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Research Article

The Distribution of Thyroid Nodules and Thyroid Cancer Based on Certain Demographic Characteristics and Blood Groups of Patients at Sabratha National Cancer Institute in Western Libya

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Abstract

Aim: A person with hypothyroidism, hyperthyroidism, or normal thyroid function may have a diffuse, nodular (one solid nodule), or multinodular enlargement.

Objectives: The current study aimed to investigate the distribution of thyroid nodules and thyroid cancer according to gender, age, region, and blood groups in patients attending Sabratha National Cancer Institute, Western Libya.

Materials and Methods: This study was performed conducted on 358 of thyroid nodules and thyroid cancer patients, attending the National Cancer Institute of Sabratha from the 1st January 2020 to the 31th December 2023. This study was approved by the Research and Ethical Committee of Sabratha University and Sabratha National Cancer Institute. All data were extracted from patients' files. The data was compared using Chi-Square using SPSS Statistics for Windows, Version 26.

Results: There was a significant (P = 0.000) difference in distribution between types of thyroid nodules and cancer according to gender. The distribution of the solitary thyroid nodule, multinodular goiter and cancer patients according to gender were 9.65%, 12.95%, and 15.69% males and 90.35%, 87.05%, and 84.31% female patients, respectively. The mean age of the solitary thyroid nodule, multinodular goiter, and cancer patients were 40.6± 11.4, 46.4± 13.2, and 48.5± 13.3 years, respectively. The results showed that a significant (P = 0.007) distribution of the types of thyroid nodules and cancer patients according to age groups. The higher distribution of the solitary thyroid nodule, multinodular goiter, and cancer patients were 41.23%, 34.72%, and 29.41% in the age group (40-49) years, respectively. The geographic regions with the highest incidence rates of the solitary thyroid nodule, multinodular goiter, and cancer patients were 22.63%, 21.51%, and 18.99% from Zawia, Sabratha, and West Sabratha, respectively. The distribution of A, B, AB, and O blood groups showed a non-significant (P = 0.221) difference between the solitary thyroid nodule, multinodular goiter, and cancer patients. The highest distribution of ABO blood groups were 50.88%, 52.33%, & 52.94% in O blood group and 35.97%, 28.50%, & 39.22% in A blood group in the solitary thyroid nodule, multinodular goiter, and cancer patients, respectively. The distribution of the ABO blood groups system and Rhesus factor showed a significant (P = 0.000) difference between the solitary thyroid nodule, multinodular goiter, and cancer patients. The highest distribution of ABO blood groups system and Rhesus factor were 42.11%, 47.15%, and 49.02% in O^+ blood group and 30.70%, 27.46%, and 37.26% in A^+ blood group in the solitary thyroid nodule, multinodular goiter, and cancer patients, respectively. The distribution of Rhesus factor showed a non-significant (P=0.078) difference between thyroid nodules and cancer patients that, were 87.72%, 94.30%& 96.08% Rh^+, and 12.28%,5.70% & 3.92% in Rh^- in the solitary thyroid nodule, multinodular goiter, and cancer patients, respectively.

Conclusion: It can be concluded that there was a non-significant (P = 0.432) difference in distribution between types of thyroid nodules and cancer according to gender. However, the proportion of thyroid cancer patients and thyroid nodule types by age group differed significantly (P = 0.007). Patients in the 40–49 age range had a greater prevalence of

malignancy, multinodular goiter, and solitary thyroid nodules. Zawia, Sabratha, and West Sabratha were the locations with the greatest incidence rates of cancer patients, multinodular goiter, and solitary thyroid nodules. Patients with a single thyroid nodule, multinodular goiter, and malignancy had non-significant (P = 0.221) differences in the distribution of A, B, AB, and O blood types. Patients with a single thyroid nodule, multinodular goiter, and malignancy had significantly different distributions of the ABO blood type system and Rhesus factor (P = 0.000). Additional research is required to validate these findings.

Keywords: thyroid nodules; thyroid cancer; gender; age groups; blood groups; Sabratha National Cancer Institute; Western Libya

1. Introduction

A diffuse, nodular (one solid nodule), or multinodular enlargement may be seen in a person with hypothyroidism, hyperthyroidism, or normal thyroid function (Jameson & Weetman, 2008, Kir *et al.,* 2018). The Metabolic Syndrome group had higher rates of goiters, an enlarged thyroid, and multinodular thyroid disease (Kir *et al.,* 2018). Hegedus *et al.* (2003) and Kir *et al.* (2018) state that a nodular goiter is a clinically detectable swelling of the thyroid gland. It is characterized by one or more areas of normal thyroid tissue growing excessively and changing structurally or functionally.

Female gender, advanced age, smoking, hypertension, fasting blood glucose/diabetes, BMI (Zhu *et al.,* 2012, Kir *et al.,* 2018), WC, multiparity (Rendina *et al.,* 2012, Kir *et al.,* 2018), and hypertriglyceridemia (Yin *et al.,* 2014, Kir *et al.,* 2018) were among the factors linked to thyroid nodule formation.

