ORIGINAL ARTICLE

Investigating the Prevalence of Thyroid Disorders and Their Contributing Factors in Iran: A Cross-Sectional Analysis

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Abstract

Background: Thyroid problems have been reported in over 110 countries worldwide. In some countries, the prevalence of known thyroid disorders has been reported to be as high as 18.9%. Given that thyroid dysfunction can adversely affect adult health, we aimed to assess the prevalence of thyroid disease and related factors in the Fasa Persian Cohort Study Centre.

Methods: This cross-sectional study was conducted in southwestern Iran. It included 10,132 participants, with an average age of 48.63. Demographic and clinical data were used as baseline cohort information. Multiple logistic regression analysis was conducted to investigate factors associated with thyroid disease.

Results: The prevalence of thyroid disease was 8.8%. According to the results of the multiple analysis gender ($AOR_{female/male}$=5.94.95% CI: 1.66-7.58), education level (AOR Literate/Illiterate=1.21, 95% CI: 1.04-1.40), diabetes ($AOR_{Yes/No}$=1.32, 95% CI: 1.09-1.69), hypertension ($AOR_{Yes/No}$=1.38, 95% CI: 1.17-1.64), depression ($AOR_{Yes/No}$=1.72, 95% CI: 1.38-2.13) were associated with the odds of thyroid disease. Also, metabolic equivalent task (MET) (AOR=0.99, 95% CI: 0.02-0.083), duration sleep ($AOR_{6-7/\leq 5}$=0.77, 95% CI: 0.61-0.97), and duration sleep ($AOR_{\geq 8/\leq 5}$=0.80, 95% CI: 0.64-0.99) were identified as protective factors in the study.

Conclusion: This study's findings indicated that the total prevalence of thyroid disease in adults was 8.8%. The researchers found that gender, education level, hypertension, diabetes, and depression increased the odds of thyroid disease. In addition, duration of sleep and MET were identified as protective factors. Further consideration of thyroid disease and screening for this population is recommended.

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Introduction

The range of disorders in the thyroid gland, a hormone-secreting organ that regulates the body's metabolism, varies from a small goiter to life-threatening diseases such as thyroid cancer.[1] Hyperthyroidism and hypothyroidism are two common diseases of the thyroid gland. These dysfunctions are reflected in the circulating thyroid-stimulating hormone (TSH) levels. The symptoms of hypothyroidism include weight gain, fatigue, and dry skin, while hyperthyroidism presents symptoms such as weight loss, increased appetite, anxiety, and rapid heartbeat.[2, 3]

In addition, there are subclinical forms of hyperthyroidism and hypothyroidism. In subclinical hypothyroidism, there is a normal thyroxin (T4) level and an increase in thyroid-stimulating hormone (TSH) levels. In subclinical hyperthyroidism, serum TSH levels are low, while T4 and T3 are within the normal range.[4]

Several factors, including the iodine supply,[5] geographical areas, age, and ethnicity have been mentioned as affecting the prevalence and incidence of thyroid disorders.[6] The short-term effects of overt thyroid dysfunction are well known. For example, hyperthyroidism affects pulse rate and blood pressure, while hypothyroidism impacts lipid levels. The long-term morbidity and mortality associated with thyroid dysfunction, including the increased risk of atrial fibrillation in people with subclinical hyperthyroidism, are also significant.[7]

Generally speaking, abnormal thyroid function has essential effects on adult health outcomes. These include cardiovascular arrhythmia, metabolism, bone health, renal disease, nonalcoholic fatty liver disease (NAFLD), and mental health.[8-10]

Thyroid problems have been reported in more than 110 countries worldwide. It is estimated that 5 to 10 percent of people experience overt thyroid dysfunction during their lifetime.[11, 12] The prevalence of thyroid disorders is estimated to be about 5% in the United States,[13] and 2,226 and 51 per 100,000 per year in Europe for hypothyroidism and hyperthyroidism, respectively.[14] In studies, the prevalence of known thyroid disorders was 18.9%[15] and the prevalence of hyperthyroidism and hypothyroidism were 0.7% and 7.4%, respectively.[16] Studies have shown that gender (being a woman), old age, increased radiation exposure, dietary changes, overweight, alcohol consumption, estrogen levels, reproductive factors, smoking status, and ethnicity are listed as risk factors for thyroid disorders.[17, 18]

Since thyroid dysfunction adversely affects adult health, various diseases can interfere with each other in adults, leading to reduced health. Therefore, it is important to pay more attention to thyroid dysfunction and screening for this age group to determine the prevalence of the disease. The factors affecting the disease can provide the basis for planning to eliminate or control risk factors or identify and diagnose them in the early stages. Therefore, the researchers intended to study the prevalence of thyroid disorders and their factors in adults.

