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ORIGINAL ARTICLE

Prevalence of sleep apnea-related symptoms in a Persian population

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Abstract
Purpose There are no published data regarding the prevalence of obstructive sleep apnea (OSA) in Iran. The purpose of this cross-sectional study was to identify individuals with a high likelihood to suffer from obstructive sleep apnea in the Persian population. This was compared to similar studies in other countries.

Materials and methods As a part of a population-based cross-sectional study, 3,600 randomly selected individuals aged 18 years or more, were invited to take part in the survey, 3,529 individuals (98%) agreed to fill out the Berlin sleep questionnaire.

Results Based on the Berlin Criteria, 176 subjects (4.98%) were identified as suspicious for OSA. This group consisted of 74 (42%) males and 102 (58%) females. The prevalence of high-risk Berlin in men and women were not significantly different with chi-square test ($p>0.2$). But high-risk Berlin subjects also were increasing with age ($p<0.001$) and increasing with obesity ($p<0.001$) and decreasing with higher education ($p<0.001$) with chi-square test. Predictors of high risk for OSA-related symptoms were female sex, age more than 50 years, and body mass index.

Conclusions We identified persons with a high risk for OSA among a representative Iranian sample. It is concluded that the prevalence of sleep apnea syndrome symptoms is lower in our population as compared with western countries which can be attributed to the excessively young Iranian population.

Keywords Sleep apnea · Epidemiology · Iran · Isfahan

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Introduction

OSA is a disorder with a high prevalence characterized by instability of the upper airways during sleep, which results in markedly reduced (hypopnea) or absent (apnea) airflow at the nose/mouth [1]. The airflow limitation episodes are usually accompanied by hemoglobin desaturation, which are usually terminated by brief micro-arousals as result of excessive respiratory drive caused by the ongoing hypox-

emia [1]. The mentioned micro-arousals result in sleep fragmentation and diminished time of slow wave and REM sleep as recorded in EEG [1].

During the past few decades, considerable attention has been paid to the sleep disordered breathing and its burden to population and also individual health.

Many epidemiological studies assessing the prevalence of sleep apnea syndrome have been carried out in representative community samples of various developed countries [2–6]; however, less effort has been made to figure out such data from developing countries.

According to the mentioned studies, OSA is impressively prevalent in countries such as the USA [2, 3], Australia [5], Hong Kong [7], Korea [8], and India [9]. In one study using Berlin sleep questionnaire, risk of OSA was reported to be as high as 26% in a US-selected population [10]. While scarce, Asian data show significantly lower levels of OSA prevalence to be near 7.5% [11].

The methodology of the studies is different in various reports which make the interpretation of the data difficult. Therefore, new epidemiologic studies using a uniform methodology including a standardized questionnaire are needed.

Valid data on the prevalence of OSA in Iran are not published.

The aim of this study is to clarify the prevalence of symptoms specific for OSA in Isfahan, Iran.

Subjects and methods

We conducted a population-based cross-sectional study on a randomly selected population aged 18–70 years living in urban areas of Isfahan–Iran.

The review board for medical ethics at the Isfahan medical school approved the study and methods.

Isfahan is a large metropolitan city situated in the center of Iran. Isfahan has a population of almost two million (1,986,542 in 2006; men 1,017,940, women 968,602) spread over an area of 107,000 km^2. Of the inhabitants, 32.4% were <20 and 7.6% were aged 60 or older in 2006 [12]. The population structure and socioeconomic status of Isfahan are similar to other parts of the country.

The Isfahan urban area was divided into 100 smaller areas. Then, we randomly selected one lane from each area, by drawing lots, and all the doors of the living places of the selected lanes were knocked by trained interviewers. All available inhabitants 18 years of age or older were invited to take part in an interview and to complete the Persian translation of Berlin questionnaire.

After the interview, body size and weight were assessed, and the corresponding body mass index (BMI) was calculated.

Interview questionnaire

The survey instrument was a standardized Berlin questionnaire which is regarded as a validated tool that predicts sleep apnea risk [13] translated to Persian by the project's working group and then translated back to English by a noninvolved person to ensure the validity of translation.

The Berlin Questionnaire is a ten-item questionnaire [13], divided in three categories according to symptoms:

- Snoring
- Sleepiness or chronic fatigue
- Presence of hypertension or obesity defined as BMI above 30 kg/m^2

A subject is considered to have a high risk for OSA if he is positive in any two of the categories. Being in the high-risk group predicted an AHI>5/h with a sensitivity of 0.86, a specificity of 0.77, and a positive predictive value of 0.89 [13].

