SLEEP AND BIOLOGICAL RHYTHMS
THE JAPANESE SOCIETY OF SLEEP RESEARCH

Sleep and Biological Rhythms 2015; **13**: 298–308 doi:10.1111/sbr.12118

ORIGINAL ARTICLE

Prevalence of sleep disorders in the Turkish adult population epidemiology of sleep study

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Abstract

Sleep disorders constitute an important public health problem. Prevalence of sleep disorders in Turkish adult population was investigated in a nationwide representative sample of 5021 Turkish adults (2598 women and 2423 men, response rate: 91%) by an interviewer-administered questionnaire. Insomnia was defined by the DSM-IV criteria, habitual snoring and risk for sleep-related

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Accepted 23 February 2015.

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breathing disorders (SDB) by the Berlin questionnaire, excessive daytime sleepiness (EDS) by the Epworth sleepiness scale score, and restless legs syndrome (RLS) by the complaints according to the International Restless Legs Syndrome Study Group criteria. Mean age of the participants was 40.7 ± 15.1 (range 18 to 90) years. Prevalence rates (men/women) were insomnia 15.3% (10.5%/20.2%; $P < 0.001$), high probability of SDB 13.7% (11.1%/20.2%; $P < 0.001$), EDS 5.4% (5.0%/5.7%; P: 0.09), RLS 5.2% (3.0%/7.3%; $P < 0.001$). Aging and female gender were associated with higher prevalence of sleep disorders except for habitual snoring. Prevalence rates of the sleep disorders among Turkish adults based on the widely used questionnaires were close to the lower end of the previous estimates reported from different parts of the world. These findings would help for the assessment of the health burden of sleep disorders and addressing the risk groups for planning and implementation of health care.

Key words: aging, epidemiology and public health, sleep disorders.

INTRODUCTION

Sleep is essential for life. As we spend one-third of our lives asleep, its quality should be an important factor for the quality of life as well. The recent International Classification of Sleep Disorders (ICSD-3) covers sleep disorders and other sleep-related conditions categorized into six major groups, which include insomnia, sleep-related breathing disorders, central disorders of hypersomnolence and sleep-related movement disorders.[1]

There is growing research evidence for an association between sleep disorders and cognitive dysfunction, work and traffic accidents as well as metabolic, cardiovascular and cerebrovascular complications and mortality.[2–6] These consequences have substantial implications in both clinical practice and health economics, which are essential for planning and implementation of public health policies. Questionnaire-based population studies have suggested high prevalence rates of sleep disorders.[7–10] However, there have been substantial differences in findings depending on the sample characteristics, definitions and/or methodology used as well as differences in regional perceptions and management practices. In an international survey carried out in France, Italy, Japan and the USA, the estimated prevalence of insomnia ranged between 6.6% and 37.2%.[8] The majority of individuals with sleep problems in that survey reported that their sleep problems had an impact on their daily quality of life either "somewhat" or "a lot". Interestingly, among individuals with a history of insomnia, the rate of reporting insomnia symptoms to physicians was generally low and of those who did consult a physician, few were prescribed any medication, reflecting a low awareness in this context.[8] In a large-scale, global cross-sectional survey conducted among 35,327 individuals in 10 countries on International Sleep Well Day (21 March 2002), based on the questionnaires, 24% of the subjects reported that they did not sleep well, 31.6% had insomnia and 11.6% were found to be "very sleepy" or "dangerously sleepy" during the day.[9]

Turkey is a large country with a population over 70 million (adult population over 48 million) with considerable cultural and social diversity. To date, there is only few local data regarding certain sleep-related symptoms such as snoring,[11] insomnia[12] and restless legs syndrome (RLS),[13] but no large-scale, nationwide survey covering a wide range of symptoms related to sleep disorders. Thus, the Turkish Adult Population Epidemiology of Sleep Disorders (TAPES) study was conducted to investigate the prevalence of sleep complaints in a random sample of 5021 individuals, representative of the general adult population in the whole country.

METHODS

Sampling

A sample of 5521 subjects representing Turkey's adult population was designed through a multi-stage stratified sampling plan. Figure 1 shows the sampling design of the TAPES study.

