Original Article

Hypothyroidism in Saudi Arabia; Prevalence, risk factors, and its relation with Diabetes Mellitus

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Abstract

This study was a cross-sectional study run among 2417 of the general population from different areas of Saudi Arabia, aiming to determine the prevalence as well as the risk factors of hypothyroidism, and its relationship with diabetes mellitus. A multistage random sampling technique has been followed. For data collection, we used a pre-designed online-disseminated questionnaire. Our study found that 18.7% of the study population had hypothyroidism, most of whom (86.3%) were females. Sense of lethargy and laziness was found in 72.9%, dryness of the skin in 71.0%, and mood changes in 69.4% of cases. Among cases with hypothyroidism, 15.3% had diabetes, 2.4% type I and 12.9% type II. The association between hypothyroidism and diabetes was significant (P=0.003). There was also a significant association between hypothyroidism and age, sex, family history of hypothyroidism, obesity, and the presence of autoimmune diseases (P<0.05). As regards treatment, 61.9% of hypothyroidism cases took medical treatment, and only 49.4% improved.

Keywords: Diabetes mellitus, Hypothyroidism, Prevalence, Risk factors

Introduction

Hypothyroidism is a significant and common endocrine disorder reported worldwide [1]. It can result from a decreased thyroid hormone production or a defect in the machinery of receptor activity associated with the thyroid hormone. It can be either acquired or congenital, where it manifests at birth, or with a delay due to different congenital defects. Hypothyroidism can have sporadic or familial congenital causes [2]. Hypothyroidism can present in various stages of dysfunction. It can be subclinical (SC Hypo), or overt status (Ov Hypo). Subclinical hypothyroidism is the state in which the serum concentrations of TSH are elevated, but the serum concentrations of the thyroid hormone are average [3]. While overt hypothyroidism is presented with an increase in the thyrotropin (TSH) levels as well as a reduction in the free thyroid hormone fractions. Hypothyroidism classification can be according to the function of the thyroid gland into primary and secondary hypothyroidism. In primary hypothyroidism, the thyroid gland is defective itself. But secondary hypothyroidism is characterized by a defect in the functions of the posterior pituitary gland, which is responsible for the secretion of thyroid-stimulating hormone or thyrotropin (TSH), a defect that can alter the functions of the thyroid [4].

Many factors can influence the prevalence of hypothyroidism, including age, sex, and other geographical factors [5]. Several studies on hypothyroidism reported from different regions worldwide estimate the hypothyroidism prevalence. The spontaneous hypothyroidism prevalence is ranging between 1% and 2%, and it is more prevalent among older females, according to many studies. The prevalence of this disease among females is ten times more than males [6]. The Ov-Hypo prevalence in Europe is 4% to 5% [7], while the prevalence of SC Hypo is about 4-15% [1]. Studies conducted in the United States showed a 0.4% prevalence of Ov-Hypo, while 4.3-8.5% prevalence of SC Hypo [8, 9]. In the KSA, studies conducted in primary care settings are minimal, while none are done among the general population. A study conducted in a tertiary hospital in Riyadh, KSA showed that the prevalence of hypothyroidism among non-endocrine females aged over 20 years or more was 15.5% [10]. The findings of a cross-sectional study conducted in King Khalid

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Hospital, Hail, KSA [11] showed that out of 175 patients, 98 (71 female and 27 males) had hypothyroidism. In Arar, Northern Saudi Arabia, another study found that the prevalence of hypothyroidism was 25.5% and that the disease was more prevalent among females than males [12]. Generally, epidemiological studies focusing on thyroid dysfunction have different limitations including the criteria of sample selection, defining overt and subclinical hypothyroidism, factors influencing the results such as sex, age, genetic, and environmental factors, and the techniques used to measure thyroid hormones and the relative scantiness of incidence data [13].

Among the factors associated with hypothyroidism are high LDL levels, triglycerides, total cholesterol, obesity, high blood pressure, and metabolic syndrome [14, 15]. Hypothyroidism and obesity are commonly associated with clinical conditions. Thyroid hormones are involved in regulating basal metabolism and thermogenesis. It also plays an essential role in the food intake, metabolism of lipids and glucose, and fat oxidation [16]. Hypothyroidism is also associated with decreased metabolic rate, thermogenesis, and higher body mass index (BMI), as well as a higher obesity prevalence [17].