The frequencies of sleep disordered breathing were graded as: never, rarely, often (one to two nights a week), habitual (3–5 nights a week) and always (every night).

Statistical analysis

A few cases with missed weight and a case with missed education data were kept in the series.

Numeric variable measurements are presented as mean ± SD. Categorical variables are presented as percentages.

Relationships among the data were examined by chi-square test.

A logistic regression model was employed to assess the association between high-risk Berlin and the following risk factors: age, sex, body mass index, and education.

Results

Demographic characteristics of the study population enrolled in the study are presented in Table 1.

Out of a total of 3,600 available participants, 71 subjects did not agree to take part and were excluded from final analysis. So, a total of 3,529 subjects were interviewed.

The study sample comprised 1,649 men (46.7%) and 1,880 women (53.3%).

More than one third of the population was younger than 30 years.

Nearly one third of all subjects had junior high school degrees or less.

Cigarette smoking was prevalent in 22.3% of males and 3% of the females.

Table 1 The distribution of demographic, anthropometric, smoking, and education characteristics

Specificities	Males	Females	Total
Total number	1,649 (46.7%)	1,880 (53.3%)	3,529 (100%)
Age (mean±SD) years	40.47±17.29	38.61±15.6	
Age categories			
18–29 years	606 (36.7%)	686 (36.5%)	1,292 (36.6%)
30–39 years	288 (17.5%)	375 (19.9%)	663 (18.8%)
40–49 years	239 (14.5%)	338 (18%)	577 (16.4%)
50–59 years	236 (14.3%)	253 (13.5%)	489 (13.9%)
60 and more years	280 (17%)	228 (12.1%)	508 (14.4%)
Height (mean±SD) cm	171.23±9.23	159.38±8.53	
Weight (kg)	71.94±12.17	64.04±12.58	
BMI	25.05±2.13	26.39±4.77	
Normal weight (BMI 25 or less)	977 (59.4%)	939 (50.7%)	1,916 (54.8%)
Over weight (BMI >25<30)	526 (32.0%)	604 (32.6%)	1,130 (32.3%)
Obese (BMI >30)	142 (8.6%)	310 (16.7%)	452 (12.9%)
Total	1,645 (47.02%)	1,853 (52.98%)	3,498 (100%)[a]
Ever smoker	368 (22.3 %)	63 (3.03%)	431 (12.2%)
Ever passive smoker	417(25.2%)	463 (24.6%)	880 (24.9%)
Education			
Junior high school or less	454 (27.5%)	665 (35%)	1,119 (31.7%)
High school	826 (49.7%)	799 (42.2%)	1,625 (45.8%)
University	369 (22.4%)	415 (22.1%)	784 (22.2%)
Total	1,649 (46.75%)	1,879 (53.25%)	3,528 (100%)[b]

BMI body mass index

[a] Weight for 31 cases had not been recorded

[b] Education had not been recorded for one subject

The age, educational, and smoking pattern of our population are relatively the same as the total population of Iran; however, in our series, the percentage of women is a little more than men. And also, percentage of people older than 60 years is little more than the Iranian population.

Half of the participants were overweight or obese.

Snoring alone was a common finding and was reported in 1,048 (29.7%) subjects.

One hundred seventy-six (4.98%) Participants assumed to have a high risk for OSA.

Comparison of each factor for each subgroup in high-risk Berlin versus low-risk Berlin subjects is presented in Table 2.

Table 2 Comparison of risk factors in each subgroups in high risk berlin versus low risk berlin

Characteristics of subjects		Risk		*P* value
		Low risk	High risk	
Age categories	18–29	1,286 (38.4%)	6 (3.4%)	<0.001
	30–39	638 (19%)	25 (14.2%)	
	40–49	538 (16.1%)	39 (22.2%)	
	50–59	440 (13.1%)	49 (27.8%)	
	60 and over	450 (13.4%)	58 (32.4%)	
Sex	Female	1,778 (53%)	102 (58%)	>0.2
	male	1,574 (47%)	74 (42%)	
BMI	Normal	1,900 (57.2%)	16 (9.1%)	<0.001
	Over weight	1,111 (33.5%)	19 (10.8%)	
	Obese	311 (9.4%)	141 (80.1%)	
Education	junior high school or less	1,004 (30%)	115 (65.3%)	<0.001
	Senior High school	1,576 (47%)	49 (27.8%)	
	University graduate	772 (23%)	12 (6.8%)	
Smoking	Ever smoker	401 (11.9%)	30 (17%)	>0.05
	Ever passive smoker	835 (24.9%)	45 (25.6%)	
	Nonsmoker	2,103 (94.9%)	115 (5.1%)	

