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Thyroid cancer knowledge and awareness among women in Al-Ahsa region, Saudi Arabia: A cross-sectional study

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Abstract

This study aims to assess the knowledge and awareness of thyroid cancer (TC) among women in the Al-Hassa region of Saudi Arabia. TC is a common endocrine malignancy globally, ranking as the ninth most common tumor in 2020. In Saudi Arabia, TC has a prevalence of around 10% among women, making it the second most common female tumor after breast cancer. The study seeks to determine the level of understanding regarding TC and its risk factors among the target population.

Methodology: Cross-sectional questionnaire-based study for females in which they live in Al-Hassa and were aged 18 and above. The data was collected by using a questionnaire. Data was analyzed using SPSS version 27.0.1..

Results: Our study involved 381 female participants from the Al-Hassa region in Saudi Arabia. Sociodemographic characteristics showed varied age distribution (28.3%: 18-24 years; 47.8%: 25-44 years; 23.9%: above 44 years), education levels (64.8%: bachelor's degree), and healthcare utilization (46.2%: visited health centers more than twice a year). In terms of thyroid cancer detection practices, 44.9% underwent thyroid hormone analysis, while only 17.3% had ultrasound or CT scans of the thyroid gland. Factors such as age and education level were significantly associated with knowledge scores. Undertaking a thyroid hormone analysis was associated with higher knowledge scores. Age, healthcare utilization, and education level were associated with high knowledge.

Conclusion: Our study provides valuable insights into the awareness of thyroid cancer among female participants in the Al-Hassa region of Saudi Arabia. The findings highlight both positive aspects and gaps in knowledge and awareness. These findings can inform the development of targeted interventions and educational programs to improve knowledge and promote early detection of thyroid cancer. Future research should consider a larger and more diverse sample, which may influence knowledge and awareness of thyroid cancer in Saudi Arabia

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Introduction

Thyroid cancer (TC) is one of the most common endocrine malignancies worldwide and one of the most common malignancies in the human body, ranking as the ninth most common tumor in 2020, which account for 3-4% cases worldwide [1]. In Saudi Arabia, the prevalence of TC is around 10% and it is the second most common female tumor after breast cancer [2,3]. Risk factors for TC include age, family history, pregnancy, oral contraceptive pills, radiations, smoking, alcohol, and environmental factors [3]. TC can be detected in an asymptomatic patient, however, patients mostly present with neck swelling, palpable nodules, dysphasia, hoarseness, or even dyspnea in advance cases [4]. TC can be easily diagnosed with ultrasound, which is noninvasive, widely available, and can be used in clinic basis, furthermore, suspicious lesions can be biopsied using fine needle aspiration techniques with ultrasound guidance [5]. TC incidents are increasing at an alarming rate in Saudi Arabia; however, TC generally has good prognosis, especially when detected at an early stage [3,4]. In this study, we aim to measure the knowledge and awareness of TC among women in Al-Hassa, Saudi Arabia.

Title: Thyroid Cancer Knowledge and Awareness Among Women in Al-Hassa Region, Saudi Arabia: A Cross-Sectional Study

Objectives

The main objectives of this study are to:

1. Assess the level of knowledge and awareness of thyroid cancer among women in Al-Hassa Region.
2. Identify the factors that influence knowledge and awareness of thyroid cancer among women in Al-Hassa Region.
3. Evaluate the attitudes and beliefs of women towards thyroid cancer screening and prevention.
4. Develop educational materials to improve knowledge and awareness of thyroid cancer among women in Al-Hassa Region.

Methodology

Study Design: Cross-sectional questionnaire-based study for females in which they live in Al-Hassa and aged 18 and above

Population: All females who live in Al-Hassa and aged 18 and above

Sample Size and Sampling Technique: The sample size is 384 which determined by using Richard Geiger equation. Population size is 472022, confidence level is 95% with margin of error of 5%.

Inclusion/Exclusion: Inclusion Criteria: females in which they live in Al-Hassa and aged 18 and above.

Exclusion Criteria: females from other regions, ages below 18 or males.

Statistical analysis: Both descriptive and inferential statistical analysis of the data was carried out. Simple descriptive statistics of the sociodemographic characteristics in the form of frequencies and percentages were calculated and tabulated.

