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Original Research Article

Ubiquitous analysis of thyroid disorders in reproductive age group females in rural field practice area of tertiary care hospital and its correlation with body mass index

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ABSTRACT

Background: Thyroid is a vital hormone producing gland that plays a major role in regulating metabolism, growth and development in the human body. It also regulates body mass index (BMI) and other metabolic functions.
Methods: The present study was done on 200 females of reproductive age group in the field practice area of tertiary care hospital JIIU's Indian institute of medical science and research, Jalna. Data collection involved general and thyroid examinations of subjects and blood sample collection for a thyroid profile. Body weight and height were also noted.
Results: Thyroid disorders and their prevalence among the overall study subjects show that 79% of the population has normal thyroid function, 11% have hypothyroidism, 4.5% have hyperthyroidism, 4% have goiter, 0.5% have thyroid adenoma, 0.5% have thyroid carcinoma, and 0.5% have thyroid cyst. The Thyroid disorders in the age group 15-24, 25-34, 35-44 and 44 and older years are 8%, 5.5%, 5% and 2.5% respectively.
Conclusions: Thyroid disorders are prevalent in reproductive age group females of rural Maharashtra commonest being subclinical hypothyroidism (SCH). Early diagnosis and treatment of thyroid disorders not only improve the quality of life of patients but also plays an important role in mitigating adverse maternal and fetal outcomes in the future. Further studies with larger sample sizes are needed to address the problem of thyroid disorders in rural areas.

Keywords: Thyroid, Reproductive age, BMI, Hypothyroidism, Hyperthyroidism, Goiter, Females, Tertiary care hospital

INTRODUCTION

The thyroid gland is a vital hormone producing gland that plays a major role in regulating metabolism, growth and development in the human body. It also helps regulate BMI and other metabolic functions. As one of the largest endocrine glands, the thyroid controls not only basal metabolic rate but also various other bodily functions. Thyroid diseases are being increasingly diagnosed and are among the chronic non-communicable diseases that affect women more frequently.[1] Despite the universal iodization of salt in recent years, the prevalence of thyroid disorders has reached epidemic proportions. Studies estimate that about 42 million people in India are affected by thyroid diseases.[2]

This study will focus on the epidemiology of five common thyroid diseases in India: Hypothyroidism, hyperthyroidism, goitre and iodine deficiency disorders, Hashimoto's thyroiditis and thyroid cancer.[2]

While much research has been conducted on thyroid disorders in urban areas, there are very few studies addressing this issue in rural areas.[3-5] Therefore, the present study is designed to address this problem. The present study is ubiquitously done in the field practice area of tertiary care hospital JIIU's Indian institute of medical science and research.

Normal thyroid function

The thyroid is an endocrine gland located in the inferior, anterior part of the neck. It is responsible for producing and secreting thyroid hormones, as well as regulating iodine homeostasis in the human body. The thyroid produces approximately 90% inactive thyroid hormone, known as thyroxine (T4), and 10% active thyroid hormone, called triiodothyronine (T3). The inactive thyroid hormone is converted outside the thyroid gland into either the active form or an alternative inactive form.

SCH is characterized by a serum thyroid-stimulating hormone (TSH) level that is higher than the upper limit of normal, despite normal levels of serum free thyroxine.

Overt hypothyroidism, where the levels of thyroxine are actually below normal, is a more severe problem and may cause fatigue, weight gain, cold intolerance, dry skin, and an increased risk of heart problems.

Subclinical hyperthyroidism is defined as a state in which TSH levels are suppressed while free thyroxine and triiodothyronine levels remain normal, without any clinical signs of thyrotoxicosis.

Overt hyperthyroidism is defined as low or suppressed TSH levels combined with elevated triiodothyronine (T3) levels and/or elevated thyroxine (T4) levels.

Thyroid adenomas are benign lesions of the thyroid gland. These lesions may be inactive or active in production of thyroid hormones. Typically, thyroid adenomas present as a solitary thyroid nodule.

Thyroid cancer is a growth of cells that originates in the thyroid. In the early stages, thyroid cancer may not produce any symptoms, however as it grows, it can lead to noticeable signs and symptoms, such as swelling in your neck, changes in voice and difficulty swallowing.

Thyroid cysts are fluid-filled enlargements of the thyroid that can range in size from small (less than 1 cm) to quite large and may develop suddenly.

BMI can be defined as a person's weight in kilograms (kg) divided by their height in meters squared.

