

has not been any research investigating the abnormal habits and body mass index (BMI) which could predict subsequent sleep disturbance. Additionally, there are few researches that studied the relation of disordered eating behavior and sleep disturbance among medical students (18).

Indeed, the aim of the present study was to determine the relation between eating behaviors and sleep disturbance among medical students in Shahid Beheshti University and also its association with body mass index.

Methods

Iranian medical students in Shahid Beheshti University completed a questionnaire on demographic data, eating behavior, and sleep disturbance in February 2017. Preclinical students of both genders were selected by convenience sampling in this cross-sectional descriptive study. It took a month to achieve enough sample size (n=172). The sample size was determined according to the previous studies (17, 19-22); and it was completed after the advice from the Health and Community Medicine specialists of Shahid Beheshti University of medical sciences. Demographic data included age, sex, height, and weight, (self-reported height and weight to calculate the BMI).

Inclusion criteria for the survey was studying in preclinical semester and consent to participate in the study after a thorough awareness of the type of research questions and objectives.

Eating Attitudes Test

The Portuguese version of Eating Attitudes Test-40 (EAT-40) (28) was used to measure the quality of eating behaviors in three specific dimensions: 1) Diet Concerns (DC), 2) Bulimic Behavior (BB), and 3) Social Pressure to Eat (SPE). The first dimension, DC, included 17 items concern regarding food and being thinner, self-control over eating, and engagement in dieting and physical exercise in order to burn calories.

The second dimension was regarding BB, integrated 10 items persistent preoccupations about food, overeating episodes, and purgative behavior. The third dimension, SPE, incorporated 6 items perceived pressure from others to gain weight and 7 items are related to pleasure for eating (PE). It is a 40-item self-report questionnaire with each item scored on a six-point Likert-scale, from "never" to "always" (0–5).

The EAT-40 questionnaire was translated into Farsi by two nutritionists, and blind back translations were carried out, in which they were advanced in English. Then the validity of each query, as well as the entire questionnaire was evaluated by three specialists in Health and Community Medicine department. Two indices (relevancy=0.81 and clarity=0.80) were evaluated for each query and four indices (relevancy, clarity, comprehensiveness, and inter-rater agreement) were computed for the whole questionnaire.

The EAT-40 questionnaire was administered to the participants and the importance of the completion of questionnaires was explained clearly. Internal inconsistency was measured by using Cronbach's alpha coefficient was

0.857. For the evaluation of the reliability, the examiner administered the questionnaire to 30 university students for the first time and they completed the questionnaire after 2 weeks for the second time.

sleep
Sleep disturbance was evaluated with two items: 1) "I have difficulty in falling asleep" (DIS); and 2) "I wake up many times during the night" (DMS). Each item was scored on a 6 points scale (always=5, very often=4, often=3, sometimes=2, rarely=1, and never=0). A total sleep disturbance score (TSDS) was calculated from the sum of DIS and DMS item scores.

BMI
BMI [weight (kg)/height (m)2] was calculated by using height and weight of individuals.

After collecting data, the statistical analysis was performed by SPSS software 15. To calculate variable associations, the individuals' correlations were used. Linear multiple regression and hierarchical multiple regression analyses were performed in order to identify variables contributing to an explanation of sleep difficulties.

Table 1. Means (SD) of body mass index, Eating Attitudes Test-40 and sleep scores regarding females, males and the total participants

	Male	Female	Total participants
	Mean (SD)	Mean (SD)	Mean (SD)
BMI	22.61 (3.08)	20.83 (2.11)	21.72 (2.78)
Eating behaviors			
DC	30.37 (12.13)	30.50 (11.50)	30.53 (11.79)
BB	18.74 (6.76)	17.33 (6.54)	18.03 (6.67)
SPE	9.71 (5.07)	9.77 (4.71)	9.74 (4.88)
PE	18.97 (4.03)	21.15 (3.69)	20.06 (4.00)
Total score	77.79 (21.98)	78.94 (20.85)	78.37 (21.37)
Sleep			
DIS	1.80 (1.55)	1.52 (1.32)	1.66 (1.44)
DMS	1.21 (1.29)	1.16 (1.32)	1.19 (1.30)

