

KNOWLEDGE, ATTITUDE, AND PRACTICE TOWARDS THYROID NODULE AMONG CLIENTS ATTENDING PRIMARY HEALTH CENTERS IN RASAFI HEALTH DIRECTORATE

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Abstract

Thyroid nodules are commonly encountered in clinical practice, with a significant variation in their size and potential malignancy. There is a public knowledge gap about thyroid nodules complicating timely diagnosis and effective management. The study aimed to evaluate the knowledge, attitudes, and practices regarding thyroid nodules among clients at primary health centers in Rasafa, Baghdad, Iraq. A descriptive cross-sectional design conducted from January to July 2024 at selected primary health centers in the Rasafa Center Directorate, Baghdad. A structured questionnaire was administered to 250 randomly selected. The study included adults aged 18 years and above, excluding those with a history of thyroid disorders. The study included 250 participants, with a majority being female (66.4%) and under 35 years old (69.6%). Knowledge of thyroid nodules was mostly fair, with 62.0% scoring between 5 and 8, while only 25.2% had good knowledge. Education level and income were significantly associated with better knowledge scores ($P = 0.0001$). In terms of attitudes, 82.4% of participants exhibited a positive attitude towards thyroid nodules. For practices, 51.2% followed up regularly with their doctor, but only 31.2% had undergone diagnostic tests. Medication adherence was relatively high at 77.2%, but lifestyle modifications were less common (34.8%). The study concluded that while participants had general awareness of thyroid nodules, there were significant gaps in understanding symptoms, complications, and diagnostic methods. Adherence to recommended practices was lacking. These findings highlight the need for tailored educational programs and improved follow-up strategies to enhance thyroid nodule management.

Keywords: Thyroid nodules; Knowledge, Attitudes, and Practices (KAP); Primary health care; Iraq.

Introduction

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Introduction

Thyroid nodules are discrete lesions within the thyroid gland, commonly detected in clinical practice. These nodules can be palpably and/or ultra-sonographically distinct from the surrounding tissue and vary significantly in size—from barely palpable to large, easily detectable growths [1]. Most thyroid nodules are benign and asymptomatic, but a small percentage may indicate malignancy, emphasizing the importance of their accurate diagnosis and management [2, 3].

The prevalence of thyroid nodules is higher in women and increases with age. Studies show that while only 4% to 7% of nodules are detected through physical examination, ultrasonography can reveal nodules in up to 68% of the population. This discrepancy underscores the importance of sensitive diagnostic methods to capture the true prevalence. Factors such as age, gender, and iodine sufficiency play crucial roles in the development of thyroid nodules [4, 5].

The risk of malignancy in thyroid nodules, though generally low, is significant enough to warrant careful evaluation. Factors increasing this risk include a history of radiation exposure, genetic predispositions, and certain molecular markers. Malignant potential dictates the clinical management, ranging from conservative monitoring to aggressive surgical interventions, depending on the nodule's characteristics and risk factors [2, 6].

The causes of thyroid nodules are diverse. Iodine deficiency is a global issue, particularly in areas without routine iodine supplementation. Autoimmune thyroid diseases such as Hashimoto's thyroiditis and Graves' disease also contribute to nodule formation through chronic inflammation and immune-mediated damage. Genetic factors further complicate the etiology, with several identified genes influencing nodule development and growth [5, 7].

Clinically, thyroid nodules are often identified incidentally during routine physical exams or imaging for unrelated issues. When symptoms occur, they may include palpitations, neck discomfort, difficulty swallowing, or visible swelling. These manifestations are more common with larger nodules or those in sensitive locations. Diagnostic evaluation typically begins with thorough history-taking and physical examination, followed by ultrasonography to assess the nodule's size, structure, and other characteristics that might suggest malignancy. Fine-needle aspiration biopsy (FNAB) is critical for differentiating benign from malignant nodules, guiding the management strategy [8].

Management of thyroid nodules is tailored based on their size, symptoms, and malignancy risk. Benign nodules usually require only regular monitoring, whereas suspicious or growing nodules may need more aggressive interventions like repeat biopsy or surgical removal. Confirmed malignant nodules often necessitate comprehensive treatment, including surgery and possibly radioactive iodine therapy or thyroid hormone suppression [2, 8].

The widespread lack of public knowledge about thyroid nodules poses a significant health challenge. Although thyroid nodules are common, many people are unaware of their risk factors, symptoms, or the importance of early detection. This gap in awareness can lead to delays in seeking medical care, potentially resulting in missed or late diagnoses, particularly for malignant nodules, which can negatively affect outcomes.

The primary aim of this study is to evaluate the knowledge, attitude, and practice towards thyroid nodules among clients attending primary health centers in the Rasafa Center Directorate and to





analyze the association between knowledge, attitudes, and practices related to thyroid nodules and some of the sociodemographic features (e.g., age, gender, education level, socioeconomic status).

Materials and Methods

A descriptive cross sectional study was conducted between January 2024 and July 2024 in the Al Rusafa Health Directorate, situated on the eastern bank of the Tigris River in Baghdad, Iraq. Four health sector catchment areas and eight primary health care centres (PHCCs) participated:

Baghdad Al Jadida Sector – Al Dubaat PHCC, Al Muthana PHCC;

Al Shaab Sector – Suliman Faithy PHCC, Hay Awr Al Namudhajy PHCC;

Al Sadr Sector – Ahmed Al Maliky PHCC, Kathem Abdul Naby PHCC;

Al A'adhmiya Sector – Al A'adhmiya Al Thalith PHCC, Al Dahalic PHCC.

All adult clients (≥ 18 years) attending the selected PHCCs for any reason during the study period were eligible. Centres were chosen by non probability convenience sampling, and every eligible attendee who consented was invited to participate. Individuals with a documented history of thyroid nodules or any thyroid disorder were excluded to ensure the assessment focused on participants without prior thyroid conditions. A target of 270 respondents was set and achieved through consecutive recruitment across the eight PHCCs. After data cleaning, 250 complete questionnaires were analysed, yielding a response rate of 92.6 %. Data were gathered with a structured, interviewer administered questionnaire developed from an extensive literature review and refined by expert supervision. It comprised four domains:

Sociodemographic characteristics – sex, age group, marital status, educational attainment, employment sector, monthly income, and family history of thyroid disease.

Knowledge – 18 items addressing awareness, symptoms, complications, risk factors and diagnostic tests for thyroid nodules (Yes/No/Don't know).

Attitude – nine positively worded statements rated on a 3 point Likert scale (Agree/Neutral/Disagree).

Practice – seven dichotomous items (Yes/No) exploring intended management behaviours should a thyroid nodule be present.

The scoring procedure was performed as follows:

Knowledge – each correct answer scored 1; total range 0–18. Using the sample mean $\pm$ SD (6.5 ± 1.5) we classified scores as Good (> 8), Fair (5–8) or Poor (< 5).

Attitude – Agree = +1, Neutral = 0, Disagree = -1; total range -9 to +9. Scores ≤ -1 were Negative, 0 Neutral, and $\geq +1$ Positive.

Practice – endorsement of > 4 recommended behaviours denoted Compliant adherence, 3–4 Partially compliant, and < 3 Non compliant.

The principal investigator administered the questionnaire in the waiting areas of each PHCC, ensuring uniform delivery and immediate resolution of queries. Responses were recorded on paper forms and later double entered into a coded database.

Content and face validity were confirmed by a panel of four subject matter experts. A pilot test with 22 clients at Al Salhyia PHCC produced Cronbach's α coefficients of 0.699 for the knowledge scale and 0.751 for the attitude scale, demonstrating acceptable internal consistency.



Data were analysed with IBM SPSS Statistics, version 26. Descriptive statistics (frequencies, percentages, means $\pm$ SD) summarised participant characteristics and KAP scores. Associations between sociodemographic variables and KAP categories were examined with χ^2 or independent samples t tests as appropriate. Cases with missing values were removed list wise to preserve analytic comparability across models. Statistical significance was defined at $p < 0.05$.

