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UNVEILING THE BURDEN OF THYROID DYSFUNCTION: A CROSS-SECTIONAL STUDY IN A TERTIARY CARE SETTING

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ABSTRACT

Background: Thyroid dysfunction is a prevalent endocrine disorder with significant public health implications. This study aimed to estimate the prevalence and patterns of thyroid dysfunction in a tertiary care center and identify associated demographic, clinical, and lifestyle factors.

Materials and Methods: This cross-sectional study was conducted at a tertiary care hospital, enrolling 712 participants. Detailed clinical evaluation, demographic data, and lifestyle information were collected. Thyroid function was assessed using serum TSH, free T3, and free T4 levels. Participants were categorized as euthyroid, hypothyroid (primary or subclinical), or hyperthyroid (primary or subclinical). Statistical analyses included chi-square tests, t-tests, and multivariate logistic regression to identify significant predictors of thyroid dysfunction.

Results: The overall prevalence of thyroid dysfunction was 33.7%, with primary hypothyroidism (13.1%) and subclinical hypothyroidism (10.9%) being the most common abnormalities. Hyperthyroidism was observed in 5.2% (primary) and 4.5% (subclinical) of participants. Increasing age (OR: 1.05, 95% CI: 1.03–1.07), female gender (OR: 1.53, 95% CI: 1.11–2.11), obesity (OR: 2.95, 95% CI: 1.96–4.45), and family history of thyroid disorder (OR: 4.11, 95% CI: 2.56–6.59) were significant predictors of thyroid dysfunction. Comorbidities such as hypertension (39.2% in hypothyroid individuals) and diabetes (32.7% in hypothyroid individuals) were significantly more common in those with thyroid dysfunction. Regular iodized salt consumption was notably higher in euthyroid individuals (83.5%) compared to those with thyroid dysfunction.

Conclusion: Thyroid dysfunction is common, with hypothyroidism being the predominant abnormality. Age, female gender, obesity, and family history were identified as key risk factors. The association between thyroid dysfunction and cardiovascular risk factors underscores the need for routine screening in high-risk populations. Promoting awareness about iodine sufficiency may further aid in reducing the prevalence of thyroid dysfunction.

Keywords: Thyroid dysfunction, Hypothyroidism, Hyperthyroidism, Risk factors, Iodine intake, Cross-sectional study.

INTRODUCTION

Thyroid dysfunction is a common endocrine disorder with significant public health implications in India. Hypothyroidism, hyperthyroidism, and subclinical thyroid dysfunction are frequently encountered conditions, with hypothyroidism being particularly prevalent. Studies have reported that the overall prevalence of hypothyroidism in India is approximately 10.95%, with certain regions showing

rates as high as 13.1% due to varying iodine sufficiency and environmental factors.[1] Among adults, women are disproportionately affected, with a prevalence nearly five times higher than men, attributed to hormonal fluctuations, autoimmunity, and genetic predisposition.[2] Subclinical hypothyroidism, an asymptomatic yet clinically relevant condition, is also common, affecting nearly 8% of the Indian population, particularly in older adults.[3]

Hyperthyroidism, though less frequent, has a reported prevalence of around 1.3% in India, with Graves' disease being a leading cause.[4] Additionally, iodine-induced hyperthyroidism remains a concern in regions where iodine fortification programs have been implemented.[5] The presence of thyroid autoantibodies, especially thyroid peroxidase antibodies (TPOAb), is an established marker for autoimmune thyroid diseases, further influencing disease patterns.[6]

Thyroid dysfunction is known to contribute to significant morbidity, including cardiovascular complications, metabolic disturbances, and adverse pregnancy outcomes. For instance, untreated hypothyroidism is associated with a twofold increased risk of ischemic heart disease, while subclinical hyperthyroidism has been linked to atrial fibrillation and osteoporosis.[7,8] In pregnant women, thyroid dysfunction has been implicated in preterm birth, low birth weight, and impaired neurocognitive development in offspring.[9,10]

Given the substantial disease burden and its varied presentations, identifying the prevalence and patterns of thyroid dysfunction is crucial.[11] Tertiary care centers, which manage a broad spectrum of cases, are ideally positioned to provide insights into these patterns.[12] This study aimed to estimate the prevalence and characterize the patterns of thyroid dysfunction in patients attending a tertiary care center, thereby offering valuable data to improve screening protocols, enhance early diagnosis, and inform targeted treatment strategies.

