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Relation between Nighttime Technology Devices Use, Stimulant Drinks Intake and Sleep Quality among Adolescent Students

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Abstract: **Sleep is a vital part of a healthy lifestyle, but with technological advances, there are number of growing factors that can inhibit this vital function and causing poor sleep quality. The aim of this study was to examine relationship between nighttime technology devices use, stimulant drinks intake and sleep quality among adolescents students. Design: Descriptive correlation design was used. Setting: The study was conducted at four preparatory and secondary governmental schools from both rural and urban schools in Menouf District, Menoufia Governorate, Egypt. Sample: A multistage stratified random sampling technique was used to select the sample composed of 352 adolescent students including 161 boys and 191 girls aged between 12-17 years. Tools of the study: 1. Self-administered structured questionnaire included socio demographic data, nighttime technology devices usage and stimulant drinks intake questionnaire. 2. Pittsburgh Sleep Quality Index for assessing sleep quality. Results: The main results showed that more than two thirds (68.2%) of studied students had poor sleep quality, it was significant higher (74.3%) among females than among males (60.9%). There was significant difference between males and females as regarding to sleep duration, sleep latency and sleep disturbance, however, there was no significant difference between males and females as regarding sleep efficiency, daytime dysfunction, and sleeping medication. In addition, it was revealed that age, gender, place of residence and family income had significant relation with poor sleep quality among students. Additionally, most of the studied students (88.1%) using different forms of technology devices at night and more than half of them had reported presence of technology devices in their bed room and used at night before sleep and the most common devices used and affected sleep were mobile phone and television. Moreover, three fourths of the studied students (75.3%) reported intake of stimulant drinks, and there was a statistically significant relation between intake of stimulant drinks and poor sleep quality. Conclusion: Poor sleep quality among studied adolescent students was high (68.2%), most of the studied students (88.1%) using different forms of technology devices at night before bed time and three fourths of students were consumed stimulant drinks. Moreover, poor sleep quality was associated with age, gender, place of residence, family income, nighttime technology media usage and intake of stimulant drinks. Recommendations: Educational and awareness programs should be implemented in schools by the ministry of health in collaboration with the ministry of education to raise awareness of adolescent students about harmful health effects of night time technology devices usage and intake of stimulant drinks.**

Keywords: **Sleep quality, Adolescents students, Nighttime, Technology usage, Stimulant drinks.**

1. INTRODUCTION

Adolescence is the most important and sensitive period of one's life and defined as a period between 10 to 19 years, and is the stage at which an individual's lifestyle patterns are initiated and shaped [1]. Sleep is recognized as a major contributing factor to physical and mental health in children and adolescents [2, 3]. A number of studies have suggested that sleep plays a key role not only in physical growth, behavior, and emotional development of adolescents, but also in

cognitive functioning, learning and attention [4,5]. The American Academy of Pediatrics identified insufficient sleep in adolescents as an important public health problem that significantly affects the health, safety, and the academic success of school students [6].

Adolescence is a time of changing sleep patterns with an evident change of bedtimes to later in the evening. This results in sleep deficiency and changes in sleep quality in many adolescent students during the school weekdays and sleeping in weekends [7]. Epidemiological data on adolescent sleep shows that it is characterized by late bedtime, long sleep onset latency and short sleep duration of approximately 6.5 h on weekdays, contributing to daily sleep deficiency of about 2 h [8]. According to National Sleep Foundation, the recommended sleep duration for adolescents is 9 hours per night for optimum health and development [9]. However, research studies show that many adolescents get far less than this amount [10, 11].

Sleep duration is not the only indicator of sleep. Sleep quality is significant indicators of sleep outcome. Sleep quality refers to continuous sleep without any interruption [9]. In addition, it can be characterized by the occurrence of certain conditions such as the early onset of sleep, fewer interruptions, and fewer early awakenings. Good sleep quality is associated with a wide range of positive outcomes such as better health, greater well-being, and better psychological functioning among adolescents [12].

Poor sleep quality is a common and disturbing problem of adolescence, affecting around 25–40% of adolescents at some point in their development [13]. Poor sleep quality and insufficient sleep are major public health problem worldwide with adverse health consequences [14]. Poor sleep not only interferes with quality of life and general well-being, but also can be hazardous to one's health and the public's well-being [15]. Lack of sleep has an effect on the endocrine, immune, and nervous systems and is associated with an increased risk of cardiovascular factors including obesity, diabetes, impaired glucose tolerance, and hypertension [16]. Furthermore, insufficient sleep has linked with poor academic performance, substance use, mood disorders, and physical inactivity [17] or behavior problems such as aggression and violence [18].

During adolescence a range of biological, psychological and social factors interact, resulting in short sleep duration and poor sleep quality [13]. Additionally, modern lifestyle factors that have negatively affect adolescents' sleep regulation include exposure to modern technologies e.g., television, cell phone, computer and video games that leading to increased light exposure and night-time arousal; consumption of wake-promoting substances, such as caffeine that affect the physiological regulation of arousal and sleep[19]. Likewise, American Academy of Pediatrics reported that many of the factors that contribute significantly to the current "epidemic" of insufficient sleep in adolescents are potentially modifiable such as electronic media use, and caffeine consumption [6].

Excessive use of technological devices has become a major part of our lives and a habit for many people especially adolescents [20]. During the last several decades, there has been marked increase in the use of electronic media during leisure time among children and adolescents and many adolescents consider the various kinds of electronic media use as their favorite leisure time activity [21]. National Sleep Foundation reported that more than half of adolescents using electronic media on most evenings during the last hour before they go to bed [22] and for more than two thirds the last activity of the day was related to electronic media use at least 3 times per week [23]. Among adolescents, the amount of time spent multitasking in late evenings, including media use such as television, mobile phone, online computer use, and computer games has found negatively related to the number of hours of sleep obtained on school nights [20]. There is a growing body of evidence that excessive time spent on internet and electronic screen products can significantly disrupt their sleep-wake schedule, influencing both quantity and quality of sleep. Several research studies on children's and adolescents' evening use of technology media and its effect on sleep showed that it is associated with delayed bedtime, reduction total sleep time and sleep disturbance [24, 25, 26, 27].

Several mechanisms have proposed through which electronic media use in the evening may reduce sleep duration and interfere with sleep quality. First mechanism, electronic media use may displace sleep time or other activities related to good sleep hygiene such as physical activity. Second mechanism, it has proposed that electronic media use in the evenings before sleep may increase mental, emotional, or physiological stimulation [24]. A study among adolescents found that playing video games in the evening decreased adolescents' sleepiness and increased sleep latency compared to more passive watching of a movie [28]. In addition, electromagnetic radiation from mobile phones has found to delay melatonin production and might related to late sleep onset [29]. A study among adolescents showed that the use of

mobile phones after lights out was associated with poor sleep and excessive daytime sleepiness [26].Third mechanism, including light emission of the screens of electronic media devices might affect sleep [24]. There is support from study with young adults that particularly light emission of modern flat screens with light-emitting diodes back light technology may interfere with sleep. This screens release an increased amount of light in the short wave length spectrum that suppresses melatonin secretion in the body (the hormone that controls sleep) in the evening and reduces subjective and objective signs of sleepiness, resulting in changes in quality of sleep [30].