Thyroid nodules are up to 50% common in women and older patients, and they are more common in areas with low iodine levels (Burguera & Gharib, 2000, Duran *et al.,* 2015). Women are more likely than males to have thyroid nodules, which affect 20% to 76% of adults (Yaseen & Abbas, 2022). Up to 67% of patients have nodules on neck ultrasounds, which means they are frequently found by accident during imaging procedures (Akhtar *et al.,* 2022). According to Moon *et al.* (2018), the correlation between thyroid nodule occurrence and metabolic disorders, such as obesity and metabolic syndrome, implies that these disorders may have had a role in the rise in thyroid nodule prevalence in Korea.

According to Pakfetrat *et al.* (2017), hemodialysis patients are more likely than controls to have thyroid hormone abnormalities, nodular goiter, and hypothyroidism. The high prevalence of hypothyroidism and nodular goiter in individuals with end-stage renal failure indicates the importance of screening for both conditions. Particularly in older populations, thyroid nodules are common clinical findings that have the potential to be malignant (Abrishami *et al.,* 2025).

In Libya, the incidence of thyroid cancer is 2.9 per 100,000 females, whereas the prevalence is 12.4 per 100,000 females. Patients with benign lesions are 36.5 years old on average, but those with thyroid cancer are 46 years old on average (Fathi *et al.,* 2015).

According to He *et al.* (2016) and Tam *et al.* (2020), thyroid cancer is the most common endocrine cancer and is growing at a quicker pace than any other cancer in both men and women. Although some studies find lower rates when long-term follow-up is taken into consideration, the malignancy rate in thyroid nodules is typically between 5% and 15% (Akhtar *et al.,* 2022, Grussendorf *et al.,* 2022). According to many studies, the incidence of thyroid cancer in nodules ranges from 3% to 10%, which is in line with global statistics. Older individuals had a greater prevalence of thyroid cancer in nodules, indicating that they require more careful monitoring and treatment (Lin *et al.,* 1997).

About 600,000 individuals are diagnosed with thyroid cancer year, and 45,000 of them pass away from the disease, making it the eleventh most common cancer in the world (Sung *et al.,* 2021, Dogan, 2023). Numerous risk factors, including family history, radiation exposure, obesity, occupational exposure, and environmental exposure, have been linked to thyroid cancer (Fiore *et al.,* 2019, Dogan, 2023). Insulin resistance, which is thought to be a risk factor for the development of cancer, may be linked to thyroid nodules (Rezzonico *et al.,* 2009, Duran *et al.,* 2015).

2. Objectives

The current study aimed to investigate the distribution of thyroid nodules and thyroid cancer according to gender, age, region, and blood groups in patients attending Sabratha National Cancer Institute, Western Libya.

3. Materials and Methods

This study was conducted on 358 of thyroid nodules and thyroid cancer patients, attending the National Cancer Institute of Sabratha from the 1st January 2020, to the 30th December 2023. This study was approved by the Research and Ethical Committee of Sabratha University and Sabratha National Cancer Institute. All data were extracted from patients' files.

Statistical analysis

The data were presented as number, and percent using chi-square-test. The Statistical Package for Social Sciences software (SPSS 26, Chicago, IL) was used for the data analysis. A p value of <0.05 was considered significant.

4. Results

4.1. The distribution of types of thyroid nodules and cancer patients according to gender.

The distribution of the solitary thyroid nodule, multinodular goiter and cancer patients according to gender were 9.65%, 12.95%, and 15.69% males and 90.35%, 87.05%, and 84.31% female patients, respectively. There was a significant (P = 0.000) difference in distribution between types of thyroid nodules and cancer according to gender (Table 1 & Figure 1).

Table 1: The distribution of types of thyroid nodules and cancer patients according to gender.

Groups Years of admission	Male patients		Female patients		Chi-Square	P-Value
	Frequency	Percent (%)	Frequency	Percent (%)		
Solitary Thyroid Nodule	11	9.65%	103	90.35%	234.626	0.000
Multinodular Goiter	25	12.95%	168	87.05%		
Thyroid Cancer	08	15.69%	43	84.31%		

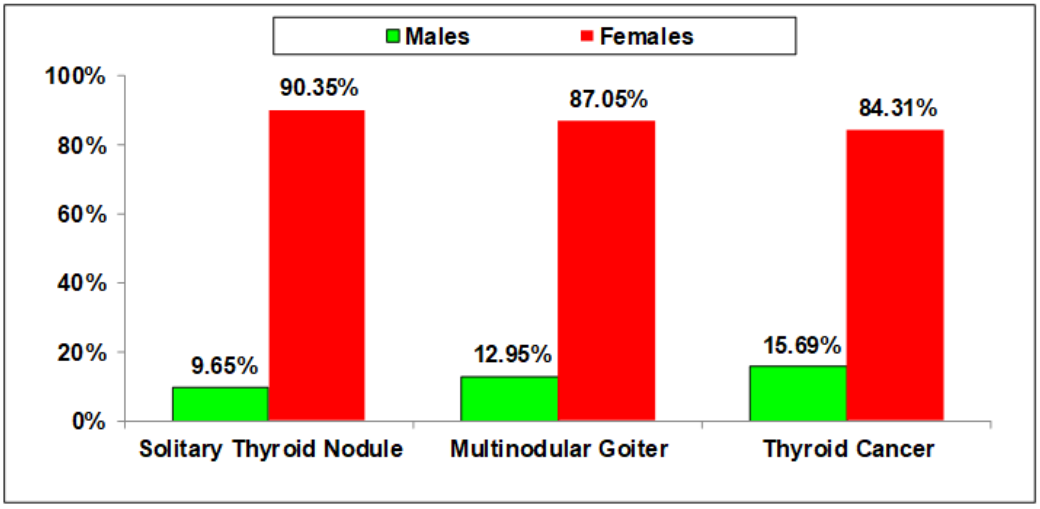

Figure 1: The distribution of types of thyroid nodules and cancer patients according to gender.