Methods

Study Population

This cross-sectional study was conducted using the baseline information from the Fasa Persian Cohort Study Center. The Fasa Adult Cohort Study Center covers individuals aged 35-70 in Sheshdeh and Qarbollaq, along with 24 villages. The study, which began in 2015, is one of 22 cohort studies currently underway in Iran, designed to investigate the factors affecting the incidence of cardiovascular diseases.

Training interviewers collected information at the Fasa Cohort Center. This information includes demographic data, anthropometric measurements, physical examinations, medical information (such as blood pressure, pulse, and oral examinations), the history of chronic and contagious diseases, nutritional status (using the FFQ125 questionnaire), biological specimens (blood, urine, hair, and nails), and body composition indexes.

The information was recorded online and updated daily through queries, then stored on a cohort server. Field supervisors checked the information, and feedback was provided to the questioners in case of any errors or mistakes. The baseline information was completed in 2016, and five follow-ups have been performed.

Inclusion and Exclusion Criteria

According to the cohort study protocol, the inclusion criteria included: 1) individuals living in the Shashdeh and Gharabolagh areas; 2) individuals aged 35-70 years; and 3) individuals who can communicate verbally. The exclusion criteria included 1) conscious dissatisfaction and 2) having mental and motor disabilities.[19]

Data Collection

Data Collection: In this study, the baseline cohort information was used. The variables studied included demographic variables such as age (year), gender (male, female), education (illiterate, literate), marital status (single, married), occupation (employed, unemployed), and socio-economic status. This variable uses the Principal Component Analysis (PCA) method on the property and social ownership variables, which includes 27 items on the questionnaires asking the study participants about their house situation(the area of the house, the number of rooms), household items and their related information (having bathroom, a fridge, a washing machine, a dishwasher, a PC, PC application frequency, a car, make of the car, car price, a motorcycle, a color TV, a vacuum cleaner, a mobile, a Laptop, access to the Internet, the number of books reads, foreign pilgrimage, and foreign travel). Other variables included BMI (underweight, normal, overweight, obesity), smoking (yes, no), sleep duration (number of hours), diabetes (yes, no), hypertension (yes, no), and depression (yes, no). The Metabolic Equivalence Task (MET) estimated the Physical Activity (PA) level per week/minute.

Thyroid disease was self-reported, so individuals

on medication and under medical supervision were considered patients.[19] The Central Cohort Team of Iran has reviewed and approved the validity and reliability of these questionnaires. The protocol for this study is endorsed by the Fasa University of Medical Sciences Ethics Committee (IR.FUMS.REC.1401.191).

Statistical Analysis

The mean and standard deviation were used to report descriptive information for quantitative variables, while frequency and percentage were used for qualitative variables. Statistical tests such as the independent t-test and chi-squared test were employed to compare healthy individuals and thyroid patients.

To study the relationship between independent variables and thyroid disease, both unadjusted and adjusted logistic regression were used. Initially, a univariate analysis was conducted to enter the variables in the multiple model, and variables with a P-value less than 0.25 in the univariate analysis were included in the multivariate analysis. The backward method was used to select variables in the final logistic regression model.

The regression model's goodness-of-fit was checked using the Akaike Information Criteria (AIC) and the Hosmer–Lemeshow test. The model with the highest steps demonstrated the best fitness. The type one error (α) was set at 0.05 in all analyses.

Results

The total number of participants in the present study was 10,132, of whom 4576 (45.2%) were men and 5556 (54.8%) were women. The mean age of the study participants was 48.63±9.57 years. The prevalence of thyroid disorders in the current study (890 patients) was 8.8%. As shown in Table 1, 45.8% of the people were illiterate, and 88.9% were married. The findings indicated a significant relationship between thyroid disease and the variables studied in the study, including gender, MET, literacy level, occupation, marital status, body mass index, current smoker, diabetes, hypertension, and depression (P<0.05). Using the chi-square test, the researchers did not find a statistically significant relationship between thyroid diseases, daytime sleep duration, and socioeconomic status (P>0.05). Multiple logistic regression assessed the relationship between independent variables and thyroid disease. The results can be seen in Table 2. The researchers found that gender (AOR female/male=5.94.95% CI: 1.66-7.58, P<0.001), education level (AOR Literate/Illiterate=1.21, 95%

Table 1: Characteristics of the study participants in people with Thyroid disease

