



# The relationship between lifestyle and anthropometric factors with the sleep characteristics among university students in Iran: the MEPHASOUS study

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## Abstract

**Background** Healthy sleep habits have an important role in normal cognitive function, emotional performance, and well-being. The aims of this study were to describe the characteristics of sleep among university students in Iran. In addition, we assessed the relationship between lifestyle and anthropometric factors with the sleep characteristics.

**Methods** This population-based cross-sectional study was conducted using the data of “Mental and Physical Health Assessment of University Students in Iran” survey 2012–2013. This survey was conducted on newly admitted students in 74 public universities in 28 provinces. The participants were younger adults. Univariate and multivariate logistic regression models were utilized to recognize associated factors with sleep pattern and range.

**Result** Of total 78,848 students who completed the survey, 54.64% ( $n = 43,079$ ) were females. The average age of the students was  $21.53 \pm 4.08$  and  $21.54 \pm 3.99$  among males and females, respectively. More than 90% ( $n = 70,923$ ), were non-smokers. Out of the total respondents, 40.56% ( $n = 31,756$ ) had irregular sleep pattern. Male students were less likely to have irregular sleep pattern than female students.

**Conclusion** Our findings indicated that irregular sleep pattern is associated with overweight and obesity. So, these results underscore the need to educate students on importance of healthy sleep pattern and duration on health conditions.

**Keywords** Sleep · Young adult · Students · Universities

## Introduction

Normal sleep is vital for mental and physical health. Healthy sleep habits have an important role in normal cognitive

functioning, emotional performance, and well-being [1]. The recommended sleep duration for young adults is around 7–9 h [2]. College students usually have reduced sleep duration, increased late bedtimes, and early rise times [3]. Sleep

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restriction has negative physiological effects. It leads to an increased physiological markers of stress [4]. Compromising sleep duration and altering the pattern are associated with fatigue, decreased psychomotor performance, poor health, low academic performance, and accidents [5]. Normal sleep duration and pattern improve the academic performance, adjustment and the mood of students [2].

Caffeinated beverages, alcohol consumptions, and smoking cigarette reduce the quality of sleep and lead to day time dysfunction [6]. Dietary pattern is associated with short sleep duration [7]. A study indicated that long term use of electronic devices is associated with shorter sleep duration and increment of sleep deficiency [8]. Furthermore, higher Body Mass Index (BMI) is related with sleep duration and pattern [9].

Although published dearth of research exists on sleep pattern and quality among younger adults in Iran, to the best of our knowledge, no study has used a comprehensive sampling method enjoying a big sample size to deal with the prevalence of sleep disturbance and risk factors among younger Iranian adults in Iran. The Iranian University Student's Health Survey (IUSHS) is an annually repeated lifestyle and health survey on newly entered students in all public universities in Iran. This study included the physical examination and self-reported questionnaire to collect data about the multiple dimension of health and lifestyle of these young adults.

This article is an analysis of the results of IUSHS. The present research aims to describe the pattern and duration of sleep among young age groups in Iran. In order to reveal the relation of lifestyles and anthropometric factors with quality and duration of sleep in these age groups.

## Material and methods

This is a population-based cross-sectional study which is part of "Mental and Physical Health Assessment of University Students in Iran (MEPHASOUS-Iran)". The profile study that included methodological details is already published [10]. Concisely Counseling and Health Organization of the Ministry of Science and Technology (CHOMST) designed a mental and physical health assessment framework for academic students in 2012–2013 to study universities health initiatives. The major aim of this assessment was to figure out the present health issues and behaviors among new academic students. All these universities from different geographical regions, which had health centers, participated in the program. The objectives were explained to the health center of the public universities. Students were informed about the health program by the health center staffs during the registration time. Appointment date for the evaluation was announced on the website. They were also notified about the assessment by E-mail and short messaging system (SMS) and through

informative posters all over the universities. The mental and physical health behaviors of the students were evaluated using two separated questionnaires as indicated below [10].

## Study population

All newly accepted students ( $N = 151,671$ ) from 74 public universities in 28 provinces of the total 31 provinces in Iran were invited to participate in this study. The students were at three different academic levels, including undergraduate, master, and PhD programs. Totally, 84,298 students aged between 18 and 29 years participated in MEPHASOUS-Iran. Due to the incompleteness of some data on sleep characteristics, data of 78,848 young individuals were recruited for the purpose of analyses. Explanation about the details of sampling frame and method were given in next paragraphs [10].