4.2 The distribution of types of thyroid nodules and cancer patients according to age groups.

The mean age of the solitary thyroid nodule, multinodular goiter, and cancer patients were 40.6± 11.4, 46.4± 13.2, and 48.5± 13.3 years, respectively.

Data in table (2) and figure (2) show a significant (P = 0.007) distribution of the types of thyroid nodules and cancer patients according to age groups. The higher distribution of the solitary thyroid nodule, multinodular goiter, and cancer patients were 41.23%, 34.72%, and 29.41% in the age group (40-49) years, respectively (Table 2 & Figure 2).

Table 2: The distribution of types of thyroid nodules and cancer patients according to age groups.

Groups Age group (Years)	Solitary Thyroid Nodule Patients		Multinodular Goiter Patients		Thyroid Cancer Patients		Chi-Square	P-Value
	Frequency	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)		
< 30	20	17.54%	15	7.77%	09	17.65%	24.093	0.007
30-39	25	21.93%	36	18.65%	10	19.61%		
40-49	47	41.23%	67	34.72%	15	29.41%		
50-59	15	13.16%	48	24.87%	10	19.61%		
60-69	06	5.26%	16	8.29%	07	13.72%		
≥70	01	0.88%	11	5.70%	0	0		

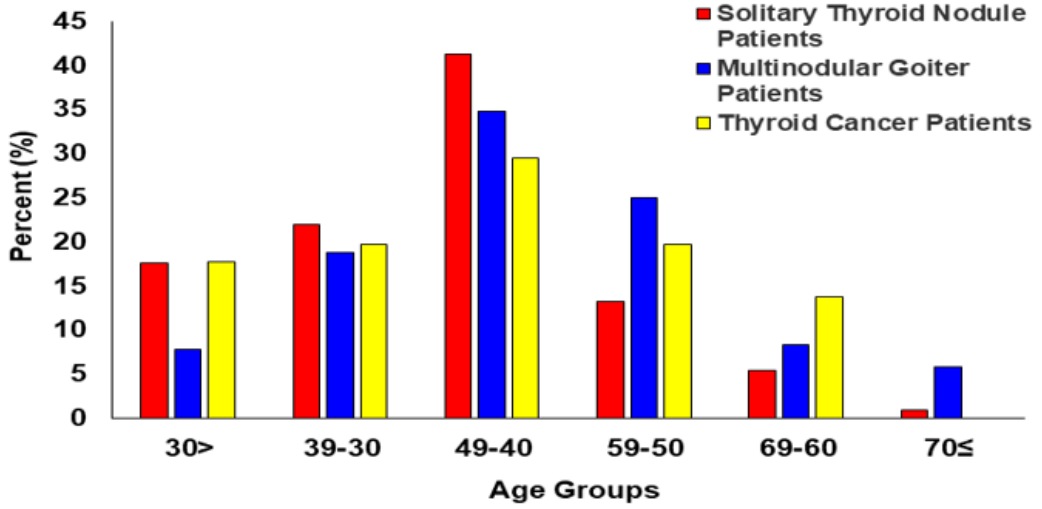

Figure 2: The distribution of types of thyroid nodules and cancer patients according to age groups.

4.3 The distribution of thyroid nodules and cancer patients according to the geographic region

The geographic regions with the highest incidence rates of the solitary thyroid nodule, multinodular goiter, and cancer patients were 22.63%, 21.51%, and 18.99% from Zawia, Sabratha, and West Sabratha, respectively (Table 3 & Figure 3).

Table 3: The distribution of thyroid nodules and cancer patients according to the geographic region.

Region	Frequency	Percent (%)
Tripoli	23	6.42%
Zawia	81	22.63%
Surman	28	7.82%
Sabratha	77	21.51%
West Sabratha	68	18.99%
Algelat	46	12.85%
South Libya	19	5.31%
Aljabl Algarbi	16	4.47%

