Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/23482
DOI URL: http://dx.doi.org/10.21474/IJAR01/23482

RESEARCH ARTICLE

ASSESSING THE THYROID DYSFUNCTION AMONG TYPE 2 DIABETES MELLITUS PATIENTS IN AL AHSA, SAUDI ARABIA

Sharon Pricilla Jeevankumar Leela[1,2], Ghadah Mohammad Alali[1,2], Wedyan Mohammed Alwashmi[1,2], Ahmad Khalid Alkhayyal[1,3] and Hussain Ibrahim Al Johar[1,3]

1. King Abdullah International Medical Research Center.
2. King Saud bin Abdulaziz University for Health Sciences.
3. Ministry of National Guards and Health Affairs. Al Ahsa, 31982, Saudi Arabia.

Manuscript Info

Manuscript History
Received: 12 March 2026
Final Accepted: 14 April 2026
Published: May 2026

Key words:-
HbA1c,Hypothyroidism, Hyperthyroidism, Thyroid dysfunction, Thyroid hormones, Type 2 Diabetes mellitus

Abstract

Background: Thyroid dysfunction is a common endocrine disorder that may coexist with type 2 diabetes mellitus (T2DM), potentially influencing metabolic control and clinical outcomes. This study aimed to assess the prevalence of thyroid hormone abnormalities among T2DM patients and explore their relationship with glycemic control and demographic factors.

Methods: A Chart-based retrospective study was conducted on 243 patients with T2DM from two hospital sites. Descriptive statistics were used to summarize demographic and clinical data. Serum levels of T3, T4, TSH, and HbA1c were measured. Pearson correlation assessed relationships between thyroid hormones and HbA1c, while non paramet ric tests evaluated associations between thyroid status and demographic variables.

Results: Thyroid abnormalities were prevalent, with 47.54% of patients showing elevated T3 and 11.52% each classified as hyperthyroid or hypothyroid based on TSH. No significant correlation was found between HbA1c and thyroid hormone levels. However, significant associations were observed between TSH abnormalities and hospital site, occupation, BMI, and hypertension status. T3 abnormalities were significantly associated with BMI, while T4 abnormalities showed no significant demographic correlations.

Conclusion: Thyroid dysfunction is common among T2DM patients but does not appear to significantly affect glycemic control. Certain demographic and metabolic factors, particularly BMI and hypertension, are associated with thyroid abnormalities. Routine screening for thyroid function may enhance comprehensive diabetes management.

Corresponding Author:-Sharon Pricilla Jeevankumar Leela
Address:-1. King Abdullah International Medical Research Center.2. King Saud bin Abdulaziz University for Health Sciences.

Introduction:-

Diabetes is a long-term metabolic disease marked by high blood glucose levels. It ultimately can cause major harm to the heart, blood vessels, eyes, kidneys, and nerves. Owing to genetic factors along with the intenselifestyle changes in Saudi Arabia, type 2 diabetes mellitus rates are rising steadily among adults. It arises when the body either fails to produce sufficient insulin due to impaired β-cell function in the pancreas or becomes resistant to the insulin that is produced.Thyroid gland disorders are conditions that result from either hypertrophy and excessive or insufficient thyroid hormone secretion affecting many metabolic processes in the body. It is mainly caused by iodine shortfall, which is necessary to synthesize thyroid hormones; thyroxine (T4) that is then converted to the active form triiodothyronine (T3). The interplay between thyroid hormones and insulin is complex. Thyroid hormones influence carbohydrate metabolism, lipid profiles, and energy expenditure. In T2DM patients, altered thyroid function can worsen both macrovascular and microvascular complications. Thyroid dysfunction is a common comorbidity in patients with type 2 diabetes mellitus (T2DM), influencing metabolic control and increasing the risk of complications. Screening is especially important for adults and women, who are at higher risk. Clinical guidelines suggest evaluating thyroid function through serum TSH and free T4 levels, particularly in patients with poor glycemic control is vital. Understanding this relationship is crucial for early detection and effective management of both conditions, which improves metabolic control and reduces the risk of complications.

