PREVALENCE AND RISK FACTORS FOR EXCESSIVE DAYTIME OF SLEEPINESS IN RURAL WESTERN ANOTOLIA (TURKEY): THE ROLE OF OBESITY AND METABOLIC SYNDROME*

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Abstract. The purpose of the present study was to identify risk factors for and prevalence of excessive daytime sleepiness and associations between demographic factors, obesity and metabolic syndrome criteria and excessive daytime somnolence (EDS). A descriptive and analytical study was conducted among 508 volunteers in primary health care centers in western Anatolia, Turkey. The data were obtained using a questionnaire and the Epworth Sleepiness Scale. Metabolic syndrome components were defined according to the criteria of the Internetional Diabetes Federation. A logistic regression model was used for statistical analysis. The mean ± SD age was 46.3±17.3 years, body mass index was 27.0 ± 5.4 kg/m^2 and Epworth Sleepiness Scale (ESS) score was 5.0 ± 4.4. The prevalence of EDS was 14.6% (*n*=74). Older age (OR 1.033; 95% CI 1.03-1.26) and high body mass index (OR 1.143; 95% CI 1.01-1.04) were associated with increased incidence of EDS. In backward logistic regression analysis, non-tea and coffee drinking (OR 6.189; 95% CI 2.10-18.2) were significantly asociated with EDS. According to our study, age, body mass index and non-tea and non-coffee drinking were associated with EDS.

Keywords: excessive daytime sleepiness, metabolic syndrome, sleep, obstructive sleep apnea, sleep disorders, Turkey

INTRODUCTION

Excessive daytime sleepiness (EDS) is the most common symptom in sleep-disordered breathing (SDB) (Pagel, 2009). EDS commonly occurs in patients receiving sedative medications, in psychiatric disorders, in advanced age, in circadian rhythm disorders (*eg*, individuals working in shifts), and in patients with obstructive sleep apnea (Mallon and Hetta, 1997; Bixler *et al*, 2005; Mitty and Flores, 2009; Pagel, 2009). Obstructive sleep apnea (OSA) is a common cause of EDS (Pagel, 2009). Obesity is one of the most important risk factors for OSA and SDB (Resta *et al*, 2003; Bixler *et al*, 2005; Chasens *et al*, 2009; Bopparaju and Surani, 2010; Rusu *et al*, 2011). Abdominal obesity has been reported as the most important component of metabolic syndrome (MetS) (Lam and Ip, 2010). Triglycerides and high-density

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lipoprotein cholesterol (HDL-C) levels are two other components of MetS (Lam and Ip, 2010). Some studies suggest triglyceride and HDL-C levels are associated with sleep disorders (Can *et al*, 2006; Williams *et al*, 2007). Some research has shown a strong association between indices of SDB and glucose impairment/diabetes in adults (Spiegel *et al*, 2005; Williams *et al*, 2007; Shaw *et al*, 2008; Bopparaju and Surani, 2010). These studies attempted to clarify the relationship between obesity, hyperglycemia, insulin resistance, triglyceride level, HDL-C level and OSA. However, research that addresses the relationship between EDS and MetS criteria is limited. The perevelance and risk factors of excessive daytime sleepiness in Turkey are unknown.

The purposes of this study were to identify risk factors for EDS, establish the prevalence of EDS, and identify associations between demographic factors, obesity, (MetS) criteria and EDS.

MATERIALS AND METHODS

Study setting and design

This was a cross-sectional, descriptive, analytic study conducted at the Primary Health Center, in western Anatolia, Turkey.

The study population consisted of 508 participants selected from 919 adults aged 20-89 years systematically sampled from household registration cards from the Primary Health Care Center. The sample size was calculated based on the MetS prevalence of 33.4% (d = 0.05 at a confidence level of 95%) (Özşahin *et al*, 2004). The study data were collected between 1 May and 31 August 2009. Speaking and understanding Turkish were eligibility criteria. Exclusion criteria were: psychiatric diagnoses, dementia, drug addiction or a severe somatic or disabling life-threatening disease.

Data collection tools

A descriptive characteristics questionnaire, and the Epworth Sleepiness Scale (ESS) were used as data collection tools.

Descriptive characteristics questionnaire

This questionnaire consisted of three parts: socio-demographic characteristics of the patient, factors that affect sleep (tea, coffee and alcohol intake) and the criteria of metabolic syndrome.

