

Research Article

Prevalence and Manifestations of Hypothyroidism among Population of Hyderabad, Sindh, Pakistan

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Abstract

The major endocrine gland is the thyroid gland, which secretes vital hormones like T3 (tri-iodothyronine), T4 (thyroxine) and TSH (thyroid stimulating hormone) which are the key performer in the maintenance of body's homeostasis of the body. The thyroid related disorders are rapidly increasing around the globe due to deficiency of iodine and other factors. There is also a high prevalence of thyroidal diseases in Pakistan. Although it is not a life threatening disorder, but if it is overlooked and remained untreated, it may develop into life threatening disorders like cancer. Moreover, as thyroid gland is a malfunctioned gland and greatly affects various functions of many other body parts which depend on the hormonal secretion of thyroid hormones for performing their normal functions. To assess the thyroidal disorder (hypothyroidism) situation of in Sindh, this study was conducted to evaluate the prevalence of hypothyroidism in population of Hyderabad. Hypothyroid diagnosed individuals were enrolled, and their serum thyroid hormones level, signs, symptoms, and clinical manifestations were observed. Thyroid function test (TFT) was done using radioimmunoassay techniques ELISA, Immunoassay test (RIA) kits. Different clinical manifestations, signs and symptoms presented by the patients were also analyzed, and disease was determined in relation to those symptoms. High prevalence of hypothyroidism was found in females. In hypothyroid patients, goiter was observed to be 27%, Hashimotos to be 9%, Thyroid Cancer to be 10%, and Iodine Deficiency to be 88% with high prevalence in 21 years to 29 years age group.

Keywords: Endocrine gland; Goiter; Hypothyroidism; Hashimotos; TSH; T3; T4; Thyroid Cancer

Introduction

The disturbance in the normal thyroid function is usually caused by perturbation in HPT (hypothalamus-pituitary-thyroid) axis, which eventually affects all mechanisms occurring in the body [1]. All across the

globe, diabetes mellitus and ailments related to thyroidal function are high prevalent glandular disorders independent of age and gender [2, 3]. Thyroidal dysfunction may be subclinical, asymptomatic, characterized by irregularities of thyroid hormone level with

normal levels of T3 and T4, and abnormal TSH level. Clinically symptomatic thyroid dysfunction is characterized by abnormal serum levels of T3 and T4 respectively [4]. Furthermore, thyroid dysfunctions include goiter, subclinical phases, Grave's disease, Hashimoto's thyroiditis, thyroid cancer and iodine deficiency disorders [5]. All of these disorders have been documented in various reports in more than 110 countries worldwide, risking a population of approximately 1.6 billion [6].

For the normal synthesis, secretion, and maintenance levels of thyroid hormones T3 and T4, iodine is an integral ingredient [7]. Food and water are the chief sources of iodine supplied to the thyroid gland to function normally, the deficiency of iodine in these sources lead towards the development of iodine deficiency disorders like cretinism, hypothyroidism, and goiter etc. [8]. The prevalence of iodine deficiency is reported in more than one third the population of the world [9]. In areas with a severe deficiency of iodine, the rate of prevalence of goiter reaches up to 80% [10]. In South Asian countries, deficiency of iodine is the reason for higher rates of thyroid disorders [9]. In most cases, it is observed that only because of the goiter the physician recommends the screening of for thyroid disorders. Among the adult population of India prevalence of goiter has been reported to be 12% [11] and in children up to 23% [12].

In Pakistan, clinical and subclinical hypothyroidism prevails up to 4.1% in adults, and 5.4% in children and high prevalence of hypothyroidism and hyperthyroidism are found in females compared to males [13]. Abnormalities in thyroid function, especially in subclinical hypothyroidism, are linked with a high risk of coronary artery disease and atherosclerosis [14]. Prevalence of arrhythmias related to supra-ventricular, increased heart rate, and enhanced mass left ventricular has been associated with

hypothyroidism [15]. Coagulation abnormalities in state of thyroid dysfunction, whether hyperthyroidism or hypothyroidism has also been observed [16]. Many other anomalies are also associated with thyroid disorder, including cardiovascular hemodynamics changes, abnormalities in diastolic function, endothelial dysfunction, hypercholesterolemia, and hyperhomocysteinemia [17].

