Original Research

Insomnia and Its Related Factors in Elderly Population of Tehran, Iran

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Received: 24 Jan. 2020 Accepted: 01 Aug. 2020

Abstract

Background and Objective: The present study aimed to determine the prevalence of insomnia and its related factors among elderly population of Tehran, Iran.

Materials and Methods: This study was a cross-sectional descriptive study. Data were collected by a three-part questionnaire. The first part included demographic information; the second part contained data on weight, height, neck circumference, menstruation status, diabetes, hypertension (HTN), and heart disease. The third part contained questions about Insomnia Screening Questionnaire (ISQ). Cluster sampling was used and 651 samples were selected for the present study.

Results: The prevalence of insomnia was significantly higher in female, single, and illiterate subjects and also in subjects with chronic diseases, psychological disorders, circadian rhythm disorder, restless legs syndrome (RLS), parasomnia, and sleep apnea.

Conclusion: According to this study, insomnia is common among elderly population of Tehran, and there is a relationship between this disorder and chronic diseases, psychological disorders, and sleep disorders.

Keywords: Elderly; Insomnia; Sleep disorders; Circadian rhythm sleep disorder

Citation: Hassani S, Adimi Naghan P, Sadr M, Malekmohammad M, Setareh J, Seyedmehdi SM. **Insomnia and Its Related Factors in Elderly Population of Tehran, Iran.** J Sleep Sci 2020; 5(3): 101-110.

Introduction

About 35% of people have difficulties in starting sleep, maintaining sleep, waking up early, and feeling fatigue after waking up (1). Sleep physiology changes due to aging (2). Circadian rhythm changes, non-rapid eye movement (NREM) sleep reduction (stage 3 of slow-wave sleep), rapid eye movement (REM) sleep reduction, increased sleep disruption, psychosomatic factors, side effects of medications, and medical and clinical conditions affect sleep by aging (3, 4). As a result, the prevalence of sleep disorders in this age group increases (5), so that more than 50% of elderlies in the community and about two-thirds of them who live in health care centers have sleep disorders (3). Aging

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affects the progression, continuity, and treatment of sleep disorders (6). Inability to sleep leads to disorders in focusing, slower response time, and memory and concentration disorders. Slow response times affect one's ability to drive and results in impaired balancing and higher risk of falling. It also increases the possibility of death. In addition, the studies have shown that mortality caused by common causes, such as heart disease, stroke, cancer, and suicide, in elderlies with sleep disorders is twice as many as those without sleep disorders (6-8). Moreover, a decrease in focus and attention, fatigue, physical and mental exhaustion, reduced motivation, irritability, and interpersonal disorders lead to decrease in the life quality of elderlies with sleep disorders (7). Inadequate sleep makes people susceptible to chronic illnesses, such as cardiovascular disease (CVD), diabetes (9, 10), and psychological illnesses, especially anxiety and depression (8); and, as a result, decreasing productivity and increasing health care costs impose a high economic and social burden on society (1, 8, 11).

The percentage of the elderly population in the world is increasing, and the elderly population is expected to be doubled by 2040 (12).

Due to the few studies that have been conducted in this field, the present study aimed to determine the prevalence of insomnia and its related factors among the elderly population of Tehran, Iran, using proper, valid, and reliable tools to offer a platform for future studies and make appropriate interventions in relation to the remedial causes and thus promote the health and quality of life (QOL) of the elderly.

Materials and Methods

Participants: This study was a cross-sectional descriptive study. The studied samples were men and women over 60 years of age, who were selected from the Survey of "Adult Sleep Disorders Survey in Tehran". Another article related to this survey has been published previously (13). Cluster sampling was used. Initially, 216 clusters were selected from 22 municipality districts of Tehran, whose boundaries were determined by the municipality map and each cluster included 10 households. Then, in each cluster, a household was randomly selected as the head cluster, and 10 neighbors of that cluster were systematically selected in a clockwise direction. Finally, in each household, a man and a woman over 18 years old were interviewed. Totally, 4021 samples were collected. 651 data were used for the present study. Inclusion criteria included: age of 60 years or older, cognitive ability to understand the questionnaire, ability to answer questions, consent to participate in the study, and signing written consent.