Factors		Thyroid disease		P value
		Yes	No	
		N (%)	N (%)	
Age (year)		48.63±9.11	48.64±9.62	0.979
Metabolic equivalent of task		38.62±8.07	41.47±11.58	<0.001
Gender	Male	115(12.9)	4458(48.3)	<0.001
	Female	775(87.1)	4479(51.7)	
Education	Illiterate	445(50.0)	4193(45.4)	0.009
	Literate	445(50.0)	5040(54.6)	
Occupation	Unemployed	645(72.6)	4370(47.4)	<0.001
	Employed	243(27.4)	4851(52.6)	
Marital status	Single	147(16.5)	972(10.5)	<0.001
	Married	743(83.5)	8265(89.5)	
Body mass index	Under weight	35(3.9)	541(5.9)	<0.001
	Normal	312(35.1)	3811(41.4)	
	Overweight	336(37.8)	3285(35.7)	
	Obesity	205(23.1)	1571(17.1)	
Economic status	Low	234(26.3)	2299(24.9)	0.198
	Moderate	204(22.9)	2326(25.2)	
	High	241(27.1)	2290(24.8)	
	Very High	211(23.7)	2322(25.1)	
Current Smoker	Yes	70(7.9)	1870(20.2)	<0.001
	No	820(92.1)	7367(79.8)	
Day sleep duration (hours)	≤5	129(14.5)	1102(11.9)	0.058
	6–7	294(33.0)	3270(35.4)	
	≥8	467(52.5)	4865(52.7)	
Diabetes	Yes	173(19.4)	1080(11.7)	<0.001
	No	717(80.6)	8157(88.3)	
Hypertension	Yes	277(31.1)	1751(19.0)	<0.001
	No	613(68.9)	7486(81.0)	
Depression	Yes	123(13.8)	557(6.0)	<0.001
	No	767(86.2)	8680(94.0)	

Table 2: Un-adjusted and adjusted association between the study variables and thyroid disease

Variables	Categories	Crude Odds Ratio (95% CI)	P value	Adjusted Odds Ratio (95% CI)	P value
Gender	Male	1	-	1	-
	Female	6.28(5.14-7.67)	<0.001	5.94(4.65-7.66)	<0.001
Education	Illiterate	1	-	1	-
	Literate	0.83(0.72-0.95)	0.009	1.21(1.04-1.40)	0.013
Current Smoker	No	1	-	1	-
	Yes	0.33(0.26-0.43)	<0.001	1.12(0.83-1.51)	0.442
Body mass index	Underweight	1	-	1	-
	Normal	1.26(0.88-1.81)	0.201	0.84(0.58-1.23)	0.386
	Overweight	1.58(1.10-2.26)	0.013	0.79(0.54-1.15)	0.229
	Obesity	2.01(1.39-2.92)	<0.001	0.80(0.54-1.15)	0.281
Diabetes	No	1	-	1	-
	Yes	1.82(1.52-2.17)	<0.001	1.32(1.09-1.59)	0.004
Hypertension	No	1	-	1	-
	Yes	1.93(1.66-2.24)		1.38(1.17-1.64)	<0.001
Depression	No	1	-	1	-
	Yes	2.49(2.02-3.07)		1.72(1.38-2.13)	<0.001
Day sleep duration (hours)	≤5	1	-	1	-
	6–7	0.76(0.61-0.95)	0.018	0.77(0.61-0.97)	0.028
	≥8	0.82(0.66-0.10)	0.059	0.80(0.64-0.99)	0.047
Metabolic equivalent of task		0.97(0.96-0.97)	<0.001	0.99(0.98-0.99)	0.039

CI: 1.04-1.40, P=0.013), diabetes (AOR Yes/No=1.32, 95% CI: 1.09-1.69, P=0.004), hypertension (AOR Yes/No=1.38, 95% CI: 1.17-1.64, P<0.001), and depression (AOR Yes/No=1.72, 95% CI: 1.38-2.13, P<0.001) were risk factors for thyroid disease. MET (AOR=0.99, 95% CI: 0.02-0.083, P=0.039), sleep duration (AOR 6-7/≤5=0.77, 95% CI: 0.61-0.97, P=0.028), and duration of sleep (AOR≥8/≤5=0.80, 95% CI: 0.64-0.99, P=0.047) were protective factors in the study.

Discussion

Thyroid dysfunction is among the primary endocrine disorders, accounting for approximately 30% to 40% of patients in an endocrine practice.[14] In the present study, we assessed the prevalence of thyroid dysfunction and various demographic and clinical risk factors. The most significant findings revealed a higher prevalence of thyroid disorders in our study compared to international statistics. We found that the prevalence of thyroid disorders was 8.8% across both sexes, with 2.51% in men and 14.75% in women. This is around 2.5 times higher than the average prevalence of total thyroid dysfunction in Europe. According to a study by Madariaga et al., the mean prevalence of total thyroid dysfunction in Europe was reported to be 3.82%.[14]