MATERIALS AND METHODS

Study Design and Setting: This cross-sectional study was conducted at the Department of Biochemistry, in a tertiary care center of North India, over a period of 12 months from June 2023 to May 2024. The study was approved by the Institutional Ethics Committee (IEC). Patients attending the outpatient department (OPD) as well as those admitted to the inpatient wards who underwent thyroid function testing as part of their clinical evaluation were included in the study. Written informed consent was obtained from all participants before enrollment.

Study Population: The study population comprised adult patients aged 18 years and above who underwent thyroid function tests during the study period. Patients with a previously diagnosed thyroid disorder who were already receiving treatment with thyroxine, antithyroid medications, or iodine supplements were excluded from the study to minimize confounding factors. Additionally, patients with acute illness, sepsis, or those admitted to intensive care units were excluded, as these conditions are known to cause transient alterations in thyroid hormone levels. Pregnant women were also excluded due to the altered physiological reference ranges for thyroid hormones during pregnancy.

Sample Size Calculation: Based on a reported prevalence of hypothyroidism of 10.95% in the Indian population, with a 95% confidence interval and a margin of error of 3%, the required sample size was calculated to be 646 participants.[13] To account for potential data loss and incomplete records, an additional 10% was added, bringing the final sample size to 712 participants.

Data Collection: Data collection was conducted using a structured proforma that included demographic details such as age, sex, and socioeconomic status, along with clinical history, comorbid conditions, and medication use. Clinical symptoms suggestive of thyroid dysfunction, including fatigue, weight changes, hair loss, palpitations, and menstrual irregularities, were also documented. Blood pressure, body mass index (BMI), and relevant anthropometric measurements were recorded during the clinical evaluation.

Laboratory Analysis: Blood samples were collected from all participants under aseptic conditions following an overnight fast. Serum levels of thyroid-stimulating hormone (TSH), free thyroxine (FT4), and free triiodothyronine (FT3) were measured using a chemiluminescent immunoassay (CLIA). The following reference ranges were used to classify thyroid function: TSH (0.4–4.5 mIU/L), FT4 (0.8–2.0 ng/dL), and FT3 (2.3–4.2 pg/mL). Based on these results, thyroid dysfunction was categorized into distinct groups: primary hypothyroidism was defined as TSH >4.5 mIU/L with low FT4, while subclinical hypothyroidism was defined as TSH >4.5 mIU/L with normal FT4. Hyperthyroidism was defined as TSH <0.4 mIU/L with elevated FT3 and/or FT4, while subclinical hyperthyroidism was defined as TSH <0.4 mIU/L with normal FT3 and FT4. Participants with TSH and FT3/FT4 values within the reference ranges were classified as euthyroid.[14]

Statistical Analysis: All collected data were entered into Microsoft Excel and analyzed using SPSS software version 21.0. Descriptive statistics were used to summarize the demographic and clinical characteristics of the participants. Continuous variables such as age, BMI, and TSH levels were presented as mean ± standard deviation (SD), while categorical variables such as sex, presence of comorbidities, and patterns of thyroid dysfunction were expressed as frequencies and percentages. The chi-square test was employed to evaluate associations between thyroid dysfunction and categorical variables, while an independent t-test or ANOVA was applied to compare continuous variables across

different thyroid function groups. Binary logistic regression analysis was performed to identify independent predictors of thyroid dysfunction, with results expressed as odds ratios (OR) and 95% confidence intervals (CI). Statistical significance was set at $p<0.05$ for all analyses.

Ethical Considerations: The study adhered to the ethical principles outlined in the Declaration of Helsinki. Participant confidentiality was ensured by anonymizing data and securely storing records. Data were accessible only to authorized research personnel.

