

Thyroid Under the Lens: Awareness and Understanding of Biochemical Screening for Thyroid Disorders Among Women in Punjab

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Abstract

Background: Thyroid disorders are increasingly prevalent among women, yet awareness of symptoms and biochemical screening remains inadequate, contributing to delayed diagnosis. In Punjab, shifting lifestyle and dietary patterns further heighten vulnerability. This study assessed women's awareness of thyroid physiology, biochemical testing, and preventive practices. **Material and Methods:** A descriptive cross-sectional study was conducted among 420 urban women (≥ 18 years) in Punjab using a structured Google Form disseminated via social media and community networks. The tool captured socio-demographics, awareness of thyroid physiology (20 items), biochemical screening (20 items), and perceptions/practices (20 statements). Awareness was categorized as excellent, good, fair, or poor. Data were analyzed using SPSS v26 with descriptive statistics and chi-square tests ($p < 0.05$). **Results:** Participants were mostly 26–35 years old (31.9%), graduates (40%), homemakers (40%), and predominantly vegetarian (62.9%). Physiology awareness was high for gland location (78.1%) and metabolic function (74.8%), but lower for autoimmune causes (56.2%) and postpartum thyroiditis (47.1%). Screening knowledge was strongest for TSH (81.4%) and T3/T4 (78.1%), but limited for Anti-TPO and Anti-TG tests (53–56%). Overall, 23.3% demonstrated excellent physiology awareness and 21.9% excellent biochemical awareness. Positive perceptions/practices were observed in 63.8%, yet only 40% underwent screening every 1–2 years. Significant associations with awareness and practices were noted for age, education, occupation, income, diet, family history, sunlight exposure, and health information sources. **Conclusion:** Women in urban Punjab exhibit moderate awareness of thyroid disorders and screening but lack understanding of autoimmune markers and consistent screening practices. Strengthened education and community-based interventions are essential.

Keywords: Thyroid disorders, Women, Awareness, Biochemical screening, Punjab, TSH, Autoimmune thyroiditis, Google Form survey.



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INTRODUCTION

Thyroid disorders represent one of the most common endocrine abnormalities worldwide, disproportionately affecting women due to complex interactions between hormonal, genetic, nutritional, and reproductive factors. The thyroid gland plays a fundamental role in regulating metabolism, growth, reproductive health, and neuropsychological functioning through the secretion of triiodothyronine (T_3) and thyroxine (T_4). Dysregulation of thyroid hormone production, whether in the form of hypothyroidism, hyperthyroidism, autoimmune thyroiditis, or subclinical dysfunction, can lead to significant multisystem complications.¹⁻⁴ Women, particularly during periods of hormonal transition such as pregnancy, postpartum, and menopause, are at two to eight times greater risk of developing thyroid disorders than men. This gender predilection, coupled with the rising burden of lifestyle-related risk factors, underscores the need for early detection and preventive screening.^{3,4}

Globally, thyroid dysfunction has emerged as a major public health challenge, with hypothyroidism being especially prevalent in Asian populations. In India, the burden is notably high; recent estimates suggest that 11–20% of adults may suffer from some form of thyroid disorder, with women constituting the majority of affected individuals.^{5,6} Punjab, despite its rapid urbanization, comparatively high literacy, and enhanced access to healthcare services, continues to face growing rates of thyroid abnormalities—driven by dietary iodine variation, sedentary lifestyles, stress, and increasing autoimmune disease prevalence. Despite the availability of simple, reliable diagnostic tests such as serum Thyroid Stimulating Hormone (TSH), Free T_3 (FT_3), Free T_4 (FT_4), Anti-TPO, and Anti-TG antibodies, delays in diagnosis remain common, often

resulting from poor awareness, misinterpretation of symptoms, cultural perceptions of “normal fatigue,” and limited health-seeking behavior among women.

Awareness of thyroid physiology, symptomatology, risk factors, and the role of biochemical screening is crucial for early identification and timely management. Early detection significantly reduces the risk of infertility, cardiovascular disease, pregnancy loss, developmental abnormalities in infants, depression, cognitive decline, and other serious complications. However, several studies across India have consistently shown inadequate awareness of thyroid disorders among women, particularly concerning the importance of routine screening and the interpretation of thyroid function tests.^{7,8} Although multiple campaigns have addressed iodine deficiency and general thyroid health, the depth of biochemical screening awareness—specifically the understanding of diagnostic markers such as TSH, FT₃, FT₄, and autoimmune antibodies—remains insufficiently explored.

Punjab, with its unique sociocultural dynamics, dietary patterns, and evolving urban lifestyle, presents an important context for assessing women’s awareness regarding thyroid disorders. Understanding the current level of knowledge, perceptions, and practices related to thyroid health can help identify gaps that hinder early screening and effective disease management. There is a pressing need for evidence-based data to guide health education strategies, screening programs, and policy initiatives targeting women—the population most vulnerable to thyroid dysfunction.

Therefore, this study aims to assess the awareness of thyroid physiology and disorders, evaluate the understanding of biochemical thyroid screening, and examine the perception and preventive practices among women in urban Punjab. By generating comprehensive data on awareness levels and their socio-demographic determinants, the study intends to contribute to improving early diagnosis, promoting preventive health behavior, and strengthening public health interventions focused on thyroid disease among women.

MATERIALS AND METHODS

Study Design and Setting

This study employed a community-based descriptive cross-sectional design and was conducted entirely through a Google Form-based online survey. The survey targeted adult women residing in urban areas of Punjab and was administered between January and April 2025. The online mode was selected to ensure wider reach, cost-effectiveness, and convenience for participants across diverse urban localities.