Materials and procedure: Data were collected by a three-part questionnaire. The first part included demographic information; the second part contained data on weight, height, neck circumference, menstruation status, diabetes, hypertension (HTN), and heart disease. The third part contained questions about Insomnia Screening Questionnaire (ISQ). Face and content validity as well as reliability of the questionnaire were determined by the opinion of 5 sleep specialists in another study. In this study, the consistency of the questionnaire's questions, based on Cronbach's alpha of 0.79 was reported appropriate (14).

Ten interviewers were selected in this study who had at least a bachelor's degree and were trained on how to complete the questionnaires. They first measured the height of the samples by a tape measure, while the person was standing and leaning against the wall. Then they measured the samples' weight using a standard digital balance, which was calibrated after 10 times measuring by a 5-kg weight. Body mass index (BMI) was obtained through dividing weight in kg by the height in meters squared (kg/m^2). Finally, the interviewers taught participants how to fill the questionnaire, and after one hour, collected the questionnaires. It should be noted that in the case of illiterate samples, the questionnaires were completed with the help of the interviewer.

Ethical considerations: The present study was approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences, Tehran. All the necessary permissions for doing the research were obtained from the Research Vice-Chancellor. Participating or quitting the research was permitted in all research units and the participants signed written consent. The researchers maintained the confidentiality of the research units during all stages of the design.

Statistical analysis: Descriptive and analytical statistics were used for data analysis by SPSS software (version 22, IBM Corporation, Armonk, NY, USA). In all tests, the significance level of the two domains was less than 0.05. All questions of the ISQ (described below) had a 5-point Likert scale to answer, which included: never, monthly 1-2 times, weekly 1-2 times, weekly 3-4 times, and always I

have a problem. The questions were classified and scored based on the instructions of ISQ as follows:

***Probability of insomnia*:** Questions such as "Do you have trouble while sleeping?", "Have you ever woken up in the middle of a night's sleep?", "Do you feel fatigued and numb after waking up?", "Do you use medication or food to sleep?", "Have you ever used alcohol to sleep?", and "Does a particular illness disrupt your sleep?" were used to assess the probability of insomnia. The possibility of insomnia was raised in people who chose option 3, 4, or 5 in the questions.

***Probability of psychological disorders*:** The following questions were used to determine the possibility of psychological disorders: "Have you lost the interest in activities and entertainment?", "Do you feel sad, irritable, and hopeless?", "Do you feel angry and anxious?", and "Do you feel uncomfortable in some parts of your body?" Choosing option 4 or 5 in mentioned questions raised the possibility of psychological disorders and the necessity of further evaluations.

Probability of circadian rhythm disorder: The question "Is your sleep schedule regular?" was used to assess the circadian rhythm disorder. Choosing option 4 or 5 in the mentioned question indicated the possibility of circadian rhythm disorder.

***Probability of restless legs syndrome (RLS)*:** The question "Do you feel uncomfortable in your legs before sleeping?" was used to evaluate the probability of RLS. Choosing option 4 or 5 in the question indicated the possibility of RLS.

***Probability of parasomnia*:** The question "Do you have unusual movements or behavior during sleep?" was used to determine the possibility of parasomnia. Options 2, 3, 4, or 5 suggested the possibility of parasomnia.

***The probability of sleep apnea*:** According to the instruction of the questionnaire, if a person chooses options 3, 4, or 5 to answer two questions of "Have you ever been told you snore during sleep?" and "Did you notice it yourself or did anyone tell you that you had breath pauses during sleep?" or two questions of "Have you ever been told you snore during sleep?" and "Do you feel fatigued most of the day?", he/she will be categorized in the high-risk group of sleep apnea, and further evaluation is required.

