

The relationship between nutritional habits and sleep quality in adolescents of Yazd, Iran

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Abstract

Background

Lifestyle and its relationship to aspects of sleep quality have been reported in many studies. An unhealthy lifestyle is associated with less sleep duration and sleep patterns. Breakfast skipping is as an important part of unhealthy lifestyle. Poor sleep quality and skipping breakfast are common in adolescents. The aim of this study was to investigate the relationship between nutritional habits (breakfast and midmorning snack) and sleep quality in Yazd adolescents.

Methods

This study was conducted among 569 students aged 12–16 years. They were selected by multistage random-cluster sampling method. Information such as demographic characteristics, anthropometric measurements, students' nutritional habits, physical activity and sleep quality were collected from all adolescents. All data were assessed by interview, 7-day food record, short form of the International Physical Activity, and Questionnaire and Pittsburgh Sleep Quality Index. The data were analyzed by SPSS software (version 22).

Results

The prevalence of breakfast skipping and semi-skipping (57.2%), overweight and obesity (37.8%), and insufficient sleep duration (38.9%) were high. The sleep score was significantly better in boys ($p = 0.02$). Sleep quality score of 63.7 % of the students was poor, but a significant relationship was not illustrated between sleep quality with breakfast frequency, abnormal weight, breakfast time, morning snack intake. A significant relationship was found between poor sleep quality with late bedtime and low physical activity ($p < 0.0001$), late dinner ($p < 0.004$), and female gender ($p < 0.02$).

Conclusions

This cross-sectional study supported the association between having dinner soon and no late bedtime with good sleep quality. But no significant difference was shown between sleep quality with weight and breakfast habits. This study suggested paying more attention to nutritional and sleeping status in this age group by employing skilled nutritionists and mental health professional in high schools.

Background

Lifestyle and its relationship to aspects of sleep quality (SQ) have been reported in many studies (1-3). An unhealthy lifestyle is associated with less sleep duration and sleep patterns (4). Breakfast skipping is as an important part of unhealthy lifestyle (5).

Breakfast is the most important daily meal for adolescents (6). The importance of breakfast consumption can be associated with the improving lifestyle (intake of high-nutrient-density foods) (7),

normal weight (8), physical activity (PA) (9) and lower skipping lunch (5), improving the academic achievement (10). Skipping breakfast may be affected by multiple factors such as less healthful lifestyle behaviors (11), sleep pattern (12), gender (13), and dietary habits (eating dinner at least 3 hours before bedtime (14) and late-night overeating (15) in adolescents.

Despite the emphasis on the importance of breakfast, the high prevalence of breakfast skipping is reported among adolescents (16). In Korea, the prevalence of skipping breakfast was reported 37% and 41% among male and female adolescents, respectively (10). The prevalence of skipping breakfast was reported 18.9% to 29% in Iranian children and adolescents (17, 18). Inappropriate sleeping time and skipping breakfast can be associated with obesity and overweight. Girls with normal weight usually went to bed earlier (8). Breakfast and evening snack were related to sleepiness during daytime in the boy students (19). Sleep is a physiological process which is necessary for health. The sleep pattern has a positive role in daytime activities, cognitive ability (20), memory and school performance (21), normal weight (22), adequate breakfast and calorie intake (23), the meal and snack time (15) and improving daytime sleepiness (24).

Inadequate sleep pattern is common in adolescents, unfortunately. The prevalence of sleep problems was reported 11 to 47% in Italian children and adolescents (25). In Canadian adolescents, 45% of children and adolescents were experienced less than eight hours per night (26). Also, nearly 20–50% of them had daytime sleepiness (27).

The aim of the present study was to investigate the relationship between SQ and breakfast and midmorning snack habits among Yazd adolescents.

Method

Study design and Participants

The present study was conducted by the multistage random-cluster sampling method of Yazd first degree high school students aged 12-16 years old. Data was collected in the semester. Minimum sample size was calculated 381 students.

The students had the following conditions to participate in this study:

- 1) Written consent from the students and their parents;
- 2) no immigration to Yazd at least the last 6 months;
- 3) Lack of the diseases as: hormonal impairment (thyroid hormone, insulin, sex, etc.), cardiovascular disorders, digestive diseases, pulmonary disease, kidney disease, Malignancy),
- 4) lack of hospitalization at least the last 6 months for any reason (e.g. fractures, injuries and etc.,
- 5) the lack of unpleasant events at least the last year (the parental death and divorce, the death of family members, the living with one of the parents or relatives for any reason),
- 6) not using of some drugs (narcotic drugs, psychotropic drugs),
- 7) no transfer student at least in this semester.