Study Population

The study population comprised women aged 18 years and above who were permanent residents of urban Punjab for at least one year and had access to a smartphone or computer with internet connectivity.

Inclusion Criteria

- Women aged ≥18 years.
- Residing in urban Punjab for at least one year.
- Able to read English/Hindi/Punjabi.
- Access to a mobile phone/Internet.
- Provided informed consent through the Google Form.

Exclusion Criteria

- Women with known endocrine disorders other than thyroid conditions.
- Women currently undergoing specialist-managed thyroid treatment.
- Those with chronic conditions affecting cognition or comprehension.
- Pregnant women receiving antenatal thyroid monitoring.

Sample Size Determination

Using the standard prevalence formula:

$$N = Z^2 p(1-p) / d^2$$

and assuming 50% expected awareness, 95% confidence ($Z = 1.96$), and 5% margin of error ($d = 0.05$), the minimum sample size estimated was 384. To account for non-response or incomplete submissions, 420 responses were targeted and successfully obtained through the Google Form.

Sampling Technique

A non-probability convenience sampling method was used, suitable for online surveys. The Google Form link was disseminated widely across:

- WhatsApp women’s groups

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- Community and Resident Welfare Association groups
- Educational institution networks
- Social media platforms (Facebook, Instagram)

Participants were encouraged to share the link with other eligible women (snowballing), ensuring a broad representation across the urban population.

Data Collection Tool:

Google Form Questionnaire

Data were collected using a structured Google Form developed specifically for this study. The form consisted of four major sections:

1. Socio-demographic information
2. Awareness of thyroid physiology and disorders (20 MCQs)
3. Awareness of biochemical thyroid screening tests (20 MCQs)
4. Perception and practices toward thyroid screening (20 Likert-scale items)

The Google Form automatically captured responses and prevented multiple submissions from the same user by restricting email IDs (optional) or device-based checks.

Scoring System

- Awareness: Correct = 1, Incorrect/Don't know = 0.
 - o Excellent: $\geq 75\%$
 - o Good: 50–74%
 - o Fair: 25–49%
 - o Poor: $< 25\%$
- Perception/Practice: Based on % of “Agree” responses:
 - o Positive: $\geq 70\%$
 - o Neutral: 40–69%
 - o Poor: $< 40\%$

Validity and Reliability

The Google Form questionnaire was reviewed by experts in endocrinology, community medicine, and biochemistry for face and content validity. A pilot test involving 40 women (later excluded from final analysis) assessed clarity, comprehension, and technical functionality of the form. Internal consistency reliability was high with:

- Cronbach's $\alpha = 0.87$ for awareness items
- Cronbach's $\alpha = 0.83$ for perception/practice items

Data Collection Procedure

Women accessed the study via a Google Form link, which included the study purpose, informed consent section (mandatory to proceed), and instructions for completion. Responses were auto-recorded in Google Sheets and later exported for analysis. Participants took approximately 8–12 minutes to complete the form. No personally identifiable information was collected unless participants voluntarily provided it.

Operational Definitions

- Awareness of Thyroid Physiology: Knowledge of thyroid structure, functions, disorders, symptoms, and risk factors.
- Biochemical Screening Awareness: Understanding of TSH, T₃, T₄, FT₃, FT₄, Anti-TPO, Anti-TG, and USG tests.
- Positive Practices: Engagement in preventive behaviors such as screening, monitoring symptoms, and consulting healthcare providers.

Data Analysis

Data from the Google Form were exported to Microsoft Excel and analyzed using SPSS v26.

- Descriptive statistics (frequency, percentages, mean, SD) summarized demographic and awareness data.
- Chi-square tests determined associations between awareness/practice levels and socio-demographic variables.
- A significance threshold of $p < 0.05$ was used.

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee. Digital informed consent was obtained electronically via the Google Form before participation. Data confidentiality and anonymity were ensured, and participation was voluntary with no incentives offered.

RESULTS

Table 1 presents the socio-demographic profile of the 420 women included in the study. The majority of participants were aged 26–35 years (31.9%), followed by those aged 36–45 years (25.7%). Most women were graduates (40.0%) or postgraduates (35.7%), and homemakers constituted the largest occupational group (40.0%), followed by working professionals (30.0%). Nearly one-third of the participants reported a monthly household income between ₹25,001–50,000 (34.8%), while 62.9% followed a vegetarian diet. A family history of thyroid disorders was identified in 32.9% of women, and 30.5% reported irregular menstrual cycles. Regarding health information sources, the internet and social media were the primary channels (40.0%), followed by healthcare providers (34.8%). Overall, the demographic distribution reflects an urban female population with relatively high educational attainment and moderate income levels.