The scoring of the participants was calculated based on the answers to the 16 questions assessing knowledge and awareness of thyroid cancer. A score of 1 was assigned for each correct answer. Thus, total possible scores ranged from 0-16. The participants were grouped into three categories based on their scores: Low Knowledge (0-50%), Moderate Knowledge (51-75%) and High Knowledge (>75%).

In order to assess the association of knowledge of thyroid cancer with various sociodemographic characteristics and practices, both univariate and multivariate analysis was carried out. For univariate analysis, Fischer's exact test was applied and interpreted while for multivariate analysis,

a multinomial logistic regression model was created. The model used Low Knowledge (0-50%) as the reference category and the results of the analysis were presented as Adjusted Odds Ratios (AORs) and p-values. Significance was established at a p-value of 0.05 or less indicating a 95% Confidence Interval. All statistical calculations were performed using IBM SPSS version 27.0.1.

Ethical Considerations: The study was conducted after obtaining the ethical clearance from Deanship of Scientific Research, King Faisal University No. #KFU-REC-2023-AUG-ETHICS1049, and in accordance with the ethical principles of the Declaration of Helsinki. Informed consent was obtained from all participants, and their confidentiality was ensured.

Results

Sociodemographic Characteristics:

The sociodemographic characteristics and practices for detecting thyroid cancer among 381 female participants from the Al-Hassa region in Saudi Arabia are summarized in **table 1**. The entire sample comprised Saudi nationals. The age distribution revealed that 28.3% were aged 18-24, 47.8% were aged 25-44, and 23.9% were above 44 years old. Most participants were married (61.9%), followed by single individuals (30.4%), with smaller percentages being divorced (4.7%) or widowed (2.9%).

In terms of education level, 64.8% of the participants held a bachelor's degree, while 31.2% had completed high school or below, and only 3.9% had pursued post-graduate education. Notably, 81.1% reported having family members or friends working in the medical field.

Regarding healthcare utilization, a significant portion (46.2%) visited health centers more than twice a year, while 20.2% visited twice, 16.3% visited once, and 17.3% did not visit health centers at all.

Regarding monthly income, 37.8% of participants earned less than 1000 Saudi Riyals per month, while 19.7% earned more than 10,000 Saudi Riyals. Income levels between 1000 and 3000, 4000 and 7000, and 8000 and 10,000 Saudi Riyals were reported by 17.8%, 11.3%, and 13.4% of participants, respectively.

Concerning thyroid cancer detection practices, 44.9% of participants had undergone a thyroid hormone analysis but only 17.3% had undergone an ultrasound or CT scan of the thyroid gland.

(Table 2) Knowledge and Awareness of Thyroid Cancer:

Regarding general perception and awareness, a majority of participants correctly knew that thyroid cancer is not incurable (51.4%) and not contagious (75.1%). However, only a small proportion (5.2%) was aware that thyroid cancer cannot be prevented. A significant number (35.7%) acknowledged that thyroid cancer is not uncommon in Saudi Arabia. Additionally, more participants correctly identified that thyroid cancer is more common in females (53.5%) and in individuals above 40 years of age (40.2%). A promising finding was that a substantial majority (82.2%) recognized that early detection of thyroid cancer allows appropriate and effective treatment.

Regarding awareness of risk factors, 32.0% of participants correctly knew that thyroid cancer can often have a genetic basis. An encouraging 61.9% were aware that lifestyle, including stability or diet, is associated with an increased risk of thyroid cancer. However, only 22.0% understood that the presence of a risk factor does not necessarily mean one will develop the disease. On a positive note, 60.9% correctly identified that physical activity can reduce the risk of thyroid cancer, and 56.2% knew that obesity increases the risk.

Regarding diagnosis and treatment, a significant majority (74.8%) recognized that thyroid cancer can appear as a lump or knot in the neck. Similarly, 81.9% were aware that monitoring swelling in the neck is helpful for early detection. Importantly, the majority of participants (91.3%) indicated that they would consult a doctor if they found a lump or knot in the thyroid area. **(Table 3)**

In summary, the study highlights a mixed level of knowledge and awareness among the female participants regarding thyroid cancer. While certain aspects of general perception and awareness were well understood, there were gaps in knowledge related to prevention and risk factors.

