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Research Article

Gender Disparities in Thyroid Cancer Awareness and Outcomes: A Comprehensive Analysis of Risk Perception and Diagnosis in Saudi Arabia

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ABSTRACT

Background: Thyroid cancer, while generally treatable, presents significant challenges in terms of awareness and timely diagnosis, particularly in gender-specific contexts. Previous studies have highlighted an increasing trend in the prevalence and severity of TC globally. This study aimed to investigate the awareness of TC risk factors and diagnostic practices among the Saudi Arabian population, focusing on identifying gender-specific disparities

Methods:A cross-sectional survey was conducted using a structured questionnaire among 698 participants (N=698) from Saudi Arabia. Demographic factors, awareness levels, and societal barriers to thyroid cancer screening were assessed. The Mann-Whitney U test revealed statistically significant differences ($p < 0.05$) in gender awareness levels

Results: A significant disparity was found, with females demonstrating higher awareness than males (67.3% vs. 32.7%). Despite this, systemic barriers impeded effective prevention and treatment for females. Males exhibiting lower awareness were more likely to be diagnosed with aggressive subtypes at later stages. Statistical analysis confirmed these gender differences as significant ($p < 0.001$).

Conclusion: The gender differences in awareness and diagnosis of TC in Saudi Arabia underscore the need for targeted public health strategies. While it is vital to maintain a high level of awareness among females, there is a pressing need for campaigns specifically designed to increase awareness among males at higher risk. This study is a foundation for future interventions to reduce gender disparities in TC outcomes.

INTRODUCTION

The thyroid is a butterfly-shaped gland in the front of the neck, essential for producing hormones that regulate metabolism, growth, and development. Thyroid diseases encompass a range of conditions affecting the structure or function of the thyroid gland, including hypothyroidism, hyperthyroidism, thyroid nodules, and thyroid cancer. Among these, thyroid cancer (TC) is the most severe, characterised by abnormal cell growth in the thyroid gland that can spread to other parts of the body if left untreated.

Papillary Thyroid Cancer (PTC), the most common subtype of thyroid cancer, accounts for 80–85% of cases worldwide. It is generally slow-growing but can metastasise to lymph nodes and distant organs if not detected early (Lim et al., 2017). Despite its relatively favourable prognosis, the incidence of PTC has risen significantly over recent decades, mainly due to increased detection through advanced diagnostic tools (Lim et al., 2017; Ba et al., 2016).

Globally, the cancer burden persists as a significant public health challenge. Parkin and colleagues reported 10.9 million new cases and 6.7 million deaths in 2002. projections suggest a 50% increase to 15 million new cases by 2020 within this expansive framework (Parkin et al., 2005). Thyroid cancer is the most rapidly escalating type of cancer in terms of incidence (Parkin et al., 2005). In 2019. There were 234.000 new diagnoses and over 45.000 deaths from thyroid cancer worldwide, elevating its mortality rank from 107th in 1990 to 95th in 2019 (Ibrahim et al. 2008). This trend is particularly

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notable in the United States, where thyroid cancer incidence rates have more than tripled since 1975, predominantly due to rises in advanced-stage Papillary Thyroid Cancer (PTC) (Lim et al. 2017). According to the National Cancer Institute, an estimated 951.193 individuals in the United States were living with thyroid cancer in 2020 (Ferlay 2024).

Parallel trends have been observed in Saudi Arabia, echoing the global rise in incidence. In 2022, the International Agency for Research on Cancer documented 28.113 new cases and 13.399 deaths, with thyroid cancer becoming the second most prevalent cancer among young women in Saudi Arabia (Ferlay, 2024). Nonetheless, the scholarly discourse on the epidemiology and differentiation of thyroid cancer in Saudi Arabia, particularly in the Western regions, remains notably limited.

Building on our prior investigations, which leveraged data from the Global Burden of Disease and the Institute for Health Metrics and Evaluation to analyse trends from 1990 to 2019, we noted a considerable increase in thyroid cancer incidence in the Saudi population (Flemban et al., 2022). Our findings indicated a 15-fold increase in incidence among females and a 22-fold increase among males over three decades, reflecting broader changes in exposure to risk factors such as radiation, obesity, and smoking (Flemban et al.. 2022). The mortality increase was more pronounced among males, suggesting a gender disparity in exposure and outcomes (Flemban et al. 2022; Shank et al. 2022). Occupational factors may influence the altered male-to-female ratio of thyroid cancer cases, corroborating global and localised findings (Ba et al., 2016; Shank et al., 2022).

