The determinants of sleep effectiveness: a survey study in young adult Turkish population

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ABSTRACT

Aim: In this study, we aimed to reveal the major parameters and sleeping habits such as sleep onset, duration, frequency of night awakenings on sleep in a healthy active population.

Material and Method: This survey study included a total of 1033 volunteer participants, The survey form included demographic data such as age and gender, and questions about the sleep quality and sleep quantity to measure sleep effectiveness via both subjective and objective assessment. In addition, among the questioned conditions, those that could be associated with having night sleep problems were determined with a logistic regression analysis.

Results: Of all participants, 38.2% experienced problems related to night sleep. The sleep duration was reported as <6 hours by 17.6%, between 6-8 hours by 51.4% and >8 hours by 31% of the participants. The COVID-19 pandemic affected sleep patterns in 66.9% of the participants. Age (p=0.007), gender (p=0.038), falling asleep immediately when going to bed at night (p<0.001), waking up from sleep, even for a short time at night (p<0.001), time to go to bed to sleep at night (p<0.001) and affected sleep patterns after the COVID-19 pandemic (p<0.001) were found as the determinants of sleep effectiveness.

Conclusion: The most important determinants of sleep problems were sleep latency, nocturnal awakenings, time to go to bed and affected sleep patterns after the COVID-19 pandemic. This study can be a reference for preparation of programs to increase sleep quality of employees and guidance for further more comprehensive epidemiological studies.

Keywords: Sleep, sleep effectiveness, sleep quality, sleep latency, sleep patterns, COVID-19

INTRODUCTION

Sleep is defined as a state of immobility with highly diminished physical responsiveness that enables reorganization of neural activity (1). Sleep is one of the major physiological processes involved in human survival (2). Enough and undisturbed sleep is essential for an individual's personal well-being and the ability to perform efficiently (3). Sleep efficiency has a significant impact on the physical and mental health of the working population. However, community managers, employers and government authorities are usually unaware of sleep efficiency on the performance of employees.

Long working hours, chronic drug use and presence of chronic diseases, lack of exercise, and excessive use of psychostimulants such as caffeine and nicotine result in decreased sleep efficacy (4). The sleep effectiveness is usually addressed in two parameters: sleep quality and sleep quantity, namely duration. The quality and

quantity of sleep have major implications for motor functioning, cognitive performance and long-term physical health (5). A decrease in sleep quality or quantity will lead to similar impacts, including sleep loss and sleep deprivation. Sleep deprivation (SP) can be resulted from lifestyle habits and sleep disorders. SP often leads to excessive daytime sleepiness, which has significant negative impacts on personal and working life, with an estimated incidence of 23.2% (6).

In modern society, sleep is often not made a priority due to the competing interests such as sports, social media usage etc., resulting in sleeping for a shorter time and feeling more sleep deficit (7). In the USA, the prevalence of short sleep duration rose to 35.6% in 2018 from 30.9% in 2010 among working Americans (8). Sleep medicine specialists dealing with sleep diseases constantly warn people who do not have insomnia complaints and restrict

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sleep times to less than 6 hours for detrimental impacts of SP on physical and mental health (9). Habitual short sleep duration has been associated with serious adverse outcomes, including obesity, type II diabetes mellitus, hypertension, cardiovascular disease, depression and all-cause mortality (10). The American National Sleep Foundation recommends an appropriate sleep duration of 7-9 hours/day for young adults and 7-8 hours/day for older adults (11).

Good quality sleep depends on many factors such as sleeping for more time, falling asleep in 30 min or less and less awakening at night. Sleep quality can be measured based on the objective and subjective determinants (12). Objective parameters for the evaluation of sleep quality include total duration of sleep, the amount of wake during the sleep episode, and the frequency and duration of awakenings across the night (13). Whereas, subjective assessment consists of reported difficulties falling asleep, sleep latency, waking up frequently during the night, or feeling tired during the day (14).

In this study, we aimed to reveal the major parameters and sleeping habits such as sleep onset, duration, frequency of night awakenings and other related information and to investigate the effects of the ongoing COVID-19 pandemic on sleep in a healthy active population that does not describe any sleep problems.