Consumption of stimulant drinks and other caffeine beverages are risk factors of poor sleep quality [31]. Stimulant drinks are a group of beverages used to provide an extra increase in energy, promote wakefulness and provide cognitive and mood enhancement [32]. Consumption of stimulants e.g., coffee, tea, Nescafe and cola drinks has increased in recent years among adolescents students [33]. Adolescents who consume higher amount of caffeinated drinks are twice as likely to experience sleep problems, both in quality and quantity and more likely to report daytime sleepiness [20].

Adolescents' health is an important element in the way towards a productive life, and lifestyle modification is regarded as a fundamental aspect of promoting health and preventing disease in adolescents [1]. Unhealthy behaviors that established in adolescence can cause morbidity and mortality in adulthood. Therefore, it is very important to identify the health hazard behaviors of adolescents and intervene early in order to prevent long-term negative effects on health and keeping adolescents as competent members of society [10].

Schools play a critical role in the healthy development of adolescence and are considered one of the most important influences in an adolescent's life [34]. Schools are the best setting for this research, school nurses are in a critical position to collaborate with students, families, teachers to identify modifiable factors such as technology use and consumption of stimulant drinks that contributing to insufficient sleep duration and poor sleep quality. Moreover, school nurses have an important role in helping adolescents adopt healthy lifestyles and improving the health [34, 35].

1.1 Significance of the study:

Strong evidence indicates that sleep plays a vital role in healthy development of children and adolescents [35]. Insufficient sleep and poor sleep quality are major public health problem worldwide with adverse health consequences [14]. Insufficient sleep in adolescents is recognized as an important public health issue that significantly affects the health and safety, as well as the academic success of school students [6]. Poor sleep quality is a common and disturbing problem of adolescence, affecting around 25–40% of teenagers at some point in their development [13]. Modern lifestyle factors that contribute significantly to the recent epidemic of insufficient sleep and poor sleep quality in adolescents are potentially modifiable such as technology media use, and caffeine intake [6]. In the last decade, we have witnessed a sharp increase in the availability and use of various electronic devices such as mobile phones, television, video games, audio devices, computers and tablets [25]. As electronic media become more lightweight and portable, people may conveniently use these devices even in bed [27]. Because of this, electronic devices have become an integral part of adolescent life. According to the National Sleep Foundation, 72% of adolescents reported using a technological device in the hour before bed [36]. Additionally, consumption of stimulants beverages e.g., coffee, black tea, Nescafe and Cola drinks has increased among adolescents. Based on an epidemiologic study, 76% reported daily consumption [37]. Lifestyle habits, which consist of repeated daily behavior, may affect positively or negatively on child's ability to obtain sufficient and high quality sleep [19]. Therefore, it is becoming important to examine relationship between sleep quality of adolescents and modern lifestyles such as technology device use at night and stimulant drinks intake.

1.2. Aim of the study:

The aim of this study was to examine relationship between nighttime technology devices use, stimulant drinks intake and sleep quality among adolescent students.

1.3. Research questions:

1. What is the quality of sleep among males and females adolescent students?
2. What is the percentage of technology devices usage at night and stimulant drinks intake among adolescent students?
3. Which kind of technology devices use at night affects sleep quality of adolescents.

4. Is there relation between nighttime technology devices use and sleep quality of adolescents?
5. Is there relation between stimulant drinks intake and sleep quality of students?
6. Is there relation between socio-demographic characteristics and sleep quality of adolescents?

2. SUBJECTS & METHODS

2.1. Research design: Descriptive correlation design was used to achieve the aim of the study.

2.2. Research setting: The study was conducted at four preparatory and secondary governmental schools from both rural and urban schools in Menouf District, Menoufia Governorate, Egypt.

2.3. Sample:

A multistage stratified random sample of 352 of adolescent students including 161 boys and 191 girls aged between 12-17 years. A multi-stage stratified random sampling technique was used to select sample. At the first stage, random selection of Menouf district from nine districts in Menoufia Governorate, Egypt. At the second stage, the schools stratified into rural and urban schools and by the level of education as preparatory and secondary schools, then simple random selection of four schools included two preparatory (one from rural and another from urban schools) and two secondary (one from rural and another from urban schools). The third stage involved simple random selection of classes stratified by grades included two classes from each first grade and second grade from each preparatory and secondary school (16 classes from 4 schools). Then fourth stage included random selection of students from each class by using a systematic random sample technique. The students' selection was based on the specific criteria that included students who were free from any physical illness e.g., asthma, sinusitis, recurrent abdominal pain, and chronic rhinitis.

Sample size: It was calculated by using the online Epi-info software for sample size calculation according to the following equation:

n = [DEFF*Np (1-p)]/ [(d2/Z21-α/2*(N-1) + p*(1-p)]

1. Population size (total preparatory and secondary students during academic year 2015 about 4150 in the selected schools in Menouf district, Menoufia Governorate (i:e (N)= 4150
2. Hypothesizes% frequency of outcome factor in the population (p):50%+/-5
3. Confidence limits as % of 100 (absolute +/- %) (d): 5%
4. Design effect (for cluster surveys-DEFF): 1
5. Sample Size (n) for 95% Confidence Levels was 352 students.

2.5. Tools of the study:

I. *Self-administered questionnaire*: It was included the following data:

1. Socio demographic data: It was developed by the researcher after reviewing the related literature, included name, age, sex, school type, place of residence (rural or urban), family income, and parents' education level.

2. Nighttime technology devices use, Likert Scale: It was developed by the researcher after reviewing the related literature, included twenty items, ten questions about technology use at night before going to sleep on usual school nights, presence and use of different technological devices in students' bedroom in the past week prior to the study. Then, students asked to identify types of technology devices were being used at night before bedtime e.g. television, mobile phone, computers/ laptop, tablet and video game console. The response option for each item was yes and no.