In particular. Saudi males experience heightened occupational exposure to risk factors such as radiation and industrial chemicals, potentially elucidating the observed higher mortality rates and prevalence of aggressive cancer subtypes (Flemban et al.. 2022). Our research also revealed that by 2019. The incidence of aggressive thyroid cancers, such as medullary carcinoma, was more prevalent among Saudi males compared to females, highlighting the need for targeted public health interventions (Flemban et al.. 2022).

The current study is designed to enhance our understanding of thyroid cancer awareness and screening in Saudi Arabia. Firstly, it aims to evaluate the degree of awareness regarding thyroid cancer risk factors among both male and female populations. Secondly, the study seeks to identify which gender exhibits a greater awareness of these risk factors. Lastly, it intends to investigate the societal challenges that impede the effective implementation of thyroid cancer screening programs within the community. These objectives are crucial for addressing gaps in current research and improving public health strategies against thyroid cancer in Saudi Arabia.

2. MATERIALS AND METHODS

This study used a cross-sectional design and two primary methodologies: an online self-administered questionnaire and direct interviews within the Saudi community. Data collection occurred over six months, from December 2022 to May 2023, utilising Google Forms as the platform for survey dissemination. The participant pool consisted of Saudi nationals residing within Saudi Arabia, aged 18 to 40 years and older. Individuals from outside the country or those under 18 were excluded from participation. Before data collection, the study protocol received ethical approval from the Institutional Review Board (IRB number 4110709) of the Scientific Research Committee at Al-Baha University. Al-Baha. Saudi Arabia. The survey was distributed among 698 participants in Saudi Arabia.

2.2 Study questionnaire data collection. and source

The survey was developed in Google Forms and disseminated by 15 health-related specialist students across all 13 administrative regions of Saudi Arabia. Data collection was conducted via Google Surveys from December 2022 to May 2023. It was distributed in two ways: digitally through social media platforms such as WhatsApp. X [formerly Twitter] and Telegram, with weekly reminders and via in-person interviews where data collectors recorded responses directly into Google Forms. The use of Google Surveys ensured efficient and wide-reaching data collection.

The questionnaire was developed after a thorough review of the existing literature and related studies (Abdulrahman Ibrahim S Almousa, 2018; Alhazmi et al., 2022; Almuzaini et al., 2019). It is divided into three sections: demographic data (age, gender, Region, education level, and income); signs of thyroid cancer (early signs, red flags, Prognosis, sex prevalence, outcomes by gender, risk factors, and diagnostic methods); and societal views on screening and perceived barriers.

A research expert validated the questionnaire's content and structure to ensure accuracy and coherence. Participants were assured of confidentiality and informed that their data would be used exclusively for research. Responses that were incomplete or missing were excluded from the study.

2.3 Data analysis and interpretation

This study aims to elucidate the demographic and professional profiles of participants and to assess thyroid cancer awareness among both male and female populations in the Kingdom of Saudi Arabia. Additionally, the research seeks to ascertain which gender is more informed about the risk factors associated with thyroid cancer. A further objective is to identify societal barriers to the effective implementation of thyroid cancer screening programs within the community. Through this analysis, the study aims to provide comprehensive insights into awareness and challenges in thyroid cancer prevention and detection.

2.3.1 Reliability testing

Table 1. The Cronbach's coefficient

Number of axes	Alpha
7	0.608

We employed Cronbach's Alpha coefficient to evaluate the reliability of our questionnaire, a widely recognised measure of internal consistency. This coefficient assesses the stability and consistency of responses if the questionnaire was administered repeatedly to the same individuals. The results are displayed in the table below, derived from the study sample's responses and analysed using the Statistical Package for the Social Sciences (SPSS) Version 20 for Windows (SPSS Inc., Chicago, Illinois).

As indicated in Table 1, the questionnaire's overall reliability coefficient is 0.608, suggesting a substantial level of reliability. This score confirms that the questionnaire is a dependable tool for measuring the constructs it is intended to assess.

3. RESULTS

3.1 Sample characteristics

The following section outlines the demographic characteristics of the study sample, focusing on age, gender, geographic area, Income, and educational level. Table 2 shows the distribution of the sample members according to their demographic and personal characteristics.