The national institutes of health (NIH) now define normal weight, overweight, and obesity according to BMI rather than the traditional height/weight charts. BMI is universally expressed in units of kg/m^2, resulting from mass in kilograms and height in meters.

According to the common definitions of BMI established by organizations such as the Indian council of medical research (ICMR), AIIMS Delhi, the diabetic foundation of India, and the national institute of nutrition, the following BMI ranges are categorized as: Underweight: less than 18, normal (healthy and low risk): 18 to 23, overweight (Little risk): 23 to 25, obesity gr. I (High risk): 25 to 30, obesity gr. II (Very high risk): 30 to 35 and obese class III (Highest risk): more than 35.

Aims and objectives

Aim and objectives were to estimate the prevalence of thyroid disorders in women of reproductive age group and to correlate thyroid disorders with BMI.

METHODS

Study type, study place and study period

This research was a community-based cross-sectional study. It was conducted in the field practice area of a tertiary care hospital, JIIU's Indian institute of medical science and research, Jalna-India. It was carried out from January 2024 to the end of June 2024.

Study population

The study population consisted of 200 females aged between 15 to 45 years, selected from the field practice area.

Sampling technique

A convenient sampling technique was used to include 200 individuals who met the inclusion criteria.

Inclusion criteria

Reproductive age group of females in between 15 to 45 years with their consent were included.

Exclusion criteria

Males, ANC and PNC women, women diagnosed with PCOD, hypertension, diabetes mellitus, women with deranged lipid profiles were excluded.

Procedure

Data collection involved conducting a general and thyroid examination of reproductive-age females presenting to the medicine and obstetrics and gynecology (OBGY)

departments. Additionally, patients presenting to the Surgery department with thyroid swellings were included. Blood samples were collected from all 200 participants to assess thyroid profiles. Body weight and height were also recorded for each participant.

Statistical analysis

The statistical analysis was done by entering all the thyroid profile data in excel sheet and then loaded that data into SPSS software. A p value level of less than 0.05 was considered a significant association.

Ethical approval was obtained from the institute's ethics committee. Written informed consent was obtained from all study participants. Data collection was conducted anonymously, and full confidentiality was maintained throughout the study.

RESULTS

Among the total of 200 subjects the majority of the study subjects are from the age group 15-24 which consists of 71 subjects (35.5%). And the minority of the study subjects are from the age group 45 and older which consists of 30 subjects (15%).

Table 2 analyzes the prevalence of thyroid disorders among the overall study population of 200 females. The findings show that 158 individuals (79%) have normal thyroid function, while 22 individuals (11%) have hypothyroidism. Additionally, 9 individuals (4.5%) are diagnosed with hyperthyroidism, 8 individuals (4%) have goiter, and there is 1 individual (0.5%) each with thyroid adenoma, thyroid carcinoma, and thyroid cyst. This table highlights the prevalence of thyroid disorders among females.

Table 1: Distribution of study subjects according to age.

Age groups (in years)	N	Percentage (%)
15-24	71	35.5
25-34	61	30.5
35-44	38	19
≥45	30	15
Total	200	100

Table 2: Prevalence of thyroid disorders.

Thyroid status	N	Percentage (%)
Normal	158	79
Hypothyroidism	22	11
Hyperthyroidism	09	4.5
Goiter	8	4
Thyroid adenoma	1	0.5
Thyroid carcinoma	1	0.5
Thyroid cyst	1	0.5
Total	200	100

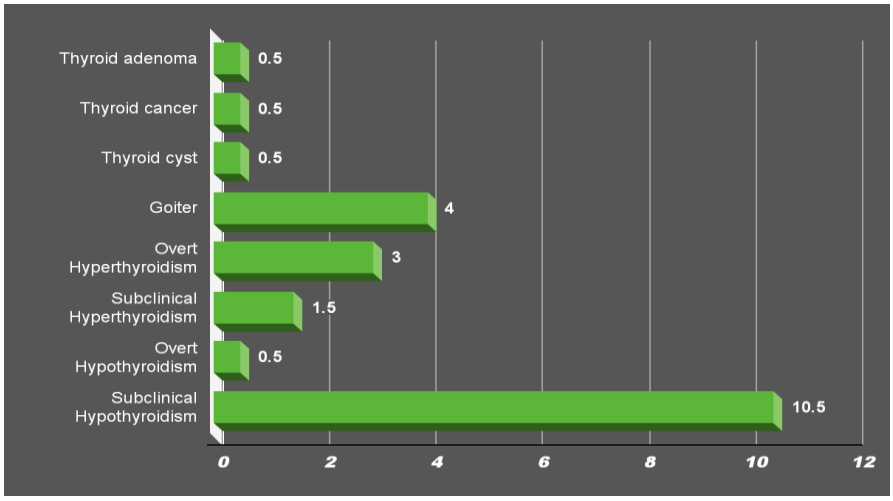

Figure 1: Prevalence of different thyroid disorders with subclinical and overt hypothyroidism.