Stratification criteria included distribution of adult population by 12 first-level territorial statistical units and by urban-rural settlements (i.e. by 24 strata in total), and the sample was proportionally allocated to these strata. From the strata a total of 137 districts (second-tier administrative divisions) were selected as primary sampling units (PSUs) by sampling with

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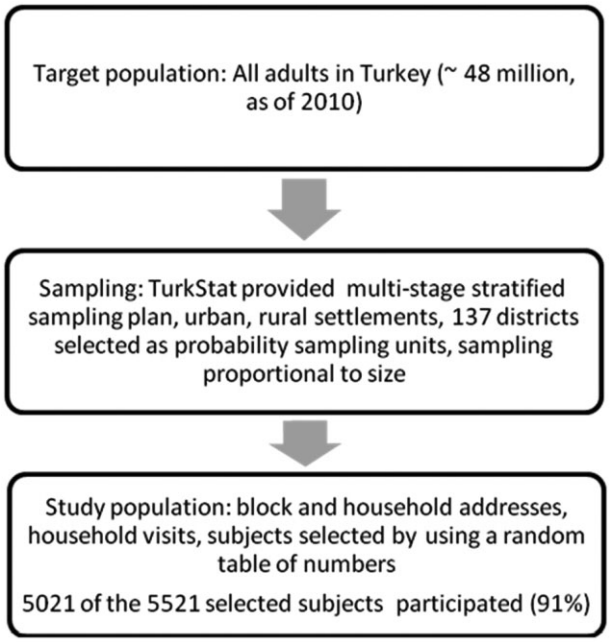


Figure 1 Sampling design of the Turkish adult population epidemiology of sleep disorders (TAPES) study.

probability proportional to size (PPS). The sample was distributed to 56 of Turkey's 81 provinces in total.

Block and household address selection for sampling was carried out by the Turkish Statistical Institute (TurkStat) through simple random sampling; a fixed number of households were selected in the second stage from each selected PSU, as required by PPS rules. As such a method (proportional stratification and true PPS sampling) yields a self-weighted sample and ensures equal probability of selection of sampling units, no weighting procedures were applied for stratification.

In the final stage of sampling, subjects in the sampled households were selected by using a table of random numbers after listing the individuals who were 18 years old or older. As this method of sampling introduces a bias in regard to probabilities of selection of individuals living in households with varying numbers of adult members, data were adjusted to account for such unequal probabilities by assigning weights to each respondent in inverse proportion to the ratio of number of adults living in the respective household to the average household size. To avoid unnecessary increase in the variance of survey estimates, however, no weighting for non-response is applied, for preliminary data analysis revealed no subgroups (in terms of, e.g. gender, age, education, marital status, employment, region of residence or type of settlement, etc.) that differ significantly in regard to case or item response/non-response rates. The overall case non-response rate remained at 9%, with 5021 of the 5521 selected subjects having assented to participate in the study.

Sleep questionnaire

A questionnaire consisting of 132 questions in total was used as data collection tool. The questions were determined by the Turkish Sleep Medicine Society (TSMS) Executive Board. The questionnaire included information on demographics, occupational history, educational and socioeconomic status, health problems, sleeping habits, depressive symptoms, sleep complaints, and sleep disorders. Questions on sleep complaints and disorders were selected by the "TAPES investigators" team. Epworth Sleepiness Scale (ESS) was used to assess excessive daytime sleepiness (EDS). ESS has been previously validated in Turkish.[14] Questions on RLS were adapted from the criteria proposed by the International Restless Legs Syndrome Study Group and used in an epidemiological investigation of RLS in Turkey before.[13,15]

The draft questionnaire was revised after a pilot study applied in a range of hospitals in Istanbul, Ankara, Izmir, and Kayseri. Scales were tested for reliability and content validity (Chronbach's alpha > 0.70).

Ethical approval was obtained from Scientific Research Assessment Commission of Hacettepe University (HEK 10/34-25). Informed consent was signed by the participants. In the consent form, it was stated that personal information would not be used in the reporting of the results and participants seeking medical help would be consulted by TSMS. A separate letter signed by the TSMS chair and principal investigator briefly explaining the potential benefits of the study and giving information about TSMS was provided to improve participation.