DC: diet concerns; SPE: social pressure to eat; PE: pleasure to eat; BB: bulimic behavior, DIS: difficulties of initiating sleep; DMS: difficulties of maintaining sleep

Results

Means (SD) are presented in Table 1 for females, males, and the total participants. The mean (SD) total score was 78.37 (21.37). Mean values for DIS and DMS were 1.66(1.44) and 1.19 (1.30), respectively. For BMI, the mean value was 21.72 (2.78). DIS was reported by 26.16% of individuals and DMS was related by 14.53% of subjects.

Sleep difficulties and eating behavior association

According to Table 2, the positive correlations were observed between sleep difficulties with EAT total scores and bulimic behavior for males (r=0.218, *P*=0.044 and r=0.432, *P*<0.001), females (r=0.219, *P*=0.043 and r=0.414, *P*<0.001) and the total participants (r=0.166, *P*=0.029 and r=0.302, *P*<0.001).

A less consistent pattern was found between sleep difficulties, specially DMS and diet concerns in males (r=0.218, *P*=0.044). Also, a significant correlation was not present between sleep difficulties and social pressure for eating males. In the total participants, DIS was associated with diet concerns but was not significantly positive direct linear relationships (r=0.225, *P*=0.003). In females, DMS (r=0.414, *P*<0.001) was related significantly with social pressure for eating.

Sleep disturbance and BMI association

One hundred and thirty-five (78.5%) of participants had normal range of BMI. Twenty-eight (13.4%) participants were overweight, and 14 (8.1%) were underweight. Negative correlation between BMI and DMS was not remarkable in males (Table 2).

Table 2. Correlation coefficient between age, body mass index (BMI), and Eating Attitudes Test-40 (EAT-40) dimensions and total score; and difficulties of initiating sleep (DIS), difficulties of maintaining sleep (DMS) and total sleep disturbance scores (TSD), in males, females and the total participants

	DIS		DMS		TSD	
	Correlation coefficient	*P*	Correlation coefficient	*P*	Correlation coefficient	*P*
Male						
DC	0.218*	0.044	0.095	0.382	0.183	0.091
BB	0.432***	0.000	0.230*	0.033	0.384***	0.000
SPE	0.056	0.611	0.165	0.128	0.119	0.274
PE	0.278	0.010	0.254	0.018	0.302	0.005
Eat total score	0.317	0.003	0.208	0.055	0.302	0.005
BMI	-0.009	0.933	-0.069	0.527	-0.041	0.706
Age	0.046	0.672	0.150	0.168	0.106	0.333
Females						
DC	0.240	0.026	0.349	0.001	0.347	0.001
BB	0.219	0.043	0.310	0.004	0.312	0.003
SPE	0.187	0.085	0.414	0.000	0.354	0.001
PE	0.039	0.720	0.096	0.377	0.080	0.464
Eat total score	0.250	0.020	0.401	0.000	0.384	0.000
BMI	0.182	0.094	0.107	0.328	0.170	0.118
Age	-0.126	0.249	-0.058	0.594	-0.108	0.320
Total						
DC	0.225	0.003	0.220	0.004	0.257	0.001
BB	0.342	<0.001	0.270	<0.001	0.355	0.000
SPE	0.112	0.143	0.286	<0.001	0.225	0.003
PE	0.139	0.068	0.166	0.029	0.175	0.021
Eat total score	0.283	<0.001	0.302	<0.001	0.337	0.000
BMI	0.088	0.249	0.009	0.911	0.058	0.448
Age	-0.022	0.770	0.049	0.523	0.013	0.863

r: Pearson's rank correlation coefficients; DC: diet concerns; BB: bulimic behavior; PE: pleasure to eat; SPE: social pressure to eat

Table 3. Regression analysis with difficulties of initiating sleep (DIS), difficulties of maintaining sleep (DMS) and total sleep disturbance scores (TSDS) as dependent variable in males, females and total participants