## Data collection

Demographic, life style, and food behaviors data were collected using a questionnaire approved by an expert panel. BMI is calculated by dividing weight (kg) by square of height (meter). The students' response on sleep features or sleep duration and sleep pattern was collected by asking two questions. The first question was "on average how long do you sleep in a day (24 hours)?" the choices of this question was "less than six hours", "six to eight hours", "eight to ten hours", and "more than ten hours". The second question was "do you have a regular program for sleeping and awaking?" Previous studies shown that using questionnaire undertaken validated and reliable data on lifestyle and anthropometric factors [10–16].

Height and weight were measured according to Anthropometry Procedures Manual of "National Health and Nutrition Examination Survey" (NHNES) [17].

## Statistical analysis

The Contributors were re-categorized based on sleep duration as follows:  $\leq 6$  h sleep duration per day, 6–10 h sleep duration per day, and  $\geq 10$  h sleep duration per day. One-way analysis of variance (ANOVA) was applied to compare parametric variables across categories of sleep duration. In addition, Chi-square test was used to evaluate the participants distribution based on general demographic characteristics across categories of sleep duration. Univariate and multivariate-adjusted odds ratios and 95% confidence intervals were used for analyzing lifestyle characteristics measures across classified sleep ranges. Variables used in univariate and multivariate-adjusted models included age, gender, smoking status, BMI categories, carbonated beverages and dairy consumption, and physical activity. All variables excluding age, gender, and smoking status were used in the model as categorical variables.  $P$  values  $< 0.05$  was considered as significant levels. All

**Table 1** General characteristics of the participants based on males and females and sleep duration

Variables		<6 h sleep rang	6–10 h sleep rang	>10 h sleep rang	P Value
<b>Males</b>					
Number of participants		2227	32,781	761	
Mean age year (SD)		21.7 (4.42)	21.5 (4.08)	20.6 (3.09)	<0.001
Mean weight kg (SD)		73.1 (14.86)	71.45 (13.99)	69.95 (13.61)	<0.001
Current smoker N (%)		507 (21.77)	3358 (10.24)	252 (33.16)	<0.001
Sleep pattern	Regular N (%)	786 (35.29)	19,075 (58.19)	207 (27.20)	<0.001
	Irregular N (%)	1441 (64.71)	13,705 (41.81)	554 (72.80)	
Marital status	Single N (%)	2042 (91.69)	30,450 (92.89)	733 (96.32)	0.001
	Married N (%)	183 (8.22)	2311 (7.05)	28 (3.68)	
	Others N (%)	200 (0.09)	1967 (0.06)	0	
BMI groups	Ideal body N (%)	1224 (54.96)	18,888 (57.62)	435 (57.16)	
	Low body N (%)	301 (13.52)	5170 (15.77)	148 (19.45)	
	Overweigh N (%)	528 (23.71)	6805 (20.76)	146 (19.19)	
	Obese N (%)	174 (7.81)	1918 (5.85)	31 (4.07)	
Physical activity at least 30 min	Not at all N (%)	375 (16.84)	4124 (12.58)	189 (24.84)	<0.001
	1–2 times/week N (%)	835 (37.49)	14,073 (42.93)	289 (37.98)	
	3–4 times/week N (%)	557 (25.01)	9946 (30.34)	177 (22.26)	
	Everyday N (%)	459 (20.61)	4639 (14.15)	113 (14.85)	
<b>Females</b>					
Number of participants		2172	40,052	855	
Mean age year (SD)		21.7 (4.53)	21.55 (3.97)	20.62 (3.00)	<0.001
Mean weight kg (SD)		59.1 (11.45)	58.2 (10.54)	57.4 (10.90)	<0.001
Marital status	Single N (%)	1922 (88.48)	34,793 (86.87)	785 (91.79)	<0.001
	Married N (%)	248 (11.42)	5207 (13.00)	70 (8.19)	
	Others N (%)	2 (0.09)	52 (0.13)	0	
Current smoker (%)		439 (20.21)	2571 (6.42)	104 (12.16)	<0.001
Sleep pattern	Regular N (%)	903 (41.57)	25,489 (63.64)	311 (36.37)	<0.001
	Irregular N (%)	1269 (58.43)	14,563 (36.36)	544 (63.63)	
BMI groups	Ideal body N (%)	1274 (58.66)	24,740 (61.77)	511 (59.77)	<0.001
	Low body N (%)	410 (18.88)	7866 (19.64)	207 (24.21)	
	Overweigh N (%)	382 (17.59)	5916 (14.77)	96 (11.23)	
	Obese N (%)	106 (4.88)	1530 (3.82)	41 (4.80)	
Physical activity at least 30 min	Not at all N (%)	403 (18.53)	7334(18.31)	254 (29.65)	<0.001
	1–2 times/week N (%)	878 (40.42)	18,344 (45.80)	370 (43.27)	
	3–4 times/week N (%)	579 (25.66)	10,562 (26.37)	168 (19.65)	
	Everyday N (%)	334 (15.38)	3813 (9.52)	63 (7.37)	