P values had been derived by chi-square test

Table 3 Predictors of high-risk Berlin subjects for OSA

Variables	Odds ratio (95% CI)	*P* value
Sex (male)	0.6 (0.41–0.89)	0.012
Female reference	1	
Age (18–29) years	0.10 (0.03–0.25)	0.000
Age (30–39) years	0.44(0.24–0.81)	0.009
Age (40–49) years	0.58(0.34–0.99)	0.04
Age (50–59) years	0.83(0.51–1.36)	0.47
Age (over 60 years) reference	1	
BMI normal	0.02(0.01–0.04)	0.000
BMI overweight	0.36(0.02–0.05)	0.000
BMI (obese) reference	1	
Junior high school or less education	1.52(0.74–3.11)	0.24
Senior high school education	0.88(0.43–1.78)	0.73
University education reference	1	

Multivariate logistic regression analysis: $P<0.05$ considered as a cutoff point for significance

BMI body mass index

There was no difference between the two groups for smoking.

Table 3 lists the odds ratio (OR) and 95% confidence intervals (CIs) for high risk for sleep apnea in relation to sex, age, weight, and education. Female sex, age above 50 years, and obesity were associated with increased risks of sleep apnea symptoms.

People with higher level education were significantly less overweight than the less-educated citizens. The relationship between education and body mass index are shown in Table 4.

Discussion

The present study represents the first population-based survey trying to estimate prevalence of OSA in a large Persian population.

The response rate differences between two genders did not seem to significantly affect the results.

We believe that our population sample is close to Persian total population because of our random selection manner and also because the characteristics of the population do agree with other reported series [12].

In a few cases, data regarding weight or education had been missed resulting in minimal discrepancies when looking at total number of cases; these case were not omitted because their inclusion could not affect the results.

Our study represents a crude estimated prevalence rate of 4.98% of sleep apnea symptoms in our population, which is lower than reported in the US population based study presented on The National Sleep Foundation poll, using the Berlin questionnaire [10], and it is lower than prevalences reported for Pakistan [14] and Jordan [15].

Despite the most published data [16], frequency of high-risk Berlin cases in our study is significantly higher in women than in men; this paradoxical finding is most probably due to denial of male subjects regarding their snoring, since snoring is a shame in Persian culture and most men do not admit to have it, but women are perhaps more honest reporters. This may imply that in Persian men suspected to have OSA, the snoring history is better to be reported by wives.

The Berlin questionnaire used in this study is a widely used, simple, validated tool for the prediction of sleep apnea risk [17].

In the present study, the frequency of subjects at high risk for OSA, as defined by Berlin questionnaire, regularly increases with age. Such a finding had been frequently reported in most of the published studies [18]. Age 50 years or more is a significant predictor of OSA in our series.

Most patients with OSA are obese, and a close association between BMI and OSA in adults has been noted in different studies [19]. Obesity has been shown to be directly related to the severity of the disease [19]. In our study, around 90% of high-risk persons for sleep apnea were overweight and obese. This significant association

Table 4 Distribution of obesity among different educational group

	Normal	Overweight	Obese	Total	*P* value
Junior high school	447 (40.27%)	431 (38.82%)	232 (20.91%)	1,110 (100%)	0.00
Senior high school	925 (57.49%)	500 (30.08%)	184 (11.44%)	1,609 (100%)	
University	544 (69.83%)	199 (25.55%)	36 (4.62%)	779 (100%)	
Total	1,916 (54.8%)	1,130 (32.3%)	452 (12.9%)	3,498 (100%)	

P values had been derived by chi-square test

was confirmed both in chi-square and in logistic regression analysis.

Despite significant association between education and OSA by chi-square test, when this finding was tested in logistic regression analysis, the significance vanished. It seems that the more educated in our community might have some different protective factors related to their body fitness; in fact, chi-square test disclosed a significant association between lower education and obesity (Table 4).

There are several possible explanations for the lower prevalence of high-risk subjects in our group:

> First of all is the fact that our population is younger than most reported series, a finding that can reduce the number of the affected persons.
>
> A second explanation is that most of the subject information was obtained from self-assessment questionnaires that might be affected by recall bias, misclassification, and incomplete information.

Since the gold standard for diagnosis of OSA is cardiorespiratory polysomnography, in the second phase of our study, which is undergoing, we continue our study by inviting suspected subjects and also some controls for polysomnography.