Ethical approval was obtained from the Director General of the Al Rusafa Health Directorate, and administrative permissions were secured from each participating sector. All respondents provided written informed consent, were free to withdraw at any time, and completed anonymised questionnaires. Data were stored securely and used solely for research purposes.

Results

The study included 250 participants, with 166 (66.4%) being female and 84 (33.6%) male. Most participants, 174 (69.6%), were under 35 years old. Marital status showed 191 (76.4%) were married, while 59 (23.6%) were single. Regarding education, 115 (46.0%) had secondary education and 83 (33.2%) primary. Employment data revealed 136 (54.4%) were unemployed. Most of the participants, 156 (62.4%), had a monthly income below 500,000 IQD. Regarding family history showed 90 (36.0%) had a history of thyroid conditions, 92 (36.8%) were unsure, and 68 (27.2%) had none as shown in table 1.

Table 1: Sociodemographic Features of Participants.

Sociodemographic features		No.	%
Sex	Female	166	66.4
	Male	84	33.6
Age	less than 35	174	69.6
	35-50	55	22.0
	more than 50	21	8.4
Marital status	Married	191	76.4
	Single	59	23.6
Educational level	uneducated	17	6.8
	primary	83	33.2
	secondary	115	46.0
	academic	35	14.0
Employment Sector	unemployed	136	54.4
	freelancer	62	24.8
	employed in private sector	4	1.6
	employed in public sector	40	16.0
	retired	8	3.2
Monthly income	less than 500k	156	62.4
	500-1000k	59	23.6
	more than 1000k	35	14.0
Family History of Thyroid condition	No	68	27.2
	Yes	90	36.0
	Don't Know	92	36.8
Total		250	100



Table 2 shows that 220 (88.0%) participants had heard about thyroid nodules, mainly from family or friends (51.4%), followed by social media (35.0%). However, only 75 (30.0%) knew the thyroid gland's function. Regarding symptoms, 153 (61.2%) recognized neck swelling, but knowledge of hoarseness and difficulty swallowing was low (16.0% each), with hypothyroidism symptoms being the least recognized (6.8%).

Knowledge of complications was varied, with 108 (43.2%) aware of hypertension risks, but fewer recognized the risks of thyroid cancer (24.8%) and thyroid dysfunction (32.0%). Knowledge of risk factors was also limited, with only 9 (3.6%) aware of radiation exposure, and 48 (19.2%) aware of iodine deficiency. Knowledge of diagnostic tests was generally low, with only 66 (26.4%) recognizing thyroid ultrasound, 41 (16.4%) fine needle aspiration, and 52 (20.8%) blood tests. Despite this, 91 (36.4%) were aware that thyroid function test is diagnostic for detection the thyroid conditions.

Table 2: Distribution of the participants Knowledge response regarding Thyroid Nodules.

Knowledge answers questions [Correct answer]			No.	%
	Have you ever heard about thyroid nodules before?			
	No		30	12.0
	Yes		220	88.0
	If yes, where did you obtain the information from?			
	● Family/Friends		113	51.4
	● TV, Radio, Books		30	13.6
	● Social media		77	35.0
1	Do you know the function of the thyroid gland? [Yes]			
	No		175	70.0
	Yes		75	30.0
2	What are the common symptoms associated with thyroid nodules? [All of it]			
	● Neck swelling	● No	97	38.8
		● Yes	153	61.2
	● Hoarseness	● No	210	84.0
		● Yes	40	16.0
	● Difficulty swallowing	● No	210	84.0
		● Yes	40	16.0
	● Symptoms of hypothyroidism (mensural disturbance, Obesity, sleep disturbance)	● No	233	93.2
		● Yes	17	6.8
3	What are the potential complications of untreated thyroid nodules? [All of it]			
	● Hypertension	● No	142	56.8
		● Yes	108	43.2
	● Increased risk of thyroid cancer	● No	188	75.2
		● Yes	62	24.8
	● Thyroid dysfunction	● No	170	68.0
		● Yes	80	32.0
4	Are you aware of the risk factors for developing thyroid nodules? [All of it]			
	● Age	● No	183	73.2
		● Yes	67	26.8



	● Sex	● No	207	82.8
		● Yes	43	17.2
	● Family history of thyroid disorders	● No	167	66.8
		● Yes	83	33.2
	● Radiation exposure	● No	241	96.4
		● Yes	9	3.6
5	● Iodine deficiency	● No	202	80.8
		● Yes	48	19.2
	Thyroid nodules can be benign or malignant? [Yes]			
	Yes it can be		61	24.4
	No		89	35.6
	Don't Know		100	40.0
6	Do you know the diagnostic tests for thyroid nodules? [all of it]			
	● Thyroid ultrasound	● No	184	73.6
		● Yes	66	26.4
	● Fine needle aspiration (FNA)	● No	209	83.6
		● Yes	41	16.4
	● Blood tests	● No	198	79.2
		● Yes	52	20.8
	● Thyroid function test	● No	159	63.6
		● Yes	91	36.4
	Total		250	100

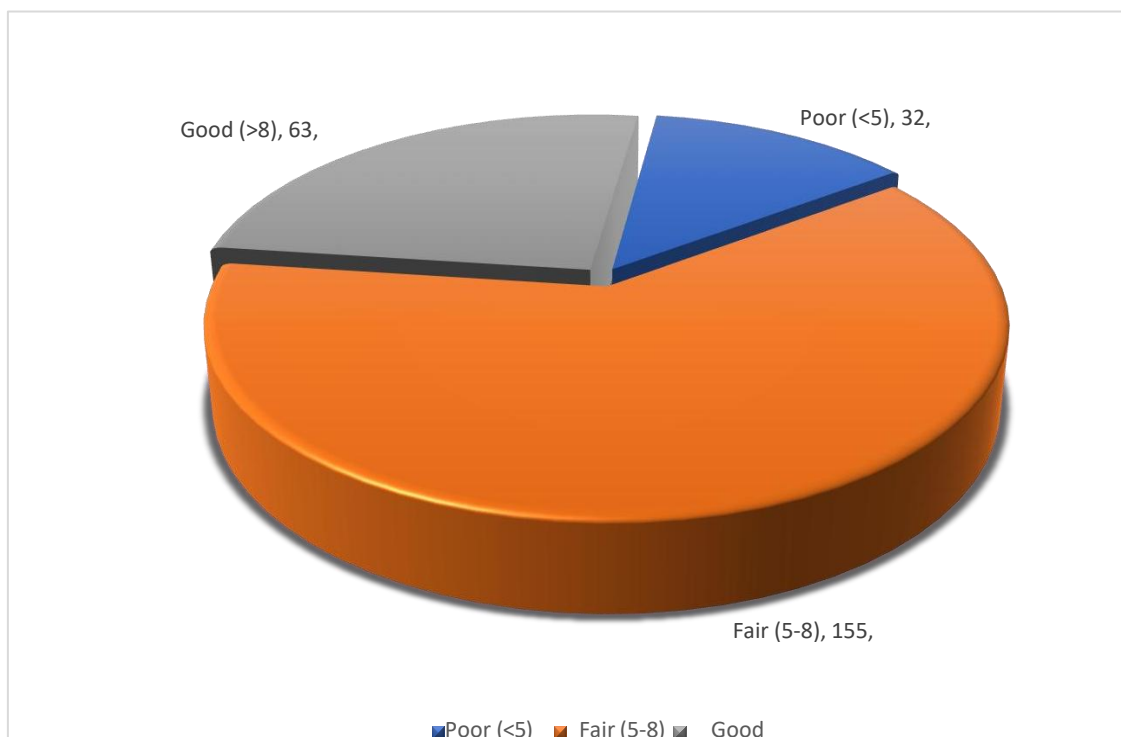


Figure 1: Overall Knowledge Score Distribution.