Factors Affecting Knowledge of Thyroid Cancer:
Univariate analysis examining the association between knowledge and awareness of thyroid cancer with various sociodemographic characteristics and practices among the participants was carried out. The knowledge scores were categorized as low knowledge (0-50%), moderate knowledge (51-75%), and high knowledge (>75%).

The findings revealed that the distribution of knowledge scores differed significantly based on age ($p=0.036$) and education level ($p=0.035$). Participants aged 18-24 demonstrated the highest proportion of moderate knowledge (51.9%), while those above 44 years had the lowest (44.0%). Similarly, participants with a post-graduate education showed the highest proportion of high knowledge (13.3%), while those with a high school education or below had the lowest (5.9%).

Marital status, having family members or friends in the medical field, visits to health centers per year, and monthly income did not show significant associations with knowledge scores ($p>0.05$).

Regarding practices for detecting thyroid cancer, participants who had undergone a thyroid hormone analysis demonstrated higher knowledge scores ($p=0.016$). Specifically, those who had done the analysis had a higher proportion of moderate knowledge (53.8%) and high knowledge (9.4%) compared to those who had not done it (41.0% and 7.6%, respectively). However, the knowledge scores did not significantly differ based on whether the participants had undergone an ultrasound or CT scan of the thyroid gland ($p=0.878$). **(Table 4)**

The **table 5** presents the results of a multivariate multinomial logistic regression, assessing the association between knowledge and awareness of thyroid cancer and various sociodemographic characteristics and practices among the participants.

For participants with moderate knowledge, the analysis revealed that those aged 18-24 had higher odds of moderate knowledge compared to participants above 44 years (AOR=1.869, $p=0.099$) although not statistically significant. Divorced participants were found to have significantly lower odds of moderate knowledge compared to single participants (AOR=0.236, $p=0.033$). Furthermore, individuals who had done a thyroid hormone analysis demonstrated significantly higher odds of moderate knowledge compared to those who had not (AOR=2.075, $p=0.004$).

Regarding high knowledge, participants aged 18-24 showed higher odds of having high knowledge compared to those above 44 years, though the difference was not statistically significant (AOR=2.158, $p=0.228$). Notably, participants who visited a health center more than twice a year had significantly lower odds of having high knowledge compared to those who didn't visit at all (AOR=0.316, $p=0.028$). Moreover, participants with post-graduate education displayed higher odds of high knowledge compared to those with high school education or below, although the difference was not statistically significant (AOR=6.150, $p=0.083$).

It is important to note that some associations, particularly with high knowledge, showed wide confidence intervals and non-significant p-values, suggesting a need for caution in interpreting these results.

In conclusion, the multivariate analysis highlights several factors associated with knowledge and awareness of thyroid cancer. Younger age, having undergone a thyroid hormone analysis, and

having higher education levels were positively linked to both moderate and high knowledge scores. On the other hand, visiting a health center more frequently was associated with lower odds of high knowledge.

Table 1 *Sociodemographic Characteristics of the Participants*

		N	%
Sex	Female	381	100.0%
Age	18-24	108	28.3%
	25-44	182	47.8%
	>44	91	23.9%
Nationality	Saudi	381	100.0%
Marital Status	Single	116	30.4%
	Married	236	61.9%
	Divorced	18	4.7%
	Widow	11	2.9%
Currently Living in the Al-Hasa Region	Yes	381	100.0%
Have Any Family Members Or Friends That Work In The Medical Field	No	72	18.9%
	Yes	309	81.1%
Education level	High school and below	119	31.2%
	Bachelor.	247	64.8%
	Post-grad education	15	3.9%
Visits to a Health Center Per Year	None	66	17.3%
	Once	62	16.3%
	Twice	77	20.2%
	More than twice	176	46.2%
Monthly Income	Less than 1000	144	37.8%
	1000-3000	68	17.8%
	4000-7000	43	11.3%
	8000-10.000	51	13.4%
	More than 10.000	75	19.7%
Total		381	100.0%

Table 2 *Practices For Detecting Thyroid Cancer Among the Participants*

		N	%
Ever done a thyroid hormone analysis	No	210	55.1%
	Yes	171	44.9%
Ever undergone an ultrasound or CT scan of the thyroid gland	No	315	82.7%
	Yes	66	17.3%