Moreover, ten questions about frequency and duration of technology use. Concerning the frequency of technology media usage at night before going to sleep, students were asked to indicate the number of days per week they watch television or use the computer or laptop, play video games, use mobile phone, spend time online on Facebook or surf the Internet. The response options on five point Likert scale ranging from never to every night or almost every night and scoring from zero to four respectively. Then total score were classified into low frequency of technology media use (<10) and high frequency (≥ 10). Regarding duration of technology use at night, students were asked to identify on five items the

average amount of time spent each night with watching TV, playing video games, using a computer/laptop, using mobile phone, spending time online on facebook or surfing the internet. The response options on a 4-point Likert scale included never, less one-hour, 1-2 hour, more than 2 hours. Average duration of technology devices use at each night was calculated by the sum of the screen viewing duration for each type of technological devices.

3. Stimulant drinks intake, Likert Scale: It was developed by the researcher after reviewing the related literature, included students' asked about intake of any stimulant drinks during the past week. Students who answered "Yes" were asked to identify the specific types of stimulant or caffeinated drinks. In this study, stimulant drinks or caffeine containing beverages included coffee, black tea, coffee mix or Nescafe and cola drinks such as coca cola and Pepsi cola. Each drink was categorized as yes or no. Additionally, amount of stimulant drinks measured by asking students about average number of cups/cans per week. Frequency of stimulant drinks intake during the previous week was assessed on a six-point Likert scale where never= zero, one time/week=1, twice a week =2 three or four times a week= 3, five or six times a week = 4, every day= 5. Participants were classified into three groups: high frequent stimulant drink intake (≥5 times/week), moderate frequent stimulant drink intake (2–4 times/week), and low stimulant drink intake (once time/week).

II. *Pittsburgh Sleep Quality Index (PSQI)*:

This instrument adopted from [38] used for assessing sleep quality among adolescent students during the previous month to the study. It consists of 19 items self-reported questionnaire. This items form seven component including subjective sleep quality, sleep latency (length of time that takes to fall asleep), sleep duration in hours (total amount of sleep obtained during night), habitual sleep efficiency (ratio of time spent asleep divided by the total amount of time in bed), sleep disturbances, use of sleeping medication, and daytime dysfunction due to sleepiness. Each sleep component evaluated on a 4-point scale 0–3; with score of zero indicated no sleep difficulties and a score of three indicated severe sleep difficulties. Then the seven component scores were summed to yield a global sleep quality score ranging from zero to 21 with higher scores indicating poor sleep quality in the last month. Participants with a total score ≥ 5 were classified as poor sleep quality, while those with a score < 5 were classified as good sleep quality. Furthermore, the assessment of sleep quality was done using the PSQI that has been translated into Arabic by [39].

2.6. Validity of the tools:

Validity indicated the degree to which the tool measures what it is expected to measure. Therefore, content validity of questionnaire was determined by a group of experts in the community medicine, community health nursing and psychiatric nursing. The necessary modifications were carried out according to the panel judgment on clarity of the sentences and appropriateness of the contents.

2.7. Reliability of the tools:

This measured by the researcher for testing the internal consistency of the tools and confirmed through test re-test method with two weeks interval on a group of students not participating in the study. The reliability of tools was analyzed using Chronbach's alpha. The overall reliability coefficient (Chronbach's alpha) for Pittsburgh Sleep Quality Index was 0.81, for nighttime technology use and stimulant drinks intake was 0.83 and 0.89 respectively. This indicates good reliability of the study tools for conducting this research study.

2.8. Pilot study:

It was conducted on 10% of the study sample to check clarity and applicability of the tools and estimate the time needed to fill in the questionnaire. Based on the results of the pilot study, the necessary modifications and clarifications of some questions were done. The pilot sample was not included in the total sample of the research work to ensure stability of the answers.

2.9. Ethical considerations:

Researchers followed all the ethical issues in conducting the research. All selected students who were willing to participate in the study and fulfilling the criteria given a written consent form to be approved by their parents, which includes simple description about aim of the study and its significance. Informed consent was obtained from both the students and their parents before participation in the study. Students informed that participation in this study is voluntary;

they can withdraw at any time during the study without giving reasons. The researcher explained aim of the study to the students and reassured about the confidentiality and anonymity of their data.

2.10. Procedure for data collection:

- This study was conducted during the period starting from February 2015 to the end of May 2015. Once permission was granted to conduct the study, the researcher was initiated collection.
- Necessary approval was obtained from the director of directorate of education and directors of selected schools after issuing letters to them from the Faculty of Nursing, Menoufia University explaining the aim of the study and method of data collection to obtain permission for conducting the study.
- After obtaining approval and written informed consent from students and their parents to conduct the study, the researcher was initiated data collection from students who fulfilled the selection criteria two days per week for four months through using self-administered structured questionnaires that involved socio-demographic data, lifestyle assessment questionnaire about nighttime technology use and stimulant drinks. Additionally, Pittsburgh Sleep Quality Index Scale was used to measure quality of sleep in the previous month
- Questionnaire was accomplished during school time under supervision of the researcher. Before distributing the designed questionnaire, the researcher was explained purpose of the study to the students in each selected class and gave them instructions to fill it. Then, the students answered the questionnaires individually and the researcher present in the classroom during data collection to clarify and simplify any question for the students.
- The average time taken for completing questionnaires was around 25-30 minutes.

Statistical analysis: Data was entered and analyzed by using SPSS (Statistical Package for Social Science) version 22. Graphics were done using Excel program. Quantitative data were presented by mean (X) and standard deviation (SD). It was analyzed using student t- test for comparison between two means. Qualitative data were presented in the form of frequency distribution tables, number and percentage. It was analyzed by chi-square (χ^2) test. Level of significance was set as P value <0.05 for all significant tests.

3. RESULTS

Table 1: Distribution of socio-demographic characteristics of adolescent students (n= 352)

Socio-demographic characteristics	No.	%
Age (years) **- Mean ±SD**	14.73 ± 1.43	
Sex - Male - Female	 161 191	 45.7 54.3
Type of school - Preparatory - Secondary	 192 160	 54.5 45.5
Fathers' Education - Illiterate - Basic education - Secondary - University	 67 81 80 124	 19.1 23.0 22.7 35.2
Mothers' education - Illiterate - Basic education - Secondary - University	 60 59 105 128	 17.0 16.8 29.8 36.4
Residence - Rural - Urban	 247 105	 70.2 29.8
Family income		

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-	Easily enough	117	33.2
-	Hardly enough	171	48.6
-	Not enough	64	18.2

Table 1: Shows that the mean age of students in the studied sample was 14.73 ± 1.43 years, more than half of them were females (54.3%) and more than half from preparatory schools. Regarding parents education and residence, more than one third of students' fathers and mothers had university education and more than two thirds (70.2%) of students were from rural area. As regards family income, about half (48.6%) of students' parents reported that income/month had hardly enough.