Figure 1 shows the distribution of overall knowledge scores among the participants. The majority, 155 participants (62.0%), had a "Fair" knowledge score ranging between 5 and 8. Meanwhile, 63 participants (25.2%) demonstrated a "Good" knowledge score above 8. However, 32 participants (12.8%) had a "Poor" knowledge score, falling below 5.

Table 3 highlights the relationship between sociodemographic features and knowledge about thyroid nodules. Gender differences showed that 47 (28.3%) of females had good knowledge scores, but this difference was not statistically significant ($P = 0.175$).

Age was a significant factor; participants under 35 years had better knowledge with 113 (64.9%) scoring fair, while those over 50 years had a higher proportion of poor scores (7; 33.3%) ($P = 0.040$). Marital status also played a role, with married participants more likely to have poor knowledge scores (32; 16.8%), while single participants had a higher proportion of good scores (21; 35.6%) ($P = 0.001$).

Education level strongly influenced knowledge scores. Uneducated participants had a higher proportion of poor scores (7; 41.2%), whereas those with academic education had the highest proportion of good scores (17; 48.6%) ($P = 0.0001$). Employment status and income also impacted knowledge, with unemployed individuals and those earning less than 500k more likely to have poor scores (25; 18.4% and 32; 20.5%, respectively). In contrast, those employed in the private sector and those earning over 1000k had the highest good scores (4; 100.0% and 19; 54.3%, respectively) ($P = 0.0001$ for both employment and income).

Participants with a family history of thyroid conditions had better knowledge, with 37 (41.1%) scoring good, compared to those unsure of their family history, who had more poor scores (25; 27.2%) ($P = 0.0001$).

Table 3: The association of Sociodemographic Features and Overall Knowledge Score.

Sociodemographic features	Overall knowledge								P value
	Poor		Fair		Good		Total		
	No= 32	%	No= 155	%	No= 63	%	No= 250	%	
Gender									
Female	18	10.8%	101	60.8%	47	28.3%	166	66.4%	0.175
Male	14	16.7%	54	64.3%	16	19.0%	84	33.6%	
Age Group									
less than 35	18	10.3%	113	64.9%	43	24.7%	174	69.6%	0.040
35-50	7	12.7%	34	61.8%	14	25.5%	55	22.0%	
more than 50	7	33.3%	8	38.1%	6	28.6%	21	8.4%	
Marital Status									
Married	32	16.8%	117	61.3%	42	22.0%	191	76.4%	0.001
Single	0	0.0%	38	64.4%	21	35.6%	59	23.6%	
Education Level									
uneducated	7	41.2%	4	23.5%	6	35.3%	17	6.8%	0.0001
primary	11	13.3%	58	69.9%	14	16.9%	83	33.2%	
secondary	14	12.2%	75	65.2%	26	22.6%	115	46.0%	
academic	0	0.0%	18	51.4%	17	48.6%	35	14.0%	
Employment Sector									
unemployed	25	18.4%	84	61.8%	27	19.9%	136	54.4%	0.0001
freelancer	7	11.3%	43	69.4%	12	19.4%	62	24.8%	

employed in private sector	0	0.0%	0	0.0%	4	100.0 %	4	1.6%	
employed in public sector	0	0.0%	20	50.0%	20	50.0%	40	16.0%	
retired	0	0.0%	8	100.0%	0	0.0%	8	3.2%	
Monthly Income									
less than 500k	32	20.5%	92	59.0%	32	20.5%	156	62.4%	0.0001
500-1000k	0	0.0%	47	79.7%	12	20.3%	59	23.6%	
> 1000k	0	0.0%	16	45.7%	19	54.3%	35	14.0%	
Family History of Thyroid condition									
No	7	10.3%	49	72.1%	12	17.6%	68	27.2%	0.0001
Yes	0	0.0%	53	58.9%	37	41.1%	90	36.0%	
I don't know	25	27.2%	53	57.6%	14	15.2%	92	36.8%	

Table 4 presents participants' attitudes towards thyroid nodules. A majority, 166 (66.4%), consider thyroid nodules a serious health concern, while 151 (60.4%) are worried about potentially having a nodule. However, all participants (100%) agreed on the importance of seeking medical advice if they suspect a nodule, and 221 (88.4%) believe that early detection is crucial for better outcomes. Knowledge of the potential impact of a thyroid nodule on overall health was noted by 157 (62.8%) participants, and 203 (81.2%) expressed willingness to undergo personal examinations if recommended by a healthcare provider. However, 131 (52.4%) of participants were aware that thyroid nodules could lead to thyroid cancer, with 214 (85.6%) agreeing on the importance of regular monitoring of nodules.

Trust in primary healthcare providers was high, with 191 (76.4%) participants expressing confidence in their provider's knowledge and expertise in managing thyroid nodules.

Table 4: Attitudes Towards Thyroid Nodules.

Attitude answers questions [Correct answer]		No.	%
1	Do you think that a thyroid nodule is a serious health concern? [Yes]		
	Yes	166	66.4
	No	37	14.8
	Don't Know	47	18.8
2	Are you worried about the possibility of having a nodule in your thyroid gland? [Yes]		
	Yes	151	60.4
	No	99	39.6
3	Do you think it is important to seek medical advice if you suspect the presence of a nodule in the thyroid gland? [Yes]		
	Yes	250	100.0
	No	0	0.0



4	Do you believe that early detection of a thyroid nodule is important for achieving better outcomes? [Yes]		
	Yes	221	88.4
	No	10	4.0
	don't know	19	7.6
5	Are you aware of the potential impact of a thyroid nodule on your overall health? [Yes]		
	Yes	157	62.8
	No	33	13.2
	Don't Know	60	24.0
6	Would you be willing to undergo personal examinations (such as regular check-ups or fine needle aspiration) if recommended by your primary healthcare provider? [Yes]		
	Yes	203	81.2
	No	41	16.4
	May Be	6	2.4
7	Do you think that a thyroid nodule can lead to thyroid cancer? [Yes]		
	Yes	131	52.4
	No	95	38.0
	I don't know	24	9.6
8	Do you think it is important to regularly monitor a thyroid nodule? [yes]		
	Yes	214	85.6
	No	30	12.0
	I don't know	6	2.4
9	Do you trust the knowledge and expertise of your primary healthcare provider in managing a thyroid nodule? [Yes]		
	Yes	191	76.4
	No	39	15.6
	May Be	20	8.0
	Total	250	100

Figure 2 displays the distribution of overall attitude scores among participants. The majority, 206 participants (82.4%), exhibited a "Positive attitude" towards thyroid nodules, while 41 participants (16.4%) had a "Neutral attitude," and only 3 participants (1.2%) showed a "Negative attitude." This indicates that most participants maintain a positive outlook on the seriousness, detection, and management of thyroid nodules.