Skewness and Kurtosis were evaluated to verify the normality of quantitative data. Descriptive statistics (mean and percentage) were used for data on demographic data. Chi-square test was used for qualitative data analysis, independent samples t-test was used for quantitative data analysis, and logistic regression model was used to predict the probability of insomnia disorder based on affective variables. There were binary logistic regression assumptions that included the binomial dependent variable and the existence of more than one independent variable; and the assumption of a linear relationship between continuous quantitative independent variables is beyond the scope of the present study.

Results

Table 1 shows the subjects' demographic and descriptive characteristics.

Table 1. Demographic and descriptive characteristics of the subjects

Variables		n (%)	Missing
Insomnia	No	299 (45.9)	11
	Yes	341 (52.4)	
Gender	Men	379 (58.2)	0
	Women	272 (41.8)	
Age (year)	60-74	548 (84.2)	0
	75-84	93 (14.3)	
	≥ 85	10 (1.5)	
Education	Illiterate	127 (19.5)	11
	Elementary school	236 (36.3)	
	High school	199 (30.6)	
	Above high school diploma	78 (12.0)	
Marital status	Married	585 (89.9)	9
	Single	29 (4.5)	
	Others	28 (4.3)	
BMI (kg/m^2)	< 18.5	9 (1.4)	17
	18.5-24.9	221 (33.9)	
	25-29.9	282 (43.3)	
	≥ 30	122 (18.7)	

BMI: Body mass index

The prevalence of insomnia in Tehran elderlies was 52.4%. In this study, 58.2% of the subjects were men and the rest (41.8%) were women. The mean age of men and women was 68.20 ± 7.07 and 66.19 ± 5.63 years, respectively. Age groups were defined as 60-74, 75-84, and more than 85 years (15). Due to the low number of elderlies over 85 years, age groups were divided into less and more than 75 years for statistical analysis. The World Health organization (WHO) classification was used to describe the status of BMI of the elderlies. Subjects with BMI < 18.5 kg/m^2 were considered as lean and subjects with BMI = 18.5-24.9 kg/m^2, BMI = 25-29.9 kg/m^2, and BMI > 30 kg/m^2 were considered as normal, overweight, and obese, respectively (16).

Table 2 shows the characteristics of the studied subjects with regard to whether they were involved in insomnia or not. Considering the gender [P < 0.0001, χ^2 (1) = 15.11], marital status [P = 0.020, χ^2 (1) = 5.38], education [P = 0.014, χ^2 (1) = 6.021], chronic illness [P < 0.0001, χ^2 (1) = 34.032], probability of psychological disorders [P < 0.0001, χ^2 (1) = 98.363], probability of circadian rhythm disorder [P < 0.0001, χ^2 (1) = 87.110], RLS [P < 0.0001, χ^2 (1) = 60.920], parasomnia [P < 0.0001, χ^2 (1) = 21.586], and the possibility of sleep apnea [P < 0.0001, χ^2 (1) = 32.847], there was a statistically significant difference between elderlies with insomnia and elderlies without it. The chi-square test was used to evaluate BMI in two groups of elderlies (with and without insomnia); there was no significant difference between insomnia in two groups with 30 < BMI < 30 kg/m^2. In addition, independent samples t-test was used to evaluate BMI. The mean BMI in subjects with and without insomnia was 26.93 ± 4.48 kg/m^2 and 26.44 ± 4.26 kg/m^2, respectively. Although BMI in the elderlies with insomnia was higher, it was not a statistically significant difference [P = 0.163, t (632) = -1.397].

Logistic regression was used to investigate the predictive effect of variables such as marital status, gender, education, chronic illness, probability of psychological disorders, probability of circadian rhythm disorder, probability of RLS, parasomnia, and the probability of sleep apnea on insomnia disorder among elderly participants in this study. The logistic regression model was statistically significant [χ^2 (9) = 177.452, P < 0.0001]. According to this model, 33.8% of insomnia variance can be explained by the independent mentioned variables (Nagelkerke R^2 = 33.8%). Data analysis showed that 71.9% of cases were classified correctly.