The implementation and supervision of the interviews through household visits, data entry and the preliminary analysis of the results were performed by SAM Research Institution against remuneration as per a contract signed on behalf of the TSMS.

Definition of sleep disorders

Investigation tools used in the study to assess the prevalence of sleep disorders are listed in Table 1. Questionnaire items used for these definitions are provided below.

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Table 1 Definitions of sleep disorders used in the Turkish adult population epidemiology of sleep disorders (TAPES) study

Sleep disorder	Source	References
RLS	International Restless Legs Syndrome Study Group Criteria	13,16
Insomnia	DSM-IV Criteria	17
Risk of SDB	Berlin Questionnaire	18
Habitual snoring	Berlin Questionnaire	18
EDS	Epworth Sleepiness Scale	14,19

EDS, excessive daytime sleepiness; RLS, restless legs syndrome; SDB, sleep disordered breathing.

Restless legs syndrome

Having unpleasant feelings in one's legs like tingling, restlessness or throbbing when resting (e.g. sitting or lying) frequently (5–15 times a month) or almost every day (16 times a month or more), and affirming that: (i) this happens sometimes in one and sometimes in the other leg, (ii) it increases during the evening, (iii) moving leads to a partial relief, and (iv) this condition hampers sleeping.[13,16]

Insomnia

"Yes" response to any of the following, as adapted from DSM–IV–TR:[17]

1. Difficulty initiating sleep at least three times a week for a month or more.
2. Difficulty maintaining sleep, a fragmented sleep at least three times a week for a month or more.
3. Early morning awakening at least once a week in the last month.

Risk of sleep disordered breathing

Positive score in at least two of the three categories in Berlin Questionnaire, including questions on snoring, witnessed apnea, daytime sleepiness, hypertension, and measurement of body mass index.[18]

Habitual snoring

Frequency of snoring described as "nearly every day" in response to Berlin questionnaire.[18]

Excessive daytime sleepiness

Scoring above 10 in the Epworth Sleepiness Scale, which was validated in Turkish.[14,19]

Sample size calculation and statistical analysis

Sample size calculation was performed according to different prevalence estimates between 5% and 15%, and margin of error between 0.625% and 1.25%, for 95%CI. These assumptions yielded the sample size of 4671 for prevalence estimate of 5% and margin of error of 0.625% (i.e. for 5% of prevalence estimate, a 95% CI of 4.3% to 5.6%). This number was corrected for a possible case response rate of 85–90%, to arrive at the final sample size of 5520.

Prevalence rates for sleep disorders were separately calculated for the age groups and genders. χ^2 testing was used for comparisons between genders and age groups. Standard errors of the estimates were provided. Mantel-Haenzel test was used in gender comparisons stratified for age-groups. *P*-values smaller than 0.05 were considered as significant in the two-tailed statistical testing.

RESULTS

Table 2 shows the demographics of the study population as compared to the general adult population. Of the respondents 2598 (51.7%) were female; 14.8%, 25.5%, 22.1%, 17.5%, 11.7% and 8.3% of the participants were between 18–24, 25–34, 35–44, 45–54, 55–64 years of age and 65 years old or older, respectively. Mean age was 40.7 ± 15.1 (range: 18 to 90) years. Almost half of the population (48.4%) were residing in the urban area, whereas 27.5% in the metropolitan area (urban areas which have a population over one million habitants) and 24% in the rural regions. Almost three quarters (74.4%) of the population was married. Educational status was primary school graduate (5 years of education) in 42.1%, illiterate (no school education) in 12.6%. Smoking status was never-smoked in 59.5%, ex-smoker in 6.9% and current smoker in 33.7%. Alcohol consumption was reported in 13.6%. Monthly household income was reported less than 750 Turkish Liras (TL), which was approximately equal to 500 US dollars, as of the time of the commencement of the study, in 36.9%, between 750 TL and 1000 TL (almost between 500 and 660 US dollars) in 24%. As compared to the general adult population of Turkey, slight differences existed in the marital status, educational status and smoking status.[20,21] Prevalence of obesity was much lower than that of a population-based study on risk factors of diabetes in a representative sample of the adult population.[22]

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Table 2 Sociodemographic characteristics of the study population as compared to adult population of Turkey