There is current clinical evidence to suggest that mild forms of hypothyroidism (subclinical) are associated with significant changes in BMI; therefore, it is a significant risk factor for obesity and overweight [18]. Studies found a deep association between DM and thyroid diseases [19]. Hypothyroidism (Hashimoto's thyroiditis) association with DM has been considered. Many studies revealed an association between type II DM and the risk of the development of thyroid diseases [20]. Decreased absorption of glucose from the GIT, along with prolonged peripheral glucose accumulation, diminished hepatic glucose output, gluconeogenesis, as well as decreased disposal of glucose, are considered main marks of hypothyroidism [21]. A study run in Spain by Diez et al. concluded that the overall prevalence of thyroid diseases in type II DM patients was 32.4% [22]. Another cross-sectional study run on 202 Indian patients with type II DM revealed that the thyroid dysfunction prevalence was 31%, of which, 11.4% had hypothyroidism and 16.3% had subclinical hypothyroidism [23].

Even though Saudi Arabia has a high prevalence of type II DM, the association between DM and thyroid diseases needs more attention. This study aimed to determine the prevalence and risk factors of hypothyroidism as well as its relationship with Diabetes Mellitus in the Saudi population.

Subjects and Methodology:

The current study is a cross-sectional study run among 2417 of the general population from different areas of Saudi Arabia, during the period from 1 May to 31 August 2019. The sample size was calculated using the sample size equation: $n=z^2p\ (1-p)/e^2$. A multistage random sampling technique was followed. A pre-designed online-disseminated questionnaire, which includes questions designed to fulfill the study objectives as follows:

- Socio-demographic characteristics including age and educational status, family income, and the number of children in the family.
- Obesity and whether diagnosed before or after the diagnosis of hypothyroidism, diabetes mellitus, and its type and treatment.
- Family history of hypothyroidism, other autoimmune diseases, and general health status.
- Hypothyroidism-related data as period, manifestations, association with DM, and use of treatment of hypothyroidism.

Ethical considerations:

The Research Ethics Committee of the Faculty of Medicine, King Faisal University has reviewed and approved the current study. The questionnaire included an introduction explaining the aims of the study to the participants. No names were recorded in the questionnaires. All answers were kept and safe.

Statistical analysis:

We used the Statistical Package for the Social Sciences for analysis (SPSS, version 23, IBM, Chicago, USA). We performed descriptive and analytic statistics. We employed the Chi-Square test ($\chi 2$) for the association and the differences between two categorical variables. P values equal to or less than 0.05 were considered significant.

Results:

Table 1 shows the demographic data of participants, family history of obesity, hypothyroidism, diabetes mellitus, and other autoimmune diseases, and general health status among the study population. Over half the participants (57.7%) were 21-40 years old, females constituted 72.2%, 67% were married, and 29.7% were single. About a third (31.0%) were obese, 10.1% were diabetics, and 41.5% had a positive family history of hypothyroidism. The general health status was good in 52.3% and excellent in 26.0% of the study population.

Table 2 and figure 1 illustrate the prevalence of hypothyroidism in the study population. Our study found that 18.7% of the study population had hypothyroidism.

Table 3 shows the period, manifestations, association with DM, and treatment of hypothyroidism among the cases. Most (60.1%) of the hypothyroidism cases were diagnosed more than two years ago. Most (86.3%) of the hypothyroidism cases were females. Sense of lethargy and laziness was found in 72.9%, dryness of the skin in 71.0%, and mood changes in 69.4% of cases. Among cases with hypothyroidism, 15.3% had diabetes (2.4% type I, and 12.9% type II). Diabetes was diagnosed before hypothyroidism in 7.5% of cases and after it in 7.7%. The general condition was good in half (51.4%) of the cases and moderate in 28.8%. Hypothyroidism was

diagnosed during pregnancy or after delivery in 55.7% of female cases and 41.4% of them had oligo-hypo-menorrhea. Regarding treatment, 61.9% of hypothyroidism cases had taken medical treatment, and only 49.4% improved after treatment.

Concerning the relationship between hypothyroidism and diabetes mellitus, our study found that there was a significant association between hypothyroidism and DM (P=0.003). Moreover, there was a significant correlation between hypothyroidism and obesity, as 42.7% of cases with hypothyroidism had obesity (P=0.001). There was also a significant correlation between hypothyroidism and age, sex, family history of hypothyroidism, and the presence of autoimmune diseases among the study group (P<0.05). (Table 4)

Discussion:

Thyroid diseases are of great importance since they have a serious effect on normal physiology, and most of them are responsive to medical management. Patients who suffer from thyroid diseases often present with symptoms associated with the excessive or deficient release of thyroid hormones (hyper- or hypothyroidism) [24]. Symptoms of hypothyroidism result from the reduction of thyroid hormone activity on tissues. Women are more affected with hypothyroidism, with a total prevalence of 1% to 2% that increases with age [3].