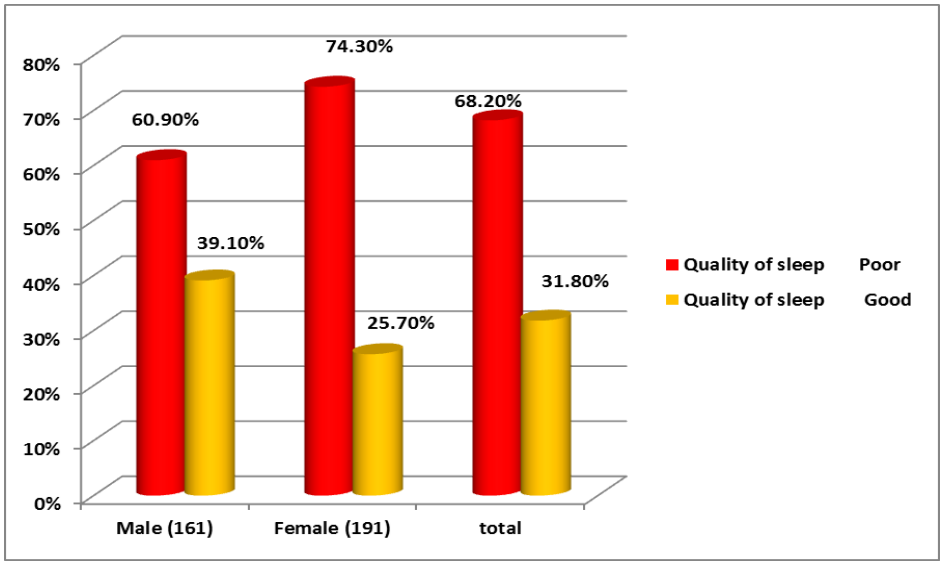

Figure1: Sleep quality among adolescent students distributed by gender (n= 352).

Figure 1: Shows that more than two thirds (68.2%) of studied students had poor sleep quality in the past month prior to the study. Poor sleep quality was significant higher (74.3%) among females than among males (60.9%). The difference between males and females was statistically significant (X2= 7.31, P = 0.01). Additionally, this table shows that the total mean score of Pittsburgh Sleep Quality Index (PSQI) among the studied students was 7.59± 3.14. Female students had significant higher mean score of PSQI (8.42 ± 3.20) compared to 6.60 ± 2.79 among males students.

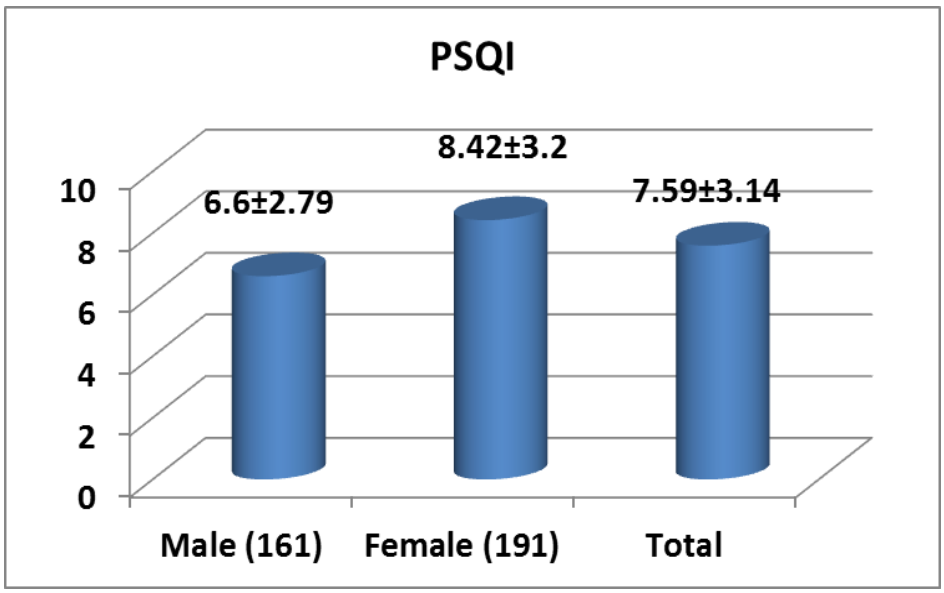

Figure 2: Mean score of Pittsburgh Sleep Quality Index (PSQI) among adolescent students distributed by gender

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Figure 2: shows that the total mean score of Pittsburgh Sleep Quality Index (PSQI) among the studied students was 7.59± 3.14. Female students had significant higher mean score of PSQI (8.42 ± 3.20) compared to 6.60 ± 2.79 among males students (t= 5.64, P 0.000*).

Table 2.Distribution of Sleep Quality components by gender of students (n= 352)

Sleep Quality components	Male (161)		Female (191)		Total (352)		P Value
	No.	%	No.	%	No.	%	
Sleep duration/night (hours)							
- ≤6	20	12.4	16	8.4	36	10.2	X^2=33.11
- 6.1-7	16	9.9	33	17.3	49	13.9	P =0.000 *
- 7.1-8	82	50.9	47	24.6	129	36.6	
- >8	43	26.7	95	49.7	138	39.2	
Mean sleep duration (hours)	6.46 ± 0.98		6.79 ± 0.65		6.62± 0.86		t= 7.38 P =0.000*
Sleep latency (minutes)							
- ≤15	45	28.0	52	27.2	97	27.6	
- 16-30 minutes	47	29.2	24	12.6	71	20.2	X^2=22.81
- 31-60 minutes	18	11.2	51	26.7	69	19.6	P =0.000*
- >60 minutes	51	31.7	64	33.5	115	32.7	
Sleep efficiency							
- <65%	3	1.9	2	1.0	5	1.4	X^2=4.77
- 65-74%	27	16.8	18	9.4	45	12.8	P =0.189 NS
- 75-84%	38	23.6	50	26.2	88	25.0	
- ≥85	93	57.8	121	63.4	214	60.8	
Sleep disturbance							
- Never	4	2.5	3	1.6	7	2.0	
- < once a week	105	65.2	89	46.6	194	55.1	X^2=25.49
- 1-2 times /week	40	24.8	95	49.7	135	38.4	P =0.000*
- ≥ three times /week	12	7.5	4	2.1	16	4.5	
Day time dysfunction							
- Never	75	46.6	72	37.7	147	41.8	
- < once a week	42	26.1	53	27.7	95	27.0	X^2=5.44
- 1-2 times /week	31	19.3	37	19.4	68	19.3	P =0.14 NS
- ≥ three times /week	13	8.1	29	15.2	42	11.9	
Sleep medication use-							
- Never	140	87.0	155	80.1	287	83.8	
- < once a week	12	7.5	21	11.0	33	9.4	X^2=2.17
- 1-2 times /week	9	5.6	15	8.9	32	6.8	P =0..34 NS
- ≥ three times /week	0	0.0	0.0	0.0	0.0	0.0	
Subjective sleep quality							
- Very good	45	28.0	37	19.4	82	23.3	X^2=7.19
- Fairly good	73	45.3	79	41.4	152	43.2	P =0..07 NS
- Fairly bad	29	18.0	51	26.7	80	22.7	
- Very bad	14	8.7	24	12.6	38	10.8	

Table 2: Reveals that the mean duration of sleep per night during school weekdays among the studied students was 6.62± 0.86 hours with statistically significant higher among males (6.79 ± 0.65) compared to 6.46 ± 0.98 among females (P=0.000). Regarding sleep latency (amount of time that takes to fall asleep) this table shows that 52.3% of adolescent

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students had long sleep latency 31-60 minutes or >60 minutes with statistically significant difference (P =0.000) between males (42.9) and females (60.2%).