In conclusion, the Iranian adult population exhibited a lower prevalence rate for sleep apnea symptoms than those of western countries and was close to earlier reports of a sample of the Jordan population. Among a variety of risk factors, obesity, older age, and female sex were associated with increased risks of sleep apnea symptoms. The present study provided plausible findings on the sleep apnea symptoms of a population in Iran.

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References

1. McNicholas WT (2008) Diagnosis of obstructive sleep apnea in adults. Proc Am Thorac Soc 5:154–160
2. Bixler EO, Vgontzas AN, Lin HM, Ten HT, Rein J, Vela-Bueno A, Kales A (2001) Prevalence of sleep-disordered breathing in women: effects of gender. Am J Respir Crit Care Med 163(3 Pt 1):608–613
3. Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S (1993) The occurrence of sleep-disordered breathing among middle-aged adults. N Engl J Med 328:1230–1235
4. Bearpark H, Elliott L, Grunstein R, Hedner J, Cullen S, Schneider H, Althaus W, Sullivan C (1993) Occurrence and correlates of sleep disordered breathing in the Australian town of Busselton: a preliminary analysis. Sleep 16(8 Suppl):S3–S5
5. Bearpark H, Elliott L, Grunstein R, Cullen S, Schneider H, Althaus W, Sullivan C, Snoring and sleep apnea (1995) A population study in Australian men. Am J Respir Crit Care Med 151(155):1459–1465
6. Brunetti L, Rana S, Lospalluti ML, Pietrafesa A, Francavilla R, Fanelli M, Armenio L (2001) Prevalence of obstructive sleep apnea syndrome in a cohort of 1, 207 children of southern Italy. Chest 120(6):1930–1935
7. Ip MS, Lam B, Lauder IJ, Tsang KW, Chung KF, Mok YW, Lam WK (2001) A community study of sleep-disordered breathing in middle-aged Chinese men in Hong Kong. Chest 119(1):62–69
8. Kim J, In K, Kim J, You S, Kang K, Shim J, Lee S, Lee J, Lee S, Park C, Shin C (2004) Prevalence of sleep-disordered breathing in middle-aged Korean men and women. Am J Respir Crit Care Med 170(10):1108–1113
9. Udwadia ZF, Doshi AV, Lonkar SG, Singh CI (2004) Prevalence of sleep-disordered breathing and sleep apnea in middle-aged urban Indian men. Am J Respir Crit Care Med 169(2):168–173
10. Hiestand DM, Britz P, Goldman M, Phillips B (2006) Prevalence of symptoms and risk of sleep apnea in the US population: Results from the national sleep foundation sleep in America 2005 poll. Chest 130(3):780–786
11. Lam B, Lam DC, Ip MS (2007) Obstructive sleep apnoea in Asia. Int J Tuberc Lung Dis 11(1):2–11
12. Aminorroaya A, Janghorbani M, Amini M, Hovsepian S, Tabatabaei A, Fallah Z (2009) The prevalence of thyroid dysfunction in an iodine-sufficient area in Iran. Arch Iran Med 12(3):262–270
13. Netzer NC, Stoohs RA, Netzer CM, Clark K, Strohl KP (1999) Using the Berlin questionnaire to identify patients at risk for the sleep apnea syndrome. Ann Intern Med 131(7):485–491
14. Taj F, Aly Z, Arif O, Khealani B, Ahmed M (2009) Risk for sleep apnea syndrome in Pakistan: a cross-sectional survey utilizing the Berlin questionnaire. Sleep Breath 13(1):103–106
15. Khassawneh B, Ghazzawi M, Khader Y, Alomari M, Amarin Z, Shahrour B, Hammouda M (2009) Symptoms and risk of obstructive sleep apnea in primary care patients in Jordan. Sleep Breath 13(3):227–232
16. Jordan AS, McEvoy RD (2003) Gender differences in sleep apnea: epidemiology, clinical presentation and pathogenic mechanisms. Sleep Med Rev 7(5):377–389
17. Blondet M, Yapor P, Latalladi-Ortega G, Alicea E, Torres-Palacios A, Rodriguez-Cintron W (2009) Prevalence and risk factors for sleep disordered breathing in a Puerto Rican middle-aged population. Sleep Breath 13(2):175–180
18. Eikermann M, Jordan AS, Chamberlin NL, Gautam S, Wellman A, Lo YL, White DP, Malhotra A (2007) The influence of aging on pharyngeal collapsibility during sleep. Chest 131(6):1702–1709
19. Fritscher LG, Mottin CC, Canani S, Chatkin JM (2007) Obesity and obstructive sleep apnea-hypopnea syndrome: the impact of bariatric surgery. Obes Surg 17(1):95–99