Literature Review:-

Thyroid dysfunction (TD) and type 2 diabetes mellitus (T2DM) are considered as endocrine disorders that affect numerous people around the world. TD generally means any abnormalities in the thyroid gland hormone secretions (TSH, T3, and T4). Those can either be classified as hypothyroidism or hyperthyroidism, which have an impact on many organ systems and affect the metabolic rates(Majeed et al., 2021)(Rong et al., 2021)It can additionally reflect thyroiditis, which means inflammation, or more severely benign or malignant tumors leading to cancer (Macvanin et al., 2023). Contrarily, T2DM is a chronic condition characterized by hyperglycemia due to the dysfunction of β cells of the pancreas, and insulin resistance (Elsayed et al., 2023).As indicated in many studies, TD and T2DM are believed to be reciprocally connected with each other. Thyroid hormones are important in the regulation of glucose metabolism; hence, any disturbances can primarily affect the clinical course of diabetes (Rong et al., 2021). Inversely, when thyroid gland is not functioning properly, T2DM is found to be directly influenced, which indicates that those two disorders are linked together. Accordingly, it is vital to assess thyroid function in T2DM patients to minimize the risk of having any complications (Majeed et al., 2021).

Compared to healthy individuals, T2DM patients are more vulnerable to thyroid disorders as demonstrated in many recent studies. For instance, a study by Ghimire et al. (2022) found that 27.94% of diabetic individuals had TD; highlighting that about 50% of those specifically suffered from subclinical hypothyroidism. This study also showed that TD prevalence was higher in women than in men(Ghimire et al., 2022). This result was almost the same as two similar studies conducted in Karachi and South East Nigeria (Bukhari et al., 2022). Additional research by Skyi et al. (2023) has supported those results by adding that TD occurs more frequently with hyperglycemic patients. In contrast, low TSH and T3 levels negatively affect controlling glucose(Sakyi et al., 2023). A further 2020 research claimed that diabetic patients have higher risk of having subclinical hypothyroidism (Gauthier et al., 2020).

In Saudi Arabia, a recent cross-sectional study which included many regions found that the relationship between DM and TD was noticeable. A strong correlation between hypothyroidism and obesity was also observed, with 42.7% of hypothyroid patients being obese. Generally, this study found that TD prevalence among Saudi patients who were diagnosed with diabetes (type I and II) is just under 30%. Highlighting that 25.3% had specifically hypothyroidism and the majority of whom had T2DM (Alqahtiani et al., 2020). Furthermore, a retrospective study involved 250 T2DM patients aged 40 to 60 showed that hyperthyroidism was seen in 14.8% of the participants, whereas hypothyroidism incidence was more than double, at 32%. All those patients were Saudi females in Madinah Hospital(Binjawhar, 2024). However, the studies conducted to discuss this issue in Saudi Arabia in specific groupare insufficient.The prevalence of diabetes in 2021 was about 10% of the global adult population, expecting that this percentage will rise by about 19.7% in 2030 and 45.8% in 2045 respectively. Whereas in the Middle East and South Africa, the prevalence in 2021 was about 14% of the adult population with an expectation to reach a 30% rise in 2030 and an 86% rise in 2045(IDF Diabetes Atlas, 2023).

This study aims to evaluate the TD among T2DM patients which remains debated. Various investigations have been carried out globally but to the best of our knowledge, this would be the first study in Alahsa region (eastern province) of Saudi Arabia.

Objectives:-

Aim:-

This study aims to assess the thyroid dysfunction among type 2 diabetes mellitus patients in King Abdulaziz Hospital (KAH) and Primary Health Care (PHC-KAH), MNGHA, Al Ahsa, Saudi Arabia.

Specific Objectives:-

- To explore the relationship between TD and T2DM among the patients who were either newly identified or already undergoing on treatment.
- To identify the prevalence of TD in T2DM in association to age, gender and duration of diabetes.
- To evaluate the TSH, T3 and T4 as a screening test for the hypo or hyperthyroidism in T2DM patients.
- To distinguish if there is any association with thyroid status in T2DM with relevance to any other comorbid condition like hypertension.