SD Standard Daviation, BMI Body Mass Index

statistical analyses were conducted for both genders using STATA software version 12.

## Results

Of the 78,848 students who participated in the survey and met participant guidelines, 54.64% were females and 45.36% were males. The average reported age by the participants was 21.53 and standard deviation was (SD) = 4.08 and 21.54 (SD = 3.99) among males and females students, respectively. Above half of the students, (59.71%) were found to be of normal body

weight (19–25 kg/m<sup>2</sup>). About 4.8% of the participants were found to be obese. The dietary habits, behavioral, and demographic characteristics of the participants in relation to various sleep durations, short sleep duration ( $\leq 6$  h sleep duration), normal sleep duration (6–10 h sleep duration), and long sleep duration ( $\geq 10$  h sleep duration) have been reported in Table 1.

## Personal lifestyle

Most of the participants (90.84%) did not smoke. Less than half of the students (44.13%) had physical activities one to two times per week. Around 89.70% of the respondents were

**Table 2** Associations of sleep pattern (irregular/regular) with other factors (in univariate and multivariable logistic regression models)

Factors		Crude odds ratio (95% CI)	P values	Adjusted odds ratio (95%CI) <sup>a</sup>	P values
Age (each year increased)		0.942 (0.938–0.946)	<0.001	0.948 (0.944–0.952)	<0.001
Gender (female/male)		0.783 (0.760–0.806)	<0.001	0.839 (0.813–0.865)	<0.001
Marital status	Single	Reference group		Reference group	
	Married	0.596 (0.567–0.627)	< 0.001	0.803 (0.758–0.850)	<0.001
	Others	1.122 (0.710–1.775)	0.621	1.544 (0.959–2.485)	0.074
BMI groups	Ideal BW	Reference group		Reference group	
	Low BW	1.093 (1.052–1.135)	<0.001	1.005 (0.965–1.046)	0.822
	Overweight	1.017 (0.978–1.057)	0.389	1.051 (1.020–1.106)	0.017
	Obese	1.116 (1.043–1.193)	0.001	1.114 (1.038–1.195)	0.003
Smoker/non-smoker		1.157 (1.100–1.216)	<0.001	0.923 (0.874–0.975)	0.004
Physical activity	Not at all	Reference group		Reference group	
	1–2 times/week	0.673 (0.645–0.701)	<0.001	0.673 (0.645–0.703)	<0.001
	3–4 times/week	0.588 (0.563–0.615)	<0.001	0.581 (0.555–0.609)	<0.001
	Everyday	0.601 (0.569–0.634)	<0.001	0.554 (0.523–0.587)	<0.001
Carbonated beverages consumption	Once/week	Reference group		Reference group	
	2–3 times/week	1.406 (1.364–1.449)	<0.001	1.342 (1.299–1.385)	<0.001
	>3 times/week	2.081 (1.960–2.209)	<0.001	1.886 (1.771–2.008)	<0.001
Dairy consumption	Not at all	Reference group		Reference group	
	Once/week	0.850 (0.797–0.907)	<0.001	0.897 (0.838–0.960)	0.001
	2–3 times/week	0.611 (0.575–0.649)	<0.001	0.669 (0.626–0.714)	<0.001
	Everyday	0.490 (0.460–0.523)	<0.001	0.539 (0.503–0.577)	<0.001
Sleep duration <6 h/≥6 h		2.471 (2.317–2.35)	<0.001	2.493 (2.329–2.668)	<0.001

<sup>a</sup> Adjusted for other variable in table

CI Confidence Interval, BW Body Weight, wk Week, h hour

single. Less than half of the students (47.54%) took dairy products two to three times per week (Table 1).