	TAPES Sample %	General population[20] %
Total (*n*)	(5021)	(48 409 606)
Gender		
Female	51.7	50.2
Male	48.3	49.8
Age group (year)		[†]
18–24	14.8	11.4
25–34	25.5	23.0
35–44	22.1	18.5
45–54	17.5	15.3
55–64	11.7	10.4
≥65	8.3	9.7
Residence		
Rural	24.1	23.7
Urban	48.4	46.4
Metropolitan	27.5	29.9
Marital status		
Married	74.4	64.3
Single	18.5	27.6
Divorced/widow	6.2	8.0
Education status		
Illiterate	12.6	12.6
Primary school	42.1	37.0
Secondary school	12.5	7.1
High school	23.7	13.3
University	9.1	5.2
Smoking status		[21]
Never smoked	59.5	58.3
Ex-smoker	6.9	10.5
Current smoker	33.7	31.2
Alcohol consumption		
No	86.4	89.1
Yes	13.6	10.9
Obesity (BMI ≥30.0 kg/m^2) Female/Male/Total	28.6/15.5/22.3	44.2/27.3/36.0[22‡]
Monthly household income		NA
<750 TL	36.9	
750–1000 TL	24.1	
1000–1500 TL	21.4	
1500–2000 TL	9.8	
>2000 TL	7.4	

[†]20–24 year was the youngest age group. 2010 figures of Turkish adult population were obtained from TurkStat, Turkey's Statistical Yearbook, 2010. Turkish Statistical Institute. Publication Number 3522.[20] 2008 figures for smoking status were obtained from TurkStat, Global Adult Tobacco Survey, 2008. Turkish Statistical Institute. Publication Number 3324.[21] TURDEP-II survey in 2010 (The Turkish Epidemiology Survey of Diabetes, Hypertension, Obesity and Endocrine Disease), Supplementary material of the article and presentation downloaded in 28 January 2015, from the URL: http://www.turkendokrin.org/files/file/TURDEP_II_2011.pdf[22] [‡]NA, not available.

Table 3 shows the prevalence of sleep disorders and symptoms. Insomnia, risk of SDB, habitual snoring, EDS and RLS were reported by 15.3%, 13.7%, 9.6%, 5.4% and 5.2%, respectively. All the sleep complaints increased with age, except for insomnia. Insomnia prevalence among women increased with age. In the analysis stratified for age groups; sleep complaints, except for EDS and habitual snoring, were more common among women than men (Table 3). Table 4 shows the prevalence of sleep disorders and complaints according to sociodemographic characteristics. All sleep disorders and sleep symptoms were significantly more common in the subjects who reported lower education status, lower average income, smoking habit and in those who were obese. As shown in Table 5, symptoms related to daytime impairment were reported at least 3

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Table 3 Prevalence of sleep disorders and complaints in the general adult population according to age and gender