MATERIAL AND METHOD

The study was carried out with the permission of Yeditepe University Clinical Researches Ethics Committee (Date: 30.12.2020, Decision No: 1337). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

This survey study included a total of 1033 volunteer participants, aged 18-50 years who responded to the questionnaire forms. The questionnaire form was prepared by the researchers by searching the relevant literature on the sleep effectiveness and sleep quality. The questions were limited to 18 considering that otherwise the participants may be bored, not accept or not interested in the survey. In addition, the survey questions were written as multi-choice short, easy to understand and reply items and the non-directive questioning technique was preferred. When preparing the survey questions, attention was paid to not imply medical terms or disease diagnosis in order to avoid causing suspicion or confusion in participants.

Although face-to-face interview technique yields more objective results in the surveys, this was impossible due to the ongoing COVID-19 pandemic. So, we chose a remote access survey compulsorily. The survey

form was prepared via the Google forms application (https://docs.google.com/forms/u/0/?tgif=d). The questionnaire forms were sent to some participants via remote access to their corporate emails and others to their mobile phones. The participants were asked to fill the survey forms based on their sleep habits within the last five years. Participants who work in shifts, who had serious chronic sleep problems or who used medication that could affect their sleep were not included in the survey.
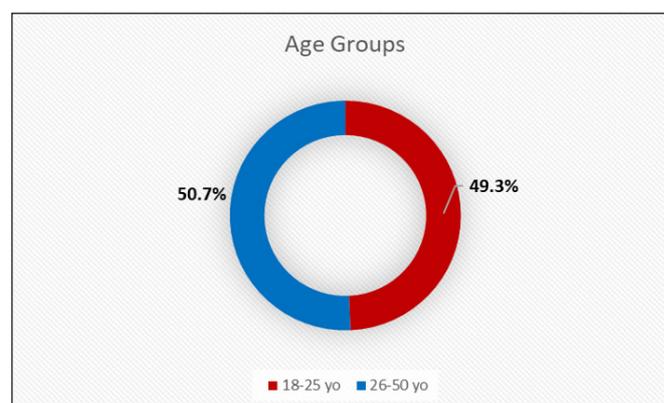
The survey form included demographic data such as age and gender, and questions about the sleep quality and sleep quantity to measure sleep effectiveness via both subjective and objective assessment. More than one option could be marked in question 15, which investigated the conditions that could have negative effects on the quality and quantity of sleep. The last question was an additional item questioning the effects of COVID-19 pandemic on sleep patterns. In addition, among the questioned conditions, those that could be associated with having night sleep problems were determined with a logistic regression analysis.

Statistical Analysis

Data obtained in this study was statistically analyzed using SPSS version 23.0 (SPS Statistical Package for Social Sciences, IBM Inc., Chicago, IL, USA). When the study data were evaluated, categorical variables were expressed as frequencies (number, percentage). The relationship between two independent variables was evaluated with the Chi-square test. The Binary Logistic Regression Model was constructed to examine the factors affecting a two-state independent variable. $p < 0.05$ values were considered statistically significant.

RESULTS

Of the 1033 participants, 36.3% were male and 63.7% were female. Age distribution of the participants is shown in **Figure 1**.

Figure 1. Age distribution of the participants

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None of the participants presented to a physician due to sleep problems previously. Of all participants, 38.2% experienced problems related to night sleep. 25.1% of the participants fell asleep immediately, while 43.2% fell asleep between 10 to 20 minutes, 16.3% in half an hour and 15.3% within 30 minutes to one hour. Of all participants, 11.4% woke up for >2 hours at night. Participant's times to go to bed at night is shown in **Figure 2**.
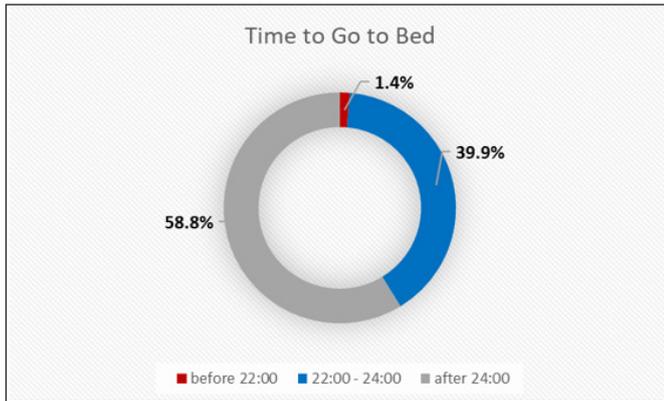
Figure 2. Participants' times to go to bed at night