Concerning sleep efficiency, more than one third (39.2%) of the adolescent students were poor sleep efficiency (<85%) and no significant difference between males and females (p > 0.05). Additionally, 42.9 of students had reported sleep disturbance at least 1-2 times per week or more than three times per week and sleep disturbance was statistically significant higher among females (51.8%) than males (32.3%). As regards daytime dysfunction, about one third (31.2%) of students had reported daytime dysfunction in performing daily activities and maintaining interest due to sleep loss 1-2 times per week or ≥ three times per week and no significant difference between males and females (p > 0.05). The most of students (83.8%) had reported not using sleep medication while 16.2% had reported using sleep medication at least once per week with no significant difference between males and females (p > 0.05). Concerning subjective sleep quality, one third of students had perceived that sleep quality had fairly and very bad and no significant difference between males and females (p > 0.05).

Table 3: Effect of socio-demographic characteristics of students on quality of sleep (n= 352)

Socio-demographic data	Quality of sleep						P value
	Poor (240)		Good (112)		Total (352)		
	No.	%	No.	%	No.	%	
Age (years) **Mean ±SD**	14.86 ± 1.36		14.45 ± 1.53		14.73 ± 1.43		t= 2.50 P =0.01*Sig
Sex						100.0	
- Male	98	60.9	63	39.1	161	100.0	X^2=7.31
- Female	142	74.3	49	25.7	191		P =0.01*Sig
Type of school							
- Preparatory	128	66.7	64	33.3	192	100.0	X^2=0.45
- Secondary	112	70.0	48	30.0	160	100.0	P =0.50 NS
Fathers' education							
- Illiterate	48	71.6	19	28.4	67	100.0	X^2=1.03
- Basic education	57	70.4	24	29.6	81	100.0	P =0.79 NS
- Secondary	54	67.5	26	32.5	80	100.0	
- University	81	65.3	43	34.7	124	100.0	
Mothers' education							
- Illiterate	44	73.3	16	26.7	60	100.0	X^2=5.43
- Basic education	46	78.0	13	22.0	59	100.0	P =0.14 NS
- Secondary	65	61.9	40	38.1	105	100.0	
- University	85	66.4	43	33.6	128	100.0	
Residence						100.0	X^2=8.14
- Rural	157	63.6	90	36.4	247	100.0	P =0.004* Sig
- Urban	83	79.0	22	21.0	105		
Family income						100.0	
Easily enough	101	88.0	16	13.7	117	100.0	X^2=36.77
Hardly enough	91	59.2	80	48.8	171	100.0	P =0.000* HS
Not enough	48	75.0	16	25.0	64		

HS = High significant, NS = not significant, Sig.= Significant.

Table 3: Shows that the type of school and parents' education were not significant associated with poor sleep quality among studied adolescent students (P >0.05). However, it reveals that age, gender, place of residence and family income had significant relation with poor sleep quality among students (p=0.01, 0.01 & 0.004, 0.000 respectively). Female students had a significant higher percentage (74.3%) of poor sleep quality compared with males (60.9%). Additionally, the mean age of poor sleep quality students was significant higher (14.86 ± 1.36 years) than mean age of good sleep

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quality students (14.45± 1.53 years). Urban students were significant higher percentage (79.0%) of poor sleep quality compared with 63.6% among rural students. Moreover, students related to easily enough family income had a significant higher percentage (85.7%) of poor sleep quality compared to hardly enough and not enough family income (54.5%, 75.0% respectively). The percentage of poor sleep quality was increased with increasing mean age of students.

Table 4: Effect of technology media usage on sleep quality of students (n= 352)

Technology media use	Quality of sleep						P value
			Poor (240)		Good (112)		
	No.	%	No.	%	No.	%	
Technology media use at night:							
- Yes	310	88.1	230	74.2	80	25.8	X^2=43.28
- No	42	11.9	10	23.8	32	76.2	P =0.000* HS
Types of technology media use:							
- Television Yes							X^2=13.36
No	297	95.8	226	76.1	71	23.9	P =0.000* HS
	13	4.2	4	30.8	9	69.2	
Computer/laptop: Yes	90	29.0	61	67.8	29	32.2	X^2= 2.73
No	220	71.0	169	76.8	51	23.2	P= 0.099 NS
- Mobile phone Yes	238	76.8	188	79.3	49	20.7	X^2=13.84
No	72	23.2	42	57.5	31	42.5	P =0.000* HS
- Tablet Yes	69	22.3	53	76.8	16	23.2	X^2= 0.32
No	241	77.7	177	73.4	64	26.6	P= 0.57 NS
- Video games consoles: Yes	57	18.4	46	80.7	11	19.3	X^2= 1.54
No	253	81.6	184	72.7	69	27.3	P= 0.21 NS
Presence/use of technology devices in bed room - Yes	168	54.2	138	82.1	30	17.9	X^2=12.11
- No	142	45.8	92	64.8	50	35.2	P =0.001* HS
Frequency of technology devices usage/night:	139	44.8	78	56.1	61	43.9	X^2=43.1
- Low	171	55.2	152	88.9	19	11.1	P =0.000* HS
- High							
Mean duration of technology usage/night(hours)	1.91 ± 1.16		2.27 ± 0.91		1.15 ± 1.27		t= 9.38
							P =0.000* HS

HS = High significant, NS = Not significant

Table 4: Reveals that most of the studied students (88.1%) using different forms of technology devices at night before bedtime such as television, mobile phone, computers/ laptop, tablet and video game console. Among students who using technology devices at night, the most common device used was television (95.8%) followed by mobile phone (76.8%), then computer or laptop (29.0%), tablet (22.3%) and video games consoles (18.4%). More than half of them had reported presence of technology devices in their bed room and used at night before sleep. In addition, it reveals that more than half of students had reported high frequency of technology devices usage at night and the mean duration of technology usage /night was 1.96 ± 0.90 hours.