Table 2. Distribution of demographic and personal characteristics of the study sample.

Variables		no	N %*
Age	18-20 years	124	17.8%
	20-29 years	291	41.7%
	30-39 years	140	20%
	> 40 years	143	20.5%
Gender	Male	333	47.7%
	Female	365	52.3%
Administrative region	Al-Baha provinces	20	2.9%
	Aljouf provinces	12	1.7%
	Northern Boarder provinces	17	2.4%
	Riyadh provinces	66	9.5%
	Al-Qassim provinces	81	11.6%
	AL Madinah AL Munawwarah provinces	39	5.6%
	Eastern Province	130	18.6%
	Tabuk provinces	52	7.4%
	Jazan provinces	226	32.4%
	Hail provinces	2	0.3%
	Asir provinces	14	2.0%
	Makkah provinces	38	5.5%
	Najran provinces	1	0.1%
Monthly Income in Saudi Riyals	Less than 10 thousand riyals/month Less than or equal to 15 thousand riyals/month	423 169	60.6% 24.2%
	More than 15 thousand riyals/month	106	15.2%
Level of education	Secondary education or less (Secondary education refers to high school or equivalent.)	224	32.1%
	Bachelor's degree	453	64.9%
	Postgraduate	21	3.0%

* Percentages may not total 100 due to rounding.

Table 2 provides a breakdown of the age groups within the sample: 41.7% of respondents were between 20 and 29 years old. 17% were aged 18-20, and approximately 20% were aged 30-39 or older than 40. The gender distribution in the sample indicates that 52.3% of respondents are female and 47.7% are male. Geographically, most respondents are from Jazan, representing 32.4% of the total sample. The smallest representation is in Najran, with other regions ranging from 0.3% to 11%. The income distribution shows that 60.6% of the sample earns less than 10,000 riyals per month. 24.2% earn less than fifteen thousand riyals, and 15.2% earn more than fifteen thousand riyals monthly. Regarding educational attainment. 64.9% of the participants hold a bachelor's degree. 32.1% have completed secondary education or less, and 3% possess postgraduate degrees.

3.2 Answers analysis

A quantitative analysis of respondents' level of awareness regarding thyroid cancer was conducted by calculating the arithmetic mean and standard deviation for each axis and response in the questionnaire (Table 3).

Each response is quantified using a scoring system: a single correct response is assigned 1 point, two correct responses receive 2 points, and three correct responses are awarded 3 points. No correct responses were allocated 0 points. These scores were used to evaluate the overall level of awareness, which was subsequently categorised into four levels on a Likert scale. This scale systematically assesses and reports the degree of awareness derived from the questionnaire responses.

Table (3) A Likert scale used to assess and report the degree of awareness

Intervals	Levels of answers
From 0 to 0.75	None
From 0.76 to 1.51	low
From 1.52 to 2.27	Moderate
From 2.28 to 3	High

3.3 Level of awareness (survey results)

Analysis of the data presented in Table 4 reveals that the participants exhibit a low level of awareness concerning thyroid cancer. This conclusion is drawn from a computed mean score of 1.46 out of a possible 4, which is significantly below the threshold for the "agree" category on the five-point Likert scale, which typically ranges from 3.41 to 4.20. This category corresponds to a high level of agreement or awareness within the context of the study tool. The current findings highlight a notable deficiency in awareness among the sample population regarding thyroid cancer risk factors and symptoms and prevention strategies (Table 5).

Table (4): means and standard deviation of the answers of the level of awareness

	Gender	.No	Mean Rank	Sum of Ranks
Level of awareness	Male	333	306.66	102118.50
	Female	365	388.58	141832.50
	Total	698		