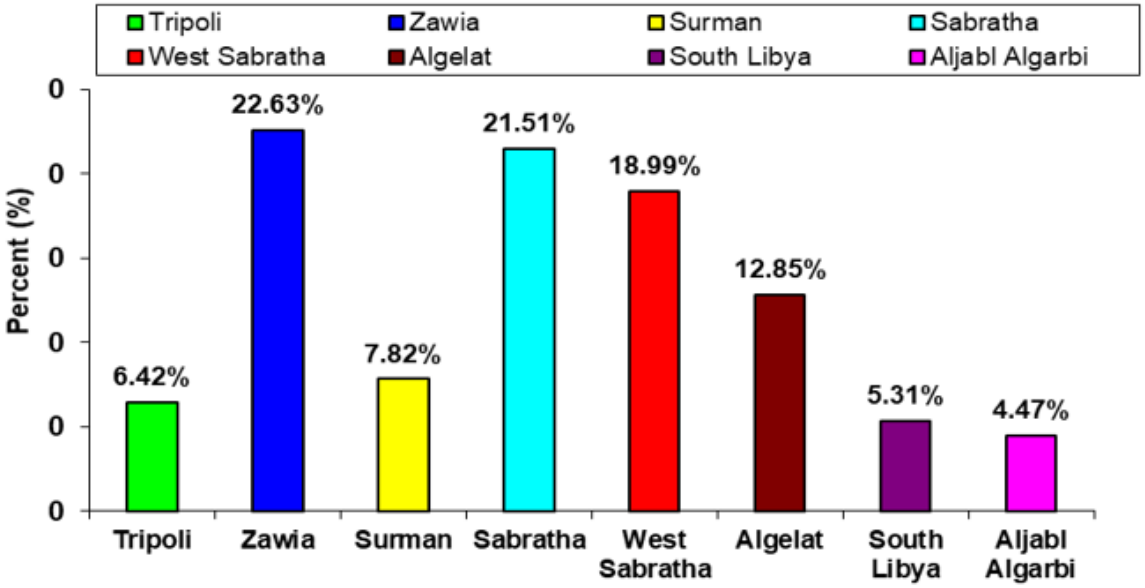

Figure 3: The distribution of thyroid nodules and cancer patients according to the geographic region.

4.4 The distribution of ABO blood groups among thyroid nodules and cancer patients.

The distribution of A, B, AB, and O blood groups showed a non-significant (P = 0.221) difference between the solitary thyroid nodule, multinodular goiter, and cancer patients. The highest distribution of ABO blood groups were 50.88%, 52.33%, & 52.94% in O blood group and 35.97%, 28.50%, & 39.22% in A blood group in the solitary thyroid nodule, multinodular goiter, and cancer patients, respectively (Table 4 & Figure 4).

Table 4: The distribution of ABO blood groups among thyroid nodules and cancer patients.

Blood group	Solitary Thyroid Nodule Patients		Multinodular Goiter Patients		Thyroid Cancer Patients		Chi-Square	P Value
	Frequency	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)		
A	41	35.97%	55	28.50%	20	39.22%	8.241	0.221
B	13	11.40%	24	12.44%	3	5.88%		
AB	2	1.75%	13	6.73%	1	1.96%		
O	58	50.88%	101	52.33%	27	52.94%		

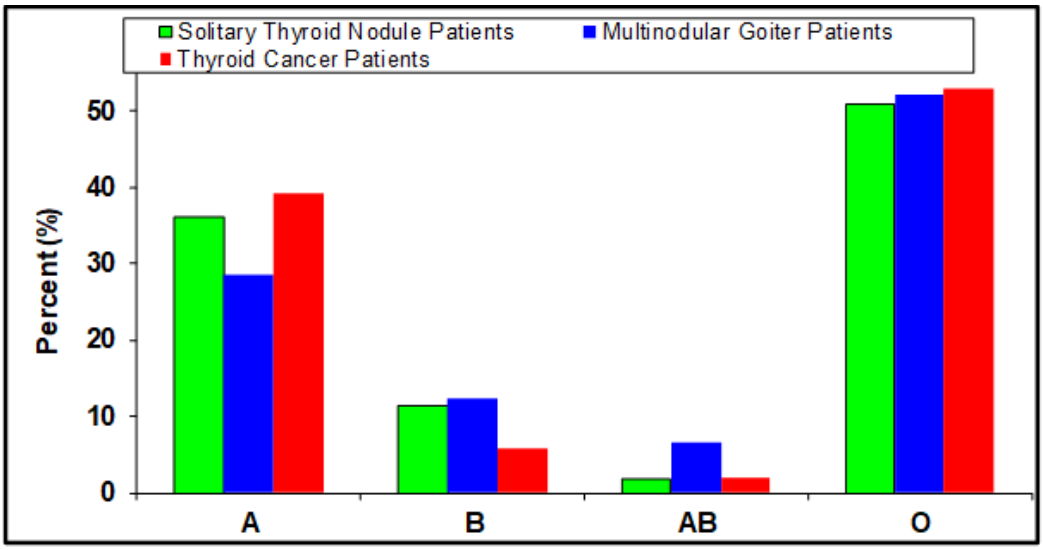

Figure 4: The distribution of ABO blood groups among thyroid nodules and cancer patients.

4.5. The Distribution of thyroid nodules and cancer patients according to the ABO blood groups system and Rhesus factor.

The distribution of the ABO blood groups system and Rhesus factor showed a significant (P = 0.000) difference between the solitary thyroid nodule, multinodular goiter, and cancer patients. The highest distribution of ABO blood groups system and Rhesus factor were 42.11%, 47.15%, and 49.02% in O+ blood group and 30.70%, 27.46%, and 37.26% in A+ blood group in the solitary thyroid nodule, multinodular goiter, and cancer patients, respectively (Table 5 & Figure 5).

Table 5: Distribution of thyroid nodules and cancer patients according to ABO blood group system and Rhesus factor.