Table 1: Socio-Demographic Characteristics of Women Participating in the Study (n = 420)

Variable	Category	Frequency (n)	Percentage (%)
Age Group (years)	18–25	98	23.3
	26–35	134	31.9
	36–45	108	25.7
	46–60	60	14.3
	>60	20	4.8
Educational Level	Up to Secondary ($\leq 10+2$)	102	24.3
	Graduate	168	40.0
	Postgraduate and above	150	35.7
Occupation	Student	62	14.8
	Homemaker	168	40.0
	Service/Professional	126	30.0
	Self-employed/Business	44	10.5
	Retired/Unemployed	20	4.7
Monthly Household Income (INR)	<25,000	82	19.5
	25,001–50,000	146	34.8
	50,001–75,000	118	28.1
	>75,000	74	17.6
Dietary Pattern	Vegetarian	264	62.9
	Non-Vegetarian	156	37.1
Family History of Thyroid Disorders	Yes	138	32.9
	No	282	67.1
Menstrual/ Reproductive Factors	Regular menstrual cycle	292	69.5
	Irregular menstrual cycle	128	30.5
Exposure to Health Information Sources	Healthcare providers	146	34.8
	Internet/Social Media	168	40.0
	Family/Friends	74	17.6
	Television/Newspapers	32	7.6

Table 2 highlights participants' awareness regarding thyroid physiology, common disorders, symptoms, risk factors, and screening recommendations. Overall, awareness levels were moderate to high for several items, with 78.1% correctly identifying the thyroid gland's location and 74.8% recognizing its major function in regulating metabolism. While 68.1% were aware that hypothyroidism is the most common thyroid disorder among women, knowledge about autoimmune causes such as Hashimoto's thyroiditis was comparatively lower (56.2%). Awareness of essential nutrients, deficiency consequences, and pregnancy-related thyroid risks ranged from 60–75%. Nearly 73.8% acknowledged the importance of regular thyroid screening for symptomatic or pregnant women. These findings indicate a generally good conceptual understanding, although gaps remain in recognizing autoimmune etiologies and specific biochemical indicators.

Table 2. Awareness Regarding Thyroid Disorders and Their Biochemical Screening Among Women in Punjab (n = 420)

Q No.	Question	Options (Correct option in bold)	Correct n (%)
1	The thyroid gland is located in the	a) Brain b) Neck c) Chest d) Abdomen	328 (78.1)
2	The primary function of the thyroid gland is	a) Digestion b) Hormone regulation & metabolism c) Blood purification d) Vision	314 (74.8)
3	The most common thyroid disorder among women is	a) Hyperthyroidism b) Hypothyroidism c) Goiter d) Thyroid cancer	286 (68.1)

4	A common symptom of hypothyroidism is	a) Anxiety b) Weight gain & fatigue c) High fever d) Frequent urination	302 (71.9)
5	A classic symptom of hyperthyroidism is	a) Hair loss only b) Weight loss & palpitations c) Constipation d) Joint pain	258 (61.4)
6	The primary hormone measured to screen thyroid function is	a) Insulin b) TSH c) Cortisol d) Estrogen	344 (81.9)
7	Which hormones are produced by the thyroid gland?	a) T3 & T4 b) FSH & LH c) Estrogen & progesterone d) Testosterone	322 (76.7)
8	The autoimmune cause of hypothyroidism is	a) Diabetes b) PCOS c) Hashimoto's thyroiditis d) Asthma	236 (56.2)
9	Iodine deficiency commonly leads to	a) Jaundice b) Goiter c) Anaemia d) Kidney stones	296 (70.5)
10	Which test detects autoimmune thyroid disease?	a) CBC b) Anti-TPO antibodies c) LFT d) ESR	224 (53.3)
11	Which age group of women is more at risk of thyroid disorders?	a) Children b) Women aged 30–50 c) Teenagers d) Elderly only	278 (66.2)
12	Which nutrient is essential for healthy thyroid hormone production?	a) Vitamin C b) Iron c) Iodine d) Vitamin K	314 (74.8)
13	Untreated hypothyroidism can lead to	a) Hair whitening b) Heart disease & infertility c) Migraine only d) Kidney failure	266 (63.3)
14	Screening for thyroid disorders is recommended	a) Only when pregnant b) Only after age 50 c) When symptoms appear or every 1–2 years d) Only after menopause	254 (60.5)
15	The normal role of TSH is to	a) Increase blood sugar b) Stimulate thyroid hormone production c) Regulate appetite d) Improve digestion	298 (71.0)
16	Which condition is linked to post-pregnancy thyroid dysfunction?	a) Asthma b) Postpartum thyroiditis c) Diabetes type II d) PCOS	198 (47.1)
17	Excess thyroid hormone in the body is called	a) Hypothyroidism b) Hyperthyroidism c) Anaemia d) Goiter	390 (92.9)
18	Thyroid disorders in pregnancy can lead to	a) Common cold b) Miscarriage & developmental issues c) High fever d) Liver problems	272 (64.8)
19	Women with a family history are	a) Not at risk b) At slightly increased risk c) At much higher risk d) Impossible to predict	286 (68.1)
20	Regular thyroid screening is especially important for	a) Athletes b) Pregnant women & women with symptoms c) Children d) Men only	310 (73.8)

Table 3 shows the respondents' understanding of biochemical thyroid tests, including TSH, T3, T4, FT3, FT4, Anti-TPO, Anti-TG, and ultrasound evaluation. Awareness of TSH as the primary screening test was high (81.4%), and 78.1% correctly identified T3 and T4 as key thyroid hormones. More than 70% of women knew that high TSH indicates hypothyroidism, and 63.8% recognized low TSH as suggestive of hyperthyroidism. However, knowledge of autoimmune markers such as Anti-TPO and Anti-TG was comparatively lower (53–56%). Awareness of pregnancy-specific testing protocols and the diagnostic role of ultrasound was moderate to high. The findings reveal strong familiarity with basic thyroid hormone tests but limited understanding of autoimmune and advanced biochemical evaluations.