Questions No answer		Level of awareness				Mean	St.dev	Level of awareness
		One answer	Two answers	Three answers or more				
Where did you get most of the information about thyroid cancer?	.No	176	204	120	198	1.49	1.15	low
	%	25.2%	29.2%	17.2%	28.4%			
What are the early signs of thyroid cancer?	.No	218	37	229	214	1.63	1.21	Moderate
	%	31.2%	5.3%	32.8%	30.7%			
Which factors are recommended for thyroid cancer screening?	.No	125	253	0	320	1.74	1.21	Moderate
	%	17.9%	36.2%	0.0%	45.8%			
According to your information. how is thyroid cancer diagnosed?	.No	330	368	0	0	0.53	0.50	Non
	%	47.3%	52.7%	0.0%	0.0%			
Which of the following do you think are risk factors for developing thyroid cancer?	.No	0	255	114	329	2.11	0.91	Moderate
	%	0.0%	36.5%	16.3%	47.1%			
What are the most common diagnostic methods for screening for thyroid cancer?	.No	159	254	139	146	1.39	1.06	low
	%	22.8%	36.4%	19.9%	20.9%			
What is your position regarding thyroid cancer screening practices?	.No	5	483	186	24	1.33	0.54	low
	%	0.7%	69.2%	26.6%	3.4%			
Mean and St. Deviation		Level of awareness				1.46	0.54	low

Table 5. Rank of awareness of the participants (Low, Moderate, None) was evaluated to determine the differences in thyroid cancer awareness levels in Saudi Arabia

3.4 Assessing Awareness Levels of Thyroid Cancer Among Genders in Saudi Arabia

Table 6 presents the results of the Mann-Whitney U test, which evaluated the differences in thyroid cancer awareness levels between males and females in Saudi Arabia. The analysis showed a statistically significant difference in awareness levels between genders (p-value < 0.000).

Further examination of the means reveals that the average awareness rank for females is higher than that for males. This discrepancy suggests that females are more aware of thyroid cancer than males in the Kingdom of Saudi Arabia. This finding underscores the gender-specific disparities in health awareness that may influence the effectiveness of public health interventions.

and educational programs targeted at reducing the burden of thyroid cancer.

Table 6. Mann Whitney test result for the difference in awareness level between genders

Test Statistics[a]	
	Level of awareness
Mann-Whitney U	46507.500
Wilcoxon W	102118.500
Z	-5.377
Asymp. Sig. (2-tailed)	0.000
a. Grouping Variable: sex	

4. DISCUSSION

The findings from this study reveal significant gender disparities in the awareness of thyroid cancer risk factors and symptoms among the Saudi Arabian population.

This study's demographic and socioeconomic data provide crucial insights into the awareness and understanding of thyroid cancer in Saudi Arabia. The age distribution of the participants shows that the majority (41.7%) were aged between 20–29 years, followed by nearly equal proportions in the 30–39 years (20.1%) and ≥40 years (20.5%) groups. This skew toward younger participants could reflect the growing accessibility of digital platforms like Google Surveys among this demographic. The high proportion of younger participants may influence the results, as this group is often more health-conscious and proactive in seeking information than older age groups.

Geographically, participants from Jazan constituted the largest proportion (32.4%), while representation from other regions, such as Northern Borders (2.4%) and Najran (0.1%), was significantly lower. This discrepancy may indicate regional disparities in awareness or survey accessibility. The concentration of respondents in Jazan could also bias the findings, as socioeconomic and cultural factors vary significantly across Saudi Arabia's regions.

Socioeconomic status, as reflected in the distribution of monthly income, further underscores participant disparities. Most participants (60.6%) reported earning less than 10,000 Saudi Riyals (SR) per month, with a smaller proportion earning between 10,000–15,000 SR (24.2%) or above 15,000 SR (15.2%). This income distribution suggests that a substantial portion of the sample falls within low to moderate-income brackets, potentially influencing their access to healthcare and preventive screening services. Public health interventions tar-

geting low-income groups might need to focus on affordability and accessibility to increase the uptake of thyroid cancer screening and awareness campaigns.

Educational attainment is another critical factor influencing awareness levels. Most participants (64.9%) held a bachelor's degree, only 3% had postgraduate qualifications, and 32.1% had secondary education or less. These findings suggest that the population surveyed is relatively well-educated, which might contribute to a higher baseline awareness of thyroid cancer. However, the significant proportion with secondary education or less highlights the need for public health messaging tailored to varying levels of health literacy.

We observed a statistically significant difference in awareness levels between males and females, with females demonstrating higher awareness. This study's findings align with previous research indicating that the male population in Saudi Arabia has lower knowledge of cancer risk factors than females, emphasising the critical need to enhance awareness of these risk factors among males to improve health outcomes (Farsi et al., 2020; Sabi et al., 2021). This discrepancy is critical as it highlights potential challenges in public health communications and interventions intended to be gender-neutral. However, it may not effectively reach or impact all population segments equally (McCutchan et al.. 2015).