Moreover, this table shows that there was significant relation between sleep quality and using technology devices at night (P =0.000). Students who were using technology devices at night had a higher significant percentage of poor sleep quality (74.2) compared to those who not use (23.8%). In addition, it reveals that mobile using and watching television at night were significant associated with poor sleep quality. However, computer use, tablet and video games consoles were no significant associated with poor sleep quality (P> 0.05). Furthermore, high frequency and duration of technology devices usage at night before sleep were significant associated with poor sleep quality (P =0.000).

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Table 5: Effect of stimulant drinks intake on sleep quality of students (n= 352)

Stimulant drinks	Quality of sleep						P value
			Poor (240)		Good (112)		
	No.	%	No.	%	No.	%	
Intake of stimulant drinks:							
- Yes	265	75.3	191	72.1	74	27.9	X^2=7.49
- No	87	24.7	49	56.3	38	43.7	P =0.01*Sig
Types of stimulant drinks:							
- **Tea** Yes							
No	215	81.1	156	72.8	59	27.4	X^2=0.13
	5	18.9	35	70.0	15	30.0	P= 0.72 NS
- **Coffee** Yes	71	26.8	47	66.2	24	33.8	X^2= 1.67
No	194	73.2	144	74.2	50	25.8	P= 0.19 NS
- **Coffee Mix** Yes	95	35.8	69	72.6	26	27.4	X^2= 0.23
No	170	64.2	122	71.8	48	28.2	P= 0.88 NS
- **Coca Cola** Yes	169	63.8	127	75.6	41	24.4	X^2= 2.83
No	96	36.2	64	66.0	33	34.0	P= 0.09 NS
Amount of stimulant drink/week:							T= 3.77
Mean number of cups	9.42 ± 6.78		10.37 ± 6.94		6.96 ± 5.67		P =0.000* HS
Frequency of stimulant drinks intake/week:							
- Low (< one time /week)	41	15.5	18	43.9	23	56.1	X^2= 19.71
- Moderate (1-4 times /week)	152	57.4	115	75.7	37	24.3	P =0.000* HS
- High (≥ 5 times /week) -	72	27.2	58	80.6	14	19.4	

HS = High significant, NS = not significant, Sig.= Significant.

Table 5: Shows that three-fourths (75.3%) of the studied students consume stimulant drinks. Students who intake stimulant drinks had a significant higher percentage of poor sleep quality (72.1%) compared with 56.3% of students who not consume stimulant drinks (P= 0.01). Also, it reveals that among students who consume the stimulant drinks, the most common drinks was tea (81.1%) followed by coca cola or Pepsi cola (63.8%), then coffee mix or Nescafe (35.8%) and coffee (26.8%) and there was no significant relation between sleep quality and types of stimulant drinks. Regarding frequency of stimulant drinks intake per week, more than half (57.4%) of the studied students were moderate frequency stimulant intake (2-4 times/week), while about one fourth (27.2%) were high frequency intake (≥ 5 times/week). There was significant relation between sleep quality and frequency of stimulant drinks intake /week, where the percentages of poor sleep quality was higher (80.6) among students who intake stimulant drinks ≥ 5 times /week compared to low frequency intake. As regards quantity of stimulant drinks, the mean number of cups /week among all students was 9.42 ± 6.78, where the amount of stimulant drinks intake was significant higher among poor sleep quality (10.37 ± 6.94) than good sleep quality (6.96 ± 5.67).

4. DISCUSSION

This study aimed to assess sleep quality among adolescent students and examine its relationship with nighttime technology devices use and stimulant drinks consumption. The current study revealed that more than two thirds of the studied adolescent students had poor sleep quality in the past month prior to the study. This result was in line with [33] who assessed sleep quality and consumption of stimulant beverages among Chilean students. They showed that more than half of students had poor sleep quality. However, the result of the present study was higher than that the results of [13] who reported that poor sleep quality is a common and disturbing problem of adolescence, affecting around twenty to forty percent of adolescents at some point in their development. Additionally, the result of the present study was higher than that the results of study conducted by [40] who studied disturbed sleep and associated factors in adolescents in South China. They found that the prevalence of a tendency towards poor sleep was about more than one third of school students from seven grades to twelve grades and its incidence increases with age. sIn addition, Zhou1 et al., [41] who conducted a

study in China among school students aged mean was 15.81±2.01 years. They showed that one fourth of students reported having poor sleep quality. The difference in the percentage value of poor sleep quality may be attributed to difference in age group, sample size, and scoring system to differentiate between good sleeper and poor sleeper**.**

According to Pittsburgh Sleep Quality Index (PSQI) components, the present results showed that there was no significant difference between males and females as regarding to sleep efficiency, daytime dysfunction, sleeping medication and subjective sleep quality. However, it revealed that there was significant difference between males and females as regarding to sleep duration, sleep latency and sleep disturbance.

According to the National Sleep Foundation released new guidelines for adequate sleep length based on a systematic review of scientific literature. These guidelines recommend a minimum range of sleep based on the age of the child. School-aged children (aged 6–13) should have a nightly sleep range of 9–11 hours, adolescents (aged 14–17) a range of 8–10 hours [42]. The results from the present study did not meet this recommendations; the mean duration of sleep per night among the studied adolescent students was 6.62± 0.86 hours with statistically significant difference between males (6.46 ± 0.98) and females (6.79 ± 0.65). In addition, the present study showed that the percentage of short sleep duration (less than 8 hours) was more than half of the studied students aged between 12-17 years. This result was in accordance with [8] who conducted epidemiological study on adolescent sleep and showed that adolescent period is characterized by late bedtime, and short sleep duration of approximately 6.5 hours on weekdays, contributing to daily sleep deficiency of about 2 hours. Similarly, results of [41] who showed that less than two thirds of school students in China had sleep duration less than seven hours. Likewise, result of [43] who revealed that large percentage of American high school students report 7 hours or fewer on an average school night. Another study conducted by [44] this study aimed to investigate the prevalence and factors associated with short sleep duration in adolescents from Santa Catarina, southern Brazil. They showed that the mean sleep duration was 7.9±1.6 hour and no differences were identified between genders and the prevalence of short sleep duration (less than 8 h) was about fifty-four percent of adolescents aged 10-19 years of both genders, regularly involved in public schools. Moreover, result of [45] who examined the association of self-reported sleep duration with physical activity, sedentary behaviors and dietary habits among Saudi adolescents. They showed that mean sleep duration was 7.17- 1.6 h/day and about one third of the adolescent secondary students obtain less than 7 hours of sleep per day with no significant differences in sleep duration between boys and girls. The difference in the duration of sleep may be due to variation in age groups of the studied samples.