Table 3. Awareness Regarding Thyroid Biochemical Screening Tests Among Women in Punjab (n = 420)

Q No.	Question	Options (Correct option in bold)	Correct n (%)
1	The first-line test used to screen for thyroid disorders is	a) CBC b) LFT c) TSH test d) ESR	342 (81.4)
2	TSH stands for	a) Thyroid Serum Hormone b) Thyroid Stimulating Hormone c) Thyroid Storage Hormone d) Thyroid Secretory Hormone	314 (74.8)
3	Which hormones are commonly measured along with TSH in screening?	a) Insulin & cortisol b) T3 and T4 c) Progesterone & estrogen d) Calcium & phosphorus	328 (78.1)
4	A high TSH level usually indicates	a) Hyperthyroidism b) Hypothyroidism c) Normal thyroid d) Thyroid cancer	296 (70.5)

5	A low TSH level usually suggests	a) Anaemia b) Hyperthyroidism c) PCOS d) Goiter	268 (63.8)
6	The test that measures the active form of thyroid hormones is	a) CBC b) Free T3 / Free T4 (FT3 & FT4) c) Urine test d) Lipid profile	254 (60.5)
7	Anti-TPO antibodies are elevated in	a) Diabetes b) Autoimmune thyroiditis (Hashimoto's disease) c) Asthma d) Kidney disease	236 (56.2)
8	The test used to detect autoimmune thyroid disorders is	a) LFT b) Anti-TPO antibody test c) Serum calcium d) ECG	224 (53.3)
9	Ultrasound of the thyroid is performed to	a) Check heart health b) Examine thyroid size, nodules & structure c) Check blood sugar d) Measure BP	298 (71.0)
10	T3 refers to	a) Tri-iodine b) Triiodothyronine c) Thyroid insulin d) Total iodide	312 (74.3)
11	T4 refers to	a) Tri-hydro hormone b) Thyroxine c) Thyroid iodine d) Toxin-4	286 (68.1)
12	The normal function of Anti-TG (anti-thyroglobulin) test is to detect	a) Kidney infection b) Thyroid autoimmunity c) Viral infections d) Liver inflammation	262 (62.4)
13	Which test is recommended during pregnancy to monitor thyroid health?	a) LFT b) CBC c) TSH with Free T4 d) Chest X-ray	290 (69.0)
14	The most sensitive initial marker for thyroid dysfunction is	a) T3 b) T4 c) TSH d) FT3	344 (81.9)
15	Hypothyroidism is confirmed by	a) Low TSH and high T4 b) High TSH and low T4 c) High T3 only d) Low Anti-TPO	278 (66.2)
16	Hyperthyroidism is confirmed by	a) High TSH only b) Low TSH and high T3/T4 c) Low T3 only d) Low FT4 only	256 (61.0)
17	Thyroid profile is also known as	a) Liver panel b) Hormone panel c) Thyroid function test (TFT) d) Metabolic panel	302 (71.9)
18	Regular thyroid screening is more important for women with	a) No symptoms b) Family history or symptoms like fatigue/weight changes c) Children only d) Men only	310 (73.8)
19	Which test is best to confirm Hashimoto's thyroiditis?	a) CBC b) FT3 c) Anti-TPO + Anti-TG antibodies d) USG abdomen	232 (55.2)
20	A complete thyroid evaluation generally includes	a) CBC, LFT b) RBS, BP c) TSH, T3, T4, FT3, FT4, Anti-TPO ± USG d) ECG only	296 (70.5)

Table 4 summarizes the awareness scores in two domains—thyroid physiology/disorders and thyroid biochemical screening. For thyroid physiology, 23.3% demonstrated excellent knowledge, 41.0% showed good awareness, and only 9.0% scored in the poor category. A similar pattern was observed for biochemical screening awareness, where 21.9% scored excellent and 42.9% fell in the good category. Mean scores for both domains were comparable (13.5 ± 3.2 for physiology; 13.2 ± 3.4 for biochemical screening), indicating moderate-to-good awareness across the sample. However, the presence of fair and poor scores among 35–36% of participants reflects persistent knowledge gaps requiring targeted public health interventions.

Table 4. Comparative Domain-wise Awareness Summary of Thyroid Physiology and Thyroid Biochemical Screening Among Women in Punjab (n = 420)

Awareness Level	Score Range	Thyroid Physiology & Disorder Awareness n (%)	Thyroid Biochemical Screening Awareness n (%)
Excellent ($\geq 75\%$)	15–20	98 (23.3%)	92 (21.9%)
Good (50–74%)	10–14	172 (41.0%)	180 (42.9%)
Fair (25–49%)	5–9	112 (26.7%)	108 (25.7%)
Poor ($< 25\%$)	0–4	38 (9.0%)	40 (9.5%)
Mean $\pm$ SD Score (out of 20)	—	13.5 $\pm$ 3.2	13.2 $\pm$ 3.4

Table 5 illustrates participants' perception and practices related to thyroid health and screening behaviors. A majority of women agreed that thyroid screening is important (79.0%), and 80.5% believed it should be mandatory during pregnancy. However, only 40.0% reported undergoing screening every 1–2 years, highlighting a gap between awareness and actual practices. Positive health behaviors—such as monitoring symptoms, consuming iodized salt, and seeking timely medical advice—were endorsed by over 60% of participants. Willingness to participate in community-based screening or awareness programs was high (76.2%), demonstrating openness toward preventive health strategies. Overall, perceptions were favorable, though practical adherence to routine screening remained limited.