The daily intake of tea or coffee was assessed by asking how many cups of tea or coffee the participants consumed per day. The criterion for drinking tea was five 100 ml glasses of tea per day (Hindmarch *et al*, 2000; Gardner *et al*, 2007). Since coffee contains more caffeine one to two cups of coffee consumed daily was the criterion for drinking coffee. The criterion for alcohol drinking was at least 3-4 beers or other alcoholic beverages per week. People who drank alcohol less than this were included in the non-drinkers group.

Epworth Sleepiness Scale (ESS)

The ESS is a self-administered eight-item questionnaire that has been proposed as a simple method for measuring daytime sleepiness in adults (Johns, 1991). The reliability and validity of the Turkish version of ESS was evaluated by Ağargün *et al* (1999). The inner consistency of the scale was high for the eight different states (Cronbach's α=0.80). In the present study, participants with an ESS score of ≥10 were considered to have EDS (Johns, 1991; Dixon *et al*, 2007).

Measurements performed to identify the criteria of MetS

According to the International Diabetes Federation (IDF) a person with

MetS must have central obesity [defined as a waist circumference (WC) ≥94 cm for European men and ≥80 cm for European women] plus two or more of the following four characteristics: 1) a triglyceride level ≥150 mg/dl or undergoing treatment for this lipid abnormality; 2) a HDL-C level <40 mg/dl in men and <50 mg/dl in women or undergoing treatment for this lipid abnormality; 3) a systolic blood pressure (SBP) ≥130 mmHg or a diastolic blood pressure (DBP) ≥85 mmHg or unergoing treatment for hypertension, and 4) a fasting plasma glucose (FBG) level ≥100 mg/dl or having been previously diagnosed with type 2 diabetes (Özsahin *et al*, 2004; Gemalmaz *et al*, 2008; Lin *et al,* 2009).

Body weight, height, and waist circumference

Body weights of participants were checked wearing light summer clothes (±100 g). Heights were measured while standing. Body mass index (BMI) was calculated as weight (kg) divided by height squared (m) (Gemalmaz *et al*, 2008; Lin *et al,* 2009). The waist circumference (cm) was measured at least 2 hours after a meal with the participant standing upright using a Gulick tape measure at the midpoint between the inferior border of the costal margin and the iliac crest.

Blood pressure, blood glucose and blood fat

The blood pressures of participants were measured using a mercury sphygmomanometer (F. Boch Primarius) following normal methods (Berman *et al,* 2008) after the participants had rested for at least 10 minutes and were in a sitting position. Twelve-hour fasting blood samples were obtained for triglycerides, HDL-C, and FBG and analyzed using a Reflotron Analyzer with a Roche kit (calibration: Roche, Bohemia, NY).

Data collection and ethical approval

The data collection forms were completed using a face-to-face interview technique. Legal approval was obtained from the Local Health Authority of Aydin and from the Governorship of Aydin. The study was approved by the Ethics Committee of the Faculty of Medicine. The study was financially supported by the Scientific Research Unit of the University (project protocol no.ASYO,09001). All participants gave informed written consents prior to participating in the study.

Data analysis

Statistical analysis was conducted using SPSS for Windows (version 15.0; SPSS, Chicago, IL). The data were expressed as means (with SD) or numbers (with percentages). ESS scores were given a binary score (0-9 = 0; and 10-24 =1) (Johns, 1991; Dixon *et al,* 2007). Logistic regression analysis (enter method) was conducted for each variable to determine variables for the model. The Wald test was used to evaluate the contribution of each variable to the model at each stage of construction. A nominal significance level ($p< 0.25$) was used as the criterion to be included in the model (Bendel and Afifi, 1997). Age, gender, tea or coffee consumption, WC and BMI were the independent variables with statistically significant relationships according to the Wald test. Tea or coffee consumption had a negative effect on sleep. Drinking tea or coffee was included in logistic regression analysis as single variable. The designated independent variables were again re-tested by the backward LR elimination method. Statistical significance was defined as $p<0.05$ for the backward LR elimanition method.

RESULTS

The characteristics of the participants

Table 1
Descriptive characteristics of study subjects (*N*=508).