Table 3 *Questions Assessing Knowledge and Awareness of Thyroid Cancer and Responses of the Participants*

Question	Correct Answer	N	%
General perception and awareness of TC			
Is thyroid cancer incurable?	No	196	51.4%
Is thyroid cancer contagious?	No	286	75.1%
Can thyroid cancer be prevented?	No	20	5.2%

Thyroid cancer is uncommon in Saudi Arabia	No	136	35.7%
Thyroid cancer is more common in (males/females)	Females	204	53.5%
Thyroid cancer is more common in those who are older than 40 years	Yes	153	40.2%
When thyroid cancer is detected early, it can be treated appropriately and adequately	Yes	313	82.2%
Have you ever attended or watched the effectiveness or special awareness campaign for thyroid cancer?	Yes	38	10.0%
Awareness of the risk factors of TC			
Is thyroid cancer often genetic?	Yes	122	32.0%
Lifestyle is associated with an increased risk of thyroid cancer, for example, stability or diet	Yes	236	61.9%
The presence of a risk factor for thyroid cancer means that the disease that I I'd be	Yes	84	22.0%
Does physical activity reduce the risk of thyroid cancer?	Yes	232	60.9%
Does obesity increase the risk of thyroid cancer?	Yes	214	56.2%
Awareness of the diagnosis and treatment of TC			
Thyroid cancer appears in the form of a lump or knot in the neck	Yes	285	74.8%
Monitoring the presence of swelling in the neck is useful for the early detection of thyroid cancer	Yes	312	81.9%
If you find a lump or knot in the thyroid area, you will visit the doctor for a consultation	Yes	348	91.3%

Table 4 *Association of Knowledge and Awareness of Thyroid Cancer with Sociodemographic Characteristics and Practices (Univariate Analysis)*

		Knowledge Scores						
		Low knowledge (0-50%)		Moderate knowledge (51-75%)		High knowledge (>75%)		P value[F]
		N	Row %	N	Row %	N	Row %	
Total		171	44.9%	178	46.7%	32	8.4%	-
Age	>44	44	48.4%	40	44.0%	7	7.7%	0.036*
	18-24	37	34.3%	56	51.9%	15	13.9%	
	25-44	90	49.5%	82	45.1%	10	5.5%	
Marital status	Divorced	13	72.2%	5	27.8%	0	0.0%	0.158
	Married	106	44.9%	113	47.9%	17	7.2%	
	Single	46	39.7%	56	48.3%	14	12.1%	
	Widow	6	54.5%	4	36.4%	1	9.1%	
Have any family members or friends that work in the medical field	No	36	50.0%	28	38.9%	8	11.1%	0.269
	Yes	135	43.7%	150	48.5%	24	7.8%	

Education level	High school and below	67	56.3%	45	37.8%	7	5.9%	0.035*
	Bachelor.	99	40.1%	125	50.6%	23	9.3%	
	Post-grad education	5	33.3%	8	53.3%	2	13.3%	
Visits to a health center per year	None	29	43.9%	27	40.9%	10	15.2%	0.174
	Once	22	35.5%	33	53.2%	7	11.3%	
	Twice	34	44.2%	38	49.4%	5	6.5%	
	More than twice	86	48.9%	80	45.5%	10	5.7%	
Monthly income	Less than 1000	71	49.3%	62	43.1%	11	7.6%	0.705
	1000-3000	32	47.1%	29	42.6%	7	10.3%	
	4000-7000	20	46.5%	20	46.5%	3	7.0%	
	8000-10.000	18	35.3%	27	52.9%	6	11.8%	
	More than 10.000	30	40.0%	40	53.3%	5	6.7%	
Practices for detecting thyroid cancer according to the participants								
Ever done a thyroid hormone analysis	No	108	51.4%	86	41.0%	16	7.6%	0.016*
	Yes	63	36.8%	92	53.8%	16	9.4%	
Ever undergone an ultrasound or ct scan of the thyroid gland	No	143	45.4%	145	46.0%	27	8.6%	0.878
	Yes	28	42.4%	33	50.0%	5	7.6%	
[F]Fischer's Exact Test *p<0.05, Significant								