The sleep duration was reported as <6 hours by 17.6%, between 6-8 hours by 51.4% and >8 hours by 31% of the participants. 83.6% of the participants stated that healthy and sufficient night sleep affects themselves during the day. The ideal sleep duration for feeling well and happy was reported as 4-6 hours by 5.4%, at least 6 hours by 26.9%, at least 8 hours by 49.6% and at least 10 hours by 8.1% of the responders. 82.4% of the participants reported that they need daytime sleep or napping. The COVID-19 pandemic affected sleep patterns in 66.9% of the participants. Distribution of the study parameters is given in **Table 1**.

The COVID-19 pandemic affected sleep patterns in 46% of the participants with problems related to sleep at night and 54% of those without sleep related problems (p<0.001) (**Figure 3**).
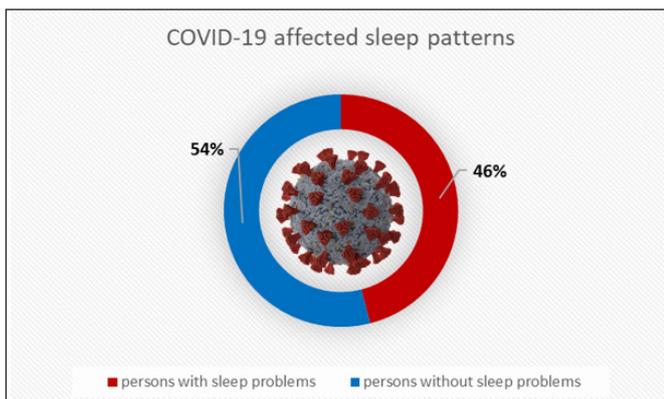
Figure 3. Effect of the COVID-19 pandemic on sleep patterns

Table 1. Distribution of the variables		
(n=1033)	N	%
Gender		
Male	375	36.3
Female	658	63.7
Age		
18-25	509	49.3
26-50	524	50.7
Seeing a doctor for sleeping problems before		
Yes	0	0
No	1033	100
Having problems with night sleep		
Yes	395	38.2
No	638	61.8
Time to falling asleep when going to bed at night		
Evet, i fall asleep immediately	259	25.1
10-20 minutes	446	43.2
In half an hour	168	16.3
30 Minutes-1 hour	158	15.3
It varies	2	0.2
Falling asleep immediately when going to bed at night		
Yes	259	25.1
No	774	74.9
Waking up from sleep, even for a short time at night		
Yes, 1-2	558	54
Yes, >2	118	11.4
It varies No	346	33.5
Wake up time in the morning		
<6:00	123	11.9
06:00-08:00	597	57.8
>8:00	313	30.3
Time to go to bed to sleep at night		
<22:00	14	1.4
22:00-24:00	412	39.9
>24:00	607	58.8
Daily sleep duration		
<6 h	182	17.6
06-08 h	531	51.4
>8 h	320	31
Self-assessment when waking up in the morning		
Fresh	131	12.7
Tired, sleep duration dependent	501	48.5
Tired, sleep duration independent	401	38.8
Thinking that a healthy and sufficient night sleep affects yourself during the day		
Yes	864	83.6
No	169	16.4
The reason why sleep pattern is important in your life		
Vigour and performance	628	60.8
Mood	260	25.2
Professional career	47	4.5
Not affect	98	9.5
Ideal sleep duration to feel good and happy		
4-6 hours	56	5.4
At least 6 hours	381	36.9
At least 8 hours	512	49.6
At least 10 hours	84	8.1
*Situations that may negatively affect sleep quantity and quality		
Evening, social activities	140	13.6
Traffic and rush	139	13.5
Too much tea, coffee, or smoking	176	17
Housework due to working until late hours	276	26.7
My job	323	31.3
Needing daytime sleep or napping		
Yes	851	82.4
No	182	17.6
Taking a technological device with you as a habit when going to bed at night		
Yes, clock for alarm	109	10.6
Yes, actively used	827	80.1
No	97	9.4
Were sleep patterns affected after the covid-19 pandemic?		
Yes	691	66.9
No	342	33.1
*Participants were able to give more than one answer to this question		