	Dependent variable	Predictors	Models	R^2	R^2 changes	F change	P	F change P	P	R partial	P
Male	DIS	Age	1	0.002	0.002	0.181	0.672	0.181	0.672	0.094	0.402
		BMI	2	0.002	0.000	0.003	0.957	0.091	0.913	-0.124	0.272
		DC	3	0.235	0.233	6.017	<0.001	4.049	0.001	-0.027	0.814
		BB								0.375	0.001
		SPE								-0.135	0.229
		PE								0.143	0.203
	DMS	Age	1	0.022	0.022	1.933	0.168	1.933	0.168	0.223	0.045
		BMI	2	0.023	0.001	0.043	0.836	0.977	0.381	-0.042	0.708
		DC	3	0.153	0.130	3.040	0.022	2.384	0.036	-0.153	0.174
		BB								0.188	0.092
		SPE								0.109	0.333
		PE								0.213	0.056
	TSCS	Age	1	0.011	0.011	0.950	0.333	0.950	0.333	0.178	0.113
		BMI	2	0.011	0.000	0.005	0.942	0.472	0.625	-0.098	0.383
		DC	3	0.220	0.208	5.276	0.001	3.707	0.003	-0.098	0.382
		BB								0.330	0.003
		SPE								-0.024	0.828
		PE								0.201	0.072
Female	DIS	Age	1	0.016	0.016	1.347	0.249	1.347	0.249	-0.078	0.488
		BMI	2	0.047	0.032	2.749	0.101	2.062	0.134	0.127	0.258
		DC	3	0.100	0.052	1.146	0.341	1.456	0.204	0.104	0.354
		BB								0.047	0.675
		SPE								0.103	0.361
		PE								-0.069	0.538
	DMS	Age	1	0.003	0.003	0.287	0.594	0.287	0.594	0.045	0.692
		BMI	2	0.014	0.011	0.924	0.339	0.605	0.548	0.032	0.774
		DC	3	0.232	0.218	5.599	0.001	3.979	0.002	0.168	0.133
		BB								0.049	0.666
		SPE								0.337	0.002
		PE								-0.120	0.287
	TSCS	Age	1	0.012	0.012	0.000	0.320	1.000	0.320	-0.023	0.837
		BMI	2	0.028	0.028	2.395	0.126	1.706	0.188	0.099	0.381
		DC	3	0.165	0.165	4.084	0.005	3.376	0.005	0.162	0.147
		BB								0.058	0.608
		SPE								0.262	0.018
		PE								-0.113	0.316
Total	DIS	Age	1	0.001	0.001	0.085	0.770	0.085	0.770	0.018	0.813
		BMI	2	0.008	0.007	1.258	0.264	0.672	0.512	0.004	0.959
		DC	3	0.118	0.110	5.135	0.001	3.669	0.002	0.014	0.853
		BB								0.253	0.001
		SPE								-0.020	0.796
		PE								0.007	0.933
	DMS	Age	1	0.002	0.002	0.409	0.523	0.409	0.523	0.103	0.187
		BMI	2	0.003	0.000	0.049	0.825	0.228	0.797	-0.015	0.852
		DC	3	0.124	0.121	5.712	0.000	3.892	0.001	0.001	0.986
		BB								0.146	0.060
		SPE								0.197	0.011
		PE								0.035	0.658

Only 8 (9.3%) females had BMI less than 18.5; eighteen males (21.0%) had BMI more than 25. To analyze sleep difficulties by BMI groups, participants were divided by BMI into three groups: (1) BMI<18.5 underweight (9.3%females; 7.0% males); (2) BMI between 18.5, and 24.9 normal (84.9% females;72.2% males).

Factors associated with sleep difficulties
Hierarchical regression was conducted to analyze which factors were contributor to sleep difficulties. Hierarchical regression was evaluated as follows: age and BMI were included in the model, followed by the three EAT dimensions (DC, BB and SPE) entered as a block. The results are summarized in Table 3. When exploring in more detail, the EAT dimensions that predicted sleep difficulties; it was observed that BB and SPE were the dimensions that significantly explained difficulties initiating and maintaining sleep and overall sleep disturbances.