Figure 1 focuses solely on the affected population with thyroid disorders and their respective percentages: 10.5% for SCH, 0.5% for overt hypothyroidism, 1.5% for subclinical hyperthyroidism, 3% for overt hyperthyroidism, 4% for goiter, and 0.5% each for thyroid cyst, thyroid cancer, and thyroid adenoma. In this analysis, we further classify hypothyroidism into subclinical and overt forms, and similarly categorize hyperthyroidism into subclinical and overt forms.

Table 3 presents the body fat distribution of the study subjects based on BMI, categorizing them into six groups: underweight, normal, overweight, obese grade 1, obese grade 2, and obese grade 3. It also correlates the BMI categories with different age groups. In the age group 15-24, there are a total of 71 subjects. Among them, 12 are categorized as underweight, 41 as normal, 6 as overweight, 9 as obese grade 1, and 3 as obese grade 2. For the age group 25-34, there are 61 subjects. This group includes 9 subjects classified as underweight, 16 as normal, 5 as

overweight, 22 as obese grade 1, 8 as obese grade 2, and 1 as obese grade 3. In age group 35-44, there are 38 subjects. Within this group, 2 are underweight, 11 are normal, 5 are overweight, 13 are obese grade 1, 4 are obese grade 2, and 3 are classified as obese grade 3. Finally, age group of 45 and older consists of 30 subjects. Among these, 4 are underweight, 11 are normal, 3-overweight, 8-obese grade 1, 3-obese grade 2, and 1 is classified as obese grade 3.

The normal study population

Table 4 presents the prevalence of thyroid disorders among females across different age groups. In the age group of 15-24 years, 27.5% of the total study population is healthy. For the 25-34-year age group, 25% are considered healthy. In the 35-44-year age group, 14% of the total study population is healthy. Finally, among those aged 45 years and older, 12.5% are healthy.

The study population with thyroid disorders

In the age group 15-24 years (which comprises 71 females), 22.53% of the population have thyroid disorders. For the age group 25-34 years (which comprises 60 females),18.03% of population have thyroid disorders.

In the age group 35-44 years (which comprises 39 females), 26.31% of population have thyroid disorders. Lastly, in the age group of 45 years and older (which comprises of 30 females), 16.66% of population are affected by thyroid disorders. Overall, the prevalence of thyroid disorders among the age groups is as follows: 8% in the 15-24 age group, 5.5% in the 25-34 age group, 5% in the 35-44 age group, and 2.5% in those aged 45 and older, based on a total population of 200.

The above two tables Table 5 and 6 demonstrates the distribution of study subjects. The study subjects having thyroid disorders are 7.40% in the total study population among the underweight (i.e. 2 in 27 underweight subjects). The study subjects having thyroid disorders are 18.98% in the total study population of normal (i.e. 15 in 79 normal subjects). The study subjects having thyroid disorders are 31.57% in the total study population of overweight (i.e. 6 in 19 overweight subjects). The study subjects having thyroid disorders are 25% in the total study population of obese grade-1 (i.e. 13 in 52 obese grade-1 subjects). The study subjects having thyroid disorders are 33.3% in the total study population of obese grade-2 (6 in 18 obese grade-2). The study subjects having thyroid disorders are not found in the total study population of obese grade-3 subjects.

Table 3: Distribution of study subjects according to age BMI.

Age groups (in years)	N	Underweight	Normal	Overweight	Obese grade-1	Obese grade-2	Obese grade-3
15-24	71	12	41	6	9	3	0
25-34	61	9	16	5	22	8	1
35-44	38	2	11	5	13	4	3
≥45	30	4	11	3	8	3	1

Table 4: Distribution of study subjects according to age and thyroid disorders.