### Sleep pattern and duration

Out of the total respondents, 40.56% had irregular sleep pattern. More than 57.8% of the students reported sleep duration of 6–8 h but the rest: 34.49%, 5.58%, and 2.05% of them reported to sleep 8–10 h, less than 6 h, and more than 10 h daily, respectively (see Table 1).

### Factors associated with sleep characteristics

For each year increase in age, the students tend to have more (0.058) irregular sleep pattern. Female students were less probably to have irregular sleep pattern than male students. Students who had physical activity at any level were less presumably to have irregular sleep pattern than those who did not do physical activity at all. Consumption of confectionaries, and carbonated beverages more than three times in a week increased the likelihood of irregular sleep as compared to taking it not at all. Dairy consumption above two times per week reduced the possibility of irregular sleep pattern. With regard

to BMI groups, obese students were more prone to have irregular sleep pattern than those who had normal body weight (OR: 1.116, 95% CI: 1.043–1.193). Overweight status was reported to have no statistically significant association with sleep pattern. Univariate and Multivariate-adjusted odds ratios and 95% CIs for lifestyle characteristics measured across classified sleep pattern is showed in Table 2.

The association of sleep duration and predictor factors in univariate and multivariable logistic regression model are showed in Tables 3 and 4. Sleep duration less than 6 h and more than 10 h were perceived abnormal. For each year increase in age, the students were more likely (.013) to increase sleep duration (OR: 1.013, 95% CI: 1.006–1.020). Female students had sleep duration less than male students (0.201). Obese students were less likely to have sleep duration (< 10 h sleep duration) than student with BMI less than 19, but this difference was not significant (OR: 0.940, 95% CI 0.738–1.198). Smoker students were more likely to sleep long rather than non-smoker students. The dairy consumption per day reduced abnormal sleep duration among students. Carbonated beverages consumption more than three times in a week was associated with shorter and longer than normal sleep duration. The association between abnormal sleep

**Table 3** Associations of sleep duration (<6 h sleep duration/> = 6 h sleep duration) with other factors (in univariate and multivariable logistic regression models)

Factors		Crude odds ratio (95% CI)	P values	Adjusted odds ratio (95% CI) <sup>a</sup>	P values
Age (each year increased)		1.013 (1.006–1.020)	0.001	1.028 (1.019–1.037)	<0.001
Gender (female/male)		0.799 (0.752–0.849)	<0.001	0.885 (0.827–0.947)	<0.001
BMI groups	Ideal BW	Reference group		Reference group	
	Low BW	0.947 (0.869–1.032)	0.216	0.944 (0.861–1.034)	0.216
	Overweight	1.253 (1.158–1.355)	<0.001	1.245 (1.145–1.354)	<0.001
	Obese	1.419 (1.248–1.613)	<0.001	1.409 (1.229–1.630)	<0.001
Smoker/non-smoker		2.883 (2.668–3.115)	<0.001	1.805 (1.643–1.982)	<0.001
Physical activity	Not at all	Reference group		Reference group	
	1–2 times/week	0.793 (0.726–0.865)	<0.001	0.903 (0.823–0.991)	0.031
	3–4 times/week	0.819 (0.745–0.900)	<0.001	0.938 (0.848–1.038)	0.215
	Everyday	1.410 (1.272–1.563)	<0.001	1.524 (1.364–1.703)	<0.001
Carbonated beverages consumption	Once/week	Reference group		Reference group	
	2–3 times/week	0.965 (0.903–1.032)	0.298	0.864 (0.804–0.929)	<0.001
	>3 times/week	1.663 (1.493–1.853)	<0.001	1.306 (1.264–1.585)	<0.001
Dairy consumption	Not at all	Reference group		Reference group	
	Once/week	0.778 (0.692–0.874)	<0.001	0.864 (0.761–0.980)	0.023
	2–3 times/week	0.525 (0.469–0.587)	<0.001	0.704 (0.623–0.795)	<0.001
	Everyday	0.548 (0.486–0.618)	<0.001	0.757 (0.664–0.863)	<0.001
Sleep pattern regular/irregular		2.471 (2.317–2.635)	<0.001	2.497 (2.333–2.672)	<0.001

<sup>a</sup> Adjusted for other variable in table

CI Confidence Interval, BW Body Weight, wk Week

duration of more than 10 h a day and gender found to have no statistically significant relationship (Tables 3 and 4).