Discussion
Our results suggested an association between eating pattern and sleeping disturbances. This relation was more significant in bulimic behavior (BB) dimension. The correlation between BB and sleep difficulties could be related to the abnormal eating patterns or the presence of binge eating episodes.

These findings are in accordance with previous report which indicated that scores on the Eating Attitudes Test-40 questionnaire were significantly related to scores on two questions on difficulties of initiating and maintaining sleep among undergraduate students (29) . Stamatakis et al. showed that fewer intake of fruits and vegetables and more intakes of energetic foods without useful nutrients which are present in individuals with less than seven hours of sleep (30). Additionally, Aspen et al. surveyed female students of college and presented that general eating disorder pathology was related to anxiety disorders, mood disorders, and insomnia. These relations strengthened with the severity of the eating disorder symptoms (31).

Eating pattern could modify sleep-waking rhythms from the molecular to behavioral level (32). Before bed time food behavior, such as consumption of coffee, tea, and other food carrying stimulants appear to reduce sleep quality (33), as well as, intake of milk, food with a high glycemic index, cereal preparations, vitamin supplements were reported to improve sleep quality (34). The biological mechanisms involved in the association between eating and sleep problems is not completely transparent. However, it is likely that the hypothalamus plays an important role in the interface between the circadian cycle and eating. For example, the lateral hypothalamic area, plays a crucial role in the regulation of both ingestive behavior and the sleep–wake cycle (35).

There is also some evidence that could not find any noticeable correlation between eating and sleeping behavior; Mostafa Lotfi et al. showed no significant difference of eating behaviors between the two groups of poor and desirable sleepers; only emotional eating was in a trend close to significance (36).

Sleep disorders may cause increases in appetite, polyphagia leading to adiposity (37). Nevertheless, based on our results in total samples, the relation between BMI and DMS was not notable. Moreover, a less significant relation appeared between BMI and DIS in the group of females. A study on medical students, reported the prevalence of poor sleep quality to be 39.8%, and found no differences in sleep quality between both sex at BMI ≥ 25 (38). According to another study, 40.6% of students had poor sleep quality and there was no significant relationship between sleep quality and BMI (39). These attained data encourage a desirable eating pattern aiming at reducing sleep difficulties.

The limitation of the current study was that, it was conducted among small sample of medical students in Shahid Beheshti University; therefore, generalizability of (prevalence) data from a convenience sample is often difficult to attain. Furthermore, most participants were preclinical students with a defined age; moreover, our sample could not be representative for the general population. There are some factors, such as stress and shift work (40, 41)that could be associated with eating and sleeping behavior; nonetheless, we were not able to study all of them in this research.

Conclusively, age and gender could be accounted as confounder variables in the association between sleep disturbance and eating behaviors. The results of this study indicated that a normal eating behavior has a positive relation with the quality of sleep.

Conflict of interest
Authors declare no conflict of interests.

References

1. Moschiano F, Messina P, D'Amico D, Grazzi L, Frediani F, Casucci G, d'Onofrio F, Demurtas A, Beghi E, Bussone G. Headache, eating and sleeping behaviors and lifestyle factors in preadolescents and adolescents: preliminary results from an Italian population study. Neurol Sci. 2012 May;33 Suppl 1:S87-90.

2. Pirzadeh A, Sharifirad G, Kamran A. Healthy lifestyle in teachers. J Educ Health Promot. 2012;1:46.

3. Schnettler B, Lobos G, Miranda-Zapata E, Denegri M, Ares G, Hueche C. Diet Quality and Satisfaction with Life, Family Life, and Food-Related Life across Families: A Cross-Sectional Pilot Study with Mother-Father-Adolescent Triads. Int J Environ Res Public Health. 2017 Oct 29;14(11).

4. Schnettler B, Miranda H, Lobos G, Orellana L, Sepúlveda J, Denegri M, Etchebarne S, Mora M, Grunert KG. Eating habits and subjective well-being. A typology of students in Chilean state universities. Appetite. 2015 Jun;89:203-14.

5. Pasdar Y, Rezaie M, Darbandi M. Dietary Pattern and Food Consumption among Kermanshah Households, 2011. Journal of Kerman University of Medical Sciences. 2014;21(1).