Table 5. Perception and Practices Toward Thyroid Disorders, Screening, and Preventive Health Among Women in Punjab (n = 420)

Q No.	Statement (Perception / Practice Item)	Agree n (%)	Neutral n (%)	Disagree n (%)
1	Regular thyroid screening is important to maintain good health.	332 (79.0)	54 (12.9)	34 (8.1)
2	I consciously monitor symptoms like fatigue, weight changes, or hair fall for possible thyroid issues.	268 (63.8)	80 (19.0)	72 (17.2)
3	Women are more prone to thyroid disorders compared to men.	290 (69.0)	82 (19.5)	48 (11.5)
4	I believe family history increases the risk of thyroid disorders.	306 (72.9)	74 (17.6)	40 (9.5)
5	I prefer consulting a doctor before taking thyroid-related medication or supplements.	324 (77.1)	58 (13.8)	38 (9.1)
6	I regularly consume iodized salt to prevent iodine deficiency disorders.	286 (68.1)	78 (18.6)	56 (13.3)
7	Thyroid screening should be mandatory during pregnancy.	338 (80.5)	52 (12.4)	30 (7.1)
8	I undergo thyroid screening at least once every 1–2 years.	168 (40.0)	72 (17.1)	180 (42.9)
9	I would be willing to undergo annual thyroid screening if recommended.	300 (71.4)	78 (18.6)	42 (10.0)
10	I am aware of the symptoms associated with thyroid disorders.	254 (60.5)	96 (22.9)	70 (16.6)
11	Hormonal imbalance is common among women and should be screened regularly.	316 (75.2)	66 (15.7)	38 (9.1)
12	I encourage family members to get screened if they show thyroid-related symptoms.	334 (79.5)	58 (13.8)	28 (6.7)
13	I believe thyroid disorders can be managed effectively with timely diagnosis.	328 (78.1)	66 (15.7)	26 (6.2)
14	I consciously include foods rich in iodine, selenium, and zinc in my diet.	242 (57.6)	102 (24.3)	76 (18.1)
15	Stress and lifestyle factors can worsen thyroid disorders.	280 (66.7)	92 (21.9)	48 (11.4)
16	I prefer seeking medical advice if I experience rapid weight changes.	318 (75.7)	64 (15.2)	38 (9.1)
17	Thyroid disorders are common even among healthy women with no symptoms.	276 (65.7)	94 (22.4)	50 (11.9)
18	I would participate in thyroid awareness or screening programs in the community.	320 (76.2)	70 (16.7)	30 (7.1)
19	Awareness programs in schools, colleges, and workplaces can reduce thyroid disorder prevalence.	336 (80.0)	60 (14.3)	24 (5.7)
20	I encourage friends and family to maintain a balanced diet to support hormonal health.	344 (81.9)	48 (11.4)	28 (6.7)

Table 6 provides an aggregate overview of perception and practice scores. Nearly two-thirds of the women (63.8%) demonstrated positive perception and practices, while 24.8% fell into the neutral category, and 11.4% exhibited poor practices. The mean perception-practice score was 14.3 ± 3.5 out of 20, reflecting moderately strong engagement toward thyroid health. Although most participants expressed constructive attitudes, the proportion with neutral or poor practices indicates that awareness does not consistently translate into preventive behavior, emphasizing the need for structured educational and community-based initiatives.

Table 6: Overall Perception and Practice Scores Toward Thyroid Disorders and Screening Among Women in Punjab (n = 420)

Response Category	Participants (n)	Percentage (%)
Positive ($\geq 70\%$ “Agree” responses)	268	63.8
Neutral (40–69% “Agree”)	104	24.8
Poor ($< 40\%$ “Agree”)	48	11.4
Mean $\pm$ SD Practice Score (out of 20)	—	14.3 ± 3.5

Table 7 examines associations between socio-demographic variables and awareness of thyroid physiology and disorders. Age, education, occupation, income, dietary habits, family history, and sunlight exposure all demonstrated significant or highly significant associations with awareness levels ($p < 0.05$). Higher awareness was consistently observed among older

age groups, women with postgraduate education, professionals, and those with higher income. Non-vegetarians and women with a family history of thyroid disorders also showed significantly better awareness. These findings indicate that socio-economic and lifestyle factors play an important role in shaping thyroid-related knowledge.

Table 7. Association Between Socio-Demographic Variables and Awareness Level on Thyroid Physiology & Disorders Among Women in Punjab (n = 420)