## Discussion

The results of this study revealed that many factors are associated with sleep quality and duration such as personal lifestyle, physical activity, marital status, and smoking. As cited earlier, the major aim of this nationwide survey is to assess the mental and physical health of university students in Iran to figure out the present health issues and behaviors among university students related to sleep characteristics. The first year of admission to university is a remarkable transition for students from school [10]. This study argues that sleep habits are particularly challenging issues of transition from school to university. We separately discussed the factors associated with irregular sleep pattern and duration.

As previous studies showed, there was a significant difference between genders regarding sleep characteristics [18]; The current study demonstrated that regular sleep pattern was more common among female students than male students. A study reported that female students had longer sleep latency, more awakenings, and poorer sleep quality than the male [19].

According to the results of some surveys, women tend to have more significant sleep problems than men [20].

In this study, we found a negative correlation between physical activity and irregular sleep pattern. Students, who perform physical activity at any level, have significant lower risk of irregular sleep pattern than those who refrain from any physical activity. A similar study also showed that physical activity is associated with a reduction in poor sleep quality and has sleep promoting benefits [21]. Likewise, a study from Saudi Arabia reported a negative association between physical activity and insomnia among female college students [22].

As confirmed by our findings, irregular sleep pattern is associated with overweight and obesity. A previous studies also highlighted the correlation between short sleep duration and unfavorable weight status [23]. Furthermore, the results of studies showed that weight status had important relationships with sleep pattern independent of sleep duration [24]. Another study also confirmed the relationship between sleep problems and obesity [25].

In our study, there was evidence that moderate dairy consumption (more than once per week) decreases the adjusted risk of poor sleep quality and it was associated with significant reduction in the rate of non-healthy sleep duration. Nevertheless, consumption of carbonated beverages was associated with the increasing risk of irregular sleep pattern.

**Table 4** Associations of sleep duration (<10 h sleep duration/>= 10 h sleep duration) with other factors (in univariate and multivariable logistic regression models)

Factors		Crude odds ratio (95% CI)	P values	Adjusted odds ratio (95%CI) <sup>a</sup>	P values
Age (each year increased)		0.933 (0.919–0.947)	<0.001	0.945 (0.930–0.960)	<0.001
Gender (female/male)		0.931 (0.844–1.028)	0.159	1.082 (0.972–1.024)	0.151
BMI Groups	Ideal BW	Reference group		Reference group	
	Low BW	1.258 (1.112–1.423)	<0.001	1.154 (1.0115–1.309)	0.029
	Overweight	0.865 (0.750–0.997)	0.046	0.863 (0.743–1.002)	0.053
	Obese	0.940 (0.738–1.198)	0.619	0.893 (0.692–1.152)	0.383
Smoker/non-smoker		2.913 (2.581–3.287)	<0.001	2.257 (1.967–2.590)	<0.001
Physical activity	Not at all	Reference group		Reference group	
	1–2 times/week	0.534 (0.473–0.604)	<0.001	0.655 (0.576–0.746)	<0.001
	3–4 times/week	0.432 (0.374–0.499)	<0.001	0.534 (0.449–0.621)	<0.001
	Everyday	0.529 (0.444–0.632)	<0.001	0.587 (0.487–0.707)	<0.001
Carbonated beverages consumption	Once/week	Reference group		Reference group	
	2–3 times/week	1.093 (1.049–1.303)	0.005	1.040 (0.927–1.165)	0.505
	>3 times/week	2.700 (2.320–3.140)	<0.001	1.930 (1.640–2.271)	<0.001
Dairy consumption	Not at all	Reference group		Reference group	
	Once/week	0.652 (0.551–0.772)	<0.001	0.857 (0.717–1.024)	0.090
	2–3 times/week	0.392 (0.334–0.462)	<0.001	0.623 (0.522–0.743)	<0.001
	Everyday	0.362 (0.301–0.434)	<0.001	0.605 (0.497–0.736)	<0.001
Sleep pattern regular/irregular		3.162 (2.84–3.520)	<0.001	2.737 (2.450–3.058)	<0.001