	Insomnia % (SE)	Risk of SDB % (SE)	RLS % (SE)	Habitual snoring† % (SE)	EDS† % (SE)
Overall age group					
18–24	12.5 (1.38)	2.2 (0.53)	1.3 (0.42)	3.4 (0.66)	4.4 (0.76)
25–34	14.3 (1.11)	6.6 (0.70)	3.4 (0.50)	4.7 (0.59)	4.2 (0.56)
35–44	14.9 (1.22)	12.1 (0.98)	3.9 (0.58)	7.4 (0.79)	4.1 (0.59)
45–54	16.5 (1.44)	19.9 (1.35)	6.6 (0.58)	15.0 (1.20)	6.1 (0.81)
55–64	18.3 (1.87)	29.4 (1.88)	8.5 (1.15)	21.1 (1.68)	8.1 (1.13)
65+	18.4 (2.35)	24.6 (2.11)	14.1 (1.70)	13.9 (1.69)	8.9 (1.39)
Total	15.3 (0.58)	13.7 (0.49)	5.2 (0.31)	9.6 (0.42)	5.4 (0.32)
P*	P: 0.07	P < 0.001	P < 0.001	P < 0.001	P < 0.001
Men age group					
18–24	10.9 (1.72)	2.3 (0.74)	0.3 (0.25)	5.3 (1.12)	3.8 (0.95)
25–34	8.0 (1.30)	5.9 (1.02)	1.5 (0.52)	6.5 (1.06)	3.7 (0.82)
35–44	10.9 (1.63)	11.2 (1.49)	2.2 (0.70)	10.5 (1.45)	3.8 (0.90)
45–54	9.3 (1.54)	14.4 (1.65)	4.2 (0.95)	17.1 (1.77)	6.2 (1.14)
55–64	13.9 (2.22)	21.9 (2.32)	5.3 (1.26)	20.4 (2.26)	6.9 (1.42)
65+	12.5 (2.39)	16.2 (2.26)	6.8 (1.54)	13.2 (2.08)	7.5 (1.62)
Total	10.5 (0.70)	11.1 (0.64)	3.0 (0.35)	11.6 (0.65)	5.0 (0.44)
P*	P: 0.18	P < 0.001	P < 0.001	P < 0.001	P: 0.03
Women age group					
18–24	14.5 (2.24)	2.0 (0.77)	2.6 (0.87)	1.2 (0.58)	5.3 (1.21)
25–34	19.2 (1.66)	7.1 (0.95)	4.7 (0.78)	3.4 (0.66)	4.6 (0.77)
35–44	17.8 (1.73)	12.7 (1.30)	5.0 (0.85)	5.3 (0.87)	4.2 (0.78)
45–54	24.7 (2.44)	25.6 (2.11)	9.1 (1.39)	12.8 (1.61)	6.1 (1.15)
55–64	24.2 (3.17)	38.1 (2.96)	12.2 (1.99)	21.9 (2.51)	9.6 (1.80)
65–+	32.5 (5.24	39.5 (3.96)	27.0 (3.60)	15.0 (2.89)	11.2 (2.56)
Total	20.2 (0.93)	16.1 (0.72)	7.3 (0.51)	7.7 (0.52)	5.7 (0.46)
P*	P: 0.001	P < 0.001	P < 0.001	P < 0.001	P: 0.001
P#	P < 0.001	P < 0.001	P < 0.001	P < 0.001	P: 0.09

EDS, excessive daytime sleepiness; RLS, restless legs syndrome; SDB, sleep disordered breathing. P*: Comparison of age groups. P#: Comparison of men and women, stratified for age groups. Mantel–Haenzel statistics was used for statistical testing. †Sleep related complaint.

days in a week by 31.7%. Daytime impairment symptoms were associated with sleep disorders. Insomnia prevalence ranged from 12.5% to 93.4% for those who reported proneness to accidents while driving and those who reported concerns or worries about sleep.

DISCUSSION

Summary of our findings

In this epidemiological study of a sample representative of the adult population of Turkey, we investigated the prevalence of sleep disorders including insomnia, RLS, excessive daytime sleepiness and risk of obstructive sleep apnea by an interviewer-administered questionnaire. Prevalence of insomnia, RLS, excessive daytime sleepiness, risk of obstructive sleep apnea and habitual snoring were found to be 15.3%, 5.2%, 5.4%, 13.7% and 9.6%, respectively. Differences in the prevalence of obesity could be partially due to the age and gender differences between our study and The Turkish Epidemiology Survey of Diabetes, Hypertension, Obesity and Endocrine Disease (TURDEP-II) study, which included a much higher proportion of women and older subjects.[22]

Insomnia

Insomnia has been reported in a wide range of figures between 5.2% and 66.4%[7–10,23–25] in previous community-based studies from different parts of the world. Different definitions have been used in these studies, which make comparison of the findings difficult. Studies that used insomnia definition as symptoms of difficulty initiating sleep or difficulty maintaining sleep almost every day and early morning awakening for 2 weeks or longer in the last 12 months, reported the prevalence as 15% and 6.4% in China and Spain, respectively.[23,24] Studies in four Latin American centers

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Table 4 Prevalence of sleep disorders and complaints according to sociodemographic characteristics