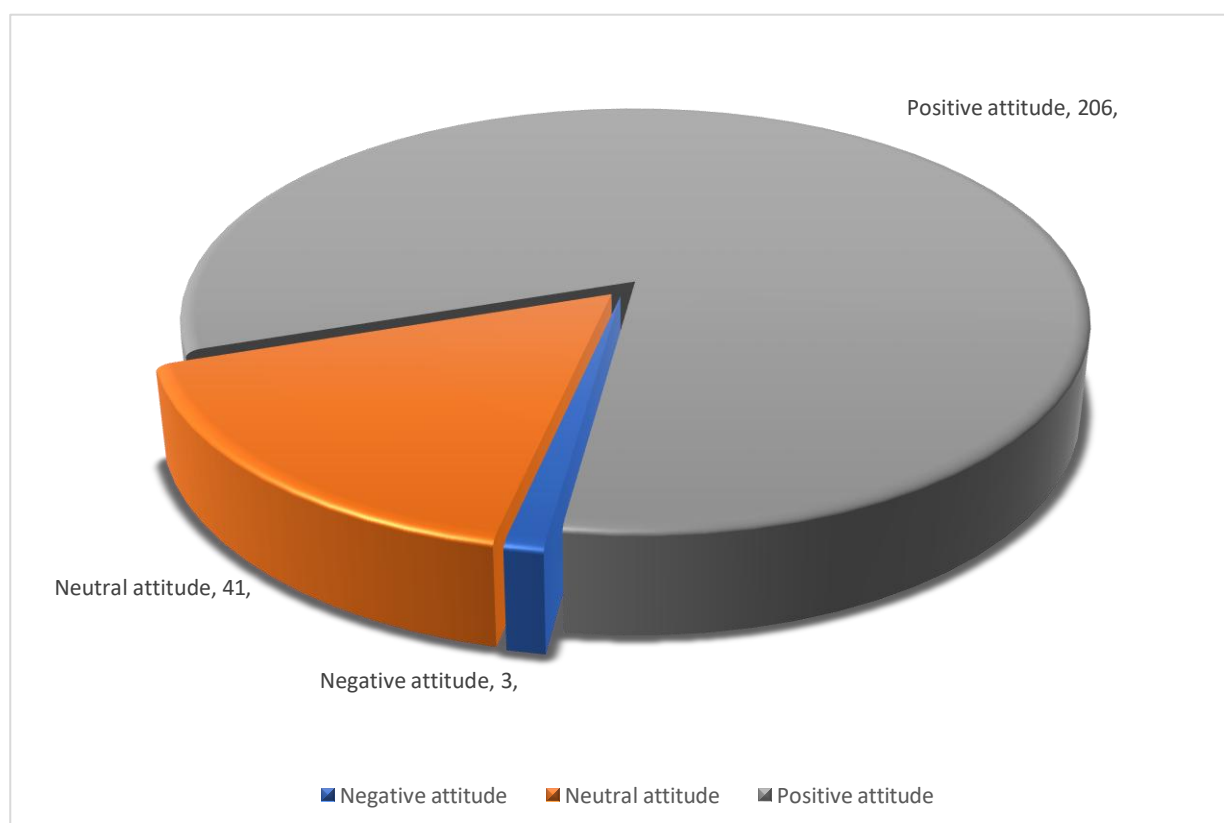


Figure 2: Overall Attitude Score Distribution.

Table 5 highlights the relationship between sociodemographic features and attitudes towards thyroid nodules. Gender significantly influenced attitudes, with 88.6% of females and 70.2% of males showing a positive attitude ($P = 0.0001$). Age was also significant, with younger participants under 35 showing a strong positive attitude (83.9%), and all participants over 50 having a positive attitude ($P = 0.044$). Married individuals were more likely to have a positive attitude (88.0%) compared to singles (64.4%) ($P = 0.0001$).

Education level played a significant role, with all uneducated participants having a positive attitude, while those with secondary education had more neutral attitudes ($P = 0.002$). Employment and income were also significant factors; unemployed individuals and those with lower incomes showed higher positive attitudes, while those in the private sector and with higher incomes had universally positive attitudes ($P = 0.001$ for employment and $P = 0.0001$ for income).

The presence of a family history of thyroid conditions were significantly more likely to have a positive attitude (100%) ($P = 0.0001$).

Table 5: The association of Sociodemographic Features and Overall Attitude Score.

Sociodemographic features	Overall Attitude								P value
	Negative		Neutral		Positive		Total		
	No=3	%	No=41	%	N=206	%	N=250	%	
Gender									
Female	3	1.8%	16	9.6%	147	88.6%	166	66.4%	0.0001
Male	0	0.0%	25	29.8%	59	70.2%	84	33.6%	
Age Group									
less than 35	2	1.1%	26	14.9%	146	83.9%	174	69.6%	0.044
35-50	1	1.8%	15	27.3%	39	70.9%	55	22.0%	
more than 50	0	0.0%	0	0.0%	21	100.0%	21	8.4%	
Marital Status									
Married	3	1.6%	20	10.5%	168	88.0%	191	76.4%	0.0001
Single	0	0.0%	21	35.6%	38	64.4%	59	23.6%	
Education Level									
uneducated	0	0.0%	0	0.0%	17	100.0%	17	6.8%	0.002
primary	0	0.0%	7	8.4%	76	91.6%	83	33.2%	
secondary	1	0.9%	29	25.2%	85	73.9%	115	46.0%	
academic	2	5.7%	5	14.3%	28	80.0%	35	14.0%	
Employment Sector									
unemployed	3	2.2%	11	8.1%	122	89.7%	136	54.4%	0.001
freelancer	0	0.0%	21	33.9%	41	66.1%	62	24.8%	
employed in private sector	0	0.0%	0	0.0%	4	100.0%	4	1.6%	
employed in public sector	0	0.0%	9	22.5%	31	77.5%	40	16.0%	
retired	0	0.0%	0	0.0%	8	100.0%	8	3.2%	
Monthly Income									
less than 500k	1	0.6%	20	12.8%	135	86.5%	156	62.4%	0.0001
500-1000k	2	3.4%	21	35.6%	36	61.0%	59	23.6%	
> 1000k	0	0.0%	0	0.0%	35	100.0%	35	14.0%	
Family History of Thyroid condition									
No	2	2.9%	14	20.6%	52	76.5%	68	27.2%	0.0001
Yes	0	0.0%	0	0.0%	90	100.0%	90	36.0%	
I don't know	1	1.1%	27	29.3%	64	69.6%	92	36.8%	



Table 6 shows that 128 participants (51.2%) followed up regularly as advised by their doctor, while 122 (48.8%) did not. Only 50 participants (20.0%) visited an endocrinologist, and 78 (31.2%) underwent diagnostic tests. Medication adherence was relatively high, with 193 participants (77.2%) taking their medication as prescribed. Knowledge of the need to monitor thyroid nodules was evident in 178 participants (71.2%). However, lifestyle modifications were less common, with only

87 participants (34.8%) following guidelines. Surgery or radioactive iodine treatment was rare, with just 7 participants (2.8%) considering or undergoing these options.

Table 6: Practice Regarding Thyroid Nodule Management

Practice answers questions [Correct answer]	No.	%
1 If you have thyroid nodules, do you follow up regularly as advised by your doctor? [Yes]		
No	122	48.8
Yes	128	51.2
2 If you have thyroid nodules, will you visit an endocrinologist for an additional evaluation? [Yes]		
No	200	80.0
Yes	50	20.0
3 If you have thyroid nodules, will you be undergoing any diagnostic tests such as ultrasound, fine-needle aspiration, or thyroid hormone tests? [Yes]		
No	172	68.8
Yes	78	31.2
4 If you have thyroid nodules, is there is need to starting medication to manage the condition, will you take the medication at the prescribed time and dosage by the doctor? [Yes]		
No	57	22.8
Yes	193	77.2
5 If you have thyroid nodules, are you understanding the importance of monitoring thyroid nodules or the presence of new nodules through detection techniques for changes in your body? [Yes]		
No	72	28.8
Yes	178	71.2
6 If you have thyroid nodules, will you following guidelines regarding lifestyle modifications (such as diet and exercise) to manage thyroid nodules? [Yes]		
No	163	65.2
Yes	87	34.8
7 If you have thyroid nodules, have you considered or undergone surgery or radioactive iodine treatment to remove a nodule in your thyroid gland? [Yes]		
No	243	97.2
Yes	7	2.8
Total	250	100

Figure 3 shows the distribution of overall practice scores among participants regarding thyroid nodule management. A significant portion, 107 participants (42.8%), demonstrated "Partially Compliant" with scores between 3 and 4. "Non-compliant" was observed in 100 participants



(40.0%), indicating a lack of adherence to recommended practices. Meanwhile, 43 participants (17.2%) showed "Compliant," with scores greater than 4.

