ASSESSMENT OF DIETARY INTAKE AND SLEEP QUALITY INDEX IN ADOLESCENTS AGED 14 TO 18 YEARS IN NERUL, NAVI MUMBAI

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ABSTRACT

Adolescence is a critical period characterized by rapid physical, cognitive, and emotional development. Adequate nutrition and quality sleep are essential for optimal growth, development, and overall well-being during this stage. However, many adolescents face challenges in maintaining healthy dietary habits and sleep patterns. This study aimed to assess the dietary intake and sleep quality index among adolescents aged 14 to 18 years in Nerul, Navi Mumbai.A cross-sectional study was conducted among 180 adolescents (70 males and 110 females) recruited from schools in Nerul, Navi Mumbai. Dietary intake was assessed using a food frequency questionnaire (FFQ) and 2-day 24 hour dietary recall, while sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI). Data on demographics and anthropometric measurements were also collected. Descriptive statistics and inferential analyses were performed to analyze the data. The results revealed that a significant proportion of adolescents had inadequate dietary intake, characterized by low consumption of fruits, vegetables, and dairy products, and high intake of fast food and sugary beverages. Moreover, the sleep quality index indicated poor sleep quality among a substantial number of participants, with factors such as irregular sleep schedules, excessive screen time, and academic stress contributing to sleep disturbances. Gender differences were observed in both dietary intake and sleep quality, with females exhibiting healthier dietary habits but experiencing more sleep disturbances compared to males. Strategies such as nutrition education programs, school-based interventions, and parental involvement could play a crucial role in promoting healthier lifestyles and overall well-being in this population.

Keyword: - *Adolescents, dietary intake, sleep quality, cross-sectional study.*

1. INTRODUCTION:

Adolescence is a transitional phase of development marked by significant physical, psychological, and social changes. It is a critical period characterized by increased energy and nutrient requirements to support growth, development, and maturation. The 1.2 billion adolescents (10-19 years) in the world today represent 16% of the

global population, and the regions of South Asia, East Asia and the Pacific have the largest share of adolescents in the world with around 650 million. About 21% of the Indian population is adolescents (about 243 million).[WHO,2020]

Adequate nutrition during adolescence is essential for achieving optimal health outcomes, including the prevention of nutritional deficiencies, supporting cognitive function, and reducing the risk of chronic diseases later in life [3].

In addition to nutrition, sleep plays a crucial role in adolescent health and well-being. Adolescents typically require 8 to 10 hours of sleep per night for optimal functioning, yet many fail to meet this requirement due to various factors such as academic pressures, social activities, and electronic device use [1]. Poor sleep quality and insufficient sleep duration have been associated with a range of adverse outcomes in adolescents, including impaired cognitive function, mood disturbances, and increased risk of obesity and metabolic disorders [2].

Despite the recognized importance of nutrition and sleep for adolescent health, studies examining the dietary intake and sleep patterns of adolescents in urban areas of India, such as Nerul in Navi Mumbai, are limited. Rapid urbanization and lifestyle changes in metropolitan cities may influence dietary habits and sleep behaviors among adolescents, potentially impacting their health outcomes. Therefore, this study aimed to assess the dietary intake and sleep quality index among adolescents aged 14 to 18 years in Nerul, Navi Mumbai.

2. METHODS AND MATERIALS:

A cross-sectional study was conducted among adolescents aged 14 to 18 years residing in Nerul, Navi Mumbai. A convenience sampling method was used to recruit participants from schools in the area. Informed consent was obtained from both participants and their parents or guardians prior to data collection.

Data collection was carried out using a structured questionnaire.The questionnaire consisted of three sections:

Demographic Characteristics: Information on age, gender, education, and food habits was collected.

Dietary Intake: Dietary intake was assessed using a food frequency questionnaire (FFQ) Participants were asked to report their frequency of consumption of various food items over the past month. A 2 day 24 hour diet recall was taken and average intake of kcal,protein,carbohydrates and fats was calculated.

Sleep Quality: Sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI), a widely used self-reported questionnaire that assesses sleep quality and disturbances over a one-month period. The PSQI comprises seven components, including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. A global PSQI score was calculated, with higher scores indicating poorer sleep quality.