Table 2. Characteristics of the studied subjects, with or without insomnia, using chi-square test

Variable		Without insomnia	With insomnia	P-value	Crude OR	95% CI		Missing
		n (%)	n (%)			Lower bound	Upper bound	
Age (year)	< 75	259 (48.1)	279 (51.9)	0.0980	1.439	0.934	2.216	11
	≥ 75	40 (39.2)	62 (60.8)					
Gender	Men	198 (53.2)	174 (46.8)	< 0.0001	1.882	1.693	2.592	11
	Women	101 (37.7)	167 (62.3)					
Marital status	Married	287 (48.3)	297 (51.7)	0.0200	1.976	1.102	3.544	20
	Single	18 (32.1)	38 (67.9)					
Education	Educated	249 (49.5)	254 (50.5)	0.0140	1.648	1.103	2.461	22
	Illiterate	47 (37.3)	79 (62.7)					
Chronic illness	No	175 (59.1)	121 (40.9)	< 0.0001	2.566	1.864	3.532	11
	Yeas	124 (36.0)	220 (64.0)					
BMI (kg/m^2)	< 30	243 (48.3)	260 (51.7)	0.1060	1.392	0.931	2.081	26
	≥ 30	49 (40.2)	73 (59.8)					
Probability of psychological disorders	Low	256 (61.2)	162 (38.8)	< 0.0001	6.552	4.420	9.714	22
	High	41 (19.4)	170 (80.6)					
Probability of circadian rhythm disorder	Low	288 (55.6)	230 (44.4)	< 0.0001	14.887	7.378	30.038	17
	High	9 (8.7)	107 (92.2)					
RLS	Low	256 (5.5)	197 (43.5)	< 0.0001	4.501	3.035	6.674	15
	High	41 (23.4)	142 (77.6)					
Parasomnia	Low	286 (49.8)	288 (50.2)	< 0.0001	4.049	2.160	7.589	11
	High	13 (19.7)	53 (80.3)					
Sleep apnea	Low risk	240 (54.2)	203 (45.8)	< 0.0001	2.793	1.949	4.000	13
	High risk	58 (29.7)	137 (70.3)					

BMI: Body mass index; RLS: Restless legs syndrome; OR: Odds ratio; CI: Confidence interval

Table 3. Risk factors related to insomnia in the elderlies, using binary logistic regression test

Variable		P-value	Adjusted OR	95% CI	β
Gender	Men	-	1	-	-
	Women	0.744	1.070	0.712-1.607	0.068
Marital status	Married	-	1	-	-
	Single	0.024	2.210	1.108-4.409	0.793
Education	Educated	-	1	-	-
	Illiterate	0.448	1.208	0.741-1.968	0.189
Chronic illness	No	-	1	-	-
	Yes	0.005	1.710	1.171-2.498	0.537
Probability of psychological disorders	Low	-	1	-	-
	High	< 0.001	3.008	1.923-4.703	1.101
Probability of circadian rhythm disorder	Low	-	1	-	-
	High	< 0.001	6.968	3.280-14.801	1.941
RLS	Low	-	1	-	-
	High	0.012	1.853	1.143-3.004	0.617
Parasomnia	Low	-	1	-	-
	High	0.013	2.524	1.220-5.225	0.926
Sleep apnea	Low	-	1	-	-
	High	0.247	1.301	0.833-2.031	0.263

RLS: Restless legs syndrome; OR: Odds ratio; CI: Confidence interval

On the basis of the logistic regression results, being single [odds ratio (OR) = 2.210, 95% confidence interval (CI) = 1.108-4.409], having chronic illness (OR = 1.710, 95% CI = 1.171-2.498), probability of psychological disorders (OR = 3.008, 95% CI = 1.923-4.703), circadian rhythm disorder (OR = 6.968, 95% CI = 3.280-14.801), RLS (OR = 1.853, 95% CI = 1.143-3.004), and parasomnia (OR = 2.524, 95% CI = 1.220-5.225) are risk factors for insomnia in the elderlies. Results of logistic regression are shown in table 3.