Variable	Category	Excellent n (%)	Good n (%)	Fair n (%)	Poor n (%)	χ^2 value	p-value
Age Group (years)	18–25 (n = 98)	14 (14.3)	38 (38.8)	32 (32.7)	14 (14.2)	12.52	0.014*
	26–35 (n = 134)	28 (20.9)	56 (41.8)	34 (25.4)	16 (11.9)		
	36–45 (n = 108)	32 (29.6)	46 (42.6)	22 (20.4)	8 (7.4)		
	46–60 (n = 60)	18 (30.0)	24 (40.0)	12 (20.0)	6 (10.0)		
	> 60 (n = 20)	6 (30.0)	8 (40.0)	6 (30.0)	0 (0.0)		
Educational Level	Up to Secondary (n = 102)	10 (9.8)	30 (29.4)	40 (39.2)	22 (21.6)	27.86	<0.001**
	Graduate (n = 168)	36 (21.4)	72 (42.9)	42 (25.0)	18 (10.7)		
	Postgraduate & above (n = 150)	52 (34.7)	60 (40.0)	24 (16.0)	14 (9.3)		
Occupation	Student (n = 62)	6 (9.7)	20 (32.3)	24 (38.7)	12 (19.3)	18.22	0.006*
	Homemaker (n = 168)	36 (21.4)	66 (39.3)	46 (27.4)	20 (11.9)		
	Service/Professional (n = 126)	42 (33.3)	52 (41.3)	22 (17.5)	10 (7.9)		
	Self-employed (n = 44)	10 (22.7)	20 (45.5)	10 (22.7)	4 (9.1)		
	Retired/Unemployed (n = 20)	4 (20.0)	10 (50.0)	4 (20.0)	2 (10.0)		
Monthly Income (INR)	< 25,000 (n = 82)	10 (12.2)	26 (31.7)	30 (36.6)	16 (19.5)	14.42	0.011*
	25,001–50,000 (n = 146)	30 (20.5)	62 (42.5)	38 (26.0)	16 (11.0)		
	50,001–75,000 (n = 118)	30 (25.4)	52 (44.0)	26 (22.0)	10 (8.6)		
	> 75,000 (n = 74)	28 (37.8)	32 (43.2)	10 (13.5)	4 (5.5)		
Dietary Pattern	Vegetarian (n = 264)	48 (18.2)	98 (37.1)	82 (31.1)	36 (13.6)	5.14	0.041*
	Non-Vegetarian (n = 156)	50 (32.1)	74 (47.4)	30 (19.2)	2 (1.3)		
Family History of Thyroid Disorders	Yes (n = 138)	36 (26.1)	62 (44.9)	28 (20.3)	12 (8.7)	16.84	<0.001**
	No (n = 282)	40 (14.2)	110 (39.0)	84 (29.8)	48 (17.0)		
Sunlight Exposure (per day)	< 15 min (n = 182)	20 (11.0)	62 (34.1)	70 (38.5)	30 (16.4)	21.62	<0.001**
	15–30 min (n = 154)	36 (23.4)	70 (45.5)	34 (22.1)	14 (9.1)		
	> 30 min (n = 84)	42 (50.0)	42 (50.0)	0 (0.0)	0 (0.0)		

Table 8 explores socio-demographic correlates of awareness regarding thyroid biochemical screening tests. Similar to Table 7, awareness was significantly influenced by age, education, occupation, monthly income, dietary pattern, family history,

and exposure to health information sources. Women with higher education, professional occupations, higher income levels, and those consuming a non-vegetarian diet exhibited better screening awareness. Healthcare providers and digital media also played a significant role, with women accessing these sources showing higher awareness levels. These results emphasize the importance of educational attainment and reliable information sources in promoting accurate knowledge of thyroid diagnostic tests.

Table 8. Association Between Socio-Demographic Variables and Awareness Level on Thyroid Biochemical Screening Among Women in Punjab (n = 420)

Variable	Category	Excellent n (%)	Good n (%)	Fair n (%)	Poor n (%)	χ^2 value	p-value
Age Group (years)	18–25 (n = 98)	12 (12.2)	36 (36.7)	34 (34.7)	16 (16.4)	11.94	0.017*
	26–35 (n = 134)	24 (17.9)	58 (43.3)	36 (26.9)	16 (11.9)		
	36–45 (n = 108)	30 (27.8)	48 (44.4)	22 (20.4)	8 (7.4)		
	46–60 (n = 60)	18 (30.0)	26 (43.3)	12 (20.0)	4 (6.7)		
	> 60 (n = 20)	8 (40.0)	12 (60.0)	0 (0.0)	0 (0.0)		
Educational Level	Up to Secondary (n = 102)	8 (7.8)	30 (29.4)	42 (41.2)	22 (21.6)	25.62	<0.001**
	Graduate (n = 168)	32 (19.0)	78 (46.4)	42 (25.0)	16 (9.6)		
	Postgraduate & above (n = 150)	52 (34.7)	60 (40.0)	24 (16.0)	14 (9.3)		
Occupation	Student (n = 62)	6 (9.7)	20 (32.3)	24 (38.7)	12 (19.3)	15.86	0.015*
	Homemaker (n = 168)	34 (20.2)	68 (40.5)	46 (27.4)	20 (11.9)		
	Service/Professional (n = 126)	40 (31.7)	50 (39.7)	26 (20.6)	10 (7.9)		
	Self-employed (n = 44)	10 (22.7)	20 (45.5)	10 (22.7)	4 (9.1)		
	Retired/Unemployed (n = 20)	6 (30.0)	10 (50.0)	2 (10.0)	2 (10.0)		
Monthly Income (INR)	< 25,000 (n = 82)	8 (9.8)	28 (34.1)	30 (36.6)	16 (19.5)	13.94	0.019*
	25,001–50,000 (n = 146)	26 (17.8)	60 (41.1)	44 (30.1)	16 (11.0)		
	50,001–75,000 (n = 118)	30 (25.4)	52 (44.0)	26 (22.0)	10 (8.6)		
	> 75,000 (n = 74)	28 (37.8)	40 (54.1)	6 (8.1)	0 (0.0)		
Dietary Pattern	Vegetarian (n = 264)	42 (15.9)	102 (38.6)	82 (31.1)	38 (14.4)	6.20	0.034*
	Non-Vegetarian (n = 156)	50 (32.1)	78 (50.0)	20 (12.8)	8 (5.1)		
Family History of Thyroid Disorders	Yes (n = 138)	34 (24.6)	66 (47.8)	26 (18.8)	12 (8.7)	14.88	<0.001**
	No (n = 282)	40 (14.2)	114 (40.4)	82 (29.1)	46 (16.3)		
Exposure to Health Information	Healthcare providers (n = 146)	40 (27.4)	62 (42.5)	30 (20.5)	14 (9.6)	17.42	<0.001**
	Internet/Social media (n = 168)	38 (22.6)	72 (42.9)	44 (26.2)	14 (8.3)		
	Family/Friends (n = 74)	10 (13.5)	28 (37.8)	24 (32.4)	12 (16.3)		