6. M Kliegman R. Nelson Textbook of Pediatrics, 2-Volume Set, (2016). Elsevier; 2016.

7. Strauch I, Meier B. Sleep need in adolescents: a longitudinal approach. Sleep. 1988 Aug;11(4):378-86.

8. Mindell JA, Moline ML, Zendell SM, Brown LW, Fry JM. Pediatricians and sleep disorders: training and practice. Pediatrics. 1994 Aug;94(2 Pt 1):194-200.

9. Dement WC. History of sleep physiology and medicine. Principles and practice of sleep medicine. 2000;5:3-15.

10. Sayar K, Arikan M, Yontem T. Sleep quality in chronic pain patients. Can J Psychiatry. 2002 Nov;47(9):844-8.

11. Birketvedt GS, Florholmen J, Sundsfjord J, Osterud B, Dinges D, Bilker W, Stunkard A. Behavioral and neuroendocrine characteristics of the night-eating syndrome. JAMA. 1999 Aug 18;282(7):657-63.

12. Soares MJ, Macedo A, Bos SC, Maia B, Marques M, Pereira AT, Gomes AA, Valente J, Nogueira V, Azevedo MH. Sleep disturbances, body mass index and eating behaviour in undergraduate students. J Sleep Res. 2011 Sep;20(3):479-86.

13. Spiegel K, Tasali E, Penev P, Van Cauter E. Brief communication: Sleep curtailment in healthy young men is associated with decreased leptin levels, elevated ghrelin levels, and increased hunger and appetite. Ann Intern Med. 2004 Dec 7;141(11):846-50.

14. St-Onge MP, Mikic A, Pietrolungo CE. Effects of Diet on Sleep Quality. Adv Nutr. 2016 Sep 15;7(5):938-49.

15. Cinosi E, Di Iorio G, Acciavatti T, Cornelio M, Vellante F, De Risio L, Martinotti G. Sleep disturbances in eating disorders: a review. Clin Ter. 2011;162(6):e195-202.

16. Eiber R, Friedman S. [Correlation between eating disorders and sleep disturbances]. Encephale. 2001 Sep-Oct;27(5):429-34.

17. Kim KR, Jung YC, Shin MY, Namkoong K, Kim JK, Lee JH. Sleep disturbance in women with eating disorder: prevalence and clinical characteristics. Psychiatry Res. 2010 Mar 30;176(1):88-90.

18. Allison KC, Spaeth A, Hopkins CM. Sleep and Eating Disorders. Curr Psychiatry Rep. 2016 Oct;18(10):92.

19. Altuğ A, Elal G, Slade P, Tekcan A. The Eating Attitudes Test (EAT) in Turkish university students: relationship with sociodemographic, social and individual variables. Eat Weight Disord. 2000 Sep;5(3):152-60.

20. Elal G, Altug A, Slade P, Tekcan A. Factor structure of the Eating Attitudes Test (EAT) in a Turkish university sample. Eat Weight Disord. 2000 Mar;5(1):46-50.

21. Talwar P. Factorial analysis of the eating attitude test (EAT-40) among a group of malaysian university students. Malaysian Journal of Psychiatry. 2011;20(2).

22. Tan X, Alén M, Cheng SM, Mikkola TM, Tenhunen J, Lyytikäinen A, Wiklund P, Cong F, Saarinen A, Tarkka I, Partinen M, Cheng S. Associations of disordered sleep with body fat distribution, physical activity and diet among overweight middle-aged men. J Sleep Res. 2015 Aug;24(4):414-24.

23. Pereira AT, Maia B, Bos S, Soares MJ, Marques M, Macedo A, Azevedo MH. The Portuguese short form of the Eating Attitudes Test-40. Eur Eat Disord Rev. 2008 Jul;16(4):319-25.

24. Pourghassem Gargari B, Kooshavar D, Seyed Sajadi N, Safoura S, Hamed Behzad M, Shahrokhi H. Disordered Eating Attitudes and Their Correlates among Iranian High School Girls. Health Promot Perspect. 2011 Jul 25;1(1):41-9.