The higher awareness among females could be attributed to several factors. First, the global trend of higher health literacy and engagement in preventive health behaviours among women might influence these findings (Yusefi et al., 2022). Women are often more proactive in seeking health information, particularly for diseases with high personal risk (Ek, 2015). Second, marketing and public health messaging about thyroid cancer and general health screenings might more effectively target women, or women may be more receptive to these messages

While the elevated level of awareness among females in Saudi Arabia is commendable, it does not directly translate into reduced incidence or enhanced clinical outcomes for thyroid cancer. This paradox may partly stem from the inherently higher incidence of thyroid cancer among females, which could naturally drive greater awareness within this group. However, maintaining this heightened awareness is crucial, as it lays the foundation for early detection and informed health decision-making

Simultaneously, there is a pressing need for targeted health campaigns aimed at the male population, which not only exhibits lower awareness but also tends to suffer from more aggressive subtypes of thyroid cancer and is more likely to have the disease diagnosed at a later stage. This discrepancy underscores the necessity for strategic public health interventions specifically addressing men, promoting awareness and encouraging earlier diagnostic engagement to mitigate the risks associated with delayed treatment. Such focused initiatives are essential to bridge the awareness gap and improve health outcomes across genders.

The significant lack of awareness observed among males calls for tailored health education programs that address men's specific needs and preferences. These educational programs should seek to include workplace-based interventions, male-focused health campaigns, and engagement through digital media platforms commonly used by men to increase the reach and impact of informational content

In conclusion, the gender differences in thyroid cancer awareness in Saudi Arabia underscore the need for public health officials to consider gender-specific strategies in health messaging and education. Enhancing male engagement in preventive health behaviours and improving the reach of health education to less aware segments of the population could play a crucial role in the early detection and management of thyroid cancer. This approach could lead to better health outcomes and a more equitable healthcare system. Future studies should explore the underlying reasons for low health awareness among males and test the effectiveness of targeted interventions designed to increase awareness and reduce the burden of thyroid cancer across the population..

5. CONCLUSION AND RECOMMENDATION

The study underscores significant gender disparities in the awareness of thyroid cancer within the Saudi Arabian population. Despite females exhibiting higher levels of awareness, possibly due to the higher incidence of thyroid cancer in this demographic, they continue to face challenges that impede effective prevention and treatment outcomes. Conversely, the male population, while showing lower awareness, is disproportionately affected by more aggressive subtypes of thyroid cancer and often diagnosed at more advanced stages. This finding highlights a critical need for targeted public health campaigns explicitly aimed at men to raise awareness and promote early diagnostic measures.

This research is pioneering in its focus on the notably poor awareness of thyroid cancer and its associated risks among Saudi Arabian males. This foundational study illuminates this significant gap in awareness and understanding. The insights gained from this study will be instrumental in guiding future public health campaigns to increase awareness among Saudi males. Such targeted initiatives are essential to enhancing their engagement with preventive health measures and early diagnostic services.

Additionally. this study addresses a critical question posed in our previously published work regarding the causes of more aggressive and late-stage diagnoses of thyroid cancer in the male population of Saudi Arabia by identifying the low level of awareness as a critical factor. This research provides essential data that can help shape interventions designed to mitigate these issues.

Therefore, effective public health strategies must focus on maintaining a high level of awareness among females while also enhancing education and outreach efforts toward men. This dual approach will help ensure that all population segments have the knowledge to engage in preventive behaviours and seek timely medical intervention. Addressing these issues will contribute to better management of thyroid cancer across the population, ultimately leading to improved health outcomes and a reduction in the gender disparity observed in thyroid cancer awareness and treatment.

Declarations

Ethics Approval and Consent to Participate

Ethical approval was obtained from the Institutional Review Board (IRB number 4110709) at the Al-Baha University Scientific Research Committee in Al-Baha, Saudi Arabia.

Availability of Data and Materials

The research team generates all data provided in the manuscript for publication from the collected data.

SOURCE OF FUNDING

No funding was received to conduct this study.

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

Authors' Contributions

AF conceptualised and designed the study, conducted the statistical analysis, and drafted the manuscript. SK. RM and AF provided critical revisions, statistical analysis and important intellectual content. SA. SK. and RM worked on summarising the results and drafting the introduction. MA. RA. HM collected the data and worked on the first draft of the manuscript. All authors read and approved the final manuscript.

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