RESULTS

The mean age of the study population was 44.6 ± 15.2 years, with the majority aged between 46–60 years (32.2%). Females constituted a higher proportion (56.6%) compared to males (43.4%). The mean BMI was 24.7 ± 4.6 kg/m², with 19% classified as obese and 33.4% as overweight. Most participants belonged to the middle socioeconomic class (54.1%) and resided in rural areas (56.7%). Employment status varied, with 45.9% employed and 26.8% homemakers. A mixed diet was reported by 47.6%, while 30.3% followed a vegetarian diet. Smoking prevalence was 12.8% (current smokers), while 22.1% reported alcohol consumption. Hypertension (27.4%) and diabetes (23.5%) were the most common comorbidities, and 14.7% had a family history of thyroid disorders. Iodized salt was consumed regularly by 77.1% of participants, while 18.4% reported occasional use, and 4.5% reported no use [Table 1].

Table 1: Demographic, Anthropometric, and Lifestyle Characteristics of the Study Population (n=712).

Variable	Frequency (%)/mean ± SD
Age (years)	44.6 ± 15.2
Age Group (years)	
18-30	131 (18.4%)
31-45	213 (29.9%)
46-60	229 (32.2%)
>60	139 (19.5%)
Gender	
Male	309 (43.4%)
Female	403 (56.6%)
BMI (kg/m²)	24.7 ± 4.6
BMI Categories	
Underweight (<18.5)	60 (8.4%)
Normal (18.5-24.9)	279 (39.2%)
Overweight (25-29.9)	238 (33.4%)
Obese (≥30)	135 (19.0%)
Socioeconomic Status	
Low	199 (27.9%)
Middle	385 (54.1%)
High	128 (18.0%)
Residence	
Rural	404 (56.7%)
Urban	308 (43.3%)
Occupation	
Unemployed	111 (15.6%)
Employed	327 (45.9%)
Student	83 (11.7%)
Homemaker	191 (26.8%)
Marital Status	
Single	109 (15.3%)
Married	520 (73.0%)
Widowed/Divorced	83 (11.7%)
Dietary Habit	
Vegetarian	216 (30.3%)
Non-vegetarian	157 (22.1%)
Mixed diet	339 (47.6%)
Smoking Status	
Current	91 (12.8%)
Former	64 (9.0%)
Never	557 (78.2%)
Alcohol Consumption	157 (22.1%)
Comorbidities	
Hypertension	195 (27.4%)
Diabetes	167 (23.5%)
Dyslipidemia	151 (21.2%)
Cardiovascular Disease	98 (13.8%)
Autoimmune Disorders	49 (6.9%)
Family History of Thyroid Disorder	105 (14.7%)
Medication Type	
Beta-blockers	73 (10.3%)

Corticosteroids	60 (8.4%)
Oral Contraceptives	84 (11.8%)
Lithium	22 (3.1%)
Iodized Salt Consumption	
Regular Use (Daily)	549 (77.1%)
Irregular Use (Occasional)	131 (18.4%)
No Use	32 (4.5%)

Among the study participants, 66.3% were euthyroid, with a higher prevalence among males (71.5%) compared to females (62.3%) ($p < 0.010$). Primary hypothyroidism was observed in 13.1% of participants, significantly more common in females (17.1%) than males (7.8%) ($p < 0.012$). Subclinical hypothyroidism was noted in 10.9% of participants, with no significant gender difference ($p = 0.125$). Primary hyperthyroidism accounted for 5.2% of cases, with a comparable distribution between males (4.9%) and females (5.5%) ($p = 0.658$). Subclinical hyperthyroidism was seen in 4.5% of participants, more frequent in males (6.8%) than females (2.7%) ($p < 0.011$). These findings suggest a significant gender disparity in primary hypothyroidism and subclinical hyperthyroidism [Table 2].

Table 2: Distribution of Thyroid Status by Gender in the Study Population (n=712).