Discussion

The prevalence of insomnia in the present study was 52.4%. Insomnia was significantly more common among women, single subjects, illiterate people, people with chronic diseases, psychological disorders, circadian rhythm disorder, RLS, parasomnia, and sleep apnea. After analyzing the relationship between different factors and insomnia, these variables were entered into the logistic regression model to investigate the predictive effect of variables that have had a significant relationship with insomnia. There was no significant relationship between gender, education, and the probability of sleep apnea and insomnia. There was a significant relationship between other variables (marital status, chronic diseases, psychological disorders, circadian rhythm disorder, RLS, and parasomnia probability) and insomnia, and 33.8% of the insomnia variance was explained by these variables (Nagelkerke R^2 = 33.8%).

***Prevalence of insomnia*:** In general, epidemiological studies have shown that more than 40% of people over 40 years old experience insomnia (17). Tsou study (17) showed the prevalence of insomnia among the elderly living in Taiwan in the population was 41.4%. In a study in Iran, Mousavi et al. found insomnia prevalence in Kahrizak elderly to be 39.2% (18). In a study, the prevalence of insomnia among rural elderlies of Egypt was 62.1% (19). Another study in Pakistan found the prevalence of insomnia among elderlies, who referred to family physician clinics to be 42.1% (20). According to a study in India, the prevalence of insomnia among hospitalized elderlies was 82.1% (21). The prevalence of reported insomnia in various studies has a wide range (20). The lack of a standard classification system to define insomnia is one of the reasons for the difference in reported prevalence in various studies (20). The method of study, data collection techniques, and insomnia diagnostic criteria also affect the rate of prevalence, and the prevalence of insomnia has been less reported in studies using Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) or strict definitions for insomnia (19, 22-24). The prevalence of insomnia in urban and rural elderlies varies, which may reflect the socio-demographic differences of the studied elderlies (19). The study place is also one of the effective factors in the prevalence of insomnia. The prevalence of insomnia in hospitalized elderly people is greater than the elderly living in the community due to the worsening medical problems of insomnia (21).

***Age and insomnia*:** In our study, there was not a statistically significant difference between the prevalence of insomnia in people older than 75 and younger than 75 years. The relationship between age and insomnia has been analyzed in many studies and has led to different results. Some studies confirmed the results of the present study and indicated that there was no relationship between aging and the prevalence of insomnia (25-27). However, the study of Mousavi et al. (18) on the elderlies of Kahrizak sanatorium, Iran, has reported that the prevalence of insomnia in people of 75-84 years old was significantly more than people of 65-74 years. In China, Wang et al. also found that the prevalence of insomnia increased due to aging (24). But El-Gilany et al. in a study in Egypt showed that the prevalence of insomnia in the elderlies of 75 years and older was significantly lower (19). Many age-related changes that affect the physiology of sleep/wake up occur in the 70s; thus, increasing age has low impact on perceived sleep quality of elderlies (27). Studies have also shown that the aging process itself is not responsible for insomnia, but rather that medical conditions, depression, and perceptions of one's health status contribute to insomnia. Consequently, age may not be the only contributing factor to the insomnia of healthy elderlies, and the relationship between insomnia and age may be influenced by other factors (17, 20).