Anthropometric measurements, including height and weight, were also recorded using standard procedures.BMI was calculated and classified as under:

TABLE 1: BMI Category

BMI Category	**BMI Range**
Underweight	Less than the 5th percentile
Normal	5th percentile to less than the 85th percentile
Overweight	85th percentile to less than the 95th percentile
Obesity	95th percentile or greater

Severe Obesity	120% of the 95th percentile or greater OR 35 kg/m2 or greater

(source : Centers for Disease Control and Prevention,2023)

Descriptive statistics were used to summarize the demographic characteristics, dietary intake, and sleep quality of the participants. Continuous variables were expressed as means ± standard deviations (SD), while categorical variables were presented as frequencies and percentages. Differences in dietary intake and sleep quality between gender groups were assessed using independent samples t-tests or chi-square tests, as appropriate. Multivariate regression analysis was performed to identify factors associated with dietary intake and sleep quality, adjusting for potential confounders such as age, gender, socioeconomic status, and lifestyle factors. Data analysis was performed using SPSS (Statistical Package for Social Sciences) software (version 25).

The ethics committee approval was sought from the Inter System Biomedica Ethics Committee (ISBEC) prior to the start of the study.

3. RESULTS:

A total of 180 adolescents (70 males and 110 females) participated in the study. The minimum age of the participants was 14 years and maximum age was 18 years.

Table 2 summarizes the demographic characteristics of the study population.

TABLE 2: Demographic Characteristics of the Study Sample

Demographic Factors		
	Frequency (n)	**Percentage (%)**
Sex		
Male	70	38.9
Female	110	61.1
Age (in years)		
14 - 16	140	77.8
16 - 18	40	22.2
Highest qualification		
Primary (1st to 4th standard)	0	0.0
Secondary (5th to 10th standard)	125	69.4
High (11th and 12th standard)	55	30.6
Food habits		

Vegetarian	155	86.1
Vegan	10	5.6
Ovo- vegetarian	0	0.0
Non vegetarian	10	5.6
Mixed	5	2.8

The study sample included 38.9% of males and 61.1% of females. In this study, the male-female ratio was 1:1.5.69.4% were in secondary school (9th standard) whereas about 30.6% of study participants were in high school that is in junior college (11th standard).86.1% of the study participants were vegetarian followed by 5.6% of vegans and non- vegetarians . Only 2.8% had mixed food habits and none of the participants were ovo-vegetarians.
The values of mean heights, weights and BMIs as per the gender are shown in Table 2

TABLE 3: Mean Distribution of Height, Weight and BMI according to Gender

Anthropometric Measurements	**Gender**		**t value**	**p value**
	Male (n=70)	**Female (n=110)**		
Weight (kg)	59.21 ± 11.15	48.53 ± 10.39	6.532	0.000*
Height (cm)	164.07 ± 11.80	153.04 ± 10.98	6.378	0.000*
BMI (kg/m2)	22.18 ± 4.74	20.85 ± 4.68	1.838	0.068

Mean ± Standard Deviation *p < 0.05

The mean height of males was 164.07 ± 11.80 cm, which was significantly higher than females (153.04 ± 10.98 cm). The mean weight of males and females were 59.21 ±11.15 kg and 48.53 ±10.39 kg, respectively. It was observed that males had significantly higher weight (p value = 0.000) than females. A similar orientation was seen in the mean BMIs between the two genders. The mean BMIs of males were 22.18 ± 4.74 kg/m2 whereas of females were 20.85 ± 4.68 kg/m2 , indicating that the study population falls under the normal category according to the BMI cut off. A slight significant difference in the mean BMIs was observed between the groups t = 1.838, p = 0.06.
Numerous research studies have identified individual risk factors associated with overweight and obesity, including insufficient physical activity, prolonged sedentary behaviours such as watching TV and playing computer games, and frequent consumption of calorie-dense and fast food items. The prevalence of overweight and obesity among children and adolescents has increased in recent decades, particularly in developing countries where improvements in socio-economic status have occurred. While better access to healthcare is typically associated with improved health outcomes, the rise in socio-economic status in low- and middle-income countries has introduced new challenges, such as increased mechanization leading to reduced daily physical activity and greater access to highly processed and fast foods. These shifts in lifestyle and dietary patterns contribute to the growing prevalence of overweight and obesity, emphasizing the need for comprehensive strategies to address these issues at both individual and societal levels.[5]

3.1 Dietary Intake:

The mean values of macronutrients such as energy, protein, carbohydrate and fat were computed.