Secondary Objectives:-

- To recognize the different types of TD among T2DM patients.
- To highlight the need of regular screening of diabetic patients for thyroid disorders.
- To compare the clinical data of the patients between the two endocrine clinics of the selected hospital to understand about the case severity.

Materials and Methods:-

Study Setting and subjects:-

This study was carried out in King Abdulaziz Hospital (KAH) and Primary Health Care (PHC-KAH), MNGHA, Al Ahsa, Saudi Arabia. All eligible patients >30 years, who attended the endocrine clinic between the period August 2024 to January 2025, data constituted the study subjects.

Inclusion and exclusion criteria:-

Patients who visited the endocrine clinic either already or newly diagnosed having T2DM irrespective of their nationalities were included in the study, excluding patients with type1 diabetes, age <30 years, having diabetic complications, previous history of TD, pregnant women, and patients with history of receiving any drug that would alter thyroid profile.

Study Design:-

It is a retrospective chart review study that was carried at King Abdulaziz Hospital (KAH) and Primary Health Care (PHC-KAH) of MNGHA, Al Ahsa using a structured survey instrument. This was extracted from an earlier study(Alyahya et al., 2021) and adjusted according to the data required to our research.

Sample Size:

Based on previous research (Khassawneh et al., 2020) targeting the same population, the sample size would be approximately (184) with (95%) of confidence interval. 10% was added to the sample size as non-response and to avoid any missing data during collection, thus the sample size was increased to 204 patients with T2DM. This may fluctuate according to the inclusion and exclusion criteria to the number of patients who visited the clinic between August 2024 to January 2025.

The sample size can be derived by computing the minimum number required for accuracy in estimating proportions by considering the standard normal deviation set at 95% confidence level (1.96), percentage picking a choice or response (14% = 0.14) and the confidence interval (0.05 = ±5). The sample size was calculated using the following equation (Cochran, 1963):

$$N = z\,2\ (p)(1\text{-}p) / c\,2$$

Data collection method, instrument used, and measurements:-
Purposive sampling method was adopted. The data was collected from electronic medical records system of the hospital of all the eligible patients. Patient privacy and confidentiality were rigorously maintained. No identifying information was collected, and all data (electronic and physical)—were securely stored within the KAMC premises.

Data were collected using a structured data-collection sheet. It had two sections, the first section of the questionnaire included the sociodemographic characteristics including age, gender, location, nationality, education level, occupation, marital status, duration of the disorder, height, and weight (BMI was calculated with the value) and hypertension, while the second part comprises the biochemical analysis report from the hospital (blood results) which was documented by the researchers electronically from the hospital information system (Best care).Biochemical analysis data include serum T3, T4 and TSH level, and blood glucose level (HbA1c). At the time of documentation, the history of hypertension was also included.

Data Management and Analysis Plan:-
The data was analyzed using SPSS Version 20 and checked for completeness, perform coding and then enter into a computer by IBM Statistical Package for Social Sciences (SPSS v20). The subjects were tagged with a specific code, to avoid redundancy. Descriptive statistics with cross-tabulations was performed, continuous variables were analyzed and reported as mean ± SD. The categorical variables were analyzed and reported as proportion. Bivariate analysis was conducted using a Chi-squared test to examine the association between variables. Data was calculated with respective 95 % Confidence Interval and will be presented as mean ± 2 SD. A p value of <0.05 will be considered as statistically significant.

Results:-

Demographic and Clinical Characteristics:-
A total of 243 patients with type 2 Diabetes mellitus (T2DM) were included in the study. Majority were female (65.43%). Saudi nationals (97.53%) and married (88.89%). The largest age group was between 60–69 years (28.81%). A significant proportion (85.60%) had T2DM for more than five years. Regarding BMI, 60.08% were overweight and 30.45% were obese. Hypertension was present in 63.37% of the cohort as presented in Table 1 along with the thyroid test results. The average serum levels were as follows: T3 = 4.16 ± 0.91, T4 = 13.04 ± 2.11, TSH = 2.46 ± 3.96, and HbA1c = 7.79 ± 1.68. Median values with interquartile ranges were also reported for these parameters.