According to the Chi-square analysis; no statistically significant correlation was found between having sleep problems at night and age, gender, daily sleep duration, ideal sleep duration to feel good and happy, needing daytime sleep or napping, and taking a technological device with oneself as a habit when going to bed at night (for all, p>0.05). On the other hand, statistically significant correlations were found between having sleep problems at night and falling asleep immediately when going to bed at night, waking up from sleep even for a short time at night, wake up time in the morning, time to go to bed to sleep at night, self-assessment when waking up in the morning, thinking that a healthy and sufficient night sleep affects oneself during the day, the reason why sleep pattern is important in one's life and affected sleep patterns after the COVID-19 pandemic (for all, p<0.05). The correlations between having sleep problems at night and the survey parameters are given in **Table 2**.

Table 2. Relationships of having sleep problems at night with the study parameters.						
	Having problems related to night sleep				Chi-square	p
	Yes		No			
	n	%	n	%		
Gender					3.782	0.052
Male	158	42.1	217	57.9		
Female	237	36	421	64		
Age					2.509	0.113
18-25	207	40.7	302	59.3		
26-50	188w	35.9	336	64.1		
Falling asleep immediately when going to bed at night					92.291	<0.001
Yes	34	13.1	225	86.9		
No	361	46.6	413	53.4		
Waking up from sleep, even for a short time at night					53.031	<0.001
Yes 1-2	195	34.9	363	65.1		
Yes >2	80	67.8	38	32.2		
No	109	31.5	237	68.5		
Wake up time in the morning					35.018	<0.001
<6	31	25.2	92	74.8		
06-8	204	34.2	393	65.8		
>8	160	51.1	153	48.9		
Time to go to bed to sleep at night					52.931	<0.001
<22	3	21.4	11	78.6		
22-24	104	25.2	308	74.8		
>24	288	47.4	319	52.6		
Daily sleep duration					4.216	0.117
<6	70	38.5	112	61.5		
06-8	217	40.9	314	59.1		
>8	108	33.8	212	66.3		
Self-assessment when waking up in the morning					86.7	<0.001
Fresh	39	29.8	92	70.2		
Tired, sleep duration dependent	132	26.3	369	73.7		
Tired, sleep duration independent	224	55.9	177	44.1		
Thinking that a healthy and sufficient night sleep affects yourself during the day					3.878	0.049
Yes	319	36.9	545	63.1		
No	76	45	93	55		
The reason why sleep pattern is important in your life					15.363	0.002
Vigour and performance	211	33.6	417	66.4		
Mood	118	45.4	142	54.6		
Professional career	19	40.4	28	59.6		
Not affect	47	48	51	52		
Ideal sleep duration to feel good and happy					5.793	0.122
4-6 hours	25	44.6	31	55.4		
At least 6 hours	138	36.2	243	63.8		
At least 8 hours	191	37.3	321	62.7		
At least 10 hours	41	48.8	43	51.2		
Needing daytime sleep or napping					0.548	0.459
Yes	321	37.7	530	62.3		
No	74	40.7	108	59.3		
Taking a technological device with you as a habit when going to bed at night					2.471	0.291
Yes, clock for alarm	37	33.9	72	66.1		
Yes, actively used	326	39.4	501	60.6		
No	32	33	65	67		
Were sleep patterns affected after the covid-19 pandemic?					53.522	<0.001
Yes	318	46	373	54		
No	77	22.5	265	77.5		