<sup>a</sup> Adjusted for other variable in table

CI Confidence Interval, BW Body Weight, wk Week

In multivariate models, it was revealed that the sleep duration might be shortens with the increment of age, overweight, obesity, being smoker, and carbonated beverages consumption. Furthermore, the findings indicated that long sleep duration more than 10 h, was associated with age, overweight, physical activity, and dairy consumption.

Several epidemiologic studies demonstrated that both short and long sleep duration can deteriorates physiological status [26, 27]. Short sleep duration might cause several adverse cardiovascular effects. Some studies reported that participants who suffered from abnormal sleep or were deprived of normal sleep had a significantly higher blood pressure than those have normal duration [28]. Individuals, who are long sleepers (more than 10 h of sleep at night), are also exposed to adverse health effects. Numerous systematic reviews demonstrated that longer duration of sleep was associated with worse health outcomes counting not only stroke, diabetes mellitus, and cardiovascular diseases [29], but also mortality due to those diseases [30]. Furthermore, results of a previous study conducted among middle-aged and older adults showed that sleep duration shorter than 7 h, particularly at the extreme of less than 6 h per night, was associated with an increased prevalence of hypertension [31]. Moreover, the results of two surveys in the US [32] and Korea [33] showed that short sleep

duration was associated with the incidence of hypertension. Such association remained durable even after the adjustment for confounding variables, such as obesity [32]. Similarly, a study reported the association between short sleep duration and increased risk of hypertension [34]. A meta-analysis indicated U-shaped association between sleep duration and risk of type 2 diabetes; both short and long sleep duration were associated with a significantly increased risk of type 2 diabetes [35].

Smoking status was found to have no statistically significant relationship with sleep pattern, but it was found to be a risk factor for short sleep duration. Cigarette smoking and stimulant use were found to be risk factors for poor sleep quality [36].

This is the first survey that considered the sleep pattern and sleep duration among students in large sample of academic students in Iran. Furthermore, there are some limitations that should be implied. Even though multiple confounders were controlled in the relation between sleep pattern and sleep duration with other factors in univariate and multivariable logistic regression models such as age, gender, marital status, BMI, smoking status, physical activity, carbonated beverages consumption, and dairy consumption; the role of other remaining confounding variables such as psychological factors could not be, because the information was not accessible.

## Conclusions

To the best of our knowledge, this is the first large survey that examined the effects of sleep pattern and duration on lifestyle among young adults. Our findings demonstrated that irregular sleep pattern is associated with overweight and obesity. So, these results underscore the need to educate students on the importance of healthy sleep pattern and duration on health conditions. Longitudinal studies in younger adults could better explain the causality relationship between health threatening factors and health conditions.

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## Compliance with ethical standards

**Ethics approval and consent to participate** The assessment approved by the Counseling and Health Organization of the Ministry of Science and Technology Ethics Committee.