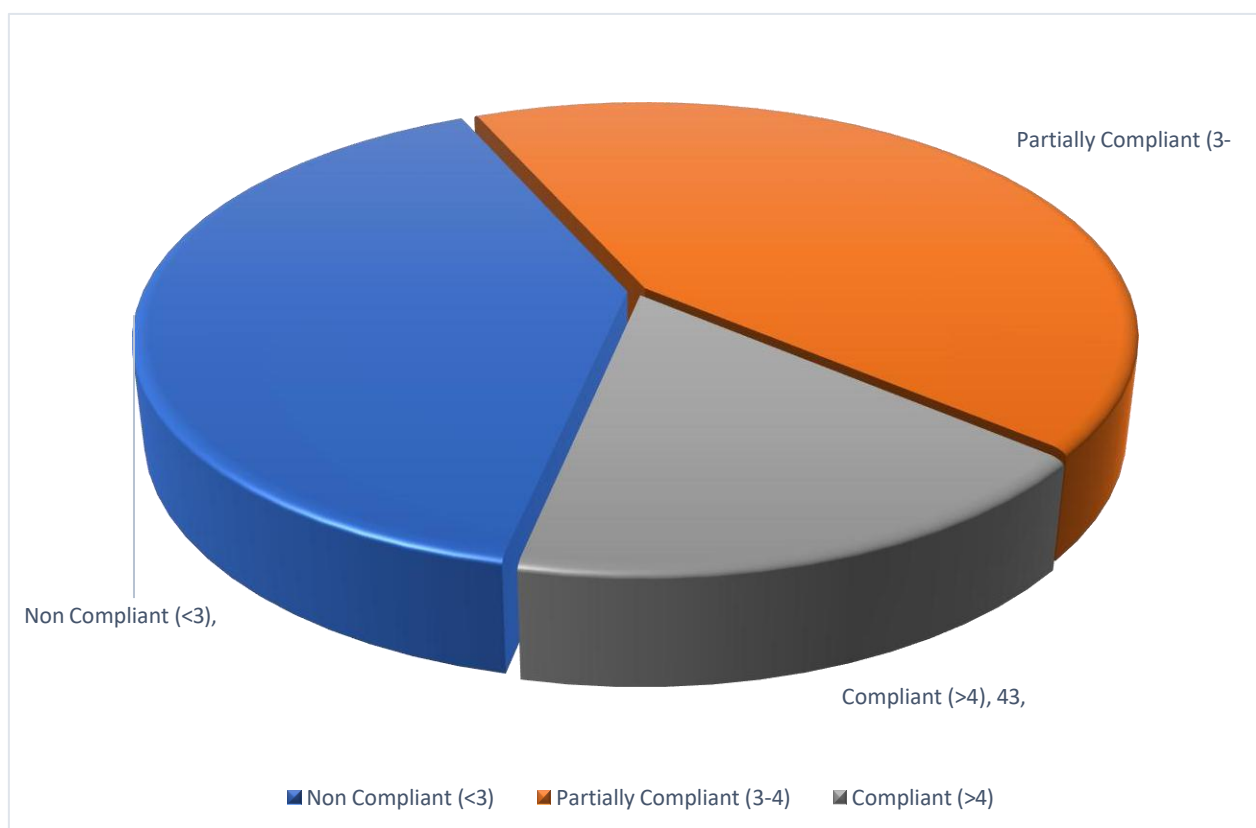


Figure 3: Overall Practice Score Distribution.

Table 7 reveals key relationships between sociodemographic factors and thyroid nodule management practices. Gender significantly influenced Compliant, with females showing higher Compliant (21.7%) than males (8.3%) ($P = 0.029$). Age was also a factor, with younger participants under 35 showing more Partially Compliant (43.7%) and Compliant (20.7%), while those aged 35-50 were more likely to show non Compliant (58.2%) ($P = 0.0001$).

Education level impacted practices, with uneducated participants showing higher compliant (41.2%) and those with primary education displaying the most non-compliant (59.0%) ($P = 0.0001$). Employment and income also played significant roles; unemployed and higher-income participants were more compliant, while those in the private sector and earning 500-1000k showed less compliant ($P = 0.0001$ for both).

Participants with a family history of thyroid conditions had higher compliant (17.8%), while those unsure of their family history were less compliant ($P = 0.002$).

Table 7: The associations of Sociodemographic Features and Overall Practice Score.

Sociodemographic features	Overall Practice								P value
	Non Compliant		Partially Compliant		Compliant		Total		
	No= 100	%	No = 107	%	No = 43	%	No= 250	%	
Gender									
Female	64	38.6%	66	39.8%	36	21.7%	166	66.4%	0.029
Male	36	42.9%	41	48.8%	7	8.3%	84	33.6%	
Age Group									
less than 35	62	35.6%	76	43.7%	36	20.7%	174	69.6%	0.0001
35-50	32	58.2%	23	41.8%	0	0.0%	55	22.0%	
more than 50	6	28.6%	8	38.1%	7	33.3%	21	8.4%	
Marital Status									
Married	78	40.8%	82	42.9%	31	16.2%	191	76.4%	0.745
Single	22	37.3%	25	42.4%	12	20.3%	59	23.6%	
Education Level									
uneducated	0	0.0%	10	58.8%	7	41.2%	17	6.8%	0.0001
primary	49	59.0%	19	22.9%	15	18.1%	83	33.2%	
secondary	40	34.8%	59	51.3%	16	13.9%	115	46.0%	
academic	11	31.4%	19	54.3%	5	14.3%	35	14.0%	
Employment Sector									
unemployed	51	37.5%	48	35.3%	37	27.2%	136	54.4%	0.0001
freelancer	32	51.6%	24	38.7%	6	9.7%	62	24.8%	
employed in private sector	4	100.0%	0	0.0%	0	0.0%	4	1.6%	
employed in public sector	13	32.5%	27	67.5%	0	0.0%	40	16.0%	
retired	0	0.0%	8	100.0%	0	0.0%	8	3.2%	
Monthly Income									
less than 500k	55	35.3%	69	44.2%	32	20.5%	156	62.4%	0.0001
500-1000k	35	59.3%	24	40.7%	0	0.0%	59	23.6%	
> 1000k	10	28.6%	14	40.0%	11	31.4%	35	14.0%	
Family History of Thyroid condition									
No	16	23.5%	42	61.8%	10	14.7%	68	27.2%	0.002
Yes	37	41.1%	37	41.1%	16	17.8%	90	36.0%	
I don't know	47	51.1%	28	30.4%	17	18.5%	92	36.8%	



Discussion

This study highlights significant gaps in knowledge, awareness, and perceptions of thyroid disorders, with particular emphasis on the understanding of the thyroid gland's functions, symptoms, risk factors, and diagnostic methods. The current study showed that only 30% of participants knew the function of the thyroid gland, and 54.8% were aware of its existence. These findings align with the study by Rai et al. (2016) among 250 participants in India, where 54.8% of them knew the meaning of "thyroid," and 49.2% were aware of terms such as hypothyroidism and hyperthyroidism[9]. Similarly, Singh et al. (2013) with 200 participants reported that only 60% of patients in India recognized the thyroid as a normal gland in the neck, reflecting limited awareness across diverse populations [10]. The current study highlighted poor recognition of key thyroid disorder symptoms. While 61.2% of participants recognized neck swelling, only 16% identified hoarseness and difficulty swallowing as symptoms. This aligns with findings from Rai et al. (2016), where 46% of women identified neck swelling or voice changes as symptoms [9].

In Saudi Arabia, Alqahtani (2021) of 1560 men and women reported moderate knowledge of thyroid cancer symptoms, with 46.1% recognizing all early signs, and 70.4% identifying hoarseness as a potential indicator [11]. These studies collectively demonstrate that symptom recognition remains inconsistent, even among educated groups.

The current study found low awareness of risk factors such as iodine deficiency (19.2%) and radiation exposure (3.6%). This is consistent with Rai et al. (2016) who reported that 46.8% of Indian women believed hypothyroidism could be treated using iodized salt, reflecting limited understanding of its preventive role [9]. In contrast, Alqahtani (2021) found better awareness, with 85.2% recognizing iodine's importance for thyroid function [11].