Gender and insomnia: The results of the present study showed that the prevalence of insomnia in women was higher than men. Many studies have confirmed this result (17, 18, 20, 21, 24, 25, 28, 29). But performed studies by Desaulniers et al. (30) in Quebec, Canada and Abd Allah (26) in Egypt found no significant relationship between insomnia and gender. Women, throughout their lives, experience more insomnia than men, and aging increases the impact of gender on insomnia (17). According to previous studies, aging and decreased production and neurogenesis of hypothalamic cells cause changes in sleep-wake rhythm and circadian rhythm (31). Decreasing the size of the ventrolateral preoptic nucleus (VLPO), as a result of aging, can justify sleep disorders in the elderlies. The size and number of cell's nucleus in the preoptic region of men and women vary, and the results have shown that particularly in aging, in this region, cell death occurs more frequently in women than in men (32). On the other hand, the decrease of circulating melatonin, which is one of the effective gender-dependent factors of sleep disorder in the aging, is more common to the aged women than in aged men (23). In addition, studies have shown that disorders influencing sleep, such as anxiety and depression, are more common to women (22). Moreover, hormonal changes after puberty, hormonal changes during menopause, and, subsequently, vasomotor symptoms, which are common in 68-85 percent of postmenopausal women, are some effective factors on the difference between men and women sleep (23). These can explain why sleep disorders and insomnia are more common in women. In the present study, although there was a significant relationship between gender and insomnia in the logistic regression model, and in the presence of other variables, no significant relationship was found between gender and insomnia, and the female gender did not increase the probability of insomnia. In the study of Tsou (17), there was a significant relationship between gender and insomnia even after being included in the regression model, and the female gender increased the probability of insomnia. In the logistic regression model presented in Sagayadevan et al. study (11) in Singapore, the female gender increased the probability of insomnia. This difference may be due to differences in the type of variables of the regression model in the present study and other studies.

Marital status and insomnia: In this study, there was a significant relationship between marital status and insomnia, so that the probability of insomnia was higher among unmarried people. In the study of Ogunbode et al. (25) in Nigeria, there was also a significant relationship between marital status and insomnia, and the prevalence of insomnia in unmarried elderlies was reported more. Other studies have also shown that the prevalence of insomnia is higher in widows and divorced people than married people (8, 20, 26). Various studies have shown that single and alone people experience lower sleep quality and poorer health outcomes (24). The singleness, especially in women, may indirectly affect the deteriorating quality of sleep by increasing the likelihood of experiencing loneliness (24). In the logistic regression model, along with other variables, singleness increased the possibility of insomnia (OR = 2.210, 95% CI = 1.108-4.409). In the model presented by Kim et al. study (33), living alone increases the probability of sleep disorders. According to the study of Tsou (17), in the per-

formed regression model, the likelihood of insomnia disorder in elderlies who were living with others was reduced. But in some studies, including the Sagayadevan et al. study (11), singleness did not increase the possibility of insomnia. This difference may be due to differences in variables entered into the regression model, or due to cultural differences and other characteristics of the studied elderlies.

Education and insomnia: In the present study, there was a significant relationship between education and insomnia, and the prevalence of insomnia in illiterate people was higher. Some studies have found a relationship between low education and insomnia (8). In Farazdaq et al. study (20) in Pakistan, insomnia was more prevalent in the less educated elderlies. However, in Desaulniers et al. study (30), there was no significant relationship between insomnia and education levels below 12 years and academic education. Low education is one of the risk factors for poor health and chronic diseases. Studies have shown that education can affect the general health of the community through income, access to health services, problem-solving skills, social networking, and social situation (29). In the present study, although there was a significant relationship between education and insomnia, in the regression model, and among other variables, there was no significant relationship between education and insomnia. In other words, illiteracy did not increase the probability of insomnia in the present study. In Kim et al. study (33), in the logistic regression model, higher education comparing illiteracy had no effect on the possibility of insomnia. But in the regression model, considering the study of Sagayadevan et al. (11), low education increased the likelihood of insomnia disorder.

Chronic diseases and insomnia: In the present study, three chronic diseases of diabetes, HTN, and heart disease were considered as the most common chronic diseases in the society. There was a significant relationship between chronic diseases and insomnia, and 64% of the elderlies with insomnia had at least one chronic disease. Other studies confirmed the results of our study (17, 19, 20, 24, 25, 28). The relationship between sleep and health is a mutual relationship (17). There is a significant relationship between factors such as physical and chronic illnesses and inadequate sleep and insomnia symptoms (17, 19). Insomnia disorder caused by chronic diseases can be due to the side effects of the medicine used to control this group of diseases (19). In the regression model, in the presence of other variables, there was a relationship between chronic diseases and insomnia that increased the probability of insomnia (OR = 1.710, 95% CI = 1.171-2.498). In the study of Tsou (17), chronic diseases also increased the possibility of insomnia. Sagayadevan et al. (11) also showed an increased probability of insomnia due to chronic diseases.