	Insomnia % (SE)	Risk of SDB % (SE)	RLS % (SE)	Habitual snoring† % (SE)	EDS† % (SE)
Residence					
Rural	15.0 (1.2)	14.3 (0.1)	7.2 (0.7)	9.0 (0.8)	6.0 (0.7)
Urban	16.0 (0.9)	13.0 (0.6)	5.2 (0.4)	9.5 (0.5)	5.0 (0.4)
Metropolitan†	14.9 (1.1)	14.1 (0.9)	3.2 (0.4)	9.9 (0.8)	6.0 (0.6)
P	P: 0.37	P: 0.51	P: < 0.001	P: 0.79	P: 0.15
Marital status					
Married	16.9 (80.7)	15.2 (0.5)	5.7 (0.3)	10.3 (0.5)	6.0 (0.4)
Single	11.0 (1.2)	3.3 (0.5)	0.5 (.2)	4.5 (0.6)	4.0 (0.7)
Divorced/widow	23.0 (2.7)	23.9 (2.2)	11.8 (1.7)	14.3 (1.8)	7.0 (1.4)
P	P < 0.001	P < 0.001	P < 0.001	P < 0.001	P 0.7
Education status					
Illiterate	23.0 (2.1)	25.5 (1.7)	13.4 (1.3)	13.8 (1.3)	9.0 (1.1)
Primary school	17.0 (1.0)	16.5 (0.8)	6.1 (0.5)	10.1 (0.6)	5.0 (0.5)
Secondary school	15.0 (1.6)	10.1 (1.2)	3.2 (0.7)	10.1 (1.2)	4.0 (0.6)
High school	10.0 (1.0)	6.4 (0.7)	1.7 (0.3)	6.4 (0.7)	4.0 (0.6)
University	12.0 (1.7)	7.4 (1.2)	1.3 (0.5)	8.1 (1.2)	5.0 (1.0)
P	P < 0.001	P < 0.001	P < 0.001	P < 0.001	P < 0.001
Smoking status					
Never smoked	14.0 (0.7)	13.9 (0.6)	6.0 (0.4)	7.6 (0.4)	6.0 (0.4)
Ex-smoker	19.0 (2.5)	22.3 (2.2)	6.3 (1.3)	17.9 (0.2)	8.0 (1.4)
Current smoker	17.0 (1.0)	11.4 (0.7)	3.5 (0.4)	11.3 (0.7)	4.0 (0.5)
P	P 0.006	P < 0.001	P < 0.001	P < 0.001	P < 0.001
Monthly household income					
<750 TL	21.0 (1.1)	17.1 (0.8)	7.5 (0.6)	11.1 (0.7)	6.0 (0.6)
750–1000 TL	14.0 (1.2)	13.8 (0.9)	4.8 (0.6)	9.1 (0.8)	5.0 (0.6)
1000–1500 TL	11.0 (1.1)	12.0 (0.9)	3.9 (0.5)	9.5 (0.8)	5.0 (0.7)
1500–2000 TL	12.0 (1.7)	8.9 (1.2)	2.6 (0.7)	6.1 (0.1)	4.0 (0.9)
>2000 TL	9.0 (1.6)	6.7 (1.2)	2.1 (0.7)	7.7 (1.3)	6.0 (1.2)
P	P < 0.001	P < 0.001	P < 0.001	P 0.009	P 0.27
Obesity					
No	14.0 (0.6)	5.9 (0.4)	4.0 (0.3)	7.0 (0.4)	4.8 (0.3)
Yes	19.8 (1.4)	41.1 (1.5)	9.5 (0.8)	18.6 (1.1)	7.7 (0.8)
P	P < 0.001	P < 0.001	P < 0.001	P < 0.001	P < 0.001

†Metropolitan regions had a population more than one million.

(Mexico City, Montevideo, Santiago, and Caracas) used difficulty falling asleep more than two times a week in the last 6 months as the definition and reported insomnia prevalence between 30.8–41.6%.[9] A cross-sectional survey conducted on International Sleep Well Day (21 March 2002), in 10 countries, assessed insomnia by using Athens Insomnia Scale. Symptoms of sleep induction, night awakening and waking earlier than desired were reported on average as 12.1%, 12.2% and 10.1%, respectively.[7] There were wide differences between the countries, with the lowest prevalence figures in Austria (7.1%, 7.6% and 10.1%, respectively) and the highest figures in Brazil (27.8% for sleep induction) and South Africa (27.8%, 32.2% and 20.0%, respectively). Insomnia symptoms more than 2 nights a week was reported as 11.5% in Brazil (calculated from the Table using the information in the article) and at least 2 nights a week as 14.9% in Korea.[7,24] Insomnia prevalence in our study (i.e. 15.3%) was within the range of these studies, and almost close to the median of these figures. We excluded subjects reporting RLS symptoms from the insomnia symptom group, which decreased the prevalence estimate in our study.