Table 5 *Results of Multivariate Multinomial Logistic Regression showing Association of Knowledge and Awareness of Thyroid Cancer with Sociodemographic Characteristics and Practices*

Knowledge Scores			Adjusted Odds Ratio (AOR)	95% Confidence Interval for AOR		P value
				Lower Bound	Upper Bound	
Low knowledge (0-50%)			Ref	Ref	Ref	Ref
Moderate knowledge (51-75%)	Age	25-44	1.042	.585	1.857	.890
		18-24	1.869	.890	3.926	.099
		>44	Ref	Ref	Ref	Ref
	Marital Status	Widow	.607	.134	2.747	.517
		Married	1.071	.587	1.957	.822
		Divorced	.236	.063	.890	.033*
		Single	Ref	Ref	Ref	Ref
	Have Any Family Members Or Friends That Work In The Medical Field	Yes	1.437	.800	2.582	.225
		No	Ref	Ref	Ref	Ref
	Education level	Post-Grad Education	2.445	.676	8.843	.173
		Bachelor	1.516	.909	2.528	.111

		High School or Below	Ref	Ref	Ref	Ref
	How often visit a health center per year	Twice	1.050	.499	2.209	.898
		Once	1.472	.666	3.253	.339
		More than twice	.905	.476	1.722	.761
		None	Ref	Ref	Ref	Ref
	Monthly Income	8000-10,000	1.580	.749	3.330	.229
		4000-7000	1.334	.618	2.880	.463
		1000-3000	1.162	.604	2.236	.653
		More than 10,000	1.637	.845	3.172	.144
		Less than 1000	Ref	Ref	Ref	Ref
	Ever done a thyroid hormone analysis	Yes	2.075	1.267	3.398	.004*
		No	Ref	Ref	Ref	Ref
	Ever undergone an ultrasound or CT scan of the thyroid gland	Yes	1.100	.554	2.181	.786
		No	Ref	Ref	Ref	Ref
High knowledge (>75%)	Age	25-44	.602	.196	1.852	.376
		18-24	2.158	.618	7.543	.228
		>44	Ref	Ref	Ref	Ref
	Marital Status	Widow	.636	.048	8.476	.732
		Married	.941	.341	2.598	.907
		Divorced	2.274E-9	2.274E-9	2.274E-9	.
		Single	Ref	Ref	Ref	Ref
	Have Any Family Members Or Friends That Work In The Medical Field	Yes	.782	.300	2.036	.614
		No	Ref	Ref	Ref	Ref
	Education level	Post-Grad Education	6.150	.791	47.839	.083
		Bachelor	1.911	.722	5.056	.192
		High School or Below	Ref	Ref	Ref	Ref
	How often visit a health center per year	Twice	.405	.118	1.397	.153
		Once	.727	.216	2.448	.606
		More than twice	.316	.113	.884	.028*
		None	Ref	Ref	Ref	Ref
	Monthly Income	8000-10,000	2.056	.592	7.138	.256
		4000-7000	1.431	.318	6.430	.640
		1000-3000	1.699	.552	5.232	.356
		More than 10,000	1.159	.327	4.106	.819

		Less than 1000	Ref	Ref	Ref	Ref
	Ever done a thyroid hormone analysis	Yes	2.368	.980	5.724	.056
		No	Ref	Ref	Ref	Ref
	Ever undergone an ultrasound or CT scan of the thyroid gland	Yes	1.033	.295	3.617	.959
		No	Ref	Ref	Ref	Ref

Discussion

The sociodemographic characteristics and practices for detecting thyroid cancer among 381 female participants from the Al-Hassa region in Saudi Arabia revealed several noteworthy findings. The age distribution of the participants showed that a significant proportion (47.8%) fell within the age range of 25-44, followed by 28.3% in the 18-24 age group and 23.9% above the age of 44. This distribution provides valuable insight into the specific age groups that should be targeted for thyroid cancer awareness and prevention programs.

Marital status revealed that the majority of participants were married (61.9%), with single individuals accounting for 30.4%. Smaller percentages were reported for divorced individuals (4.7%) and widowed individuals (2.9%). These findings indicate the importance of tailoring educational and screening initiatives to meet the needs of different marital statuses, as married individuals might have different healthcare-seeking behaviors compared to single or divorced individuals.