***Obesity and insomnia*:** To examine the relationship between obesity and insomnia, BMI was divided into two groups of < 30 and ≥ 30 kg/m^2, and BMI ≥ 30, according to the definition of WHO, is obesity. In the present study, obesity had no effect on insomnia. Some studies have found a significant relationship between obesity and insomnia (25). Gureje et al. (34) in a study in Nigeria showed that insomnia symptoms were more stable among fat people. But in some studies such as the study of Ogunbode et al. (25) in Nigeria and the study of Desaulniers et al. (30), there was no significant relationship between obesity and insomnia. Intensive care and treatments used in obese people have adverse effects on their sleep status (35).

***The probability of psychological disorders and insomnia*:** In the present study, the prevalence of psychological disorders was 33.5%, and there was a significant relationship between them and insomnia. The elderlies, in whom the probability of psychological disorders was higher, showed more insomnia. The proposed questions in this research questionnaire indicate the probability of a psychological disorder (not a specific type of disorder) and the necessity of analyses and future screening. The relationship between mental disorders and insomnia symptoms in the young population has been approved, but this relationship is less clear in the elderlies. It should be noted that the impact of psychological factors on the sleep of the elderlies should not be overlooked due to other factors, such as physical health (17).

Depression is a common psychological disorder in old age (19), and various studies have suggested the relationship between depression and insomnia disorder (19, 20, 24). Stress and anxiety are also psychological factors related to insomnia, and the occurrence of stressful events is highly related to chronic insomnia (19, 24). Various studies have shown that stressful changes and events associated with aging, including retirement and widowhood, affect insomnia (17). Tsou (17), in

his study, used a questionnaire to screen mental disorders rather than a specific type of disorder. The results of his study also showed that people with mental disorders experienced more insomnia. Singareddy et al. (36) found in their study that mental health was a strong predictor factor to raise chronic insomnia. El-Gilany et al. (19) in their study found that elderlies who were exposed to life stresses and were worried about their children, were more at risk of insomnia. In the regression model, in the presence of other variables, there was a relationship between the probability of psychological disorders and insomnia that increased the possibility of insomnia (OR = 3.008, 95% CI = 1.923-4.703). In Tsou study, the mental disorders in the logistic regression model increased the likelihood of insomnia disorder. In the regression model presented in El-Gilany et al. study (19), life stress, anxiety, and depression were associated with an increased probability of insomnia.

***Probability of circadian rhythm disorder and insomnia*:** In this study, the prevalence of shift work and irregular sleep schedule was 18.3% and was significantly related to insomnia. Circadian fluctuations affect the performance related to different parts of the body, including sleep and wake rhythms (28).

Aging is associated with a decrease in electrical hormonal activity and gene expression in the cells of the suprachiasmatic nucleus (SCN), which leads to a disorder in the circadian activity throughout the body (23). In circadian rhythm disorder, sleep is relatively normal but occurs at abnormal times. In advanced sleep phase disorder (ASPD), sleep begins before the normal hour and ends earlier (37). Although some of these changes are age-related, some studies have shown that its prevalence, especially among the elderlies, is not solely due to aging and is the result of concomitant diseases that occur commonly in old age (23). In the regression model, and in the presence of other variables, there was a relationship between the probability of shift work and irregular sleep schedule with insomnia and it increased the probability of insomnia (OR = 6.968, 95% CI = 3.280-14.801).

***The probability of RLS and insomnia*:** In the present study, the prevalence of RLS was 28.7% and there was a significant relationship between it and insomnia. Insomnia was more frequent in the elderlies with the probability of RLS. The prevalence of RLS in public is 5%-15% and increases to 10-35 percent among the elderlies over 65 years (2). The results of other studies confirmed this finding (27). In the study of Farazdaq et al. (20), also, there was a significant relationship between RLS and insomnia. Kim et al. (33) also in a study on analyzing insomnia-related factors in elderlies of South Korea found that there was a significant relationship between RLS and insomnia. In the regression model, and in the presence of other variables, there was a relationship between RLS and insomnia that increased the probability of insomnia (OR = 1.892, 95% CI = 1.169-3.062). In the logistic regression model presented in the performed study by Kim et al., RLS also increased the probability of insomnia.