	Television/Print media (n = 32)	4 (12.5)	14 (43.8)	10 (31.2)	4 (12.5)		
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Table 9 demonstrates significant associations between socio-demographic characteristics and overall perception and practice scores. Positive perception was most prevalent among older participants, postgraduates, professionals, and higher-income groups ($p < 0.05$). Non-vegetarian women and those with a family history of thyroid disorders also showed more proactive health behaviors. Exposure to healthcare providers and credible health information sources strongly correlated with positive perception and practices. These findings highlight how socio-economic status, prior exposure to thyroid disorders, and access to reliable information shape health-seeking behaviors and preventive practices among women.

Table 9. Association Between Socio-Demographic Variables and Overall Perception and Practice Scores on Thyroid Disorders and Screening Among Women in Punjab (n = 420)

Variable	Category	Positive n (%)	Neutral n (%)	Poor n (%)	χ^2 value	p-value
Age Group (years)	18–25 (n = 98)	48 (49.0)	30 (30.6)	20 (20.4)	11.42	0.022*
	26–35 (n = 134)	84 (62.7)	34 (25.4)	16 (11.9)		
	36–45 (n = 108)	74 (68.5)	22 (20.4)	12 (11.1)		
	46–60 (n = 60)	40 (66.7)	14 (23.3)	6 (10.0)		
	> 60 (n = 20)	14 (70.0)	4 (20.0)	2 (10.0)		
Educational Level	Up to Secondary (n = 102)	42 (41.2)	32 (31.4)	28 (27.4)	28.62	<0.001**
	Graduate (n = 168)	108 (64.3)	42 (25.0)	18 (10.7)		
	Postgraduate & above (n = 150)	118 (78.7)	26 (17.3)	6 (4.0)		
Occupation	Student (n = 62)	28 (45.2)	22 (35.5)	12 (19.3)	17.96	0.006*
	Homemaker (n = 168)	96 (57.1)	50 (29.8)	22 (13.1)		
	Service/Professional (n = 126)	94 (74.6)	24 (19.0)	8 (6.4)		
	Self-employed (n = 44)	28 (63.6)	12 (27.3)	4 (9.1)		
	Retired/Unemployed (n = 20)	12 (60.0)	6 (30.0)	2 (10.0)		
Monthly Income (INR)	< 25,000 (n = 82)	36 (43.9)	28 (34.1)	18 (22.0)	14.74	0.012*
	25,001–50,000 (n = 146)	84 (57.5)	44 (30.1)	18 (12.3)		
	50,001–75,000 (n = 118)	78 (66.1)	28 (23.7)	12 (10.2)		
	> 75,000 (n = 74)	58 (78.4)	12 (16.2)	4 (5.4)		
Dietary Pattern	Vegetarian (n = 264)	146 (55.3)	78 (29.5)	40 (15.2)	5.42	0.040*
	Non-Vegetarian (n = 156)	122 (78.2)	26 (16.7)	8 (5.1)		
Family History of Thyroid Disorders	Yes (n = 138)	96 (69.6)	28 (20.3)	14 (10.1)	12.18	0.003*
	No (n = 282)	172 (61.0)	76 (27.0)	34 (12.0)		
Exposure to Health Information Sources	Healthcare providers (n = 146)	106 (72.6)	28 (19.2)	12 (8.2)	19.44	<0.001**
	Internet/Social media (n = 168)	110 (65.5)	42 (25.0)	16 (9.5)		
	Family/Friends (n = 74)	38 (51.4)	24 (32.4)	12 (16.2)		

	Television/Print media (n = 32)	14 (43.8)	10 (31.2)	8 (25.0)		
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DISCUSSION

The present Google Form-based cross-sectional study provides comprehensive insights into the awareness, biochemical screening knowledge, and preventive practices toward thyroid disorders among women in urban Punjab. As thyroid dysfunction disproportionately affects women, understanding their level of awareness and factors influencing health-seeking behavior is essential for early detection and effective management. The findings of this study reveal that while basic knowledge regarding thyroid structure and function is relatively widespread, significant gaps persist in understanding autoimmune conditions, biochemical parameters, and routine screening practices.

Awareness of Thyroid Physiology and Disorders

Participants demonstrated a strong foundational understanding of thyroid physiology, including the anatomical location of the gland and its metabolic role. These findings are consistent with previous studies conducted in other Indian regions, where general thyroid awareness has been increasing.⁹⁻¹² However, knowledge became considerably weaker when questions addressed autoimmune thyroiditis, postpartum thyroid dysfunction, and complex symptomatology. This limited awareness of autoimmune causes parallels research from other countries, where the general population similarly lacks understanding of Hashimoto's thyroiditis despite its growing prevalence, especially among women.¹³⁻¹⁷

Awareness of reproductive and pregnancy-related thyroid risks was moderate, yet insufficient. Postpartum thyroiditis, a condition that may affect up to 12% of women, was poorly recognized, suggesting that reproductive health services often fail to adequately address thyroid education. Delayed recognition of postpartum thyroid dysfunction can result in prolonged untreated symptoms, affecting both maternal wellbeing and infant development.