Thyroid Status	Total (n=712)	Male (n=309)	Female (n=403)	p-value
	Frequency (%)			
Euthyroid	472 (66.3%)	221 (71.5%)	251 (62.3%)	<0.010
Primary Hypothyroidism	93 (13.1%)	24 (7.8%)	69 (17.1%)	<0.012
Subclinical Hypothyroidism	78 (10.9%)	28 (9.1%)	50 (12.4%)	0.125
Primary Hyperthyroidism	37 (5.2%)	15 (4.9%)	22 (5.5%)	0.658
Subclinical Hyperthyroidism	32 (4.5%)	21 (6.8%)	11 (2.7%)	<0.011

The prevalence of euthyroidism decreased significantly with increasing age, from 80.2% in the 18-30 years group to 51.1% in those aged >60 years ($p < 0.001$). Conversely, primary hypothyroidism was significantly more prevalent in older age groups, rising from 3.1% in the youngest group to 24.5% in those aged >60 years ($p < 0.001$). Subclinical hypothyroidism showed no significant variation across age groups ($p = 0.121$). Primary hyperthyroidism increased modestly with age, peaking at 7.2% in the oldest group, though this trend was not statistically significant ($p = 0.134$). Subclinical hyperthyroidism showed no clear age-related trend ($p = 0.478$). These findings highlight a notable age-related increase in primary hypothyroidism and decrease in euthyroidism [Table 3].

Table 3: Distribution of Thyroid Status Across Different Age Groups in the Study Population (n=712).

Thyroid Status	Age Group (years), Frequency (%)				p-value
	18-30 (n=131)	31-45 (n=213)	46-60 (n=229)	>60 (n=139)	
Euthyroid (n=472)	105 (80.2%)	154 (72.3%)	142 (62.0%)	71 (51.1%)	<0.001
Primary Hypothyroidism (n=93)	4 (3.1%)	17 (8.0%)	38 (16.6%)	34 (24.5%)	<0.001
Subclinical Hypothyroidism (n=78)	10 (7.6%)	24 (11.3%)	28 (12.2%)	16 (11.5%)	0.121
Primary Hyperthyroidism (n=37)	5 (3.8%)	8 (3.8%)	14 (6.1%)	10 (7.2%)	0.134
Subclinical Hyperthyroidism (n=32)	7 (5.3%)	10 (4.7%)	7 (3.1%)	8 (5.8%)	0.478

Patients with hypothyroidism exhibited significantly higher frequencies of fatigue (77.2%), weight gain (63.2%), hair loss (57.3%), dry skin (59.1%), and constipation (33.9%) compared to euthyroid individuals (all $p < 0.001$). Hyperthyroid patients also showed elevated symptom prevalence, particularly palpitations (65.2%) and hair loss (60.9%). Laboratory results revealed significantly elevated TSH in hypothyroidism (8.92 ± 3.51 mIU/L) and markedly reduced levels in hyperthyroidism (0.12 ± 0.06 mIU/L) ($p < 0.001$). Conversely, FT4 and FT3 levels were significantly lower in hypothyroid patients and elevated in hyperthyroid individuals (both $p < 0.001$). Lipid profiles indicated higher serum cholesterol (226.2 ± 36.1 mg/dL) and triglycerides (178.6 ± 42.5 mg/dL) in hypothyroid patients, while hyperthyroid patients had comparatively lower levels. HbA1c was significantly higher in hypothyroidism ($6.4 \pm 0.7\%$) and lower in hyperthyroidism ($5.3 \pm 0.4\%$) compared to euthyroid individuals ($p < 0.001$). These findings emphasize the distinct clinical and biochemical profiles associated with thyroid dysfunction [Table 4].

Table 4: Symptom Profile and Laboratory Parameters in Euthyroid, Hypothyroid, and Hyperthyroid Patients (n=712).