In children and adolescents, residing in areas of iodine-sufficient thyroablative therapy and autoimmune thyroid disease are the foremost causes of hypothyroidism [18]. If the thyroidal disorders remain untreated, they can seriously affect whole mechanisms of body especially the cardiovascular system [19]. Therefore, in order to cope with the consequences of thyroid disease, public awareness regarding thyroidal ailments and importance of iodine intake is necessary. This research study aims at evaluating prevalence, clinical manifestation and pathophysiological features of hypothyroidism in population.

Materials and Methods

It was a prospective study comprised of 204 hypothyroid patients to check prevalence, clinical manifestation and pathophysiological features of hypothyroidism in them who visited various private and government hospitals of Hyderabad, Sindh, Pakistan. The study setting was different Hospitals of Hyderabad, including Civil Hospital Hyderabad, Aga Khan Hospital, NIMRA Hospital Hyderabad, Shah Bhitai Hospital Hyderabad, and Sindh Government Hospital Qasimabad, Hyderabad, after seeking approval by the governing bodies and ethics committee of the hospitals.

Data collection

The data for the study was collected by using a specially designed questionnaire, x-rays reports, thyroid ultrasound reports, and other laboratory test reports in order to analyze the

hypothyroid patients. The questionnaire was designed to collect the information by interviewing patients about their general sociodemographic data, including weight, age, height, signs and symptoms, clinical manifestations, etc. Body mass index was calculated according to the criteria by WHO using the weight of females in kilograms divided by taking the height square in meters (Kg/m^2). The BMI of less than $18 \text{ Kg}/\text{m}^2$ is considered as underweight; $18.5\text{--}24.9 \text{ Kg}/\text{m}^2$ as moderate; $25.0\text{--}29.9 \text{ Kg}/\text{m}^2$ as overweight, and greater than $30 \text{ Kg}/\text{m}^2$ falls in the category of obese. To evaluate the degree of deficiency regarding thyroid hormones, serum level of (tri-iodothyronine), T4 (thyroxine), and TSH (thyroid stimulating hormone) was recorded using radioimmunoassay techniques (ELISA), Immunoassay test kits. The obtained values of T3, T4, and TSH were analyzed using software IBM SPSS version 20.0 and expressed as means \pm SD.

Results

In the study total of 204 patients with hypothyroidism were included. BMI was calculated using the height and weight of the patients. The mean and standard deviation was also calculated. The BMI was high in the clinical hypothyroid patients' group, i.e., 26.84 ± 4.08 because of the weight gain, which is a general trend in this group. BMI of subclinical hypothyroid patients was 24.63 ± 3.51 . However, not much difference was found in values of BMI, which showed the weight increase trend in hypothyroidism (Table 1).

The TFT or thyroid function test for assessment of T3, T4, and TSH was also carried out and compared with standard ranges. The mean value and standard deviations were calculated (Table 1). Decreased values of T3 were found in case of clinical hypothyroidism state $3.97 \pm 3.9 \mu\text{g}/\text{dl}$ and nearly normal values in subclinical state

$3.55 \pm 5.3 \mu\text{g}/\text{dl}$. Likewise, T4 mean values were lower in hypothyroid patients as compared to normal ranges.