Blood groups	Solitary Thyroid Nodule Patients		Multinodular Goiter Patients		Thyroid Cancer Patients		Chi-Square	P-Value
	Frequency	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)		
A^+	35	30.70%	53	27.46%	19	37.26%	93.639	0.000
A^-	6	5.26%	2	1.04%	1	1.96%		
B^+	13	11.40%	19	9.84%	3	5.88%		
B^-	0	0%	5	2.59%	0	0%		
AB^+	2	1.75%	13	6.74%	1	1.96%		
AB^-	0	0%	0	0%	0	0%		
O^+	48	42.11%	91	47.15%	25	49.02%		
O-	10	8.78%	10	5.18%	2	3.92%		

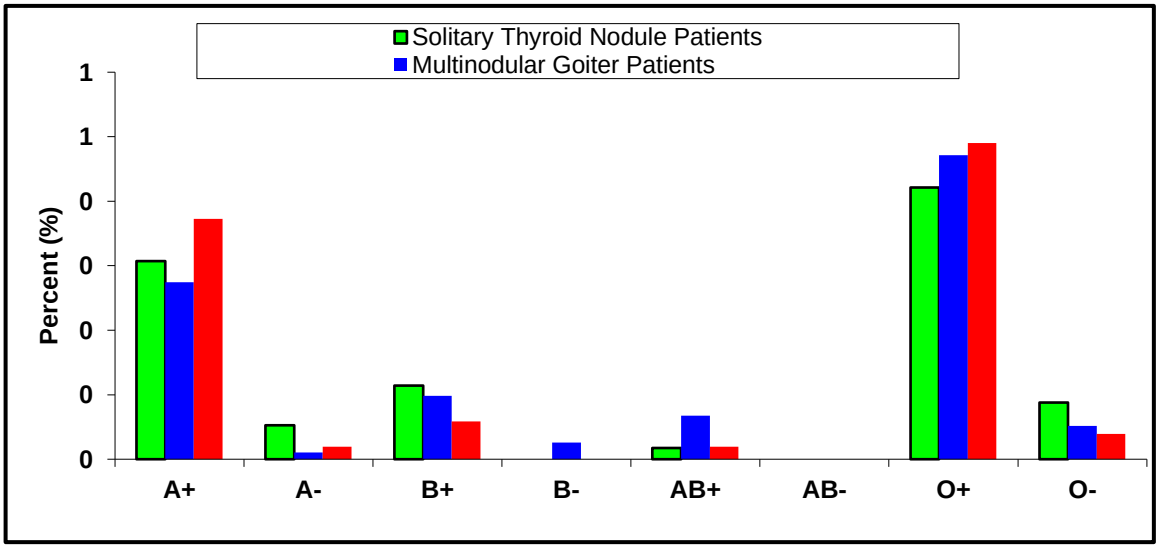

Figure 5: The distribution of thyroid nodules and cancer patients according to ABO blood group system and Rhesus factor.

4.6. The distribution of thyroid nodules and cancer patients according to Rhesus factor.

The distribution of Rhesus factor showed a non-significant (P=0.078) difference between thyroid nodules and cancer patients that, were 87.72%, 94.30%& 96.08% Rh+, and 12.28%,5.70% & 3.92% in Rh- in the solitary thyroid nodule, multinodular goiter, and cancer patients, respectively (Table 6 & Figure 6).

Table 6: The distribution of thyroid nodules and cancer patients according to Rhesus factor.

Groups / Rhesus factor	Solitary Thyroid Nodule Patients		Multinodular Goiter Patients		Thyroid Cancer Patients		Chi-Square	P Value
	Frequency	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)		
Rh+	100	87.72%	182	94.30%	49	96.08%	5.101	0.078
Rh-	14	12.28%	11	5.70%	2	3.92%		

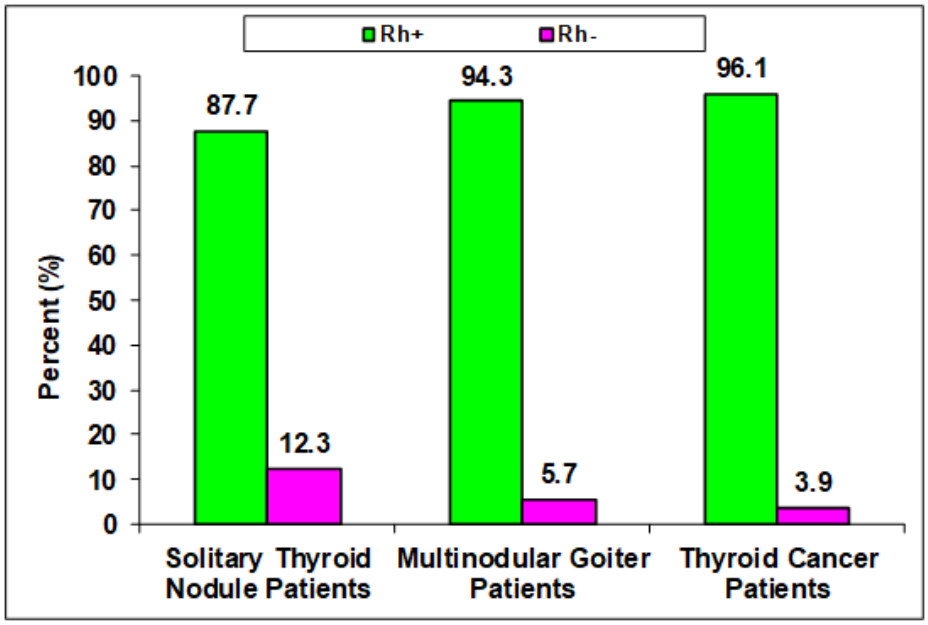

Figure 6: The distribution of thyroid nodules and cancer patients according to Rhesus factor.