Age groups (in years)	No. of normal study subjects	% of normal subjects out of total 200 study subjects	No. of thyroid disorders study subjects	% of thyroid disorders w. r. t. age groups	Total study subjects in age groups (in years)	% of thyroid disorders out of 200
15-24	55	27.5	16	22.53	71	8
25-34	50	25	11	18.03	61	5.5
35-44	28	14	10	26.31	38	5
≥45	25	12.5	5	16.66	30	2.5

Table 5: Distribution of study subjects according to BMI and thyroid disorders.

BMI (kg/m^2)	No. of normal study subjects	% of normal study subjects	No. of thyroid disorders study subjects	% of thyroid disorders	Total study subjects
Underweight	25	92.59	2	7.40	27
Normal	64	81.01	15	18.98	79
Overweight	13	68.42	6	31.57	19
obese grade-1	39	75.00	13	25.00	52
obese grade-2	12	66.7	6	33.3	18
obese grade-3	5	100	0	0	5
Total	158	79	42	21	200

Table 6: Distribution of study subjects according to BMI with respect to different thyroid disorders.

Variables	Underweight	Normal	Overweight	Obese grade-1	Obese grade-2	Obese grade-3
SCH	1	8	3	8	1	0
Overt hypothyroidism	0	0	0	0	1	0
Subclinical hyperthyroidism	0	2	0	0	1	0
Overt hyperthyroidism	0	2	0	2	2	0
Goiter	0	2	2	3	1	0
Thyroid nodules	1	1	1	0	0	0
Normal subjects	25	64	13	39	12	5
Total	27	79	19	52	18	5

Table 7: Distribution of study subjects according to mean and standard deviation in normal and thyroid disorders subjects.

Thyroid hormone levels	Normal study subject's mean	Normal study subject's SD	Thyroid disorders subject's mean	Thyroid disorders subject's SD	P value
T3 levels	114.11	30.90	133.75	31.09	0.0024
T4 levels	10.17	2.44	11.33	2.46	0.0227
TSH levels	2.004	1.097	7.206	7.132	0.0405

*T3 levels: t=3.0691, df=198, t4 levels: t=2.295, df=198, tsh levels: t=2.062, df=198 student t-test was applied.

DISCUSSION

The current study analyzes thyroid disorders in reproductive age group females and their correlation with BMI which is discussed below. We have organized this discussion in 6 main categories plus sub categories and compared our findings with other studies to get a comprehensive view of analysis of the prevalence of thyroid disorders and BMI correlation, which are as follows:

Total thyroid disorders

The prevalence of total thyroid disorders in the current study is 21%, with 42 females affected with thyroid disorders which is greater than the study of Du et al that shows 13.52% of total thyroid disorders and less than studies of Rashad et al and Jimoh et al that shows 29.3% and 17.9% of total thyroid disorders respectively.[17,18,20]

Hypothyroidism

Total hypothyroidism

The current study finds that 11% (22 females) of the total 200 study subjects have hypothyroidism. This percentage is higher than those reported in studies conducted by Unnikrishnan et al (10.95%), Okamura et al (4.5%), Schaaf et al (0.105%), Monabeka et al (7.4%), Sidibé (8.8%), Ogbera et al (7%), Diab et al (6.88%), and Wouters et al (10.1%). However, it is lower than the percentages reported by Paul et al (11.56%) and Rashad et al (65%).[5,7-12,16,18,19]

Subclinical and overt hypothyroidism

SCH

The current study finds that 10.5% of participants (21 females) have SCH. This prevalence is greater than that reported in studies by Okamura et al (4.2%), Schaaf et al (0.09%), Paul et al (6.59%), Diab et al (6.06%), and Wouters et al (9.4%). However, it is lower than the findings of Rashad et al who reported a prevalence of 44.4% for SCH.[7,8,10,16,18,19]

Overt hypothyroidism

The current study shows that 0.5% of females (1 individual) have overt hypothyroidism. This rate is greater than the findings of Okamura et al (0.3%) and Schaaf et al (0.015%), but lower than those reported by Paul et al (4.97%), Diab et al (0.82%), Rashad et al (20.6%), and Wouters et al (0.7%).[7,8,10,16,18,19]

Hyperthyroidism

Total hyperthyroidism

The current study reports that 4.5% of the participants (9 females) have total hyperthyroidism. This prevalence is higher than that found in the studies by Okamura et al (0.9%), Schaaf et al (0.36%), Paul et al (1.51%), and Diab et al (1.04%). However, it is lower than the findings of Monabeka et al (20.8%), Sidibé (13.1%), Ogbera et al (84%), Rashad et al (35%), and Jimoh et al (13.5%).[7,12,16,18,20]