Regarding sleep latency, the present study showed that more than half of adolescent students had long sleep latency 31-60 minutes or >60 minutes with statistically significant higher among females than males. This result was in line with [33] who showed that about forty-two percent of the students needed more than 30 minutes to fall asleep. However, the result of the present study was higher than that the results of [41] who conducted study in China among school students mean age was 15.81±2.01 years. They showed that about one fourth of students reported sleep latencies over 30 minutes. This difference may be related to socio culture differences. Concerning sleep efficiency, the results of the present study showed that more than one third of the adolescent students were poor sleep efficiency (<85%) and no significant difference between males and females ($p > 0.05$). This finding was in accordance with [33] who showed that about one third of students were classified as having poor sleep efficiency (<85%). Similarly, a study conducted by [41] who showed that twelve percent of school students had poor sleep efficiency (<85%).

As regards sleep disturbance and daytime dysfunction, the present result revealed that less than half of students had reported sleep disturbance at least 1-2 times per week or more than three times per week and sleep disturbance was statistically significant higher among females than males. On the contrary, result of [41] who showed that three fourths of the students reported sleep disturbances. According to the result of the present study, about one third of studied students had reported daytime dysfunction in performing daily activities and maintaining interest due to sleep loss 1-2 times per week or ≥ three times per week and no significant difference between males and females ($p > 0.05$). This result was in line with [33] who showed that about one fourth of students reported having daytime dysfunction due to sleep loss at least once per week. In contrast, another study conducted by [41] who revealed that three fourths of the students reported a sleep disturbances.

Regarding sleep medication use, the present result showed that most of students had reported not using sleep medication while sixteen percent had reported using sleep medication at least once per week with no significant difference between

males and females (p > 0.05). This result was in agreement with [33] who reported that four percent of students using sleep medication at least once per week. Additionally, result of [41] who showed that most of students had reported not using sleep medication.

Relationship between socio-demographic characteristics of students and quality of sleep: the current study showed that the type of school and parents' education were not significant associated with poor sleep quality among studied adolescent students (P >0.05). However, it was revealed that age, gender, place of residence and family income had significant relation with poor sleep quality among students. Regarding gender, the present study revealed that the percentage of poor sleep quality was higher among females students than among males. The difference between males and females was statistically significant (P=0.01). The total mean score of Pittsburgh Sleep Quality Index among the studied students was 7.59± 3.14. Female students had significant higher mean score of (8.42 ± 3.20) compared to 6.60 ± 2.79 among males students. This finding was in accordance with [41] who conducted a study in China among school students and reported a higher proportion of girls were poor sleepers than boys. Similarly, a study by [33] who showed that female students were more likely to have poor sleep quality compared with males. On the contrary, a study conducted among adolescents in South China by [40] who found no significant difference between genders. This difference may be related to culture differences and different methodologies to measure sleep quality. .

Regarding age, the results of the present study showed that among poor sleep quality students, the mean age was significant higher (14.86 ± 1.36 years) than mean age of good sleep quality students (14.45± 1.53 years). This result was in agreement with [46] who analyzed sleep quality in adolescents and focus on the differences between adolescents with good versus poor sleep quality. They concluded that age was indicator factors for sleep quality among adolescents in Portugal, aged between 12 and 18 years old. Similarly, a meta-analysis, reviewing several studies about adolescent's sleep patterns concluded that as increased age there was a trend for later sleep patterns [47]. Moreover, Felden et al., 2016 [44] who investigated the prevalence and factors associated with short sleep duration in adolescents from Maravilha, Santa Catarina, Southern Brazil. They showed that the age range was strongly associated with the sleep duration. Therefore, adolescents' aged15- 16 and 17-19 years had a higher prevalence of short sleep duration, when compared to the age group of 10-12years.

Concerning place of residence, the results of the present finding revealed that urban students were significant higher percentage of poor sleep quality than rural students. This result was consistent with [48] who conducted a study aimed to identify and compare the socio demographic and economic factors associated with perceived sleep quality and sleep duration in adolescent students from Santa Catarina, Brazil. They revealed that urban environment was strongly associated with increased percentage of poor sleep quality and short sleep duration in adolescent students. Similarly, results of [44] who showed that urban students had a higher percentage of short sleep duration than rural students but the difference was statistically not significant.

Regarding family income, the present finding showed that students related to easily enough family income had a significant higher percentage of poor sleep quality compared to hardly enough and not enough family income. This result was in line with [48] who reported that high family income was strongly associated with increased percentage of poor sleep quality and short sleep duration in adolescent students in Brazil. In contrast, a study conducted among adolescent students in Shanghai, China by [40] who concluded that socioeconomic status was no significant associated with poor sleep quality. The difference may be related to variation in socioeconomic status in different countries.

Excessive use of technological devices has become a major part of our lives and a habit for many people especially adolescents [20]. During the last several decades, there has been marked increase in the use of electronic media during leisure time among children and adolescents [21]. National Sleep Foundation reported that more than half of adolescents using electronic media on most evenings during the last hour before they go to bed [22]. According to the results of the present study, most of studied students are using different forms of technology devices at night before sleep such as television, mobile phone, computers/ laptop, tablet and video game console. This result was in accordance with [49] who studied sleep and use of electronic devices in adolescence in Hordaland County in Norway. They showed that most adolescents used electronic devices in the hour before going to sleep. Similarly, another study conducted by [50] who studied Australian adolescent sleep patterns and nighttime technology. They showed most of adolescents used electronic devices in bed before bedtime. Moreover, similar to the results of [23] who examined an association between electronic

media use and sleep habits of adolescence attending five middle schools in the city of Tours, France. They revealed that more than two-thirds the last activity of the day was related to electronic media use at least 3 times per week.

The present result showed that there was significant relation between sleep quality and using technology devices at night before sleep (P =0.000). Students who were using technology devices at night had a higher significant percentage of poor sleep quality compared to those who not use. This finding was in accordance with [49] who reported that bedtime and daytime use of electronic devices in adolescents were both related to sleep measures, increased risk of short sleep duration, and long sleep onset latency. Similarly, results of [51] who studied the role of environmental factors on sleep patterns and school performance in adolescents. They confirmed that electronic media use before bedtime were negatively affecting sleep. Likewise, another study conducted by [52] who evaluated media use, sleep and memory in children and adolescents. They reported negative relationships between increased screen media usage and reduced sleep quantity and quality. Moreover, results of [10] who examined association between screen viewing duration and sleep duration, sleep quality, and excessive daytime sleepiness among adolescents in Hong Kong. They found negative effects between sleep duration, sleep quality, and daytime sleepiness and increased screen viewing of different types of devices.