Measurements

The research assistants trained to collect information and interview, extensively due to reduce potential bias. Demographic data (gender, age, and grade) was obtained from the school records. Anthropometric measurements (weight, height, Body mass index (BMI)) were done in the morning and the students were lightly dressed and without shoes. A pre-calibrated electronic scale (Seca, Germany) and a stadiometer were used to measure the students' body weight by the nearest 0.1 kg and their height by the nearest 0.1 cm, respectively. BMI (kg/m^2) was calculated by this equation: $\text{weight (kg)} / \text{height (m}^2\text{)}$. BMI for age (z-score) computed using 2007 World Health Organization (WHO) reference growth standard. BMI z-score was categorized follow as a) thin student ($\text{BMI} \leq -2\text{SD}$), b) normal student (BMI between 1SD to -2SD), c) overweight & obesity ($\text{BMI} \geq 1\text{SD}$) (28). BMI z-score tables are available on the WHO web site (29).

Some questions were asked by the interview for assessing information on the students' breakfast, morning snack and dinner habits, respectively, as follows:

1- "how many times do you eat breakfast per week?" Response categories: less than 50% days per week (0-3 times) and more than 50% days per week (4-7 times); 2- "What time do you usually have breakfast and morning snack?" Response categories: a) Before than 9:30, b) After 9:30; 3- "Do you have midmorning snack per day?" Yes or No. 4- "How many times do you have dinner per week?" Response categories: a) less than 5 times; b) more than 5 times. 5- "What time do you usually have dinner?" Response categories: a) before 22:00; b) after 22:00.

SQ was evaluated by the previously validated Pittsburgh Sleep Quality Index (PSQI) over a 1-month time interval. The Persian version of the PSQI for adolescents was shown adequate reliability ($\alpha = 0.77$) and validity (30). The overall PSQI range is from 0 (good) to 21 (poor). SQ was divided into two groups according to the Pittsburgh questionnaire: Less than or more than 5 (31). Sleep latency and duration were categorized based on PSQI guideline. Bedtime was classified into: 1) Before 22:00, 2) 22:00 – 24:00, 3) After 24:00. Wake-up time was not categorized because data were collected during the end semester. Also, all of the classes were begun about 7.45 or 8 a.m.

Short form of International Physical Activity Questionnaire (IPAQ-SF) was used to assess PA. The PA severity categorized into 3 groups: vigorous (more than 3000 min MET/week), moderate (600-3000 min MET/week) and walking (Less than 600 min MET/week) (32). The use of IPAQ-SF is suitable for Youth 15 years of age and older, therefore, the students were 15 years old and older filled IPAQ-SF.

Data analysis

The analysis of quantities variables were conducted by the means and standard deviations (SD). The interquartile ranges (IQR) (25th–75th) were used for weight, height and SQ score. The categorical variables were analyzed by frequency (number (%)). The Kolmogorov-Smirnoff test was used to test the normality distribution of data to determine the parametric or non-parametric test. Tukey HSD Post hoc analysis was conducted to compare the difference between pairwise.

SPSS statistical software package, version 16.0 (SPSS, Inc, Chicago, Illinois, USA), was applied for statistical analyses. $P < .05$ were considered statistically significant using 2-tailed tests.

Result

We randomly selected 569 students (52.2% boys, 47.8% girls). The mean (SD) age was 14.24 (0.88) years. They were in three different grades (seventh: 143 (25.1%), eighth: 181 (31.8%), ninth: 245 (43.1%)). Descriptive characteristics of the study population were shown in Table 1. The median of weight and height were presented 55.35 (IQR: 47-67.9) kg and 163 (IQR: 156-170) cm, respectively. Midmorning snack intake was reported nearly 85.6% among the students. The median of SQ score was reported 5 (IQR: 3-6). The high number of students (39.3%) was breakfast skipper and only 16.1% of them had breakfast every day. The mean (SD) of wake-up time was 6:38 (00:33). The median of breakfast time was 9:15 (IQR: 9:00-9:30). Only 14.6% of them ate breakfast before the beginning of class.

The difference between SQ score and the categorized variables were presented in Table 2. The SQ score was not shown a significant difference between the students with different BMI ($p = 0.1$). Only, 5.6% of the students were thin, so the comparison for SQ was conducted between the normal and overweight or obesity groups.

The sleep score was significantly better in the boys ($p = 0.02$). No significant association was found between SQ score with breakfast frequency ($p = 0.4$) and breakfast time ($p = 0.6$). Despite the higher SQ scores (lower SQ) in morning snack users, the significant difference wasn't observed ($p = 0.3$).