TSH mean values were observed to be significantly increased in case of clinical hypothyroidism $34.69 \pm 13.50 \text{ mIU}/\text{L}$ and abnormally high in subclinical hypothyroid patients $7.945 \pm 1.05 \text{ mIU}/\text{L}$ shown in Table 1. The investigation of the age range showed that out of 204 patients, 104 (50.98%) were between the age range of 20 years to 29 years, 40 (19.60%) between 30 years to 39 years, 27 (13.23%) between 40 years to 49 years and 34 (16.66%) were between 50 years to 59 years. The age range from 20 to 29 years was observed to be more vulnerable to have different thyroidal disorders. Based on the gender of hypothyroid patients, women were observed more commonly affected by hypothyroidism than males (Fig. 1 & Table 2).

The signs and symptoms commonly experienced by hypothyroid patients were depression (83.3%), weight gain (68%), constipation (66%), muscle pain (68%), hair loss (53.4%), feeling exhausted after sleep (32%), neck discomfort (48%), in females menstrual irregularities (46%), hoarseness (70%), cold intolerance (50%), Skin problem (48%) other symptoms were eye pain, dry hair, sleep disturbances, bleeding gums, anxiety, lethargy and loss of appetite, etc. Table 3 shows all the number of cases, symptoms, manifestations, and different demographic features along with percentages, which shows the high prevalence of hypothyroidism in people living in rural areas (Table 3)

In hypothyroid patients, the prevalence of goiter was observed to be 27%, Hashimotos to be 9%, Thyroid Cancer to be 10%, and Iodine Deficiency to be 88% and other causes of hypothyroidism include congenital 11%, genetic 18%, and miscellaneous 39% respectively (Fig. 2 & Table 4).

Table 1. BMI and thyroid hormones level in the patients

	Subclinical Hypothyroid N=60	Clinical Hypothyroid N=144
BMI (kg/m ²)	Mean \pm SD	Mean \pm SD
	24.63 \pm 3.51	26.84 \pm 4.08
TSH (mIU/L)	7.945 \pm 1.05	34.69 \pm 13.50
T3 (μ g/dl)	3.55 \pm 5.3	3.97 \pm 3.9
T4 (μ g/dl)	12.94 \pm 1.3	15.19 \pm 1.6

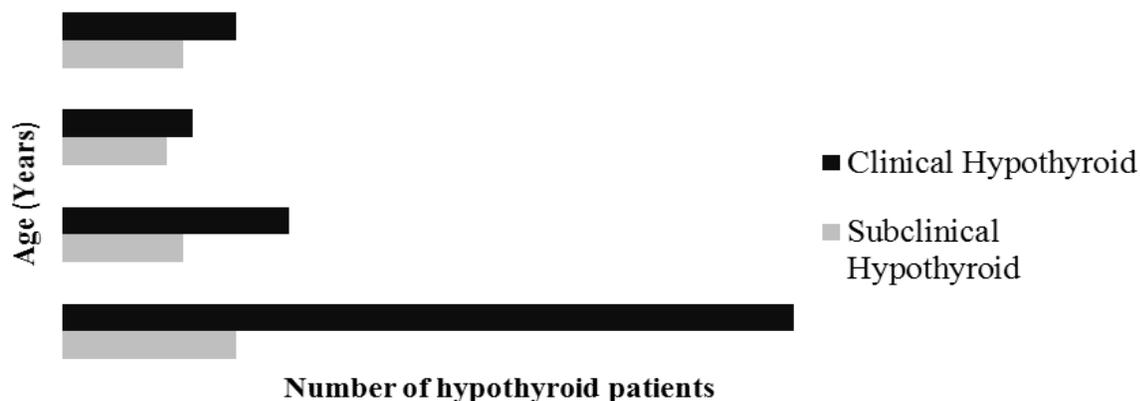


Figure 1. Age distribution in Hypothyroidism

Table 2. Age and Gender Distribution amongst different clinical state in population

Age (Years)	Subclinical Hypothyroid		Clinical Hypothyroid	
	Gender			
	Females	Males	Females	Males
20-29	13	7	73	11
30-39	10	4	18	8
40-49	7	5	9	6
50-59	11	3	15	5
Total	41(26%)	19(39%)	115(73%)	30(62%)