TABLE 4: Mean Distribution of Macronutrients according to Gender

Nutrients	**Total (N=180)**	**Gender**		**t value**	**p value**
		Male (n=70)	**Female (n=110)**		
Energy (kcal)	1528.5 ± 269.14	1548.29 ± 287.85	1515.91 ± 257.12	0.786	0.433
RDA Energy %	57.65%	53.78%	62.47%		
Protein (g)	35.81 ± 8.00	39.21 ± 8.85	33.64 ± 6.57	4.837	0.000*
RDA Protein %	98%	107.83 %	96.88 %		
Carbohydrate (g)	198.39 ± 37.40	200.29 ± 40.50	197.18 ± 35.43	0.542	0.589
RDA CHO %	140%	155.33 %	145 %		
Fat (g)	61.36 ± 13.54	62.14 ±14.10	60.86 ± 13.22	0.617	0.538
RDA Fat %	80 %	77.77%	112.9%		

Mean ± Standard Deviation *p < 0.05

The analysis compared nutrient intake between male and female participants, focusing on energy, protein, carbohydrate, and fat consumption. Results revealed that male participants consumed, on average, 1548.29 kilocalories (kcal) per day, with a standard deviation of 287.85, while females consumed slightly less at 1515.91 kcal per day, with a standard deviation of 257.12. The t-test for energy intake yielded a non-significant result ($t = 0.786$, $p = 0.433$), indicating no significant difference between genders. However, a notable difference emerged in protein intake. Males consumed an average of 39.21 grams of protein per day (SD = 8.85), significantly higher than females who consumed 33.64 grams (SD = 6.57), as indicated by the t-test ($t = 4.837$, $p < 0.05$). In contrast, no significant differences were observed in carbohydrate and fat intake. For carbohydrate intake, males consumed an average of 200.29 grams per day (SD = 40.50), while females consumed 197.18 grams (SD = 35.43), with a non-significant t-test result ($t = 0.542$, $p = 0.589$). Similarly, fat intake showed no significant differences between genders, with males consuming 62.14 grams per day (SD = 14.10) and females consuming 60.86 grams (SD = 13.22), as supported by the non-significant t-test result ($t = 0.617$, $p = 0.538$). Overall, while protein intake varied significantly between males and females, no significant differences were observed in energy, carbohydrate, or fat consumption ($p>0.05$ for all comparisons). Both genders showed comparable mean values for these nutrient categories.

A study revealed diverse dietary patterns among the girls, with 87% expressing a preference for processed and fast foods such as pizza, burgers, fries, and sugary snacks. Conversely, fresh fruits, vegetables, and whole grains were less favoured. Peer influence emerged as a significant factor shaping dietary choices, as 76% of adolescent girls with

friends favouring healthier foods were more likely to adopt similar habits, while those with friends favouring unhealthy options tended to follow suit.[6]
The average percent adequacy intake of food groups for cereals was 63.5%, pulses 71%, vegetables 54%, fruits 60%, milk and milk products 69%, sugar 187% and visible fat/oils 196%. The energy intake from fat was 35%, which was high.17% adolescents were overweight and 42% were underweight.[8].
68% of adolescents were undernourished, out of which 30% skipped their regular meals. Consuming junk food and buying eatables from street shops were significantly associated in adolescents from the age group of 15-19 years.[7]
23.4% adolescents skip breakfast and 13.91% skip their lunch. 39.67% boys and 33.02% girls of the sample were underweight with low BMI. 7.44% boys and 11.01% girls were at risk of obesity due to their eating behaviour i.e., high intake of street food and less intake of fruits and vegetables.[9]

3.2 Sleep Quality:

TABLE 5: Mean Sleep Quality Scores of the study participants according to Gender.

Mean PSQI scores	**Total (n=180)**	**Gender**		**t value**	**p value**
		Males (n=70)	**Females (n=110)**		
	9.17 ± 6.13	8.65 ± 6.26	9.50 ± 6.05	-0.908	0.365

Mean ± Standard Deviation *p < 0.05

The analysis of mean PSQI scores among males and females revealed insights into sleep quality but did not demonstrate a statistically significant difference between the two gender groups (t = -0.908, p= 0.365).

Both males and females exhibited similar mean PSQI scores, with males averaging 8.65+- 6.26 and females averaging 9.50 =-6.05. Despite the lack of statistical significance, the observed mean PSQI scores suggested that both gender groups experienced sleep disturbances, as the scores were notably higher than the ideal PSQI score of 5 or less, indicating good sleep quality. The sleep quality item scores were studied and compared between the groups using Chi square test and statistically significant difference was found with regards to all the items in the questionnaire (p<0.001) except for items like trouble in sleeping due to waking up in middle of the night, having to get up to use the bathroom, cough and snore and having breathing issues.