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A binary logistic regression analysis was performed to determine the variables affecting the status of having problems related to sleep at night (**Table 3**). As seen in the table, age (p=0.007), gender (p=0.038), falling asleep immediately when going to bed at night (p<0.001), waking up from sleep, even for a short time at night (p<0.001), time to go to bed to sleep at night (p<0.001) and affected sleep patterns after the COVID-19 pandemic (p<0.001) were found to statistically signşificantly affect the status of having problems related to sleep. Odds ratio (OR) for having sleep problems was 1.541 folds higher in the male participants than female participants, 1.430 folds higher in the participants aged between 26-50 years compared to those aged between 18-25 years, 5.034 folds higher in the participants who reported that they falling asleep immediately when going to bed at night compared to those who could not, 2.472 fold higher in participants who go to the bed after 24:00 compared to those going to bed before 22:00, and 2.769 folds higher in the participants with sleep patterns affected by the COVID-19 compared to those with sleep patterns that were not affected.

Table 3: examining the variables affecting the status of having problems related to night sleep						
	B	St. Error	P	Odds ratio	95% Condfidence interval	
					Lower	Upper
Gender (female)						
Male	0.433	0.160	0.007*	1.541	1.127	2.108
Age (18-25)						
26-50	0.358	0.173	0.038*	1.430	1.019	2.007
Immediate sleepinh when going to bed (yes)						
No	1.616	0.219	0.000*	5.034	3.276	7.736
Waking up from sleep, even for a short time at night (no)			0.000*			
Yes 1-2 times	0.128	0.168	0.446	1.136	0.818	1.579
Yes >2 times	1.652	0.268	0.000*	5.215	3.083	8.824
Morning wake up time (<6)			0.289			
06:00-08:00	0.250	0.279	0.370	1.284	0.743	2.218
>8	0.544	0.363	0.134	1.722	0.846	3.507
Time to go to bed to sleep at night (<22)			0.000*			
22-24	-0.515	0.813	0.527	0.598	0.121	2.942
>24	0.905	0.233	0.000*	2.472	1.565	3.906
Daily sleep time (<6)			0.165			
6-8 Hours	-0.418	0.247	0.091	0.659	0.406	1.069
>8	-0.153	0.198	0.441	0.858	0.582	1.266
Thinking that a healthy and sufficient night sleep affects oneself during the day (No)						
Yes	0.055	0.247	0.824	1.057	0.651	1.714
Why sleep pattern is important in your life (does not affect)			0.072			
My stamina and performance	-0.531	0.318	0.095	0.588	0.315	1.097
Emotions	-0.132	0.329	0.689	0.877	0.460	1.672
Meslek kariyer	-0.152	0.440	0.730	0.859	0.363	2.035
Ideal sleep time to feel good and happy (4-6 hours)			0.765			
At least 6 hours	-0.229	0.410	0.577	0.796	0.356	1.778
At least 8 hours	-0.190	0.288	0.509	0.827	0.471	1.453
At least 10 hours	-0.036	0.280	0.897	0.964	0.557	1.670
Needing or sleeping in the daytime (no)						
Yes	0.174	0.200	0.384	1.190	0.804	1.763
Taking a technological device with you as a habit when going to bed at night (yes, clock for alarm)			0.871			
Yes, active usage	0.131	0.255	0.608	1.140	0.691	1.880
No	0.147	0.368	0.691	1.158	0.563	2.383
Situation of affecting sleep patterns after the covid-19 outbreak (no)						
Yes	1.018	0.179	0.000*	2.769	1.950	3.932
:P<0.05 (Statistically significant). Omnibus chi square =259,532, p=0,000, dependent variable: having problems with night sleep (1: yes 0:no)						

DISCUSSION

This survey study provides evidence regarding the determinants of sleep quality and quantity among healthy individuals without any chronic disease. The rate of the participants who stated to have problems related to night sleep was found as 38.2%. Ramaswamy et al. (15) found the rate of having sleep problems as 36.3% among Sothern Indian 15-60 year old population. These data were determined in accordance with the data we obtained in the survey.