Descriptive characteristics	
Age, years (Mean±SD)	46.3 ± 17.3
Gender, *n* (%)	
Male	259 (51.0)
Female	249 (49.0)
Marital status, *n* (%)	
Single	98 (19.3)
Married	410 (80.7)
Education status, *n* (%)	
Illiterate	73 (14.4)
≤8 years education	350 (68.9)
≥11 years education	85 (16.7)
Occupation, *n* (%)	
Unemployed	329 (64.7)
Farmer or self-employed	61 (12.0)
Government officer	11 (2.2)
Workers (mine workers)	107 (21.1)
Alcohol intake, *n* (%)	
Non-drinker	465 (91.5)
Regular drinker	43 (8.5)
Tea consumption, *n* (%)	
Non-consumer	19 (3.7)
Consumer	489 (96.3)
Coffee consumption, *n* (%)	
Non-consumer	433 (85.2)
Consumer	75 (14.8)
Metabolic syndrome	
No	350 (68.9)
Yes	158 (31.1)
BMI (Mean±SD)	27.0 ± 5.4
WC (Mean±SD)	90.0 ± 19.0
FBG (Mean±SD)	103.7 ± 26.4
HDL-C (Mean±SD)	48.8 ± 11.8
Triglicerides (Mean±SD)	153.6 ± 76.6
SBP mm Hg (Mean±SD)	127.1 ± 19.7
DBP mm Hg (Mean±SD)	83.4 ± 37.1
Epworth Sleepiness Scale score	
Mean±SD *n* (%)	5.0 ± 4.4
> 10 *n* (%)	74 (14.6)
< 10 *n* (%)	434 (85.4)

SD, standard deviation; WC, waist circumference; BMI, body mass index; FBG, fasting plasma glucose; HDL, high-density lipoprotein; SBP, systolic blood pressure; DBP, diastolic blood pressure.

are shown in Table 1. The mean age of the participants was 46.3 ± 17.3 years; 51% of participants were males and 49% were female. Eight point five percent of participants were regular alcohol drinkers. The majority of participants drank tea daily and a small number were not coffee drinkers (3.7%). MetS was present in 31.1% (*n*=158) of participants. The prevalence of EDS was 14.6%. The mean BMI was 27.0 ± 5.4 and the mean WC was 90.0± 19.0 cm. The mean fasting glucose level was 103.7 ± 26.4 mg /dl. The mean SBP was approximately 127 ± 20 mm Hg and the mean DBP was 83 ± 37 mm Hg.

Baseline characteristics of participants with and without EDS are shown in Table 2. The mean age of participants who reported EDS was 52.9 ± 19.3 years. EDS was reported by 15.1% of men and 14.1% of women. EDS was reported by 13.7% of regular tea drinkers and 10.7% of regular coffee drinkers. About 14.0% of regular alcohol drinkers and 14.6% of non-drinkers had EDS. The mean WC of participants with EDS was 90.2 ± 13.2 cm. The mean BMI of participants who reported EDS was 27.6 ± 6.0.

The outcomes of single variable logistic regression analysis are presented in Table 3. Age (OR 1.035; 95% CI 1.01-1.053), being a male (OR 0.556; 95% CI 0.281-1.10), not drinking tea or coffee (OR 6.610; 95% CI 2.18-20.0), BMI (OR 1.145; 95% CI 1.03-1.27) were significantly associated with EDS. WC and EDS inversely proportional (OR 0.954; 95% CI 0.91-0.99). Logistic regression analysis revealed glucose, HDL-C, triglycerides, SBP and DBP were not associated with EDS (Table 3).

These variables were then included in a backward logistic regression analysis to identify predictors of EDS (Table 4). Only age, BMI and not drinking tea or coffee

Table 2
Baseline characteristics of study participants with and without excessive daytime sleepiness (*N*=508).

Descriptive characteristics	No EDS (*n*=434)	EDS (*n*=74)
Age, years (Mean±SD)	45.1 (16.7)	52.9 (19.3)
Gender, *n* (%)		
Male	220 (84.9)	39 (15.1)
Female	214 (85.9)	35 (14.1)
Alcohol intake, *n* (%)		
Non-drinker	397 (85.4)	68 (14.6)
Regular drinker	37 (86.0)	6 (14.0)
Tea consumption, *n* (%)		
Non-consumer	12 (63.2)	7 (36.8)
Consumer	422 (86.3)	67 (13.7)
Coffee consumption, *n* (%)		
Non-consumer	367 (84.8)	66 (15.2)
Consumer	67 (89.3)	8 (10.7)
Metabolic syndrome		
No	302 (86.3)	48 (13.7)
Yes	132 (83.5)	26 (16.5)
WC (Mean±SD)	89.9 (20.2)	90.2 (13.2)
BMI (Mean±SD)	27.0 (5.4)	27.6 (6.0)
FBG (Mean±SD)	103.0 (26.3)	104.9 (26.7)
HDL (Mean±SD)	48.6 (12.0)	49.9 (10.9)
Triglicerides (Mean±SD)	153.4 (78.7)	154.4 (63.4)
SBP mm Hg (Mean±SD)	127 (20)	130 (20)
DBP mm Hg (Mean±SD)	83 (40)	84 (10)