The results of the present study showed that among students who using technology devices at night, the most common device used was television followed by mobile phone then computer or laptop, tablet and video games consoles. Additionally, it was revealed that that excessive mobile using and watching television at night were significant associated with poor sleep quality, however, computer use, tablet and video games consoles were no significant associated with poor sleep quality (P> 0.05). This finding was in line with [50] they showed that among adolescents, devices used in bed a few nights per week or more was cellphone, followed by computer, then TV and radio. The use of cell phones and televisions at higher doses was associated with delayed sleep/wake schedules, potentially damaging health and educational outcomes. Similarly, results of [51] who reported that watching TV and/or using social media 30 minutes before bed was strongly associated with later bedtimes and reduced total sleep time. Likewise, results of [23] who showed that among electronic media devices available in the adolescents' bedroom, only cell phones and MP3 players were associated with sleep problems.

Regarding the presence of technology devices in adolescent students' bedroom, the results of the present study showed that more than half of students had reported presence of technology devices in their bedroom and used at night before sleep. This finding was in line with [50] who studied Australian adolescent sleep patterns and nighttime technology. They showed that more than two thirds of adolescents reported two or more electronic devices in their bedroom at night and use devices in bed.

As regards frequency of technology devices, the present result showed that high frequency of technology devices usage almost every night before sleep was significant associated with poor sleep quality (P =0.000). In addition, the mean duration of technology devices usage at night before sleep was significant higher (2.27 ± 0.91 hours) among poor sleep quality students than among good sleep quality (1.15 ± 1.27 hours). This finding was in agreement with [53] who examined associations between specific technologies and adolescent sleep quantity and sleep quality. They showed that frequent weekday technology use at bedtime was associated with significant adverse effects on multiple sleep parameters. Similarly, results of [54] who assessed the influence of social media on sleep quality of undergraduate students in Chongqing. They found that social media users who spend 0.5 to 2 hours on social media are more likely to experience poor sleep than those who spend less than 0.5 hours. Likewise, results of [23] who found that evening screen time of one hour or more is associated with a higher risk of sleep problems particularly going to bed late and difficulty waking up.

Caffeine has revealed to fight sleepiness and to restore alertness and performance. However, usual daily caffeine drinking has related to sleep disturbance and sleepiness. Evening intake of caffeine has shown to increase sleep latency, decrease sleep duration, and sleep efficiency [55].. The present finding showed that three fourths of the studied students consumed stimulant drinks that contain caffeine as black tea, coffee mix, Nescafe and coca cola in the past week prior to the study. This finding was in agreement with [57] who assessed consumption of energy drinks and the associated socioeconomic and behavioral factors among middle and secondary school children in Hail, Northern of Saudi Arabia. They showed that about two thirds of the school children were current energy drink consumers. Similarly, epidemiologic study conducted among Icelandic adolescents by [37] who showed that about three fourths of adolescents had reported daily caffeine consumption. This result was approved by [33, 55, 56] they showed that intake of stimulants drinks has increased among adolescents students.

According to the results of the present study, students who intake stimulant drinks had a significant higher percentage of poor sleep quality compared with students who not intake. This result was in accordance with [51] who studied the role of environmental factors on sleep patterns and school performance in adolescents. They confirmed that caffeine consumption before bedtime was negatively affecting sleep. Similarly, results of [46] who analyzed sleep quality in adolescents and focus on the differences between adolescents with good and poor sleep quality. They showed that intake of caffeine was negatively associated with sleep quality. Moreover, results of [20] who studied effects of caffeine and technology on sleep duration and daytime functioning. They showed that stimulatory effect of energy drinks has negatively influence sleep quality.

Regarding frequency of stimulant drinks intake per week, the present result showed that more than half of the studied students were moderate frequency intake (2-4 times per week) while about one fourth were high frequency intake (≥ 5 times per week). There was significant relation between sleep quality and frequency of stimulant drinks intake per week, where the percentage of poor sleep quality was higher among students who consume stimulant drinks ≥ 5 times per week compared to low frequency intake. This result was in line with [58] who conduct study aimed to investigate the associations between energy drink intake and mental health problems, in a nationally representative sample of Korean adolescents. They showed that adolescents who consumed energy drinks for 5 days or more every week were at the greatest risk of sleep dissatisfaction, stress, and depressive mood than less frequent use (1–4 times/week). Similarly, this result was in accordance with [59] who showed the adverse health effects of energy drink consumption.

According to European Food Safety Authority (EFSA) Panel on Dietetic Products, Nutrition and Allergies [60] reported recommended amount of caffeine intakes for children and adolescents (3 mg/kg of body weight per day). In the present study amount of caffeine intake is likely to have exceeded the recommendations of the EFSA Panel. The present result revealed that the mean number of cups of stimulant drinks per week among studied students was 9.42 ± 6.78, where the amount of stimulant drinks intake was significant higher among poor sleep quality (10.37 ± 6.94) than good sleep quality (6.96 ± 5.67). This finding was in line with [61] who assessed caffeine consumption and general health in secondary school children. They revealed that total weekly caffeine consumption varied considerably between participants, with mean intakes of 419.84 ± 550 mg/week.

The growing evidence supporting the importance of sleep and the negative impact of sleep lack has taken the problem to the attention of public health professionals. Healthy People 2020 [43] which sets the nation's public health program, included 'sleep health' and developed objectives for sleep health, including increase the proportion of adolescent students who get sufficient sleep defined as ≥8 hours, reduction in unhealthy sleep behaviors as overuse of electronic media in the bedroom, intake of excessive caffeine and the potential consequences of inadequate sleep.

5. CONCLUSION

- This study indicated that poor sleep quality among studied adolescent students was high (68.2%), it was significant higher among females (74.3%) than among males (60.9%). There was significant difference between males and females as regarding to sleep duration, sleep latency and sleep disturbance, however, there was no significant difference between males and females as regarding sleep efficiency, daytime dysfunction, and sleeping medication.
- Most of the studied students (88.1%) using different forms of technology devices at night before bedtime and the most common devices used and affected sleep were mobile phone and television.
- Intake of stimulant drinks among studied students was high (75.3%) and more than three fourths of them were moderate and high frequency intake.
- poor sleep quality was associated with age, gender, place of residence, family income, excessive intake of stimulant drinks, nighttime technology media usage and presence of technology devices in students bed room.

6. RECOMMENDATIONS

1. Educational and awareness programs should be implemented in schools by the ministry of health in collaboration with the ministry of education to raise awareness of adolescent students about harmful health effects of night time technology devices usage and consumption of stimulant drinks.

2. Health care professionals especially school nurse should educate students and their parents on the importance of sleep and influence of unhealthy lifestyle choices on their sleep quality and overall health.
3. Limiting the availability of technology media devices in students' bedrooms and discouraging their night-time use to promote sleep
4. Further in-depth analytic study designs are needed and recommended to determine whether the observed associations in this study, is actually a causal valid association?

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