Subclinical and overt hyperthyroidism

Subclinical hyperthyroidism

The current study found that 3% (6 females) of participants had overt hyperthyroidism. This prevalence is higher than the findings of Okamura et al (0.7%), Schaaf et al (0.03%), Paul et al (0.86%), and Diab et al (0.26%), but lower than the study conducted by Rashad et al which reported a prevalence of 19.2%.[7,8,10,16,18]

Overt hyperthyroidism

The current study shows 3% (6 females) of overt hyperthyroidism which is greater than studies of Okamura et al, Schaaf et al, Paul et al and Diab et al which shows 0.7%, 0.03%, 0.86% and 0.26% of overt hyperthyroidism respectively and lesser than study of Rashad et al with 19.2% of overt hyperthyroidism.[7,8,10,16,18]

Goiter

The current study identified that 4% (8 females) of participants had total goiter. This rate is significantly lower compared to the studies by Cardozo et al (67%), Monabeka et al (58.7%), Paul et al (10.49%), Sidibé (72%), Ogbera et al (13%), and Nggada et al (75%).[6,9-13]

Euthyroid goiter

The studies conducted by Schaaf et al, Sidibé, and Jimoh et al reported rates of euthyroid goiter at 20%, 54.7% and 46% respectively which are significantly higher than the current study which found only 2.5% (5 females) with euthyroid goiter.[8,11,20] The study of Paul et al reported a prevalence of 7.35% for diffuse goiter.[10] The study of Nggada et al has also commented on occurrence of 1.8% for toxic goiter.[13]

Thyroid nodules

In a study by Jiang et al the prevalence of thyroid nodules was reported to be 49%, after standardization, this figure was adjusted to 40.1%.[14] Other studies conducted by Yunhai et al and Dong et al reported prevalence rates of 36.9% and 33.3%, respectively, in contrast, the current study found a much lower prevalence of thyroid nodules at 1.5%, which corresponds to 3 females among the 200 study subjects.[21,22] The Thyroid Nodules are further divided in 3 categories: thyroid adenoma, thyroid carcinoma and thyroid cyst.

Thyroid adenoma

The studies conducted by Monabeka et al, Sidibé, and Nggada et al reported prevalence rates of thyroid adenoma of 7%, 13.5%, and 6%, respectively, these figures are notably high compared to the current study, which found a prevalence of only 0.5% (1 female) among 200 study subjects.[9,11,13]

Thyroid carcinoma

The research by Monabeka et al, Sidibé, and Nggada et al revealed prevalence rates of thyroid carcinoma at 0.007% (4 cases), 13.5%, and 11%, respectively, these rates are significantly higher than current study's finding of 0.5% (1 female) with thyroid carcinoma in study population.[9,11,13]

Thyroid cyst and thyroiditis

The current study reported a prevalence of 0.5% (1 female) for thyroid cysts, which is lower than the 1.8% prevalence found by Nggada et al in their affected population.[13]

BMI and its correlation to thyroid disorders

The current study reveals a notable prevalence of thyroid disorders among subjects classified as obese grade 1 and grade 2, with affected females constituting 25% and 33.3% of these groups, respectively. Additionally, the study indicates a slight increase in thyroid disorders among underweight individuals, with a prevalence rate of 7.4%. A study conducted by Mahdavi et al found a significantly higher prevalence of hypothyroidism in obese individuals-11.6% overall, including 4.0% with overt hypothyroidism and 7.6% with SCH-compared to those with a normal BMI, which aligns with some findings from our study.[23]

The study by Ríos-Prego et al found that overweight or obesity was present in 76.5% of hypothyroid patients and 58.8% of hyperthyroid patients.[15]

Limitations

The limitation of present study is that it has been conducted in a single tertiary care centre hence does not represent the entire population of the state. Similar studies with larger sample size carried out in multiple centers would provide better information regarding incidence and prevalence of thyroid disorders in rural areas.

CONCLUSION

The current study analyzed the prevalence of thyroid disorders among females of reproductive age in rural Maharashtra, with SCH being the most common condition identified. The study found that the prevalence of thyroid disorders was higher in obese patients, while underweight individuals also exhibited abnormal thyroid function. Early diagnosis and treatment of thyroid disorders not only improve the quality of life for patients but also play a crucial role in reducing adverse maternal and fetal outcomes in the future. There is a need for further studies with larger sample sizes to better address the issue of thyroid disorders in rural areas.

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