Discussion

This study was performed conducted on 358 of thyroid nodules and thyroid cancer patients, attending the National Cancer Institute of Sabratha from the 1st January 2020 to the 30th December 2023 to investigate the distribution of thyroid nodules and thyroid cancer according to gender, age, region, and blood groups in patients attending Sabratha National Cancer Institute, Western Libya.

The current study showed that there was a significant (P = 0.000) difference in distribution between types of thyroid nodules and cancer according to gender. The distribution of the solitary thyroid nodule, multinodular goiter and cancer patients according to gender were 9.65%, 12.95%, and 15.69% males and 90.35%, 87.05%, and 84.31% female patients, respectively. These findings are in line with those of earlier research (Burguera & Gharib, 2000; Zhu *et al.*, 2012; Duran *et al.*, 2015; Kir *et al.*, 2018; Yaseen & Abbas, 2022). Thyroid nodule development was linked to several characteristics, including female gender, according to these research (Burguera & Gharib, 2000, Zhu *et al.*, 2012, Duran *et al.*, 2015, Kir *et al.*, 2018, Yaseen & Abbas, 2022). According to Moon et al. (2018), among 72,319 participants who had thyroid US at three health checkup sites in Korea, the prevalence of thyroid nodules was 34.2% (n = 24,757). Thyroid nodules were found in 9,919 patients (27.0%) out of the 36,710 men. Nodules were found in 14,838 patients (41.7%) out of the 35,609 women. Women and older age groups were more likely to have thyroid nodules. According to the findings, a high frequency of thyroid nodules among participants who had thyroid US performed during physical examinations and a rising prevalence in older age groups suggest that thyroid US's widespread use has helped detect more thyroid nodules and cancer in the general population.

Given that estrogen directly affects thyroid tissue, it is possible that the increased occurrence of thyroid nodules in women in the current research is caused by this hormone. The higher prevalence of thyroid nodules in women, especially those with uterine fibroids, which are also impacted by estrogen is indicative of this (Kim *et al.*, 2010, Li & Li, 2015). Thyroid nodules and uterine fibroids are substantially correlated; research indicates that women are more likely to have both illnesses, which may indicate a common hormonal route (Spinos *et al.*, 2007, Kim *et al.*, 2010).

The present study recoded that the mean age of the solitary thyroid nodule, multinodular goiter, and cancer patients were 40.6± 11.4, 46.4± 13.2, and 48.5± 13.3 years, respectively. The results showed that a significant (P = 0.007) distribution of the types of thyroid nodules and cancer patients according to age groups. The higher distribution of the solitary thyroid nodule, multinodular goiter, and cancer patients were 41.23%, 34.72%, and 29.41% in the age group (40-49) years, respectively. Fathi *et al.* (2015) observed similar findings, noting that the average age of thyroid cancer patients is 46 years. Several variables, including advanced age, were linked to the development of thyroid nodules (Zhu *et al.*, 2012, Kir *et al.*, 2018). According to Dagdeviren *et al.* (2019), 79.7% of the patients in Turkey with

benign thyroid disorders were female. 51.5 ± 16.8 years was the average age. Up to 50% of women and elderly individuals have thyroid nodules (Burguera & Gharib, 2000, Duran *et al.,* 2015). Women are more likely than males to have thyroid nodules, which affect 20% to 76% of adults (Yaseen & Abbas, 2022).

Particularly in older populations, thyroid nodules are common clinical findings that have the potential to be malignant (Abrishami *et al.,* 2025). Older individuals have a greater prevalence of thyroid cancer in nodules, indicating that they require more careful monitoring and care (Lin *et al.,* 1997).

Statistical analysis of the current study found that the geographic regions with the highest incidence rates of the solitary thyroid nodule, multinodular goiter, and cancer patients were 22.63%, 21.51%, and 18.99% from Zawia, Sabratha, and West Sabratha, respectively. The variations of incidence of thyroid nodules and thyroid cancer, which can be explained by the prevalence of socioeconomic factors, because of the regional difference in the prevalence of diagnosis, and thyroid dysfunction.

The carbohydrate moieties that are present on the surface of red blood cells and linked to a protein backbone called the H antigen are what determine the ABO blood types. The ABO gene, which is found on chromosome 9q34, determines a person's blood type. Three glycosyltransferases with distinct substrate specificities are encoded by three alternative alleles of this gene (Reid & Mohandas, 2004).

According to the distribution of blood type frequencies in the Sabratha population, blood group O had the largest frequency (43.19%), followed by A (34%), B (18.13%), and AB (4.68%). Additionally, the findings showed that 16.47 percent of donors were Rh negative and 83.53% of donors were Rh positive (Sakal *et al.,* 2019).