RLS is a common disease that is less commonly diagnosed (38). Symptoms are discomfort in the legs and need for moving to relieve unpleasant sensations in the legs. These symptoms follow the circadian rhythm and occur mostly at night. The discomfort caused by this syndrome interferes with the onset of sleep and the continuation of sleep after waking up and may lead to sleep disorders and insomnia (22, 28, 38-40).

***The probability of parasomnia and insomnia*:** The prevalence of parasomnia in this study was 10.3%, and there was a significant relationship between it and insomnia. Insomnia was more frequent in the elderlies with parasomnia. 3-4 percent of the elderlies experience parasomnia (40). This disorder is caused by a lack of atonia of the skeletal muscles during REM sleep. The etiology of parasomnia is unclear, but its diagnosis is highly important due to its strong relationship with some neurological, neurodegenerative disorders, such as dementia and Parkinson's disease (PD) (41). In the regression model, and in the presence of other variables, there was a relationship between parasomnia and insomnia and it increased the probability of insomnia disorder (OR = 2.524, 95% CI = 1.220-5.225). According to the research authors, there was no study investigating the relationship between parasomnia and insomnia in the elderlies.

***The probability of sleep apnea and insomnia*:** In this study, the prevalence of high-risk sleep apnea among the elderlies was 30.4%. In general, the prevalence of obstructive sleep apnea (OSA) in the elderlies has been reported 19% to 57% (39). The prevalence of this disorder increases due to aging (2). Physiological and anatomical changes, including increased fat in the upper airways and elongation of the soft palate, increase the pos-

sibility of airway collapse and consequently cause OSA (42). In this study, there was a significant relationship between high risk of sleep apnea and insomnia, so that insomnia was more prevalent in the high-risk elderlies group. Some studies confirmed the results of our study. Abd Allah et al. (26) in a study on the related factors with insomnia in the elderlies used a self-report questionnaire to find apnea and they found a significant relationship between sleep apnea and insomnia. While Kim et al. (29) found no significant relationship between sleep apnea and insomnia in their study. They used two questions about "nocturnal snoring" and "the opinion of patient's partner on the breath interruption of his/her partner during sleep" to diagnose sleep apnea.

There is much evidence on the association of OSA and insomnia. OSA can exacerbate the symptoms of insomnia due to sleep interruption and poor sleep quality. On the other hand, insomnia caused by sleep interruption can also exacerbate the symptoms of OSA by increasing the lighter stages of NREM sleep or having a negative effect on upper airway muscles strength (43). In the present study, although there was a significant relationship between sleep apnea and insomnia, in the regression model and the presence of other variables, the sleep apnea did not increase the probability of insomnia. In the presented regression model in Kim et al. study (29), sleep apnea did not increase the probability of insomnia. It seems that other variables in the regression have influenced this result. As mentioned, sleep apnea and insomnia are common. This combination will increase the likelihood of various diseases including CVD and treatment failure (failure of simultaneous diagnosis of these two diseases, as a result, the treatment of only one of these two diseases will lead to ineffective treatment) (43). Therefore, the study of patients with insomnia considering sleep apnea and vice versa should always be considered by experts of this field.

This study is a community-based study with appropriate sample size. But there were also some limitations: all variables have been studied through questionnaires and patient statements, the type and amount of medication used by the elderlies were not examined in this study. Moreover, the present study is a cross-sectional study, which shows the relationship between the studied variables, but a longitudinal study is needed to show their relationship and determine their causal relationship.

Conclusion

This study showed that insomnia was common in the elderly population of Tehran, and there was a relationship between it and chronic diseases, psychological disorder, and primary sleep disorders. The results of this study can be used as a basis for other studies such as interventional studies.

Conflict of Interests

Authors have no conflict of interests.

Acknowledgments

The authors wish to thank all the participants who willingly participated in this study.

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