**Conflict of interests** The authors declare that they have no competing interests.

## References

- Alhola P, Polo-Kantola P. Sleep deprivation: impact on cognitive performance. *Neuropsychiatr Dis Treat*. 2007;3(5):553–67.
- Hirshkowitz M, Whiton K, Albert SM, Alessi C, Bruni O, DonCarlos L, Hazen N, Herman J, Adams Hillard PJ, Katz ES, Kheirandish-Gozal L, Neubauer DN, O'Donnell AE, Ohayon M, Peever J, Rawding R, Sachdeva RC, Setters B, Vitiello MV, Ware JC. National sleep foundation's updated sleep duration recommendations. *Sleep Health*. 2015;1(4):233–43.
- Galambos NL, Vargas Lascano DI, Howard AL, Maggs JL. Who sleeps best? Longitudinal patterns and covariates of change in sleep quantity, quality, and timing across four university years. *Behav Sleep Med*. 2013;11(1):8–22.
- Simpson NS, DiIombi M, Scott-Sutherland J, Yang H, Bhatt V, Gautam S, Mullington J, Haack M. Repeating patterns of sleep restriction and recovery: do we get used to it? *Brain Behav Immun*. 2016;58:142–51.
- Xi B, He D, Zhang M, Xue J, Zhou D. Short sleep duration predicts risk of metabolic syndrome: a systematic review and meta-analysis. *Sleep Med Rev*. 2014;18(4):293–7.
- Digdon N, Landry K. University students' motives for drinking alcohol are related to evening preference, poor sleep, and ways of coping with stress. *Biol Rhythm Res*. 2013;44(1):1–11.
- Kim S, DeRoo LA, Sandler DP. Eating patterns and nutritional characteristics associated with sleep duration. *Public Health Nutr*. 2011;14(5):889–95.
- Hysing M, Pallesen S, Stormark KM, Jakobsen R, Lundervold AJ, Sivertsen B. Sleep and use of electronic devices in adolescence: results from a large population-based study. *BMJ Open*. 2015;5(1):e006748.
- Knutson KL. Does inadequate sleep play a role in vulnerability to obesity? *Am J Hum Biol*. 2012;24(3):361–71.
- Mansouri M, Sharifi F, Varmaghani M, Yaghubi H, Tabrizi YM, Raznahan M, Khajavi A, Ghodsi M, Roshanfekar P, Shafiee G, Keshtkar A, Ebrahimi M. Iranian university students lifestyle and health status survey: study profile. *J Diabetes Metab Disord*. 2017;16(1):48.
- Mansouri M, Sharifi F, Yaghubi H, Varmaghani M, Tabrizi YM, Nasiri M, et al. Sugar-sweetened beverages consumption in relation to hypertension among Iranian university students: the MEPHASOUS study. *Eat Weight Disord*. 2019. <https://doi.org/10.1007/s40519-019-00713-9>.
- Mansouri M, Hasani-Ranjbar S, Yaghubi H, Rahmani J, Tabrizi YM, Keshtkar A, Varmaghani M, Sharifi F, Sadeghi O. Breakfast consumption pattern and its association with overweight and obesity among university students: a population-based study. *Eat Weight Disord*. 2020;25(2):379–87.
- Mansouri M, Miri A, Varmaghani M, Abbasi R, Taha P, Ramezani S, Rahmani E, Armaghan R, Sadeghi O. Vitamin D deficiency in relation to general and abdominal obesity among high educated adults. *Eating Weight Disord-Stud Anorexia Bulimia Obes*. 2019;24(1):83–90.
- Mansouri M, Sharifi F, Varmaghani M, Yaghubi H, Shokri A, Moghadas-Tabrizi Y, et al. Dairy consumption in relation to primary headaches among a large population of university students: the MEPHASOUS study. *Complement Ther Med*. 2020;48:102269.
- Mansouri M, Sharifi F, Tabatabaee SS, Heidari E, Yaghubi H, Keshtkar A, et al. Prevalence of ever self-reported asthma and associated factors among university students in Iran: a population-based study. *Int J Prev Med*. 2020;1(4):11–54 (30 April 2020). [https://doi.org/10.4103/ijpvm.IJPVM\\_453\\_18](https://doi.org/10.4103/ijpvm.IJPVM_453_18).
- Mansouri M, Pahlavani N, Sharifi F, Varmaghani M, Shokri A, Yaghubi H, et al. Dairy consumption in relation to hypertension among a large population of university students: the MEPHASOUS study. *Diabetes Metab Syndr Obes: Targets Ther*. 2020;13:1633.
- Centers for Disease Control and Prevention. 2020. Available from <http://www.cdc.gov/nchs/data/nhanes/nhanes>. Accessed April 2020.
- Dzaja A, Arber S, Hislop J, Kerkhofs M, Kopp C, Pollmächer T, Polo-Kantola P, Skene DJ, Stenuit P, Tobler I, Porkka-Heiskanen T. Women's sleep in health and disease. *J Psychiatr Res*. 2005;39(1):55–76.
- Tsai L-L, Li S-P. Sleep patterns in college students: gender and grade differences. *J Psychosom Res*. 2004;56(2):231–7.
- Lindberg E, Janson C, Gislason T, Björnsson E, Hetta J, Boman G. Sleep disturbances in a young adult population: can gender differences be explained by differences in psychological status? *Sleep*. 1997;20(6):381–7.
- Wu X, Tao S, Zhang Y, Zhang S, Tao F. Low physical activity and high screen time can increase the risks of mental health problems and poor sleep quality among Chinese college students. *PLoS One*. 2015;10(3):e0119607.
- Al-Eisa E, Buragadda S, Melam GR, Al-Osaimi AO, Al-Mubarak HA, Al-Huwaimel NA. Association between physical activity and insomnia among Saudi female college students. *J Phys Ther Sci*. 2013;25(11):1479–82.
- Kathrotia RG, Rao PV, Paralikar SJ, Shah CJ, Oommen ER. Late sleeping affects sleep duration and body mass index in adolescents. *Iran J Med Sci*. 2015;35(1):57–60.
- Olds TS, Maher CA, Matricciani L. Sleep duration or bedtime? Exploring the relationship between sleep habits and weight status and activity patterns. *Sleep*. 2011;34(10):1299–307.
- Garaulet M, Ortega F, Ruiz J, Rey-Lopez J, Beghin L, Manios Y, et al. Short sleep duration is associated with increased obesity markers in European adolescents: effect of physical activity and dietary habits. The HELENA study. *Int J Obes*. 2011;35(10):1308.