Table 3 Variables of hypothyroid Patients

Demographics and signs	Cases (N)	Percentage (%)
Location	142	70
Rural		
Urban	62	30
Life Style	120	58.8
Sedentary		
Active	84	41.1
Feeding habit	167	81.8
Veg		
Non-Veg	37	18.1
Salt Intake	88	43.1
Non-Iodinated		
Iodinated	116	56.8

Weight Gain	138	68
Skin problem	24	48.98
Bleeding Gum	71	34.80
Throat discomfort	98	48.03
Hair loss	109	53.43
Hoarseness	143	70.09
Cold intolerance	102	50
Obstructive Sleep apnea	67	32.84
Loss of Appetite	43	21.07
Anxiety/Panic attacks	132	64.70
Depression	170	83.3
Muscle aches	140	68.6
Lethargy	92	45
Constipation	136	66.6
Menstrual irregularities	95	46.5

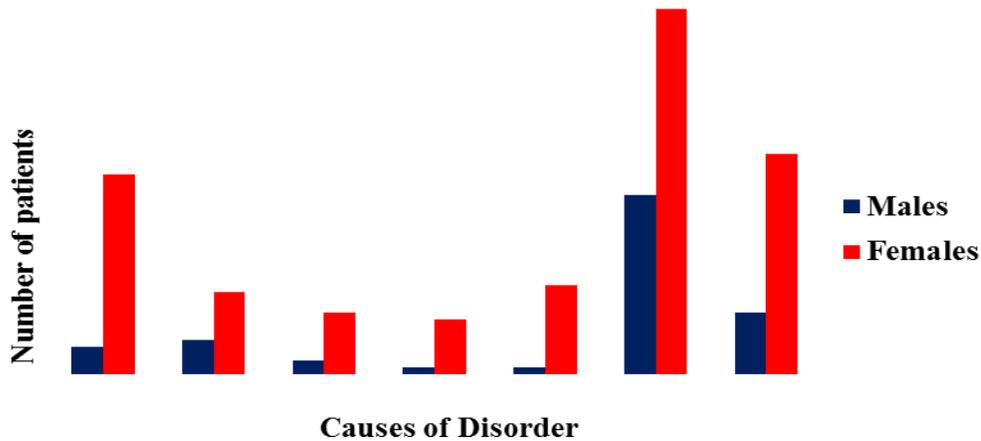


Figure 2. Number of hypothyroid patients presenting different disorders

Table 4. Number of hypothyroid patients representing different disorders

Cause of Disorder	Cases (N)		Percentage (%)	
	Male	Female	Male	Female
Goiter	4	29	8.33	18.58
Genetic	5	12	10.41	7.69
Hashimotos	2	9	4.16	5.76
Thyroid Cancer	1	8	2.08	5.12
Congenital	1	13	2.08	8.33
Iodine Deficiency	26	53	54.16	33.97
Miscellaneous	9	32	18.75	20.51
Total	48/204	156/204	23.53	76.4

Discussion

In mammals for normal growth of the body, its development, and regulation of other

normal mechanisms and neuronal differentiation, thyroid hormones are essential to be released in sufficient

concentration in blood serum [20]. In amphibians, thyroidal hormones are also necessary for metamorphosis [21]. All of these mentioned activities are more evident in the deficient state of thyroid hormone known as hypothyroidism. Events that take place in the dysfunctioning of the thyroid gland are usually due to various contributing factors like demographical division, eating habits, consumption of iodine in the diet, and predisposition or mutation in genes [22].

This research study aims at evaluating the prevalence, clinical manifestation, and pathophysiological features of hypothyroidism in population of Hyderabad, Sindh. This study includes 204 hypothyroid patients, out of which 76% were females, and 24% were males, and females were found to be more prone to have hypothyroidism. As per reports, hypothyroidism is more prevalent in females as compared to males. In females, it is found to be 2% to 5% with a ratio of 5:1 to males between the age range of 20 years to 40 years [23].