The participants' education level was another crucial sociodemographic characteristic examined in the study. It was found that the majority (64.8%) held a bachelor's degree, while 31.2% had completed high school or below, and only 3.9% had pursued post-graduate education. This finding highlights the relatively high educational attainment of the participants, which suggests that health promotion efforts can utilize a more advanced level of health literacy in the target population.

Interestingly, a significant proportion (81.1%) of the participants reported having family members or friends working in the medical field. This finding suggests that participants may have access to healthcare-related information and resources, potentially influencing their health-seeking behaviors and awareness of thyroid cancer.

Regarding healthcare utilization, the study examined the frequency of visits to health centers. The results showed that a substantial number of participants (46.2%) visited health centers more than twice a year, indicating a relatively proactive approach to seeking medical care. However, it is important to note that 17.3% of participants reported not visiting health centers at all. This finding highlights the need for targeted interventions to promote regular health check-ups and raise awareness about the importance of preventive measures, including thyroid cancer screening.

The participants' monthly income levels were also assessed in the study. It was observed that a considerable percentage (37.8%) earned less than 1000 Saudi Riyals per month, while 19.7% earned more than 10,000 Saudi Riyals. Income levels between 1000 and 3000, 4000 and 7000, and 8000 and 10,000 Saudi Riyals were reported by 17.8%, 11.3%, and 13.4% of participants, respectively. These findings suggest the need for targeted interventions that take into account the financial constraints faced by individuals with lower income levels, ensuring that thyroid cancer detection practices are accessible to all socioeconomic groups.

Regarding the participants' practices related to thyroid cancer detection, it was found that while 44.9% of participants had undergone a thyroid hormone analysis, only 17.3% had undergone an

ultrasound or CT scan of the thyroid gland. This disparity suggests that there may be a gap in awareness and utilization of imaging techniques for thyroid cancer detection. Efforts should be made to educate the population about the importance of these diagnostic procedures and address any barriers that may hinder their uptake.

Regarding the knowledge and awareness of thyroid cancer among the participants. It is encouraging to note that a majority of participants correctly knew that thyroid cancer is not incurable and not contagious, which indicates a general understanding of the disease. These findings are consistent with previous studies that have also shown a similar level of awareness regarding the curability and non-contagious nature of thyroid cancer (6), (7).

However, the study reveals a gap in knowledge concerning the prevention of thyroid cancer, with only a small proportion of participants being aware that the disease cannot be prevented. This finding is consistent with previous studies that have reported limited awareness about the prevention aspect of thyroid cancer (8). It highlights the need for educational interventions and awareness campaigns to emphasize the importance of early detection and risk reduction strategies rather than solely focusing on prevention.

In terms of understanding risk factors associated with thyroid cancer, the results of this study indicate a moderate level of awareness. A significant proportion of participants recognized the genetic basis of thyroid cancer, which aligns with previous research highlighting the importance of genetic factors in the development of the disease (9), (10). Moreover, a considerable percentage of participants acknowledged the association between lifestyle factors, such as stability or diet, and increased risk of thyroid cancer. These findings are in line with earlier studies that have emphasized the role of lifestyle in the etiology of thyroid cancer (11), (12).

However, there was limited understanding among participants that the presence of a risk factor does not necessarily guarantee the development of thyroid cancer. This misconception is consistent with previous studies that have also reported a lack of knowledge in this regard (13). It underscores the importance of providing accurate information to the public to avoid unnecessary anxiety and misconceptions associated with risk factors.

Regarding the diagnosis and treatment of thyroid cancer, the study findings indicate a satisfactory level of knowledge among the participants. Most participants correctly recognized that a lump or knot in the neck could be a symptom of thyroid cancer, and they were aware of the importance of monitoring swelling in the neck for early detection. These results are consistent with previous studies that have reported similar levels of awareness regarding the clinical manifestations of thyroid cancer (14), (15).

A particularly positive finding is that the majority of participants expressed a willingness to consult a doctor if they found a lump or knot in the thyroid area. This indicates a proactive attitude toward seeking medical help for potential thyroid cancer symptoms, which is crucial for early diagnosis and treatment. Similar findings have been reported in previous studies, highlighting the importance of promoting healthcare-seeking behaviors (16).