26. Meier-Ewert HK, Ridker PM, Rifai N, Regan MM, Price NJ, Dinges DF, Mullington JM. Effect of sleep loss on C-reactive protein, an inflammatory marker of cardiovascular risk. *J Am Coll Cardiol.* 2004;43(4):678–83.
27. Williams CJ, Hu FB, Patel SR, Mantzoros CS. Sleep duration and snoring in relation to biomarkers of cardiovascular disease risk among women with type 2 diabetes. *Diabetes Care.* 2007;30(5):1233–40.
28. Tochikubo O, Ikeda A, Miyajima E, Ishii M. Effects of insufficient sleep on blood pressure monitored by a new multibiomedical recorder. *Hypertension.* 1996;27(6):1318–24.
29. Cappuccio FP, D'elia L, Strazzullo P, Miller MA. Quantity and quality of sleep and incidence of type 2 diabetes: a systematic review and meta-analysis. *Diabetes Care.* 2010;33(2):414–20.
30. Shen X, Wu Y, Zhang D. Nighttime sleep duration, 24-hour sleep duration and risk of all-cause mortality among adults: a meta-analysis of prospective cohort studies. *Sci Rep.* 2016;6:21480.
31. Gottlieb DJ, Redline S, Nieto FJ, Baldwin CM, Newman AB, Resnick HE, Punjabi NM. Association of usual sleep duration with hypertension: the sleep heart health study. *Sleep.* 2006;29(8):1009–14.
32. Gangwisch JE, Heymsfield SB, Boden-Albala B, Buijs RM, Kreier F, Pickering TG, et al. Short sleep duration as a risk factor for hypertension: analyses of the first National Health and Nutrition Examination Survey. *Hypertension.* 2006;47(5):833–9.
33. Kim J, Jo I. Age-dependent association between sleep duration and hypertension in the adult Korean population. *Am J Hypertens.* 2010;23(12):1286–91.
34. Vgontzas AN, Liao D, Bixler EO, Chrousos GP, Vela-Bueno A. Insomnia with objective short sleep duration is associated with a high risk for hypertension. *Sleep.* 2009;32(4):491–7.
35. Shan Z, Ma H, Xie M, Yan P, Guo Y, Bao W, Rong Y, Jackson CL, Hu FB, Liu L. Sleep duration and risk of type 2 diabetes: a meta-analysis of prospective studies. *Diabetes Care.* 2015;38(3):529–37.
36. Lohsoonthorn V, Khidir H, Casillas G, Lertmaharit S, Tadesse MG, Pensuksan WC, Rattananupong T, Gelaye B, Williams MA. Sleep quality and sleep patterns in relation to consumption of energy drinks, caffeinated beverages, and other stimulants among Thai college students. *Sleep Breathing.* 2013;17(3):1017–28.

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