Variables	Euthyroid (n=472)	Hypothyroidism (n=171)	Hyperthyroidism (n=69)	p-value
	Frequency (%)/mean ± SD			
Symptoms				
Fatigue (n=271)	92 (19.5%)	132 (77.2%)	47 (68.1%)	<0.001
Weight gain/loss (n=189)	45 (9.5%)	108 (63.2%)	36 (52.2%)	<0.001
Hair loss (n=212)	72 (15.3%)	98 (57.3%)	42 (60.9%)	<0.001

Palpitations (n=106)	29 (6.1%)	32 (18.7%)	45 (65.2%)	<0.001
Menstrual irregularities (n=132)	41 (8.7%)	68 (39.8%)	23 (33.3%)	<0.001
Dry Skin (n=183)	56 (11.9%)	101 (59.1%)	26 (37.7%)	<0.001
Depression/Anxiety (n=164)	53 (11.2%)	82 (48.0%)	29 (42.0%)	<0.001
Constipation/Diarrhea (n=118)	42 (8.9%)	58 (33.9%)	18 (26.1%)	<0.001
Laboratory parameters				
TSH (mIU/L)	2.43 ± 1.02	8.92 ± 3.51	0.12 ± 0.06	<0.001
FT4 (ng/dL)	1.32 ± 0.24	0.79 ± 0.18	2.15 ± 0.46	<0.001
FT3 (pg/mL)	3.21 ± 0.47	2.41 ± 0.39	5.87 ± 0.82	<0.001
Serum Cholesterol (mg/dL)	178.4 ± 28.5	226.2 ± 36.1	161.8 ± 29.3	<0.001
Serum Triglycerides (mg/dL)	136.3 ± 34.7	178.6 ± 42.5	112.6 ± 27.8	<0.001
HbA1c (%)	5.6 ± 0.5	6.4 ± 0.7	5.3 ± 0.4	<0.001

Hypothyroid and hyperthyroid patients demonstrated a significantly higher prevalence of hypertension (39.2% and 37.7%, respectively), diabetes mellitus (32.7% and 33.3%), and dyslipidemia (34.5% and 26.1%) compared to euthyroid individuals (all $p < 0.001$). Cardiovascular disease was also significantly more frequent in hypothyroid (20.5%) and hyperthyroid patients (17.4%) than in euthyroid individuals ($p = 0.002$). Autoimmune disorders were notably higher in hypothyroid patients (15.8%) compared to euthyroid individuals (3.0%) ($p < 0.001$). Regarding iodized salt consumption, regular daily use was more common in euthyroid individuals (83.5%) than in those with hypothyroidism (68.4%) or hyperthyroidism (55.1%) ($p < 0.001$). Conversely, irregular and no iodized salt use were significantly more frequent among hypothyroid and hyperthyroid patients. These findings highlight key associations between thyroid dysfunction, comorbidities, and dietary patterns (Table 5).

Table 5: Comorbidities and Iodized Salt Consumption Patterns in Euthyroid, Hypothyroid, and Hyperthyroid Patients (n=712).

Variables	Euthyroid (n=472)	Hypothyroidism (n=171)	Hyperthyroidism (n=69)	p-value
	Frequency (%)			
Comorbidity				
Hypertension (n=195)	102 (21.6%)	67 (39.2%)	26 (37.7%)	<0.001
Diabetes Mellitus (n=167)	88 (18.6%)	56 (32.7%)	23 (33.3%)	<0.001
Dyslipidemia (n=151)	74 (15.7%)	59 (34.5%)	18 (26.1%)	<0.001
Cardiovascular Disease (n=98)	51 (10.8%)	35 (20.5%)	12 (17.4%)	0.002
Autoimmune Disorders (n=49)	14 (3.0%)	27 (15.8%)	8 (11.6%)	<0.001
Iodized Salt Consumption				
Regular Use (Daily) (n=549)	394 (83.5%)	117 (68.4%)	38 (55.1%)	<0.001
Irregular Use (Occasional) (n=131)	59 (12.5%)	38 (22.2%)	34 (49.3%)	<0.001
No Use (n=32)	19 (4.0%)	16 (9.4%)	3 (4.3%)	0.038