Risk of sleep disordered breathing and habitual snoring

The Berlin questionnaire has been developed to investigate the risk for sleep disordered breathing and tested in the primary care with sleep studies.[18] In a validation study conducted in primary care settings in Europe and the US, the prevalence of high risk of SDB was found in

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Table 5 Prevalence of sleep disorders and complaints in the subjects who reported daytime impairment symptoms at least three times a week

	n (%)	Insomnia %	Risk of SDB %	RLS %	Habitual snoring† %	EDS† %
Any symptom	1590 (31.7)	45.2	25.4	12.4	14.8	9.9
Daytime fatigue	914 (18.2)	54.1	32.6	16.8	17.1	11.3
Social/Vocational dysfunction or poor school performance	220 (4.4)	66.4	35.9	18.2	17.3	15.5
Irritability	564 (11.2)	56.4	32.4	15.2	17.6	11.9
Daytime sleepiness	537 (10.7)	58.6	35.4	17.3	18.1	12.7
Motivation/Energy/Initiative reduction	679 (13.5)	53.8	36.1	16.6	16.5	12.1
Tension headaches in response to sleep loss	537 (10.7)	53.5	34.6	16.6	16.4	11.5
Gastrointestinal symptoms in response to sleep loss	365 (7.3)	49.5	34.5	15.3	19.7	14.5
Concerns or worries about sleep	320 (6.4)	93.4	35.3	20.0	15.6	9.4
Proneness for errors/accidents while driving	12 (0.2)	12.5*	16.7*	16.7*	8.3*	16.7*
Proneness for errors/accidents at work/school	28 (0.6)	44.4	14.3*	3.6*	10.7*	25.0

Row percentages of the sleep disorders and sleep symptoms are given in the Table. *$P > 0.05$, in the other comparisons of prevalence of sleep disorders and symptoms between daytime impairment reported at least three days a week and those reported less than three days a week $P < 0.001$.

the range of 19.9% to 66.7%.[26] Studies from Norway, Porto Rico and USA found high risk of SDB as 24.3%, 56% and 26%; respectively.[27–29] Lower prevalence figures were reported from Iran (4.98%) and Pakistan (12.4%).[30,31] Habitual snoring was reported in the range of 4% to 66.4%.[9,10,29,32] Our findings for both risk of SDB (13.7%) and habitual snoring (9.6%) are close to the lower end of the range of figures found in previous studies. Differences in the age distribution (e.g. younger age in our study with a mean of 40 years as compared to other studies with a mean in the range of 55–60 years in Latin American cities) could be an explanation for this difference.[9] As an example, prevalence of habitual snoring in the age groups older than 45 was almost twice (17%) the prevalence of habitual snoring in the all sample. It is also possible that subjects might have denied such symptoms, as these would be socially undesirable. Subjects may be unaware of these symptoms, as these were not reported to them. Such possibilities could be investigated by asking such information to the partners and family members of an individual in the second stage of our study.

Excessive daytime sleepiness

Excessive daytime sleepiness defined according to ESS, was reported between 6.2% and 24.5% in China and South Africa, respectively.[7,9,16] Prevalence rate in our study (5.4%) was lower than the lowest of these figures. The Turkish version of ESS has been validated in a previous study in a group of 194 healthy controls and 150 consecutive subjects attending the sleep centre with symptoms of sleep-disordered breathing.[17] However, there may still be problems in the comprehension of these questions and difficulty in relating these items to daily life situations, which could be an explanation for this discrepancy. More than half our study population had only primary school education or less. Due to social and cultural features of our population, responding to some of the items on ESS, which are not common in daily life (as travelling in a bus, driving a car, reading or going to a cinema or theater), could be difficult.