TABLE 6 : Correlation Between Sleep Quality and Diet Intake within Male & Female Participants

Variables	**Good sleep quality (PSQI<5)**		**Bad sleep quality (PSQI >5)**		**F value**	**T value**	**p value**
	Male	**Female**	**Male**	**Female**			
Energy (kcal)	1438.38 ± 181.89	1446.82 ±173.53	1694.8 ±337.3	1585 ± 302.9	22.61	-4.755	0.000*
Carbohydrate (g)	187.25 ±23.83	188.73 ± 31.75	217.6 ± 50.9	205.6 ± 37.1	16.52	-4.065	0.000*
Protein (g)	37.75 ± 5.87	35.09 ±5.76	41.17 ±11.54	32.18 ± 7	0.51	0.717	0.47

Fat (g)	55.25 ± 9.27	55.91 ± 5.84	71.33 ±14.29	65.82 ± 16.39	44.78	-6.692	0.000*

Mean ± Standard Deviation *p < 0.05

The table presents data on sleep quality categorized by gender and dietary intake. Sleep quality is assessed using the PSQI (Pittsburgh Sleep Quality Index), with a cutoff of 5 distinguishing between good (PSQI < 5) and bad (PSQI > 5) sleep quality. For males, those with bad sleep quality consumed significantly more energy (1694.8 ± 337.3 kcal) compared to those with good sleep quality (1438.38 ± 181.89 kcal), as indicated by the high F value of 22.61 and a significant T value of -4.755 ($p < 0.05$). A similar pattern is observed for carbohydrate and fat intake. Females with bad sleep quality also showed significantly higher intake of energy, carbohydrate, and fat compared to females with good sleep quality. For all these variables, the p-values were less than 0.05, indicating statistical significance. However, there were no significant differences in protein intake between good and bad sleep quality groups for either males or females, as reflected by the non-significant F value (0.51) and T value (0.717) for males, and a p-value of 0.47. Overall, the findings suggest a clear association between dietary intake and sleep quality, particularly in terms of energy, carbohydrate, and fat intake, with no significant gender differences observed in this context.

A Korean survey study showed that the consumption frequencies of certain food items were found to be associated with sleep duration and quality in adolescents. Higher frequencies of instant noodle, fruits, vegetables, and milk intake were linked to longer sleep durations. Conversely, higher frequencies of soda, soft drinks, fast food, and confectionery intake were associated with shorter sleep durations.[4]

For those with short sleep durations (less than 6 hours), there was a higher intake frequency of soft drinks and confectioneries at least five times a week. Additionally, there was an increasing trend in soda and fast food intake in the group reporting less than 6 hours of sleep. Moreover, poor sleep quality was associated with a lower intake frequency of fruits, vegetables, and milk for at least five times a week, and a higher intake frequency of soda, soft drinks, fast food, instant noodles, and confectionaries. These findings emphasize the potential impact of dietary habits on both the duration and quality of sleep in adolescents. [4]

A similar study in China explored the role of sleep duration (independent variable) in food intake (dependent variable). The prevalence of short sleep duration (less than 7 hours) was 17.6%, with higher rates observed in girls and older children. Short sleep duration was linked to increased sugar beverage intake (SBI) among 6- to 12-year-old children and boys aged 13- to 17 years. For girls aged 13–17 years, findings indicated a positive association between sleep duration and food intake (FI) and vegetable intake (VI). Insufficient sleep duration was associated with an elevated likelihood of consuming sugar beverages among younger children and boys, but a reduced likelihood of consuming vegetables and fruits among older children and girls. [10]

CONCLUSION:

For males, those with bad sleep quality consumed significantly more energy (1694.8 ± 337.3 kcal), carbohydrate (217.6 ± 50.9) and fat (71.33 ±14.29) compared to those with good sleep quality (1438.38 ± 181.89 kcal, 187.25 ±23.83 carbohydrates and 55.25 ± 9.27 fat), ($p < 0.05$). Females with bad sleep quality also showed significantly higher intake of energy, carbohydrate, and fat compared to females with good sleep quality. For all these variables, the p-values were less than 0.05, indicating statistical significance.

A clear association between dietary intake and sleep quality, particularly in terms of energy, carbohydrate, and fat intake, with no significant gender differences was observed. Overall, while there were some marginal differences in protein intake for males, the results suggest that stress levels did not have a significant impact on energy, carbohydrate, and fat intake among both males and females in this study.

In this study, some potential shortfalls need to be considered.

1. The sample size of the study was small.
2. Additionally, the study's cross-sectional design may limit the ability to establish causal relationships between variables.
3. The study has relied on self-reported dietary intake,which can be subject to recall bias and social desirability bias.
4. Factors such as socioeconomic status, family dynamics, academic pressure, and physical activity levels could impact these variables but not have been adequately addressed in the analysis.

Longitudinal studies would provide a more comprehensive understanding of how diet and sleep and quality interact and influence each other over time. Incorporation of objective measures like biomarkers for dietary intake and physiological indicators for sleep quality would help to supplement self-reported data.

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