Misconceptions were prevalent in the current study, with many participants attributing significant weight gain to hypothyroidism. This finding is consistent with the study by Singh et al. (2013) [10], where 79.5% of patients believed hypothyroidism caused excessive weight gain. Similarly, Rai et al. (2016) reported that 54.4% of women associated hypothyroidism with obesity [9]. These studies underline the need for targeted education to address common myths surrounding thyroid disorders. The current study revealed limited knowledge about thyroid diagnostic tools, with only 26.4% recognizing thyroid ultrasound and 20.8% recognizing blood tests. These findings are in line with Rai et al. (2016), where only 25.2% of women had undergone thyroid screening, predominantly upon a doctor's recommendation (73.02%) [9]. Both the current study and the study by Alqahtani (2021) found that gender and educational background significantly influenced thyroid health awareness. The current study showed limited awareness among the general population, while Alqahtani (2021) found higher awareness, particularly women [11]. These differences highlight the role of education and professional training in improving health literacy.

In the current study, the high percentage of participants (88.0%) who had heard of thyroid nodules aligns with studies like Maheshwari et al. (2017) among 101 participants [12]. Similarly, the finding that only 30.0% of participants knew the function of the thyroid gland is consistent with Kumar et al. (2017) with 250 participants, who found that only 35.2% of patients in New Delhi understood the meaning of "thyroid." These results highlight widespread superficial awareness without deeper understanding [13].





In terms of symptom recognition, the current study's finding that 61.2% of participants identified neck swelling as a symptom of thyroid nodules parallels Liu et al. (2021), who observed that awareness of thyroid nodule malignancy risk improved with targeted education among participants. However, the low recognition rates for hoarseness (16.0%) and difficulty swallowing (16.0%) reflect a broader gap in symptom awareness, necessitating further public education efforts [14].

The study's findings regarding complications of untreated thyroid nodules reveal moderate awareness of hypertension (43.2%) and thyroid dysfunction (32.0%) but lower recognition of thyroid cancer risk (24.8%). These results echo Kumar et al. (2017) [13], who found low public understanding of hypothyroidism's broader consequences, such as its effects on pregnancy and weight. Both studies suggest that awareness campaigns should emphasize the serious complications associated with untreated thyroid conditions.

Regarding risk factors, the current study identified iodine deficiency as the most recognized factor (80.8%), consistent with Mohapatra et al. (2001), who reported substantial knowledge about iodine's role in thyroid health in an Indian population [15]. However, awareness of other critical risk factors, such as radiation exposure (3.6%) and familial risk (33.2%), was markedly low. This aligns with Mohapatra et al.'s observation that knowledge of radiation exposure as a risk factor was negligible. These gaps highlight the need for education on lesser-known risk factors to improve preventive measures. Awareness of diagnostic tools, such as thyroid ultrasound (26.4%) and fine needle aspiration (16.4%), was limited in the current study, similar to Alharazi et al.'s findings, where only 25.7% of participants relied on physicians for information. The reliance on combined sources, including social media, in both studies highlights the growing role of digital platforms in health education but also raises concerns about the accuracy of information shared online [16].

The current study's findings revealed that the majority of participants (62.0%) exhibited a "Fair" knowledge level, with 25.2% achieving "Good" knowledge scores and 12.8% scoring "Poor." These results align with a study conducted in Saudi Arabia by Qusty et al. (2023) with a sample size of 2,030 participants, which found that 40.3% of participants had moderate knowledge of thyroid cancer, while only 9.3% had high knowledge [17]. Both studies highlight the prevalence of moderate knowledge levels in the general population, indicating gaps that need to be addressed through awareness initiatives.

Gender differences in the current study showed that females were more likely to have better knowledge scores (28.3% "Good") compared to males (19.0%), though this difference was not statistically significant ($P = 0.175$). This is consistent with the findings of Syed et al. (2022), who conducted a study among 141 participants in Saudi Arabia, reporting that 60.3% of female participants were knowledgeable compared to 39.7% of males ($P = 0.049$). The similarity across studies suggests that gender differences may persist across diverse populations, with females generally showing a higher tendency toward health-related knowledge [18].

Age was found to be a significant factor in the current study ($P = 0.040$), with participants under 35 years showing better knowledge than those above 50 years. This finding resonates with the study by Qusty et al. (2023), which observed higher knowledge scores among participants aged 18–24 compared to older age groups. The trend highlights the role of younger generations' access





to health information, likely influenced by digital literacy and exposure to educational content [17].

Education played a critical role in determining knowledge levels, as observed in the current study, where participants with academic qualifications were significantly more likely to have "Good" knowledge scores ($P=0.0001$). Similarly, in the study by Alyahya et al. (2021), conducted among 394 participants in Saudi Arabia's Eastern Province, higher education levels were strongly associated with better knowledge of thyroid disorders [19]. These findings emphasize the necessity of targeting less-educated populations through accessible health education programs. Employment and income status were also significant determinants of knowledge in the current study. Participants employed in the private sector and earning over 1000k were more likely to score "Good," while unemployed individuals and those earning less than 500k had higher "Poor" scores. These results are consistent with the study by Qusty et al. (2023), which identified a positive correlation between higher monthly income and knowledge scores ($P < 0.001$) [17]. The findings underline the importance of addressing socioeconomic barriers to health literacy.

Clinical history influenced knowledge in both studies. In the current study, individuals with prior thyroid diagnoses were more likely to have poor scores, contrasting with those without diagnoses, who showed better knowledge ($P = 0.005$). Similarly, Qusty et al. (2023) noted that participants who had undergone thyroid function tests or imaging were more knowledgeable than those who had not ($P < 0.001$) [17]. These findings suggest a gap in patient education post-diagnosis and highlight the need for improved communication between healthcare providers and patients. The association of family history with better knowledge was evident in the current study, where participants with a known family history of thyroid conditions had significantly higher "Good" scores ($P = 0.0001$). This is consistent with the findings of Alhazmi et al. (2022), who studied 250 participants in Saudi Arabia and reported that a family history of thyroid disease was positively associated with increased awareness of risk factors and symptoms [20].

The current study highlights participant attitudes toward thyroid nodules, revealing a positive outlook on early detection, monitoring, and trust in healthcare providers. A significant proportion (66.4%) of participants identified thyroid nodules as a serious health concern. This finding is consistent with Qusty et al. (2023), conducted among 2,030 participants, where 63.9% recognized neck lumps as a potential symptom of thyroid cancer [17]. This growing awareness emphasizes the importance of public health education in promoting knowledge about thyroid nodules and associated risks. A notable concern about having a thyroid nodule was expressed by 60.4% of participants in the present study. Similarly, Syed et al. (2022), with a sample of 450 participants, observed a high level of concern about thyroid health among specialized groups, suggesting a parallel in awareness between general and specialized populations [18]. The unanimous agreement (100%) on the importance of seeking medical advice for suspected thyroid nodules reflects a universal acknowledgment of professional consultation's value, aligning with Alyahya et al. (2021), where 75.5% of 2,100 participants agreed on the importance of consulting healthcare providers for thyroid-related issues [19]. In this study, 88.4% of participants emphasized the importance of early detection for better outcomes, echoing findings by Alhazmi et al. (2022), which surveyed 1,200 participants and found widespread agreement on the benefits of timely diagnosis and monitoring [20].