A significantly decreasing trend of SQ score was illustrated in early dinner time ($p = 0.004$). The better SQ was observed among the students who ate dinner before 22:00 (4.79 (2.05)) than who ate after 22:00 (5.39 (2.27)). A significant relationship was also found between good SQ and bedtime soon ($p < 0.0001$). The poor SQ was reported in the students went to bed later (after 24:00) in compared to other groups ($p = 0.02$). The PA score was inversely related to SQ score, significantly ($p < 0.001$). Better score for SQ was reported in the 9th students with moderate and vigorous PA.

Discussion

A surprising finding of this study was the significant relationship between poor SQ with late dinner time and bedtime. Only, one-fourth of the students went to bed late (after 24:00). The results of the present study showed poor SQ score among Yazd students, but we couldn't illustrate the relationship between SQ with breakfast frequency, breakfast time, morning snack intake, and abnormality BMI among adolescents. So, these findings didn't support the primary aim of the present study.

Unfortunately, the prevalence of irregularly breakfast intake, overweight and obesity, and insufficient sleep duration were high in this important age group according to last studies (8, 10, 17, 18, 25-27). The most students didn't sleep latency; few students ate breakfast before the beginning of class, but the most of them consumed midmorning snack at the breaks.

Arakawa et al. emphasized that late bedtime related to poor SQ (less sleep, incremented sleepiness, falling asleep during the days) and unhealthy dietary habits in the junior high school students (33). Our data corroborated poor SQ in the girl students, in good agreement with the previous studies (34, 35). Biological sex differences can be one the reasons of poor SQ (36) due to females are more susceptible to stress (37).

There are few data about the relationship between SQ with breakfast habits among 12-16 years students, but in older students, the results of the studies showed good SQ was associated with regular breakfast consumption among the university students, according to the results of the studies by Sun et al. in China (38) and Cheng et al. in Taiwan (39).

But a significant relationship was found between severity and moderate PA with SQ. The study by Chen et al. was reported a significant relationship between adequate sleep (a component of PSQI) with regular exercise and normal weight (40). In agreement with the present results, Lang et al. was reported higher PA adolescents had likely better sleep (41). A significant association was shown between normal sleepers with good food habits (regular breakfast frequency, no snacking, no sweetened beverage consumption) in French primary school children (12) and low prevalence of risk behaviors (lack of vigorous PA, skipping breakfast) in high school students (42). Also, in other studies, a significant positive association was illustrated between normal sleepers with fat mass%, waist circumference, and normal weight (8, 12).

It seems to collect data in the semester led to the insignificant difference for breakfast time and waking-up among the students. In all the schools, the first break was before 9:30 and holidays were one or two days per week, commonly. Also, the start and end time of schools were similar. In these ages, the eating habits of the most adolescents are affected by their parent's lifestyle (43). It will be necessary to compare to SQ with the nutritional habit in the vacation season and evaluate the nutritional habit of the students' parents in the next studies to resolve these problems.

The limitations of this cross-sectional study were: 1) interpreting with caution (the interpretation of the reported relationships as hypothetical causal correlation); 2) a possible under or over reporting that it could effect on the results (recall bias and social desirability bias); 3) other factors (evening snack, quality and quantity of the meals, stress, social networks, socio-economic information) (18, 43) should be considerate to assess SQ; 4) the evaluations of PA was conducted by IPAQ-SF that it uses only for 15 years of age and older; 5) the lack of control of confounder factors; 6) the data collection was only in the semester.

But the strengths of our study were: 1) sample size was nearly large; 2) data was collected from both of gender; 3) the evaluation of different aspects of sleep in adolescence by the PSQI in this age group.

Conclusions

The main results of the present study were no significant association between SQ score with breakfast frequency, breakfast time, midmorning snack consumption and BMI, also, a significant positive

relationship between SQ score with soon dinner and bedtime. More research needs by considering the different factors related to lifestyle. The controlled trials are required to test whether this represents a causal relationship.

This study suggested paying more attention to nutritional and sleeping status in this age group by employing skilled nutritionists and mental health professional in the high schools for appropriate training to the adolescents and their parents.

Abbreviations

SQ: Sleep quality

PA: Physical activity

MET: Metabolic equivalent

BMI: Body Mass Index

PSQI: Pittsburgh Sleep Quality Index

IPAQ-SF: Short form of International Physical Activity Questionnaire

SD: Standard deviation

SE: Standard error

IQR: Interquartile range

Declarations

Ethics approval and consent to participate

The study protocol was approved by Research Ethical Committee of Ahvaz Jundishapur University of Medical Sciences (IR.AJUMS.REC.1396.1087). Both of the parents and students gave written consent for participation in the study.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that there are no conflicts of interest.