The current cross-sectional study was conducted among 2417 of the studied population aiming to estimate the prevalence and risk factors of hypothyroidism as well as its relationship with Diabetes Mellitus.

Our study found that the prevalence of hypothyroidism was 18.7%. In Jeddah, Saudi Arabia, a retrospective single-center study was conducted among 3872 subjects at King Fahad Armed Forces Hospital, which found 29.1% of cases with hypothyroidism [4]. In Arar City, Saudi Arabia, another study carried out among 454 participants reported that the prevalence of hypothyroidism was 25.5% [12]. However, another cross-sectional survey conducted in Arar among 160 participants reported the total prevalence of 15.6% [24]. Generally, the hypothyroidism prevalence was found to be 6.18% in Libya and 47.34% in KSA, according to a study that focused on thyroid diseases in the Arab world [25]. Another study done in India with 5360 participants reported a prevalence of 10.9% [26]. Another study conducted by Velayutham et al. [5] in South India found that the prevalence of hypothyroidism was 7.3%.

Deep association is established correlating thyroid dysfunction and DM [27]. Studies found that diabetic people were much more likely to have thyroid dysfunction compared to those who are nondiabetic. Moreover, studies show that DM and thyroid gland disorders can influence each other [28, 29]. The current prevalence of thyroid diseases among Saudi diabetic individuals is 16-28.5%, 25.3% of whom have hypothyroidism [30].

DM-II and hypothyroidism have been found to be associated in many studies. However, different studies revealed varying strengths of the association. Regarding the association between hypothyroidism and diabetes, our study found that from cases with hypothyroidism 15.3% had diabetes (2.4% type I and 12.9% type II) and the association between hypothyroidism and diabetes was significant (P=0.003). Similar to our results, in King Abdul-Aziz University Hospital (KAUH), a case-control study found a positive relationship between hypothyroidism and type II DM. The study reported that type II DM was more prevalent among cases with hypothyroidism (77.2%) than the controls (22.8%) [31]. In Jeddah, Saudi Arabia, a study estimated the prevalence of thyroid gland diseases among type II DM patients and found that hypothyroidism was present in 30.7% of patients with type II DM [32]. These results were higher than what reported by the Scotland study, which found that 13.4% cases of hypothyroidism among Type 1 DM as well as type II DM or by the study conducted in Jordan, where it was 12.5% among T2DM patients [33, 34]. Another study conducted on type II DM individuals showed a primary hypothyroidism prevalence of 11.8% [35].

Hypothyroidism is held as a responsible factor causing obesity in the common perception of many physicians. However, it is controversial to link them causally. Modest weight gain is associated with overt hypothyroidism. However, there is a lack of clarity concerning subclinical hypothyroidism [36]. According to the relationship between hypothyroidism and obesity, our study found a significant correlation between them. 42.7% of cases with hypothyroidism had obesity (P=0.001). Similar to our results, a study reported a significant association between hypothyroidism and obesity (P=0.001), which found that 63.8% of cases were obese [12]. Also, another study reported that 100% of cases with hypothyroidism had morbid obesity [24]. Higher incidence of hypothyroidism in obese individuals than in the general population and the association between obesity and hypothyroidism seems to be milder than previously thought, even more in individuals with treated hypothyroidism [37].

Conclusion and Recommendations:

Our study found that 18.7% of the study population had hypothyroidism. Most of the hypothyroidism cases were females. The association between hypothyroidism and diabetes was significant (P=0.003). There was also a significant relation between hypothyroidism and age, sex, family history of hypothyroidism, obesity, and the presence of autoimmune diseases (P<0.05). So, we recommend health education for the public about the nature of the disease, its risk factors, as well as the apparent association between DM and thyroid gland disorders, encouraged people with DM to be periodically checked for thyroid dysfunction. Also, we recommend more detailed researches must be conducted regarding this issue.

Conflict of interest:

None declared.