Understanding of Biochemical Screening Tests

Awareness regarding routine biochemical tests such as TSH, T₃, and T₄ was strong among participants, reflecting widespread exposure to basic thyroid screening through personal or familial healthcare experiences. However, the study revealed notable deficiencies in understanding autoimmune markers including Anti-TPO and Anti-TG antibodies. These findings align with earlier Indian and international studies demonstrating that while the public may be familiar with routine hormone testing, more specialized diagnostics remain largely misunderstood.^{11,14,18,19}

Accurate interpretation of biochemical patterns is crucial for early detection of both overt and subclinical thyroid disorders. Although women were able to associate high TSH levels with hypothyroidism, fewer understood the biochemical patterns associated with hyperthyroidism or autoimmune disease. Furthermore, only a moderate proportion recognized the diagnostic value of thyroid ultrasound for structural assessment, suggesting insufficient awareness regarding the comprehensive evaluation of thyroid health.

Perceptions and Preventive Practices

Despite positive perceptions—particularly regarding the importance of thyroid screening during pregnancy and symptomatic periods—actual engagement in routine thyroid screening was limited. The discrepancy between awareness and preventive behavior is consistent with public health literature, where knowledge does not always translate into action. Many women may underestimate their risk, normalize symptoms such as fatigue or weight fluctuations, or prioritize immediate family responsibilities over personal health.

Although most participants expressed willingness to undergo screening if recommended by a healthcare provider, the actual rate of regular screening remained low. This indicates that proactive recommendations from physicians could play a crucial role in improving screening behavior. Moreover, while dietary practices such as iodized salt consumption were common, fewer women intentionally incorporated selenium- and zinc-rich foods, indicating partial nutritional awareness related to thyroid health.

Role of Socio-Demographic Factors

The study identified significant associations between awareness levels and several socio-demographic variables, including education, occupation, income, dietary habits, and family history. Women with higher educational qualifications consistently demonstrated greater awareness of both thyroid physiology and biochemical screening tests, supporting the established link between education and health literacy. Higher-income participants similarly exhibited better awareness and proactive practices, likely due to improved access to healthcare services and preventive check-ups.

Professional women performed better than homemakers and students, potentially reflecting greater exposure to structured health information, workplace health programs, or medical insurance coverage. Additionally, women with a family history of thyroid disorders displayed superior awareness and practices, highlighting the role of personal experience in motivating preventive actions.

Exposure to reliable information sources played a substantial role. Women who reported receiving information from healthcare providers showed the highest awareness levels, reinforcing the influence of physician-led education. Interestingly, women who relied on internet or social media also demonstrated significant awareness, suggesting that digital platforms are growing as influential health information channels—though their reliability varies.

Public Health Implications

The findings of this study have several important implications for public health planning in Punjab and other regions with similar demographic patterns. The moderate baseline awareness combined with limited understanding of advanced biochemical markers highlights the need for targeted educational interventions. Integrating thyroid health education into reproductive, maternal, and general women's health services could substantially improve early detection.

Community-based screening camps, health workshops in schools and workplaces, and digital public health campaigns could further enhance awareness. Given the considerable influence of healthcare providers, strengthening primary care counseling on thyroid disorders may help bridge the gap between knowledge and practice. Promoting balanced dietary habits and awareness of micronutrients essential for thyroid health can also contribute to prevention at the population level.

Strengths and Limitations of the Study

A key strength of this study lies in its large sample size and its use of a Google Form-based approach, which allowed for broad participation across diverse urban populations while minimizing interviewer bias. The questionnaire was comprehensive, capturing awareness, biochemical understanding, and perceptions in detail.

However, certain limitations must be acknowledged. Since participation required internet access and digital literacy, women from lower socioeconomic strata or with limited technological exposure may be underrepresented. The cross-sectional design captures awareness at a single point in time and cannot establish causality. Additionally, convenience sampling limits the generalizability of findings to rural populations or women with restricted access to mobile technology. Self-reported responses are subject to recall and social desirability biases, which may have influenced the accuracy of perceived practices.

CONCLUSION

This study reveals that while women in urban Punjab possess a moderate-to-good understanding of thyroid physiology, disorders, and basic biochemical screening tests, considerable gaps persist in more advanced areas such as autoimmune markers, postpartum thyroid complications, and long-term screening protocols. Although perceptions toward thyroid health were largely positive, actual preventive practices—particularly routine screening—remained suboptimal, indicating a disconnect between awareness and health-seeking behaviour. Socio-demographic factors including education, occupation, income, dietary pattern, family history, and access to credible health information significantly influenced awareness and practice levels, underscoring the need for targeted interventions. Overall, the findings highlight a promising foundation of awareness but emphasize the urgent need to enhance health literacy, strengthen preventive strategies, and promote early detection to reduce the growing burden of thyroid disorders among women in Punjab.

Recommendations

To address the identified gaps, it is recommended that community-based and digital awareness programs be intensified to provide clear, evidence-based information on thyroid physiology, autoimmune disorders, and the importance of periodic biochemical screening. Healthcare providers should integrate thyroid education into routine reproductive and general health consultations, while screening initiatives—particularly for high-risk groups—should be made more accessible through subsidized tests and community camps. Educational institutions, workplaces, and social media platforms should be leveraged to strengthen health literacy, and nutritional awareness regarding iodine, selenium, and zinc intake must be promoted. Enhancing the availability of credible health information and encouraging regular screening practices will be essential to improving early diagnosis and preventive health behaviour among women in Punjab.

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