Our study examined the factors influencing knowledge of thyroid cancer among participants, with a focus on sociodemographic characteristics and practices related to thyroid cancer detection. The findings revealed significant associations between knowledge scores and age as well as education level. Additionally, the study explored the relationship between knowledge scores and various sociodemographic factors and practices.

Age was found to have a significant impact on knowledge scores, with participants aged 18-24

demonstrating the highest proportion of moderate knowledge. This finding suggests that younger individuals may have better awareness and knowledge of thyroid cancer compared to older age groups. This result aligns with previous studies that have reported a positive association between younger age and higher levels of health-related knowledge (17). The reasons behind this age disparity could be attributed to factors such as increased exposure to health information through various media platforms and a higher likelihood of engaging in health-seeking behaviors among younger individuals.

Education level was another significant factor influencing knowledge scores in this study. Participants with post-graduate education exhibited the highest proportion of high knowledge, while those with a high school education or below had the lowest proportion. These findings are consistent with previous research indicating that higher education levels are associated with better health-related knowledge and awareness (18). Higher education equips individuals with critical thinking skills, information-seeking behaviors, and the ability to comprehend complex medical concepts, which may contribute to greater knowledge about thyroid cancer.

Contrary to expectations, marital status, having family members or friends in the medical field, visits to health centers per year, and monthly income did not show significant associations with knowledge scores. These results differ from some previous studies that have reported associations between socioeconomic factors and health knowledge (19). However, it is important to note that the influence of socioeconomic factors on health knowledge can vary across different populations and cultural contexts, highlighting the need for further investigation in diverse settings.

In terms of practices related to thyroid cancer detection, the study found a significant association between knowledge scores and undergoing a thyroid hormone analysis. Participants who had undergone the analysis demonstrated higher knowledge scores compared to those who had not. This finding suggests that individuals who proactively engage in health-related practices, such as thyroid hormone analysis, are more likely to possess greater knowledge about thyroid cancer. This finding is consistent with previous studies highlighting the positive relationship between health behaviors and health knowledge (20).

However, the study did not find a significant association between knowledge scores and undergoing an ultrasound or CT scan of the thyroid gland. This unexpected result may be due to various factors, including limited awareness among participants regarding the role of imaging modalities in thyroid cancer detection or the possibility of a smaller sample size.

The findings from the multivariate multinomial logistic regression analysis indicate several sociodemographic characteristics and practices that are associated with knowledge and awareness of thyroid cancer among the participants. In terms of moderate knowledge, the analysis revealed that participants aged 18-24 had higher odds of moderate knowledge compared to participants above 44 years, although the difference was not statistically significant. This finding suggests that younger individuals may have a slightly better understanding of thyroid cancer compared to older individuals (21). However, it is important to note that further research with a larger sample size may be needed to confirm this association.

Interestingly, the study found that divorced participants had significantly lower odds of moderate knowledge compared to single participants. This finding suggests that marital status may play a role in the level of knowledge about thyroid cancer. It is possible that divorced individuals may have other pressing concerns or may not have access to as much health-related information as single individuals, thus leading to a lower level of knowledge. This finding highlights the importance of targeted educational interventions for divorced individuals to improve their knowledge of thyroid cancer.

Furthermore, individuals who had undergone a thyroid hormone analysis demonstrated significantly higher odds of moderate knowledge compared to those who had not. This finding is consistent with previous studies, which have shown that individuals who engage in preventive health screenings or have previous medical tests are more likely to possess better knowledge about thyroid cancer (22). The association between thyroid hormone analysis and moderate knowledge suggests that healthcare utilization and engagement with medical tests can positively influence individuals' knowledge of thyroid cancer.

Turning to high knowledge, participants aged 18-24 showed higher odds of having high knowledge compared to those above 44 years, although the difference was not statistically significant. This finding is consistent with previous studies, which have also shown a trend towards higher knowledge levels among younger individuals (23). It is possible that younger individuals have greater exposure to health information through various channels, including the internet and social media, leading to a higher level of knowledge about thyroid cancer.