Awareness of the broader health implications of thyroid nodules was noted among 62.8% of participants, which is comparable to Almuzaini et al. (2019), who reported that 62.4% of 367 respondents understood the impact of thyroid dysfunction on overall health, such as cholesterol levels [21]. However, the slightly lower proportion in this study suggests room for improvement in educating the public on the systemic effects of thyroid health. The willingness of 81.2% of participants to undergo personal examinations, such as fine-needle aspiration or check-ups when recommended by a healthcare provider, demonstrates proactive health attitudes. This finding is supported by Qusty et al. (2023), where 82.6% of respondents affirmed their readiness to consult a doctor upon detecting a neck lump [17]. These findings indicate a growing trust in preventive healthcare measures and a willingness to follow professional recommendations for managing thyroid conditions. Despite these positive attitudes, only 52.4% of participants in the current study correctly identified the potential link between thyroid nodules and thyroid cancer. This finding aligns with Alyahya et al. (2021), where moderate awareness of the association between thyroid disorders and cancer was noted among participants [19]. Similarly, Almuzaini et al. (2019) found that only 42.1% of participants correctly identified genetic factors related to thyroid dysfunction, suggesting persistent misconceptions that need addressing [21]. Educational campaigns should focus on these gaps to enhance understanding and reduce risks associated with delayed or misinformed medical decisions. The high level of trust in primary healthcare providers, expressed by 76.4% of participants, is consistent with studies such as Syed et al. (2022) [18] and Alhazmi et al. (2022) [20], which highlighted the critical role of healthcare providers in fostering patient compliance and ensuring effective management of thyroid nodules. This trust underscores the importance of equipping healthcare professionals with updated knowledge and skills to support patient education and care. Compared to Almuzaini et al. (2019) [21], where 57.32% of respondents demonstrated good knowledge of thyroid disorders, the present study reflects slight improvements in awareness, particularly regarding the recognition of thyroid nodules as a serious health concern and the readiness to seek medical advice. These findings suggest that public health efforts and access to educational resources may have improved over time, though gaps remain in specific areas such as the link between nodules and cancer.

The current study highlights a predominantly positive attitude toward thyroid nodules among participants, with 82.4% exhibiting positive attitudes. This finding underscores a growing public awareness of thyroid health and its implications. Consistent with the study by Qusty et al. (2023) [17], conducted with 2,030 participants in Saudi Arabia, where 63.9% of participants recognized neck lumps as a significant health concern, the current findings indicate an increasing understanding of the importance of thyroid health.

The results revealed that gender significantly influenced attitudes, with 88.6% of females showing a positive attitude compared to 70.2% of males ($P = 0.0001$). This aligns with findings by Almuzaini et al. (2019) [21], which involved 367 participants and reported that females were more likely to have good knowledge about thyroid disorders. The increased awareness among females may reflect their higher susceptibility to thyroid-related conditions and greater involvement in health-seeking behaviors, as also supported by the findings of Syed et al. (2022) among 250 participants [18].





Age played a significant role, with participants under 35 and all individuals over 50 years showing predominantly positive attitudes ($P = 0.044$). This aligns with findings by Alhazmi et al. (2022) [20], which included 1,200 participants and reported higher awareness among younger age groups, possibly due to increased accessibility to online health information. Married participants exhibited significantly more positive attitudes (88.0%) compared to singles (64.4%) ($P = 0.0001$), consistent with findings by Alyahya et al. (2021) [19], where family responsibilities motivated better engagement with health concerns. Educational attainment was another significant factor ($P = 0.002$). Interestingly, all uneducated participants in this study exhibited positive attitudes, contrasting with findings by Almuzaini et al. (2019) [21], where participants with higher education demonstrated greater knowledge. The discrepancy may stem from increased health outreach efforts targeting undereducated populations in recent years. Employment status also influenced attitudes, with unemployed individuals showing the highest positive attitudes (89.7%) and private-sector employees exhibiting universally positive attitudes ($P = 0.001$). These findings align with Alyahya et al. (2021) [19], who noted that higher socioeconomic status often correlates with proactive health attitudes. Participants with a family history of thyroid conditions were significantly more likely to have positive attitudes (100%, $P = 0.0001$). This finding aligns with Qusty et al. (2023) [17], which noted that individuals with familial exposure to thyroid conditions were more aware of related health risks. However, the presence of a previous diagnosis or other thyroid conditions did not significantly affect attitudes ($P = 0.450$ and $P = 0.248$, respectively). These findings are consistent with Almuzaini et al. (2019) [21], who observed that knowledge levels were not significantly influenced by a history of thyroid disorders. Income levels played a pivotal role, with participants earning over 1000k all showing positive attitudes ($P = 0.0001$). This aligns with findings by Haugen et al. (2015), which emphasized that socioeconomic status can influence access to healthcare resources and awareness [22].

The strong positive attitudes among those with lower incomes in this study may reflect successful public health campaigns targeting these groups, as suggested by Alyahya et al. (2021) [19]. The positive attitudes observed in this study highlight the success of current health campaigns and the importance of trust in healthcare providers, with 76.4% of participants expressing confidence in their provider's expertise. This mirrors findings by Syed et al. (2022) [18], who emphasized the critical role of healthcare providers in shaping patient attitudes and compliance. However, gaps in attitudes based on gender, education, and age emphasize the need for targeted health education programs.

In the current study, despite some positive trends, such as high adherence to prescribed medication (77.2%) and moderate awareness of the importance of monitoring thyroid nodules (71.2%), significant gaps in knowledge and misconceptions persist. These findings align with several previous studies. The current study's observation that only 31.2% of participants underwent diagnostic tests is consistent with the study by Rai et al. (2016), which found that only 25.2% of women had undergone thyroid screening tests in Indore, India ($n=250$) [9]. This reflects a broader lack of awareness about the importance of diagnostic procedures. Similarly, Singh et al. (2013) reported that 68.8% of their participants had not undergone diagnostic tests such as fine-needle aspiration or thyroid hormone evaluations [10]. Awareness of thyroid gland function and disorders also shows concerning gaps.





The current study's finding that 71.2% of participants were aware of the need to monitor thyroid nodules aligns with Li et al. (2023) [23], where participants scored an average of 5.76 out of 12 on knowledge (n=510). Furthermore, Rai et al. (2016) reported that only 54.8% of women understood the thyroid gland's role [9], while Singh et al. (2013) found similar results, with 60% recognizing the thyroid as a normal gland [10]. These findings consistently highlight a need for public health education focused on thyroid disorders. The current study observed low rates of lifestyle modifications (34.8%) and misconceptions about advanced treatments, such as surgery or radioactive iodine therapy, considered by only 2.8% of participants. These findings are consistent with the study by Li et al. (2023) [23], where many participants were uncertain about treatment modalities, including fine-needle aspiration and surgical interventions.

Additionally, misconceptions about dietary triggers and treatment are prevalent across studies. Rai et al. (2016) found that 44.8% of participants believed foods like cabbage and cauliflower should be avoided in thyroid disorders [9], while Singh et al. (2013) reported that 59.5% of participants were unaware of these dietary recommendations [10]. In the current study, similar misconceptions may explain the low adherence to lifestyle modifications. Attitudes toward treatment adherence also reflect a gap in understanding. In the current study, adherence to medication was high (77.2%), but misconceptions about when to stop treatment persist. Rai et al. (2016) found that 35.2% of participants believed medication could be discontinued once thyroid test results normalized [9], and Singh et al. (2013) reported similar results (40%) [10].

The current study observed moderate rates of regular follow-up (51.2%) and low utilization of specialist services, with only 20.0% visiting an endocrinologist. This is consistent with findings by Rai et al. (2016), where 55.08% of participants were unaware of thyroid screening tests [9], and by Singh et al. (2013) [10], where nearly half of the participants failed to follow up regularly as advised by their doctor (48.8%). Li et al. (2023) provided additional context, identifying socioeconomic disparities in access to healthcare [23]. Their study revealed that participants with higher income and education levels demonstrated better knowledge and practices, consistent with the current study's findings that limited specialist consultations may result from access barriers.

The current study highlights significant disparities in overall practice scores regarding thyroid nodule management among participants, influenced by various sociodemographic factors. The findings reveal patterns of "No Compliant," "Partial Compliant," and "Compliant," reflecting adherence levels to recommended practices. These results align with findings from similar studies and emphasize the need for targeted interventions to improve thyroid nodule management practices. The study found that females demonstrated higher levels of "Compliant" (21.7%) compared to males (8.3%), indicating gender differences in adherence to thyroid nodule management. This finding is consistent with Rai et al. (2016) [9], who noted that women, particularly those of reproductive age, are more likely to seek thyroid-related care due to the impact of thyroid disorders on menstruation, fertility, and pregnancy.