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Table 1: Socio-demographic characteristics, obesity, family history of hypothyroidism, diabetes mellitus, and other autoimmune diseases, and general health status among the study population (N=2417)

Variables	No.	%
Age group		
• <20	272	11.3
• 21 - 40	1395	57.7
• 41 - 60	698	28.9
• >60	52	2.2
Sex		
• Female	1746	72.2
• Male	671	27.8
Average monthly income of the family		
• <5000	459	19.0
• 5000-10000	774	32.0
• 10000-15000	590	24.4
• >15000	594	24.6
Marital status		
• Married	1620	67.0
• Single	719	29.7
• Divorced/widow	78	3.2
No. of children in the family		
• One	176	7.3
• Two	204	8.4
• Three	210	8.7
• Four	192	7.9
• Five	161	6.7
• Six	128	5.3
• >6	211	8.7
Obesity		
• No	1668	69.0
• Yes	749	31.0
Family history of hypothyroidism		
• No	1415	58.5
• Yes	1002	41.5
Diabetes mellitus		
• No	2173	89.9
• Yes	244	10.1
Type of diabetes		
○ Type I	42	1.7
○ Type II	202	8.4
• No diabetes	2173	89.9
Treatment of diabetes		
• Insulin and tablets	49	2.0
• Tablets	109	4.5
• Insulin	48	2.0
• Diet control	38	1.6
• No diabetes	2173	89.9
Autoimmune diseases		
• No	2304	95.1
• Yes	113	4.7
General health status		
• Good	1264	52.3
• Excellent	629	26.0
• Moderate	500	20.7
• Bad	24	1.0

Table 2: Prevalence of hypothyroidism among the studied Saudi population (N=2417)

Hypothyroidism		
• No	1966	81.3
• Yes	451	18.7

Table 3: Period, manifestations, association with DM, and treatment of hypothyroidism among the cases (N=451)

Variables	No.	%
Period of hypothyroidism		
• < 1	99	22.0
• 1-1.5	43	9.5
• 1.5-2	38	8.4
• >2	271	60.1
Sex		
• Female	389	86.3
• Male	62	13.7
Manifestations of hypothyroidism		
• Chest tightness	237	52.5
• Swilling around the eyes	157	34.8
• Sense of lethargy and laziness	**329**	**72.9**
• Cold sensation	213	47.2
• Chronic constipation	214	47.5
• Dryness of the skin	320	71.0
• Mood changes	313	69.4
• Unexplained numbness around the extremities	229	50.8
• Previous exposure to radiation in the head and neck region	130	28.8
Diabetes with hypothyroidism	**69**	**15.3**
• Type I	11	2.4
• Type II	58	12.9
Diabetes was diagnosed before or after hypothyroidism		
• After	35	7.75
• Before	34	7.5
The general condition		
• Good	232	51.4
• Bad	14	3.1
• Moderate	127	28.2
• Excellent	78	17.3
Hypothyroidism diagnosed during pregnancy or after delivery (N=389)	**217**	**55.7**
• 1st pregnancy	42	19.3
• 2nd pregnancy	30	13.8
• 3rd pregnancy or more	145	66.8
Oligohypomenorhea in females (N=389)	161	41.4
Treatment		
• Take treatment for hypothyroidism	279	61.9
• Improvement after treatment	223	49.4

Table 4: The relationship between Hypothyroidism and age, sex, family history of hypothyroidism, diabetes, obesity, and presence of autoimmune diseases among the studied population (N=2417)

Parameter	Responses	Hypothyroidism		Total (N=2417)	P-value*
		Yes (n=451)	No (n=1966)		
Age	<20	23	249	272	**0.002**
		5.1%	12.7%	11.3%	

	21 - 40	241	1154	1395	
		53.4%	58.7%	57.7%	
	41 - 60	161	537	698	
		35.7%	27.3%	28.9%	
	> 60	26	26	52	
		5.8%	1.3%	2.2%	
Sex	Female	389	1357	1746	**0.0001**
		86.3%	69.0%	72.2%	
	Male	62	609	671	
		13.7%	31.0%	27.8%	
Family history of hypothyroidism	No	162	1253	1415	**0.001**
		35.9%	63.7%	58.5%	
	Yes	289	713	1002	
		64.1%	36.3%	41.5%	
Diabetes	No	382	1791	2173	**0.003**
		84.7%	91.1%	89.9%	
	Yes	69	175	244	
		15.3%	8.9%	10.1%	
Obesity	No	259	1409	1668	**0.001**
		57.4%	71.7%	69.0%	
	Yes	192	557	749	
		42.6%	28.3%	31.0%	
Autoimmune diseases	No	422	1882	2304	**0.037**
		93.6%	95.7%	95.3%	
	Yes	29	84	113	
		6.4%	4.3%	4.7%	

*Chi-square test was used.