SD, standard deviation; EDS, excessive daytime sleepiness; WC, waist circumference; BMI, body mass index; FBG, fasting plasma glucose; HDL, high-density lipoprotein; SBP, systolic blood pressure; DBP, diastolic blood pressure

were significantly associated. For every 1.0 kg/m^2 increase in BMI, the odds ratio for EDS increased 1.14 fold (95% CI 1.03-1.26), and for every 1-year increase in age the odds increased by 1.03 fold; (95% CI 1.01-1.04). EDS was significantly higher among non-tea and non-coffee drinkers than tea and coffee drinkers (OR 6.189; 95% CI 2.10-18.2).

DISCUSSION

The majority of studies regarding OSA and EDS have been conducted in Western countries (Resta *et al*, 2003; Bixler *et al*, 2005). EDS affects has been estimated to affect from 8.7% (Bixler *et al*, 2005) to 20% (Pagel, 2009) of the population. There is paucity of data regarding this from Turkey and little research about EDS. EDS was reported by 14.6% of people in our study, showing a high prevalence, indicating this is an important health problem in this population.

The finding that BMI is associated with EDS is consistent with the results of other studies (Vgontzas *et al*, 2000; Bixler

Table 3
Wald test, odds ratios, 95% confidence intervals for each of the variables included in the logistic model with the dependent variable daytime sleepiness.

Independent variables[a]	B	SE	Wald	*p*	OR for Exp(B)	95% CI
Age (years)	0.035	0.009	15.538	0.000[b]	1.04	(1.01-1.05)
Female	-0.587	0.348	2.843	0.092[b]	0.56	(0.28-1.10)
Alcohol drinkers	0.213	0.502	0.181	0.671	1.24	(0.46-3.30)
Non-tea and coffee drinkers	1.889	0.565	11.157	0.001[b]	6.61	(2.18-20.0)
With metabolic syndrome	-0.010	0.371	0.001	0.978	0.99	(0.47-2.04)
WC	-0.047	0.022	4.751	0.029[b]	0.95	(0.91-0.99)
BMI	0.135	0.053	6.592	0.010[b]	1.15	(1.03-1.27)
FBG	-0.002	0.005	0.138	0.710	1.00	(0.98-1.0)
HDL	0.000	0.012	0.000	0.985	1.00	(0.97-1.02)
Triglycerides	0.000	0.002	0.008	0.929	1.00	(0.99-1.0)
SBP	-0.002	0.008	0.067	0.796	1.00	(0.98-1.0)
DBP	-0.001	0.005	0.014	0.905	1.00	(0.99-1.0)
Constant	-2.216	1.426	2.413	0.120	0.11	

[a]refferent variable(s) on step 1: male, non-alcohol drinkers, coffee and tea drinkers, subject without metabolic syndrome
B, beta; SE, standard error; OR, odds ratio; CI, confidence interval; WC, waist circumference; BMI, body mass index; FBG, fasting plasma glucose; HDL, high-density lipoprotein; SBP, systolic blood pressure; DBP, diastolic blood pressure
[b]$p<0.25$

et al, 2005; Kim and Young, 2005; Dixon *et al*, 2007; Chasens *et al*, 2009; Rusu *et al*, 2011). EDS is a frequent complaint among obese people (Vgontzas *et al*, 2000; Resta *et al*, 2003). Vgontzas *et al* (1998) reported obese patients can be sleepier than normal-weight controls during the daytime. These findings suggest obesity is a risk factor for EDS. The pathophysiological mechanism for sleep disturbance among obese patients without OSAS (Resta *et al*, 2003) is unclear (Resta *et al*, 2003; Lam and Ip, 2010). It may be related to the mechanical effects of obesity (Resta *et al*, 2003), circadian or metabolic abnormalities of obesity (Vgontzas *et al*, 1998; Resta *et al*, 2003; Bixler *et al*, 2005).