Interestingly, participants who visited a health center more than twice a year had significantly lower odds of having high knowledge compared to those who did not visit at all. This unexpected finding contradicts previous studies, which have consistently shown that frequent health center visits are associated with higher levels of knowledge about various health conditions (24). The reasons behind this inverse association are unclear and warrant further investigation. It is possible that individuals who visit health centers more frequently may focus on specific health concerns and neglect to acquire comprehensive knowledge about thyroid cancer. Alternatively, there may be other unmeasured confounding factors influencing this association.

Moreover, participants with post-graduate education displayed higher odds of high knowledge compared to those with high school education or below, although the difference was not statistically significant. This finding aligns with previous studies, which have consistently shown a positive relationship between higher education levels and knowledge about thyroid cancer (25). Individuals with post-graduate education often have access to more extensive educational resources and are more likely to engage in critical thinking, which may contribute to their higher levels of knowledge. However, the lack of statistical significance in this study may be due to the small sample size or other confounding factors, emphasizing the need for further research with a larger and more diverse population.

It is important to acknowledge the limitations of this study. First, the small sample size might have limited the statistical power to detect significant associations, particularly for high knowledge. Therefore, caution should be exercised when interpreting the results, and further studies with larger sample sizes are warranted to confirm these findings. Additionally, the study relied on self-reported data, which is subject to recall bias and may introduce inaccuracies.

Conclusion

Our study provides valuable insights into the awareness of thyroid cancer among female participants in the Al-Hassa region of Saudi Arabia. The findings highlight both positive aspects and gaps in knowledge and awareness. These findings can inform the development of targeted interventions and educational programs to improve knowledge and promote early detection of thyroid cancer. Future research should consider a larger and more diverse sample, as it may influence knowledge and awareness of thyroid cancer in Saudi Arabia.

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Annexure

Demographic data

- **Age (years)**
- <18
- 18-35
- 36-50
- >50

- **Nationality**
Saudi
Non-Saudi

- **Marital status**
Single
Married
Others

- **Do you currently live in Makkah region?**
Yes
No

- **Do you have any family members or friends that work in the medical field?**
Yes
No

- **Education level**
High school and below
Bachelor
Post-grad education

- **How often do you visit a health center per year?**
None
Once
Twice More
than twice

- **Monthly income**
▪ Less than 1000
▪ 1000-3000
▪ 4000-7000
▪ 8000-10.000
▪ More than 10.000

Practices for detecting thyroid cancer according to the participants

Have you ever done a thyroid hormone analysis?
Yes
No

Have you ever undergone an ultrasound or CT scan of the thyroid gland?
Yes
No

3- General perception and awareness of TC Is thyroid cancer incurable?
Yes
No
I don't know

Is thyroid cancer contagious?
Yes
No
I don't know

Can thyroid cancer be prevented?
Yes
No
I don't know

Thyroid cancer is uncommon in Saudi Arabia
Yes
No
I don't know

Thyroid cancer is more common in (males/females)
Male
Female
I don't know

Thyroid cancer is more common in those who are older than 40 years Yes
No
I don't know

When thyroid cancer is detected early, it can be treated appropriately and adequately
Yes
No
I don't know

Have you ever attended or watched the effectiveness or special awareness campaign for thyroid cancer?
Yes
No
I don't know

4- Awareness of the risk factors of TC Is thyroid cancer often genetic?
Yes
No

I don’t know

Lifestyle is associated with an increased risk of thyroid cancer, for example, stability or diet
Yes
No
I don’t know

The presence of a risk factor for thyroid cancer means that the disease that I I’d be
Yes
No
I don’t know

Does physical activity reduce the risk of thyroid cancer?
Yes
No
I don’t know

Does obesity increase the risk of thyroid cancer?
Yes
No
I don’t know

5- Awareness of the diagnosis and treatment of TC

Thyroid cancer appears in the form of a lump or knot in the neck
Yes
No
I don’t know

Monitoring the presence of swelling in the neck is useful for the early detection of thyroid cancer
Yes
No
I don’t know

If you find a lump or knot in the thyroid area, you will visit the doctor for a consultation
Yes
No
I don’t know

Low knowledge = 0 to 50%
Moderate knowledge = 51% to 75%
High knowledge = more than 75%