Increasing age was significantly associated with a higher likelihood of being non-euthyroid, with an odds ratio (OR) of 1.05 (95% CI: 1.03–1.07, $p < 0.001$). Female gender showed a notable association with non-euthyroid status (OR: 1.53, 95% CI: 1.11–2.11, $p = 0.008$). Obesity (BMI ≥30 kg/m²) was strongly linked to non-euthyroid status (OR: 2.95, 95% CI: 1.96–4.45, $p < 0.001$), while overweight individuals also had a modestly increased risk (OR: 1.41, 95% CI: 1.01–1.97, $p = 0.042$). Conversely, underweight status did not show a significant association ($p = 0.823$). Smoking and alcohol consumption were not significantly linked to non-euthyroid status ($p = 0.534$ and $p = 0.364$, respectively). Notably, a family history of thyroid disorder markedly increased the odds of being non-euthyroid (OR: 4.11, 95% CI: 2.56–6.59, $p < 0.001$), indicating a strong genetic predisposition (Table 6).

Table 6: Association of Demographic and Lifestyle Factors with Non-Euthyroid Status in Study Participants (n=712).

Variable	Euthyroid (n=472)	Non-Euthyroid (n=240)	Odds Ratio (95% CI)	p-value
	Frequency (%)/mean ± SD			
Age (per year increase)	41.2 ± 12.6	46.5 ± 13.8	1.05 (1.03–1.07)	<0.001
Female Gender (n=403)	251 (53.2%)	152 (63.3%)	1.53 (1.11–2.11)	0.008
Obesity (BMI ≥30 kg/m²) (n=135)	62 (13.1%)	73 (30.4%)	2.95 (1.96–4.45)	<0.001
Overweight (BMI 25–29.9 kg/m²) (n=238)	146 (30.9%)	92 (38.3%)	1.41 (1.01–1.97)	0.042
Underweight (BMI <18.5 kg/m²) (n=60)	39 (8.3%)	21 (8.8%)	1.06 (0.58–1.94)	0.823
Smoking Status (Current) (n=91)	63 (13.4%)	28 (11.7%)	0.85 (0.51–1.41)	0.534
Alcohol Consumption (n=157)	109 (23.1%)	48 (20.0%)	0.83 (0.55–1.24)	0.364
Family History of Thyroid Disorder (n=105)	39 (8.3%)	66 (27.5%)	4.11 (2.56–6.59)	<0.001

DISCUSSION

Our study demonstrated a prevalence of 33.7% for thyroid dysfunction, with hypothyroidism (both primary and subclinical) accounting for the majority of cases. Primary hypothyroidism was observed in 13.1% of participants, while subclinical hypothyroidism affected 10.9%. Hyperthyroidism,

including both primary (5.2%) and subclinical (4.5%) forms, was relatively less common. These findings align with previous Indian studies by Kothari et al., Gairola et al., and Bose et al., reporting hypothyroidism prevalence between 10% and 20% and hyperthyroidism rates between 3% and 5%.[15-17] The observed gender disparity, with females exhibiting higher prevalence rates of both hypothyroidism and hyperthyroidism, is well-established in the studies by Bose et al., and Sayanna et al.[17,18] Female participants demonstrated significantly higher rates of primary hypothyroidism (17.1% vs. 7.8%) and subclinical hypothyroidism (12.4% vs. 9.1%) than males. This aligns with studies by Hassan-Kadle et al., and Kjaergaard et al., indicating that estrogen, increased autoimmune susceptibility, and genetic predisposition contribute to higher thyroid dysfunction rates in females.[19,20]

Age-specific analysis revealed a significant increase in hypothyroidism prevalence with advancing age, rising from 3.1% in those aged 18–30 years to 24.5% in those above 60 years. This trend is consistent with studies Sayanna et al., and Babu et al., indicating that thyroid dysfunction becomes more common in older adults due to glandular atrophy, declining thyroid reserve, and increased autoantibody production.[18,21] Conversely, euthyroidism rates were higher among younger participants, reinforcing the protective effect of youthful metabolic stability.[21,22]