However, the persistence of "No Compliant" in a significant portion of females (38.6%) highlights the need for broader educational initiatives tailored to both genders. Younger participants (under 35) showed higher "Compliant" (20.7%) and "Partially Compliant" (43.7%) compared to older age groups. Conversely, participants aged 35-50 were more likely to show "No Compliant" (58.2%). These results align with Li et al. (2023) [23], where younger individuals demonstrated better





practice scores due to greater exposure to healthcare information and digital resources. However, the higher compliant in participants over 50 (33.3%) in this study may reflect increased concern for health conditions in older age, as observed in Singh et al. (2013) [10]

Education played a critical role in influencing thyroid nodule management practices. Uneducated participants exhibited the highest "Compliant" (41.2%), possibly due to reliance on healthcare professionals for guidance. In contrast, those with primary education showed the highest "No Compliant" (59.0%), indicating a gap in understanding or access to resources. Li et al. (2023) similarly reported that higher educational attainment was associated with better practices, highlighting the importance of tailoring educational interventions to individuals with lower educational backgrounds. Employment sector and income levels significantly impacted compliant to thyroid nodule management. Unemployed participants showed the highest "Compliant" (27.2%), possibly due to more available time to engage in healthcare activities. Conversely, those employed in the private sector exhibited "No Compliant" (100%), likely due to time constraints and workplace pressures. Participants with higher monthly incomes (>1000k) were more likely to demonstrate "Compliant" (31.4%), consistent with Li et al. (2023) [23], where socioeconomic status positively correlated with better practice scores.

Participants with a prior thyroid diagnosis or family history of thyroid conditions were significantly more likely to demonstrate "Compliant" (53.7% and 17.8%, respectively). These findings align with Rai et al. (2016), who reported that personal or family experiences with thyroid disorders increase awareness and proactive behavior [9]. However, those without a diagnosis or unaware of their family history showed higher "non-compliant" rates, indicating a lack of awareness and perceived risk. Participants with coexisting thyroid conditions exhibited the highest "Compliant" (53.2%), highlighting the influence of disease burden on adherence to management practices. This aligns with findings from Singh et al. (2013) [10], where patients with more severe symptoms or comorbidities demonstrated higher engagement in healthcare practices.

Conclusions

The study concluded that while participants had general awareness of thyroid nodules, there were significant gaps in understanding symptoms, complications, and diagnostic methods. Despite positive attitudes towards management, adherence to recommended practices was lacking, particularly among lower-income and less-educated individuals. Younger, better-educated, and higher-income participants demonstrated better knowledge and adherence. These findings highlight the need for tailored educational programs and improved follow-up strategies to enhance thyroid nodule management.

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**References**

1. Kapre M, editor. Thyroid Surgery: Principles and Practice. CRC Press; 2020 Apr 14.
2. Moini J, Pereira K, Samsam M. Epidemiology of thyroid disorders. Elsevier; 2020 Jan 8.
3. Anandkumar S, Chacko J, Usha M. Thyroid disorder: An overview. Research Journal of Pharmacology and Pharmacodynamics. 2020;12(1):1-4.
4. Prabhu SR. Pathology of organ systems of the body. InTextbook of General Pathology for Dental Students 2023 Jul 4 (pp. 133-146). Cham: Springer Nature Switzerland.
5. Connelly KJ, Park JJ, LaFranchi SH. History of the thyroid. Hormone research in paediatrics. 2022 Nov 29;95(6):546-56.
6. Awla HK, Saleh LS. The Association of Age and Gender with the Histopathological Features among Thyroid Cancer Patients in Erbil City, Iraq: Clinical Analysis of 153 Cases. Iraqi Journal of Science. 2023 Nov 30:5554-63.
7. Turkkan E, Uzum Y, TURKKAN E, UZUM Y. Evaluation of Thyroid Nodules in Patients With Fine-Needle Aspiration Biopsy. Cureus. 2023 Sep 2;15(9).
8. Alexander EK, Doherty GM, Barletta JA. Management of thyroid nodules. The Lancet Diabetes & Endocrinology. 2022 Jul 1;10(7):540-8.
9. Rai S, Sirohi S, Khatri AK, Dixit SD, Saroshe S. Assessment of knowledge and awareness regarding thyroid disorders among women of a cosmopolitan city of central India. National Journal of Community Medicine. 2016 Mar 31;7(03):219-22.
10. Singh A, Sachan B, Malik NP, Sharma VK, Verma N, Singh CP. Knowledge, awareness, and practices among patients with thyroid swelling attending cytology clinic in a Medical College, Meerut. IJCP Group of Publications. 2014 Jan;24(8):753.
11. Alqahtani SM. Awareness of thyroid disorders among the Saudi population. Age. 2021;20(30):377.
12. Maheshwari P, Mohan R, Shanmugarajan TS. KAP study on thyroid disorders (hypothyroidism and hyperthyroidism) in a tertiary care hospital. Research Journal of Pharmacy and Technology. 2017;10(1):41-3.
13. Kumar P, Khandelwal D, Mittal S, Dutta D, Kalra S, Katiyar P, et al. Knowledge, awareness, practices and adherence to treatment of patients with primary hypothyroidism in Delhi. Indian journal of endocrinology and metabolism. 2017 May 1;21(3):429-33.
14. Liu P, Lin J, Nie Y, Cao Z, Xu X. Awareness of thyroid cancer among medical students: A questionnaire-based study. Science Progress. 2021 Jun;104(2):00368504211023654.
15. Mohapatra SS, Bulliyya G, Kerketta AS, Geddam JJ, Acharya AS. Elimination of iodine deficiency disorders by 2000 and its bearing on the people in a district of Orissa, India: a knowledge–attitude–practices study. Asia Pacific Journal of Clinical Nutrition. 2001 Feb 14;10(1):58-62.
16. Alharazi RM, Almarri LK, Ibrahim HM, Abdulshakour LS, Ahmad MA, Bashool RA. Awareness of Thyroid Diseases and Their Risk Factors Among the Residents of Jeddah, Saudi Arabia. Cureus. 2024 Jun10;16(6):e62113.
17. Qusty NF, Albarakati AJ, Almasary M, Alsalamah S, Alharbi L, Alharthi A, et al. Thyroid Cancer Knowledge and Awareness in Saudi Arabia: A Cross-Sectional Study. Cureus. 2023 Oct;15(10).





18. Syed W, Samarkandi OA, Alsadoun A, Harbi MK, Al-Rawi MB. Evaluation of clinical knowledge and perceptions about the development of thyroid cancer—an observational study of healthcare undergraduates in Saudi Arabia. *Frontiers in Public Health*. 2022 Aug 15;10:912424.
19. Alyahya A, AlNaim A, AlBahr AW, Almansour F, Elshebiny A. Knowledge of thyroid disease manifestations and risk factors among residents of the Eastern Province, Saudi Arabia. *Cureus*. 2021 Jan;13(1).
20. Alhazmi RA, Alobaid AM, Althunayyan SM, Syed W, Al-Rawi MB. A cross-sectional assessment of knowledge, awareness of risk factors, and perceptions of thyroid disease (TD) among adults living in Saudi Arabia—A community based study. *Frontiers in Public Health*. 2022 Nov 23;10:1041745.
21. Almuzaini A, Alshareef B, Alghamdi S, Munshy AA, Aljarallah AK, Salman SA, et al. Assessment of knowledge and awareness regarding thyroid disorders among Saudi people. *IJDMC*. 2019;3:1070-6.
22. Haugen BR, Alexander EK, Bible KC, Doherty GM, Mandel SJ, Nikiforov YE, et al. 2015 American Thyroid Association management guidelines for adult patients with thyroid nodules and differentiated thyroid cancer: the American Thyroid Association guidelines task force on thyroid nodules and differentiated thyroid cancer. *Thyroid*. 2016 Jan 1;26(1):1-33.
23. Li Y, Wang L, Ni J, Gu J. Knowledge, awareness and perception towards thyroid cancer in general population: a systematic review. *Iranian Journal of Public Health*. 2023 Feb;52(2):219.