In Jordan, the prevalence of hypothyroidism (characterized by high TSH and low T4) was approximately 6% among females and 4.4% among males.[20] Overall, studies suggest that the prevalence of thyroid dysfunction in adults in the general population ranges from 1 to 10 percent, with even higher rates in selected groups.[5] The results of this study are at the upper end of this range. However, Alqahtani reported a prevalence of thyroid dysfunction at 49.8% in Saudi Arabia.[21] According to the studies, age is one of the factors that increases the prevalence of thyroid disorders. Studies with a lower average age tend to report a lower disease prevalence. In our study, the mean age of the patients was 48 years, which is higher than in some studies and lower than in others.[5, 22, 23] Our study found that the prevalence of thyroid disorders is higher in women than in men, a finding consistent with other community-based epidemiological studies.[24] According to a study by Valdes et al., women were 2.5 times more likely to have hypothyroidism (all types) than men.[23] However, Baral N et al. reported a contrasting result, observing an equal prevalence of thyroid dysfunction in males and females.[25]

Overall, the variations in the prevalence of thyroid disorders across different countries could be attributed to several factors. These include differences in the testing site (whether community-based or medical clinic), age, sex, race/ethnicity, geographical variations in dietary iodine intake, and the method of assessment used. Furthermore, it's often unclear whether individuals with known thyroid disease, those undergoing thyroid hormone therapy, or those with other conditions that may affect thyroid function were included or excluded from the study group.[5, 26, 27]

Results from the multivariate regression model indicated that patients with diabetes were more likely to suffer from a thyroid disorder, a finding that aligns with other studies.[28] Similarly, studies conducted in Saudi Arabia and India reported thyroid dysfunction in 31.2% and 28.5% of type 2 diabetic patients, respectively.[29, 30]

Determining the temporal relationship in cross-sectional studies is challenging. It remains unclear whether thyroid dysfunction exacerbates diabetes or vice versa. However, studies have demonstrated that higher levels of circulating insulin, associated with insulin resistance, can have a proliferative effect on thyroid tissue.[28] Conversely, both hyperthyroidism and hypothyroidism could pose as risk factors for glucose intolerance.[31]

Our study demonstrated an association between blood pressure and thyroid disorders. However, other studies have indicated that hormonal changes resulting from thyroid disorders can elevate blood pressure.[32-34] Given the chronic nature of thyroid disorders, they can lead to an increased prevalence of hypertension among affected individuals over time. Therefore, due to the difficulty in establishing a temporal relationship, the interpretation of associations in cross-sectional studies should be cautiously approached.[35] Research has revealed that individuals with shorter or longer sleep durations face a higher risk of subclinical hyperthyroidism compared to those with normal sleep patterns.[36, 37]

Our study's findings revealed that an average sleep duration of 6 to 7 hours had a supportive effect on thyroid disorders. As sleep duration increased, this supportive effect diminished and transitioned into a risk factor, a finding consistent with other studies. Kim et al. also explored the relationship between sleep and thyroid disorders, suggesting that 7 to 8 hours of sleep could reduce the likelihood of thyroid disease.[36]

Contrarily, some studies have proposed that hyperthyroidism is a prevalent cause of sleep disorders.[38, 39] Sridhar et al. suggested that elevated thyroid hormone levels were associated with various aspects of sleep dysfunction, including prolonged sleep latency, difficulty maintaining sleep, and excessive daytime sleepiness.[39]

The precise mechanism underlying the interaction between sleep dysfunction and thyroid function remains unclear. In our study, we discovered a statistically significant correlation between educational status and thyroid dysfunction, which aligns with the findings of Gupta et al.[40] Kansra et al.'s study also demonstrated a link between educational status and thyroid dysfunction.[41] Kant Singh et al. observed an increased incidence of thyroid disorder in individuals with higher education, potentially indicating an impact due to associated dietary and lifestyle changes.[42]

Strength and limitation: Our study's large sample size ensured that the findings were representative of our study population. However, the potential limitations of the study cannot be overlooked. The estimated prevalence of thyroid disorder, as analyzed in this article, is not differentiated between hypothyroidism and hyperthyroidism. This lack of segregation could potentially affect the specificity of our findings.

Conclusion

In this study, the prevalence of thyroid dysfunction was 8.8% in both genders and 2.51% and 14.75% in males and females, respectively. A significant relationship was observed between thyroid dysfunction and gender, education, diabetes, hypertension, depression, sleep duration (in terms of hours), and MET. The results of this study found that the prevalence of thyroid dysfunction among women is very high compared to international statistics.

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Ethical Approval and Consent to participate

Fasa University of Medical Sciences reviewed the study protocol and informed written consent was obtained from all participants.

Availability of Supporting Data

The data sets generated are not publicly accessible as they are the intellectual property of Fasa University of Medical Sciences. However, they are available from the corresponding author upon reasonable request.

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Authors' Contribution

SA and MSH conceptualized the idea and wrote the manuscript. NB and MD contributed to the manuscript, and MF and AF critically reviewed it.

Conflict of Interest: None declared.

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