Our study identified several clinical symptoms strongly associated with thyroid dysfunction. Fatigue (77.2%), weight gain (63.2%), and hair loss (57.3%) were frequently reported by hypothyroid patients, while palpitations (65.2%) and weight loss (52.2%) were common in hyperthyroid cases. These findings mirror established pathophysiological mechanisms, where hypothyroidism impairs metabolic processes, leading to reduced energy production and tissue repair, while hyperthyroidism accelerates metabolism, increasing sympathetic stimulation.[22,23] Comorbidity analysis revealed that individuals with thyroid dysfunction exhibited significantly higher rates of hypertension (39.2% in hypothyroid patients vs. 21.6% in euthyroid individuals), diabetes (32.7%), and dyslipidemia (34.5%). These associations are consistent with studies Yadav et al. and Patrizio et al., demonstrating that hypothyroidism disrupts lipid metabolism, promotes endothelial dysfunction, and contributes to insulin resistance, thereby elevating cardiovascular risk.[24,25] Additionally, autoimmune disorders were notably prevalent among hypothyroid patients (15.8%), reinforcing the established link between autoimmune thyroiditis and systemic immune dysfunction.[26]

Our findings regarding lifestyle factors emphasize the role of iodine consumption in thyroid health. Regular iodized salt use was significantly more common among euthyroid individuals, while those with hypothyroidism or hyperthyroidism had higher rates of irregular or absent iodine intake. This highlights the protective role of adequate iodine consumption in maintaining thyroid homeostasis, as both iodine deficiency and excess are known to impair thyroid function.[27,28]

Multivariate analysis identified key independent risk factors for thyroid dysfunction. Increasing age (OR: 1.05, 95% CI: 1.03–1.07), female gender (OR: 1.53, 95% CI: 1.11–2.11), obesity (OR: 2.95, 95% CI: 1.96–4.45), and family history of thyroid disorder (OR: 4.11, 95% CI: 2.56–6.59) significantly elevated the risk. These findings align with previous studies Castello et al., and Bansal et al., that have established obesity as a disruptor of the hypothalamic-pituitary-thyroid axis and linked family history to genetic predisposition and autoimmune pathways in thyroid dysfunction.[29,30]

Collectively, these findings highlight the complex interplay between demographic, clinical, and lifestyle factors in determining thyroid dysfunction patterns. Strengthening routine screening programs, particularly in high-risk groups such as older adults, females, individuals with obesity, and those with a positive family history, is crucial. Additionally, promoting awareness about iodine sufficiency may help mitigate the burden of thyroid disorders in resource-limited settings.

Limitations: Our study has certain limitations that must be acknowledged. First, being a cross-sectional study, it establishes associations rather than causation, limiting our ability to infer temporal relationships between risk factors and thyroid dysfunction. Second, data collection relied on self-reported information for certain lifestyle variables such as dietary iodine intake and family history, which may introduce recall bias. Third, although our sample size was robust, the study was conducted at a single tertiary care center, which may limit the generalizability of the findings to broader populations, particularly in rural and underserved regions. Additionally, we did not assess the influence of certain environmental factors such as exposure to goitrogens, which could further impact thyroid dysfunction patterns. Lastly, while we identified key comorbidities and risk factors, genetic testing and detailed immunological markers were not included, which may have provided deeper insights into the pathophysiological mechanisms of thyroid dysfunction. Future longitudinal studies involving diverse populations and comprehensive biochemical profiling are warranted to validate our findings.

CONCLUSION

Our study revealed a substantial prevalence of thyroid dysfunction (33.7%), with primary and subclinical hypothyroidism accounting for the majority of cases. Increasing age, female gender, obesity, and a positive family history emerged as significant risk factors. Additionally, our findings highlight the association between thyroid dysfunction and comorbid conditions such as hypertension, diabetes, and dyslipidemia, underscoring the need for comprehensive risk

assessment in clinical practice. The observed protective role of regular iodized salt consumption emphasizes the importance of dietary iodine sufficiency in maintaining thyroid health. Strengthening targeted screening programs, particularly for high-risk groups, alongside public health initiatives promoting iodine awareness, may help reduce the burden of thyroid disorders in resource-constrained settings.

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