In a systematic review on sleep quality by Crivello et al. (16) the appropriate sleep onset latency was reported as 0-30 minutes for adults. In the same study, the appropriate number of awakenings was stated as 0-1, while more than 3 awakenings were reported to be inappropriate. In a study by Saferzade et al. (17) with adolescents, the mean sleep patency was reported as 21.41 minutes. In our study, sleep latency was reported as 30 minutes by 84.6% of the participants, while %15.3 reported the sleep latency as 30 minutes-1 hour. Again in our study, the number of self-reported awakening was found as 1-2 in 54% of the participants, while 33.5% reported no awakening during night sleep. Within this context, our findings are consistent with the literature.

According to the Joint Consensus Statement of the American Academy of Sleep Medicine and Sleep Research Society, the appropriate sleep duration is 7-9 hours, while ≤ 6 hours is inappropriate for optimal health in adults (18). Young adults who slept <7 hours are more likely to report poor general health and low overall physical and mental health-related quality of life (19). In the present study, self-reported sleep duration was found as < 6 hours in 17.6%, 6-8 hours in 51.4% and >8 hours in 31% of the participants. In a survey study includingw over 15.000 American adults, Jean-Louis et al. (20) found the mean sleep duration as < 6 hours in 15.0%, 6-8 hours in 73% and >8 hours in 12% of the participants.

In the present study, binary logistic regression analysis revealed the determinants of having problems related to sleep at night as age (p=0.007), gender (p=0.038), falling asleep immediately when going to bed at night (p<0.001), waking up from sleep, even for a short time at night (p<0.001), time to go to bed to sleep at night (p<0.001) and affected sleep patterns after the COVID-19 pandemic (p<0.001). Similarly, studies in the literature have reported the determinants of poor sleep quality as ease of falling asleep, frequency of awakening and sleep continuity (21, 22). In a study by Silva et al. (23) with nursing students, the determinants of sleep quality were found as time to falling asleep and sleep duration, and duration of travel from school to the

home. Wesselius et al. (24) found the most significant factor affecting sleep problems as nocturnal awakenings in the hospitalized patients. Rocha et al. (25) reported the factors affecting sleep quality as sleep latency and fragmented sleep. In general, the results of our study and those of the previous studies are consistent in terms of the determinants of sleep efficiency with sleep latency and nocturnal awakening was more common in the reviewed studies.

Traumatic events such as those caused by the COVID-19 pandemic can lead to anxiety and psychological distress that negatively affect sleep quality (26). One important finding of our study was the fact that the ongoing COVID-19 pandemic affected sleep patterns negatively in 66.9% of all participants. This effect was seen in 46% of the participants with sleep problems and 54% of those without sleep problems. Cellini et al. (27) investigated the changes in sleep patterns caused by COVID-19 outbreak and found that people went to bed and woke up later, and spent more time in bed with a lower quality of sleep. Li et al. (28) showed that time in bed and total sleep duration, and thuse sleep efficiency significantly decreased due to the COVID-19 pandemic. In a more recent study, Marelli (29) found that the rate of early morning awakening decreased from 78.6% to 70% in students and from 75.6% to 61.3% in workers after the COVID-19 pandemic. These results are consistent with our findings.

Study Limitations

The major limitation of this study is the inability to conduct the survey through face-to-face interviews due to the ongoing pandemic. In addition, the number of participants is relatively low for such an online survey. Finally, different groups (age, gender etc.) could be created to compare the survey results. However, this can be a subject for future studies. On the other hand, being the first study conducted on sleep quantity and quality, namely sleep effectiveness in Turkey is a strong aspect of the study.

CONCLUSION

A considerable portion of the study population had problems related to nocturnal sleep. Majority of the participants went to bed after 24:00, which causes inappropriate sleep duration especially in the working population. The most important determinants of sleep problems were sleep latency, nocturnal awakenings, time to go to bed and affected sleep patterns after the COVID-19 pandemic. We believe that this study can be a reference for preparation of programs to increase sleep quality of employees and guidance for further more comprehensive epidemiological studies.

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ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Yeditepe University Clinical Researches Ethics Committee (Date: 30.12.2020, Decision No: 1337).

Informed Consent: All patients signed the free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare. Financial Disclosure: The authors declared that this study has received no financial support.

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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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