Glycoproteins known as human blood group antigens are expressed on the surface of red blood cells as well as a number of other tissue types, such as platelets, sensory neurons, vascular endothelia, and epithelia (Franchini *et al.,* 2016, Tam *et al.,* 2020). Tumor development may arise from persistent inflammation brought on by dysregulated ABO glycosyltransferase enzymatic activity (Grivennikov *et al.,* 2010, Dogan, 2023). According to clinical research, ABO blood types may be involved in a number of illnesses, including cancer. There is the strongest evidence that specific blood kinds are more likely to develop gastric and pancreatic cancers (Franchini & Liumbruno, 2013, Tam *et al.,* 2020).

According to Liumbruno and Franchini (2014), people with blood type A may be somewhat more likely to acquire stomach cancer and other digestive tract malignancies. Pancreatic cancer may be more likely to strike AB (Kim & Scherer, 2012). Compared to other blood types, blood type O may be somewhat less likely to experience blood clots and venous thromboembolism. An autoimmune disorder called lupus may be somewhat more likely to occur in those with blood type B (Hovinga *et al.,* 2007). According to certain research, blood type and specific thyroid conditions are related (Vierbuchen *et al.,* 1992; Dagdeviren *et al.,* 2019; Deniz *et al.,* 2023).

Our results mentioned that the distribution of A, B, AB, and O blood groups showed a non-significant (P = 0.221) difference between the solitary thyroid nodule, multinodular goiter, and cancer patients. The highest distribution of ABO blood groups were 50.88%, 52.33%, & 52.94% in O blood group and 35.97%, 28.50%, & 39.22% in A blood group in the solitary thyroid nodule, multinodular goiter, and cancer patients, respectively. The distribution of the ABO blood groups system and Rhesus factor showed a significant (P = 0.000) difference between the solitary thyroid nodule, multinodular goiter, and cancer patients. The highest distribution of ABO blood groups system and Rhesus factor were 42.11%, 47.15%, and 49.02% in O+ blood group and 30.70%, 27.46%, and 37.26% in A+ blood group in the solitary thyroid nodule, multinodular goiter, and cancer patients, respectively. The distribution of Rhesus factor showed a non-significant (P=0.078) difference between thyroid nodules and cancer patients that, were 87.72%, 94.30%& 96.08% Rh+, and 12.28%,5.70% & 3.92% in Rh- in the solitary thyroid nodule, multinodular goiter, and cancer patients, respectively. These findings are consistent with those of Dagdeviren *et al.* (2019), who found that 90% of patients with benign thyroid disorders were Rh-positive, with 47.1% belonging to the O blood type, 30% to the A blood group, 15.2% to the B blood group, and 7.7% to the AB blood group. The O blood group had a higher prevalence of autoimmune disorders, while the AB blood group had a considerably lower prevalence ($p < 0.001$). Additionally, Sencan *et al.* (2015) found that, in contrast to the general Turkish population, which has a blood distribution of A>O>B>AB, individuals with benign thyroid illness had a blood distribution of O>A>B>AB.

Dagdeviren *et a*l. (2019) ascribed this discrepancy to the high prevalence of O group and the fact that the majority of research participants were patients with Hashimoto's thyroiditis. Multinodular nodules did not vary from solitary nodules among the blood groups in the nodule type study. Malignant nodules were distributed histopathologically as follows: Six (33.3%) O-groups (Rh+:27%; Rh-:5,5%), seven (63,6%) A-groups (Rh+:54,5%; Rh-:0,9%), two (20%) B-groups (Rh+:20%; Rh-:0%), and one (33%) AB-group (Rh+:33%) Rh-:0%).

According to Gong *et al.* (2012), blood type A had a reduced incidence of thyroid cancer than group O. Additionally, the B blood group was more likely to develop thyroid cancer than non-B groups (OR = 1.30, 95%CI = 1.02–1.66). Another study identified the B blood type as one of the independent risk factors for anaplastic thyroid carcinoma (Zivaljevic *et al.,* 2014). Another study found that patients with A had a lower incidence of thyroid cancer than those in the O-group, and that the non-B blood group and the B-group had comparable findings (Zivaljevic *et al.,* 2014).

According to Tam *et al.* (2020), individuals who were Rh positive had a 1.359 (95% CI: 1.005–1.838) times greater chance of developing cancer than those who were Rh negative (p =.047). In earlier research, the ABO blood type system was linked to the emergence of cancer, heart disease, and other illnesses (Liumbruno & Franchini, 2013, Tam *et al.,* 2020). Compared to people with blood type A, individuals with blood type O were more likely to acquire benign thyroid nodules (Tam *et al.,* 2020). It has been demonstrated that blood type and autoimmune thyroid disorders are related (Balazs, 2012). According to research on the connection between blood types and malignant illnesses, some blood types are more likely to acquire specific cancers than others (Liumbruno & Franchini, 2014).

Other factors that have been linked to thyroid cancer in the literature include body mass index, insulin resistance, dietary habits, occupational exposure, smoking, alcohol consumption, pregnancy, use of oral contraceptives, high thyrotropin levels, and familial inheritable genetic factors (Fei *et al.,* 2014, Tam *et al.,* 2020). There may be a connection between the O blood group and autoimmune thyroid disorders like Hashimoto's thyroiditis, as evidenced by the significant prevalence of the O blood group among patients with Hashimoto's hypothyroidism in a study involving 958 patients with benign thyroid diseases (Dağdeviren *et al.,* 2019).