Graphical representation of age distribution showed steepness in peak in the age group of 21 years to 30 years, and graphs showed a decline with the increase in age. Various studies on thyroid dysfunction reported the increase in its prevalence during the middle ages [24]. Many patients with thyroid disorder showed normal TSH levels or only 1% to 2% with low serum TSH than normal. In the elderly population of 80 years or more low plasma TSH levels are seen in about 3% of the population [25].

Several studies also reported a high prevalence of thyroid ailments in Pakistan. As it is considered as iodine deficient area, high rates of thyroid disorders are observed, which may be due to insufficient dietary intake of required iodine, iodized salt or autoimmune disorder leading towards thyroid gland hyper or hypo functionality (hypothyroidism or hyperthyroidism) [26]. On the other hand, in Western and European

countries, a high prevalence of hypothyroidism has been observed. In females, high degree points of hypothyroidism due to various factors of gestation are involved, which may be the contributing factors for stimulating autoimmunity in the body. The autoimmune response is observed to produce antibodies causing destruction of the thyroid gland [27]. The nature of most of the thyroid disorders is autoimmunity such as Hashimoto's thyroiditis, Graves's diseases, thyrotoxicosis, goiter, and hypothyroidism [28].

One of the outcomes of abnormal pathophysiology of thyroid gland is goiter. According to the data collected in this study on hypothyroid patients, 27% of the subjects had a goiter, 9% had Hashimoto's, 10% had Thyroid Cancer, and 88% with Iodine Deficiency with high prevalence in females. The incidence of thyroid maladies and goiter is assessed by multifaceted interaction amongst environmental factors, gender, and genetics. The intake status of iodine is the key environmental factor that verifies goiter dominance [29]. Additionally, the high rate of goiter prevalence in females is attributed by estrogen effect, which is proliferative on the thyroid gland's thyrocyte cells [30].

The common manifestation and symptoms of hypothyroidism include feeling of weakness, coarse and dry skin, constipation, intolerance due to cold, slow or reduced metabolism, anxiety and depression [31]. In hypothyroid patients included in the study presented common symptoms including depression (83.3%), weight gain (68%), constipation (66%), muscle pain (68%), hair loss (53.4), feeling exhausted after sleep (32%), neck discomfort (48%), in females menstrual irregularities (46), hoarseness (70%), cold intolerance (50), Skin problem (48%) other symptoms were eye pain, dry hair, sleep disturbances, bleeding gums, anxiety, lethargy and loss of appetite, etc.

The hypothyroid state is also strongly associated with unbalanced levels of lipid consequential towards atherosclerosis. The thyroid hormones and their substrates in hypothyroid conditions promote the utilization of lipid and lipid substances, triggering the high mobility of stored triglycerides in adipose tissue. Clinical hypothyroidism, accompanied by hypertension and hypercholesterolemia, has been associated with various cardiovascular diseases [32].

A study also reported the high subclinical hypothyroidism prevalence among females with a history of myocardial infarction and aortic atherosclerosis. Evidence of thyroid peroxidase antibodies were found in females having these manifestations [33].

Conclusion

Females are more prone to be at the risk of developing thyroid disorders as compared to the male population. Depression and hypertension is positively associated with hypothyroidism. In order to encounter the issues of thyroid problems, public awareness regarding the importance of dietary intake of iodine is necessary, which can significantly contribute to overcome the increasing prevalence due to deficiency of iodine.

Authors' contributions

Conceived and designed the experiments: NA Shah, Performed the experiments: N Shah & NA Shah, Analyzed the data: TJ Ursani, Contributed materials/ analysis/ tools: N Shah & TJ Ursani, Wrote the paper: N Shah & HMZ Raza.

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