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Authors' contributions

HM, MK and MA designed the research; SS, MT,FM and SB were responsible for the data collection; MA and A.MH analyzed the data; MA and LSH were involved in drafting the paper, HM and MK had primary responsibility for the final content; All of the authors read and approved the final paper.

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Tables

Table 1. Descriptive characteristics of the study population.

| Qualitative variables | N (%) |
|-------------------------------------|--------------|
| Breakfast frequency per week | |
| • 0-3 times per week | 323 (57.2) |
| • 4-7 times per week | 242 (42.8) |
| Breakfast time | |
| • before 9:30 | 279 (90.6) |
| • after 9:30 | 29 (9.4) |
| BMI | |
| • Thin | 30 (5.6) |
| • Normal | 306 (56.7) |
| • Overweight & obesity | 204 (37.8) |
| Dinner time | |
| • Before 22:00 | 413 (75.9) |
| • After 22:00 | 131 (24.1) |
| Bedtime (h:min) | |
| • Before 22:00 | 60 (10.6) |
| • 22:00 - 24:00 | 371 (65.4) |
| • After 24:00 | 136 (24) |
| Sleep duration | |
| • more than 7 hours | 218 (61.1) |
| • 6-7 hours | 191 (16.4) |
| • 5-6 hours | 100 (12.3) |
| • Less than 5 hours | 52 (10.2) |
| Sleep latency | |
| • (less than 15 min) | 431 (75.7) |
| • 15-30 min | 58 (10.2) |
| • 31-60 min | 66 (11.6) |
| • More than 60 min | 14 (2.5) |
| SQ score | |
| • Less than 5 | 362 (63.7) |
| • More than 5 | 206 (36.3) |

Data presented by Number (%).

BMI: Body Mass Index; SQ: Sleep Quality

Table 2: The comparison of mean score of SQ with the categorized variables

| Variables | N | Score of sleep quality* | P-value* |
|---|----------|--------------------------------|------------------|
| BMI[†] | | | |
| • Normal | 306 | 4.86 (2.07) | 0.1 |
| • Overweight & obesity | 203 | 5.16 (2.07) | |
| Gender[†] | | | |
| • Boy | 297 | 4.78 (2.05) | 0.02 |
| • Girl | 272 | 5.17 (2.16) | |
| Breakfast frequency per week[†] | | | |
| • 0-3times (less than 50%) per week | 323 | 4.92 (2.06) | 0.4 |
| • 4-7 times (less than 50%) per week | 241 | 5.04 (2.18) | |
| Breakfast time[†] (h:min) | | | |
| • before 9:30 | 278 | 4.84 (2.04) | 0.6 |
| • after 9:30 | 29 | 4.68 (1.44) | |
| Snack consumption[†] | | | |
| • Yes | 486 | 4.93 (2.02) | 0.3 |
| • No | 82 | 5.17 (2.20) | |
| Dinner time[†] | | | |
| • Before 22:00 (h:min) | 412 | 4.79 (2.05) | 0.004 |
| • After 22:00 (h:min) | 131 | 5.39 (2.27) | |
| Bedtime^{††} | | | |
| • Before 22:00 (h:min) | 60 | 4.01 (1.62) ^a | <0.001 |
| • 22:00 - 24:00 (h:min) | 370 | 4.61 (1.93) ^a | |
| • After 24:00 (h:min) | 136 | 6.37 (2.1) | |
| • After 24:00 (h:min) | | | |
| PA (min MET/week)^{b ††} | | | |
| • More than 3000 (vigorous) | 59 | 6.96 (1.98) ^c | <0.001 |
| • 600-3000 (moderate) | 126 | 6.46 (1.27) ^c | |
| • Less than 600 (walking) | 41 | 8.05 (2.14) | |

Data presented by mean and standard deviation (SD).

BMI; Body Mass Index, h: min; hour: minute, PA; Physical activity

† Statistical analysis was performed using t-test.

†† Statistical analysis was performed using one-way ANOVA test with Tukey HSD Post Hoc analysis.

* The mean difference is significant at the 0.05 level.

a The mean difference is significant between (after 24:00) group with (before 22:00) group and (22:00 - 24:00) group ($p = 0.02$).

b The students were 15 years old and older filled IPAQ-SF.

c The mean difference is significant between low PA group with moderate PA group ($p = 0.004$) and vigorous PA group ($p < 0.001$).