Restless legs syndrome

Restless legs syndrome was defined according to the four criteria proposed by the International Restless Legs Syndrome Study Group.[15,33] In the Restless legs syndrome prevalence and impact multinational general population study (REST) conducted in the United States and five European countries (France, Germany, Italy, Spain, and the United Kingdom); the prevalence of RLS symptoms occurring at least once a week was found in the range of 2.7–6.6.[34] A single screening question addressing the features of RLS was used in a study conducted in Kentucky, and age adjusted prevalence of RLS was found to be 10%.[35] A study among Korean adults found the prevalence as 3.9%, which defined the frequency of symptoms as at least once a month.[36] National Sleep Foundation (NSF) Sleep in 2005 Poll in America, collected data by a telephone interview of a random, representative sample of US adults found the

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prevalence of RLS symptoms a few nights per week as 9.7%.[37] Our prevalence figure (i.e. 5.2%) is within the range, closer to the lowest of these findings and closer to that of Asian countries. Compared to other studies conducted in Turkey, which reported prevalence of RLS as 3.19% and 9.7%, there was a huge difference. These studies included population from different parts of Turkey and the second study with the prevalence finding of 9.7% assessed the prevalence among a population of 40 years of age and older. Therefore, differences due to regions, age groups and methodology could be an explanation for these discrepancies.[13,38]

Major risk groups for sleep disorders

In our study, prevalence of SDB and RLS were significantly higher among women than men and among the elderly, as reported by previous population-based studies,[9,10] whereas habitual snoring was more frequent among men than women. Higher prevalence of risk of SDB among women was surprising. This could mostly likely be due to high prevalence of obesity among women in our study. Further analysis of the data and the second stage of the study will help to elucidate our findings.

Strengths and weaknesses of the study

This study was conducted in a large sample of subjects, which was randomly selected as a representative sample of the general adult population. Information was obtained by face-to-face interviews. The questionnaire includes questions on various sleep complaints and disorders. Questions on excessive daytime sleepiness were earlier validated in Turkish language.[14] Questions on RLS were used in previous studies before.[13] Questions on SDB risk and insomnia were adapted from Berlin Questionnaire and DSM-IV criteria, respectively. Test-retest reliability of these questions and testing in a sample of diagnosed cases and healthy controls were found appropriate. The sample was a random sample selected by the National Institute of Statistics (TurkStat) as representative of the adult population of Turkey. The participation rate was high. Thus our findings are highly likely to reflect the situation in the general adult population of Turkey. Lack of polysomnography for the diagnosis of SDB is a limitation of the study. Cross-sectional design of the study is a limitation for the causality interpretation of our findings. However, we think that our findings representing the status in the general adult population would help for comparisons with investigations using similar methodology, particularly those from neighboring countries, for comparisons over time and also for raising awareness of sleep-related problems in our population.

As for daily life, siesta is not common in Turkey, and as depicted by the higher prevalence of obesity, the majority of women do not work and do not exercise. Investigation of transcultural differences, particularly with the neighboring countries would provide interesting information on the epidemiology of sleep habits and sleep disorders. Turkey has historical connections and similarities in lifestyle with Arabic countries and Iran. However, data related to sleep epidemiology, obtained through standard methodolology is scanty in these populations. In our study, prevalence of high risk of SDB was higher than that of Iran, and prevalence of insomnia was lower than that of Greece for insomnia.[29,39] Further studies in our region would help to delineate these differences.

The prevalence rates of sleep disorders and complaints in this investigation, with a representative sample of the adult population of Turkey, were close to the lower end of the prevalence rates reported from previous population-based studies in different parts of the world. However, our findings showed that problems related to sleep were not rare in the adult population. Aging and female gender were associated with higher prevalence for most of the sleep disorders and complaints, respectively; however, insomnia prevalence increases with aging only among women and EDS and habitual snoring were more common among men.

This study was the first part of the big study on epidemiology of sleep habits and sleep disorders in the Turkish adult population. Our next plan is to invite a sample of these subjects to sleep clinics for polysomnography and clinical evaluation as a second stage and to follow them as a third stage of this project. Investigations of this sort can help us for the assessment of the health burden of sleep disorders and addressing the risk groups for planning and implementation of health care.

ACKNOWLEDGMENTS

The research was financially supported by Gen Ilac ve Saglik Urunleri and Cephalon Pharmaceuticals Companies without any impact on the study design and interpretation of the data.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest related to the study or preparation of the manuscript.

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