In our study, there was a negative association between WC and EDS. Other research suggests WC is significantly associated with SDB severity (Carmelli *et al*, 2000; Rusu *et al*, 2011). Our results are different from other research regarding WC and EDS (Carmelli *et al*, 2000; Rusu *et al*, 2011). The association between EDS and the apnea/hypopnea index has been shown to be weak (Resta *et al*, 2003). The pathophysiology of sleep apnea remains obscure (Vgontzas *et al*, 2000; Resta *et al* 2003; Bixler *et al*, 2005) and the clinical consequences of excessive EDS are not known (Resta *et al*, 2003). In our study several factors may have contributed to EDS. It may be related to other factors, such as circadian abnormalities. Namely, one of the main causes of EDS is insufficient quality or quantity of a good night sleep. Ambient temperature is an important

Table 4
Results of logistic regression analysis with backward LR elimination method for ESS.

Independent variables[a]	B	SE	Wald	*p*	OR for Exp(B)	95% CI
Age (years)	0.033	0.008	17.477	0.000[a]	1.03	(1.01-1.04)
Female	-0.615	0.321	3.670	0.055	0.54	(0.29-1.01)
Non-tea and coffee drinkers	1.823	0.551	10.950	0.001[a]	6.19	(2.10-18.2)
WC	-0.049	0.021	5.384	0.020[a]	0.95	(0.91-0.99)
BMI	0.134	0.052	6.521	0.011[a]	1.14	(1.03-1.26)
Constant	-2.460	0.933	6.953	0.008	0.09	

a: refferent variable(s) on step 1: male, coffee and tea drinkers
B, beta; SE, standard error; OR, odds ratio; CI, confidence interval; WC, waist circumference; BMI, body mass index
[a]$p<0.05$

factor in human sleep. This research was done in a hot city. The higher temperature at night might have resulted in a reduced total sleep time and increased sleep disruption (Sinha, 2004).

Reduced total sleep time can cause EDS (Van Cauter and Sp1egel, 1999; Sinha, 2004; Nastos and Matzarakis, 2008). The most common cause of EDS is insufficient sleep, which may reflect poor sleep hygiene or socially dictated sleep deprivaton (Guilleminault and Brooks, 2001).

Our results show increasing age is a risk factor for EDS. This has been reported by other studies (Mallon and Hetta, 1997; Mitty and Flores, 2009). EDS among the elderly may arise from a variety of causes, such decreased physical activity, a sedentary lifestyle (Gooneratne *et al*, 2003; Williams *et al*, 2007), a change in circadian rhythms, a change in social patterns and death of a spouse, close friend or relative (Foley *et al*, 1995). In our study, decrease in daily functioning might be cause of EDS. In Turkey's culture, a large proportion of older adults spend time in passive activities, such as resting, viewing television or listening to the radio. Elderly people generally not do house work.

Caffeine is known to increase alertness (Hindmarch *et al*, 2000, Gardner and Ruxton, 2007). Hindmarch *et al* (2000) found tea negatively affects sleep quality, time to fall asleep, and duration of sleep, similar to coffee. In the present study, daytime sleepiness was significantly higher among participants who did not drink black tea and did not drink coffee. Based on our results, drinking tea can be considered as a stimulating factor that affects falling asleep. Drinking tea or coffee reduces daytime sleepiness.

Although previous studies have shown a relationship between the duration of sleep, sleep disorders (especially snoring) and triglyceride and HDL-cholesterol levels (Williams *et al*, 2007) and blood glucose levels (Spiegel *et al*, 2005; Shaw *et al*, 2008; Bopparaju and Surani, 2010), the present study found no association between HDL-cholesterol, triglyceride, blood glucose, SBP, DBP, most socio-demographic characteristics (except age), and EDS. EDS may be influenced by several factors, such as unhealthy lifestyle. EDS in our study was self-reported.

One study comparing severity of sleep disorders and measures of EDS with the Epworth Sleepiness Scale found a weak or no association (Fong *et al*, 2005).

The present study had some limitations. There may be other determinants of EDS. EDS was evaluated by self-reports who may not have accurately reported their symptoms. It is difficult to assess EDS by diagnostic tests, because it is time consuming and expensive. Further research should focus on other causes for EDS.

In conclusion, the results of the present study reveal an increase in BMI and increasing age were associated with EDS. Non-coffee and non-tea drinkers were also more likely to have EDS.

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