ABO blood group antigens may be linked to a general inflammatory response, according to certain research, and single nucleotide polymorphisms in the ABO locus may raise levels of soluble intercellular

adhesion molecule-1 (ICAM-1) and TNF-α (İslamoglu & Unal, 2018; Dagdeviren *et al.,* 2019). It was demonstrated by Hakomori *et al.* (1999) that the blood type antigens expressed on the surface of cancerous cells differed from those expressed on healthy cells. By altering cell motility, susceptibility to apoptosis, and immune evasion, this altered expression of blood type antigens on the surface of cancer cells may aid in the initiation and spread of cancer (Zhang *et al.,* 2014, Tam *et al.,* 2020).

Another theory is that because some tumor antigens and ABO antigens have similar structures, there is a reduced tumor immune response. Forssmann antigen is among the most well-known. It is physically nearly comparable to the A antigen determinant and is mostly generated in stomach and colon cancers. In individuals with blood group A, this may result in the immune system's incapacity to identify and combat tumor cells that express Forssmann antigen (Zhang *et al.,* 2014, Tam *et al.,* 2020). Another possible explanation for the link between ABO blood types and cancer is the host inflammatory response (Tam *et al.,* 2020). Tumor formation has been reported to be induced by inflammatory cells and mediators (Coussens & Werb, 2002, Tam *et al.,* 2020).

Chromosome 9q34 contains the ABO blood group gene, which codes for glycosyltransferases. Glycosyltransferases catalyze the production of ABO blood type antigens (Yazer, 2005). This protein controls intercellular adhesion, cellular membrane transmission, and the immune system's reaction to the host (Hakomori, 1999, Dogan, 2023). One possible mechanism for the development of cancer is disruption of the enzymatic activity of the ABO glycosyltransferases (Dogan, 2023). Specifically, chronic inflammatory diseases are associated with tumor invasion and metastasis and predispose people to various cancers (Mantovani *et al.,* 2008, Tam *et al.,* 2020).

Angiogenesis, tumor development, invasion, and migration are known to be influenced by serum tumor necrosis factor-alpha (TNFα), soluble intracellular adhesion molecule-1 (sICAM-1), E-selectin, and P-selectin. Research indicates that an increase in these compounds is linked to single nucleotide polymorphisms at the ABO locus (Barbalic *et al.,* 2010; Tam *et al.,* 2020). The relationship between ABO blood types and cancer risk may be explained in part by these processes.

However, thyroid cancer was found to occur at a similar prevalence across all ABO blood types in a register-based cohort of 1.6 million blood donors (Vasan *et al.,* 2016; Tam *et al.,* 2020). Patients with the A blood type had a lower risk of thyroid cancer than those with the O blood group, and those with non-B blood groups had a lower risk than those with the B blood group (Vasan *et al.,* 2016, Gong *et al.,* 2012, Dagdeviren *et al.,* 2019).

According to Deniz *et al.* (2023), the following is the histological distribution of malignant nodules (p=0.782): A groups: (63,6%), O-groups: (33.3%) (Rh+:27%; Rh-:5,5%) B groups: 20% (Rh+:20%; Rh-:0%), (Rh+:54.5%; Rh-:0,9%) as well as AB groups: 33% Rh-:0% (Rh+:33%). The A-group had the greatest rate of malignant nodules, whereas the B-group had the lowest. Compared to those with other blood types, individuals with blood type A were more likely to develop autoimmune thyroid illness (Dammann & Weber, 2012, Deniz *et al.,* 2023).

According to Dogan (2023), the ABO blood group distributions in the control group (42% A, 16% B, 8% AB, 34% O) and the papillary thyroid cancer patient group (47.4% A, 11.9% B, 8.2% AB, 32.4% O) were (P =.8). Although there was a numerical rise in the prevalence of the A blood group and a numerical drop in the frequency of the B blood group, the differences were not statistically significant. The features of the sick and healthy control group were found to have comparable distributions in terms of Rh factor (P = 0.6). There is no known direct correlation between thyroid nodule and blood type (Burgos *et al.,* 2022). Similar to our investigation, Vasan *et al.* (2016) were unable to find any connection between blood types and thyroid malignancies.

Conclusion

Based on the data, it was determined that the distribution of thyroid cancer and nodule types by gender was non-significant (P = 442). However, the proportion of thyroid cancer patients and thyroid nodule types by age group differed significantly (P = 0.007). Patients in the 40–49 age range had a greater prevalence of malignancy, multinodular goiter, and solitary thyroid nodules. Zawia, Sabratha, and West Sabratha were the locations with the greatest incidence rates of cancer patients, multinodular goiter, and solitary thyroid nodules. Patients with a single thyroid nodule, multinodular goiter, and malignancy had non-significant (P = 0.221) differences in the distribution of A, B, AB, and O blood types.

Patients with a single thyroid nodule, multinodular goiter, and malignancy had significantly different distributions of the ABO blood type system and Rhesus factor (P = 0.000). Additional research is required to validate these findings. geographic cluster detection is a useful technique for cancer prevention and control because it identifies geographic discrepancy in cancer incidence depending on the spatial cluster, which leads to appropriate priority setting, healthcare resource allocation, and medical policy implementation.

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