25. Mostafavi SA, Keshavarz SA, Mohammadi MR, Hosseini S, Eshraghian MR, Hosseinzadeh P, Chamari M, Sari Z, Akhondzadeh S. Reliability and Validity of the Persian Version of Compulsive Eating Scale (CES) in Overweight or Obese Women and Its Relationship with Some Body Composition and Dietary Intake Variables. Iran J Psychiatry. 2016 Oct;11(4):250-256.

26. Behrad M, Kamali M. The relationship of thought control strategies with eating disorders in female students of Payam-e-Noor University in Yazd. Zahedan Journal of Research in Medical Sciences. 2011 Dec 1;13(7):22-7.

27. Babai S, Khodapanahi MK, Saleh Sedghpur B. The validity and reliability of the attitudes test. Journal of behavioral sciences. 2007;1:61-8.

28. Pereira AT, Maia B, Bos S, Soares MJ, Marques M, Macedo A, Azevedo MH. The Portuguese short form of the Eating Attitudes Test-40. Eur Eat Disord Rev. 2008 Jul;16(4):319-25.

29. Tromp MD, Donners AA, Garssen J, Verster JC. Sleep, eating disorder symptoms, and daytime functioning. Nat Sci Sleep. 2016 Jan 18;8:35-40.

30. Stamatakis KA, Brownson RC. Sleep duration and obesity-related risk factors in the rural Midwest. Prev Med. 2008 May;46(5):439-44.

31. Aspen V, Weisman H, Vannucci A, Nafiz N, Gredysa D, Kass AE, Trockel M, Jacobi C, Wilfley DE, Taylor CB. Psychiatric co-morbidity in women presenting across the continuum of disordered eating. Eat Behav. 2014 Dec;15(4):686-93.

32. Winsky-Sommerer R, Yamanaka A, Diano S, Borok E, Roberts AJ, Sakurai T,Kilduff TS, Horvath TL, de Lecea L. Interaction between the corticotropin-releasing factor system and hypocretins (orexins): a novel circuit mediating stress response. J Neurosci. 2004 Dec 15;24(50):11439-48.

33. Shilo L, Sabbah H, Hadari R, Kovatz S, Weinberg U, Dolev S, Dagan Y, Shenkman L. The effects of coffee consumption on sleep and melatonin secretion. Sleep Med. 2002 May;3(3):271-3.

34. Afaghi A, O'Connor H, Chow CM. High-glycemic-index carbohydrate meals shorten sleep onset. Am J Clin Nutr. 2007 Feb;85(2):426-30. Erratum in: Am J Clin Nutr. 2007 Sep;86(3):809.

35. Damiola F, Le Minh N, Preitner N, Kornmann B, Fleury-Olela F, Schibler U. Restricted feeding uncouples circadian oscillators in peripheral tissues from the central pacemaker in the suprachiasmatic nucleus. Genes & development. 2000 Dec 1;14(23):2950-61.

36. Lotfi M, Al-Hosseini MK, Jafarirad S. The relationship of sleep quality with eating behavior and food intake among Male University students. J Sleep Med Disord. 2015;2(5):1034.

37. Froy O. Metabolism and circadian rhythms--implications for obesity. Endocr Rev. 2010 Feb;31(1):1-24.

38. Ardani AR, Moghani M, Nejati R, Sabouri S, Hoseini S. Assessment the rules of demographic variables and body mass index in sleep quality among medical students. J Fundamentals Mental Health. 2012;14(2):132-9.

39. Ghoreishi A, Aghajani AH. Sleep quality in Zanjan university medical students. Tehran University Medical Journal TUMS Publications. 2008 Mar 15;66(1):61-7.

40. Drake CL, Roehrs T, Roth T. Insomnia causes, consequences, and therapeutics: an overview. Depress Anxiety. 2003;18(4):163-76.

41. van Drongelen A, Boot CR, Merkus SL, Smid T, van der Beek AJ. The effects of shift work on body weight change - a systematic review of longitudinal studies. Scand J Work Environ Health. 2011 Jul;37(4):263-75.