Table 1: Descriptive Statistics

Variables	Frequency (%)	Average ± STD	Median (IQR)
Hospital Code			
1. KAH	118 (48.56%)		
2. KAH-PHC	125 (51.44%)		
Gender			
1. Male	84 (34.57%)		
2. Female	159 (65.43%)		
Location			
1. Rural	15 (6.17%)		
2. Urban	228 (93.83%)		
Age			
1. 30-39	22 (9.05%)		
2. 40-49	42 (17.28%)		
3. 50-59	64 (26.34%)		
4. 60-69	70 (28.81%)		
5. 70-79	45 (18.52%)		
Nationality			
1. Saudi	237 (97.53%)		
2. Non-Saudi	6 (2.47%)		
Occupation			
1. Unemployed	62 (25.51%)		

2. Employed	136 (55.97%)		
3. Retired	45 (18.52 %)		
Marital status			
1. Married	216 (88.89%)		
2. Unmarried	26 (10.70%)		
3. Missing response	1 (0.41%)		
Duration of T2DM			
1. < 1 year	11 (4.53%)		
2. 1-5 years	24 (9.88%)		
3. > 5 years	208 (85.60%)		
Body Mass Index			
1. Underweight	1 (0.41%)		
2. Normal	22 (9.05%)		
3. Obese	74 (30.45%)		
4. Overweight	146 (60.08%)		
Hypertension			
1. Yes	154 (63.37%)		
2. No	89 (36.63%)		
Serum T3 level		4.16 ± 0.91	4.2 (0.9)
Serum T4 level		13.04 ± 2.11	12.8 (2.7)
Serum TSH level		2.46 ± 3.96	1.63 (1.5)
HbA1c		7.79 ± 1.68	7.50 (2.20)

Correlation between Thyroid Hormones and HbA1c:-

Pearson correlation analysis revealed a strong negative correlation between T3 and TSH ($r = -0.69092$, $p < 0.0001$), and a moderate negative correlation between T4 and TSH ($r = -0.25982$, $p = 0.0001$). No significant correlation was found between HbA1c and any of the thyroid hormones, indicating that glycemic control may not be directly influenced by thyroid hormone levels in this population as depicted in Table 2.

Table 2: Assessing the Relationship between T3, T4, and TSH through Pearson Correlation:

Pearson Correlation Coefficients				
Parameters	**T3**	**T4**	**TSH**	**HbA1c**
T3	1.00000	0.16601 0.0938	**-0.69092** **<.0001**	-0.01326 0.8848
T4	0.16601 0.0938	1.00000	**-0.25982** **0.0001**	-0.08906 0.1997
TSH	-0.69092 <.0001	-0.25982 0.0001	1.00000	-0.03630 0.5733
HbA1c	-0.01326 0.8848	-0.08906 0.1997	-0.03630 0.5733	1.00000

Thyroid Hormone Abnormalities:-

Table 3 displays the classification of thyroid hormone abnormalities 47.54% of patients had elevated T3 levels, while 49.18% were within the normal range and 3.28% were hypothyroid. For T4, 96.17% were normal and 3.83% were hypothyroid. TSH abnormalities were evenly distributed, with 11.52% each for hyperthyroid and hypothyroid states, and 76.95% within the normal range. Notably, T3 had 121 missing values and T4 had 34 missing values.

Table 3: Frequency and classification of abnormalities for TSH, T3, and T4

Parameters	Hyperthyroid	Normal	Hypothyroid
T3	58 (47.54%)	60 (49.18%)	4 (3.28%)
T4	-	201 (96.17%)	8 (3.83%)
TSH	28 (11.52%)	187 (76.95%)	28 (11.52%)

HbA1c Comparison across Thyroid Status:-

Median HbA1c levels were compared across thyroid status groups. No statistically significant differences were observed for TSH ($p = 0.7630$), T3 ($p = 0.2483$), or T4 ($p = 0.3222$), suggesting that thyroid dysfunction did not significantly impact glycemic control in this cohort in Table 4

Table 4: Comparing the HbA1c values abnormalities for TSH, T3, and T4

Parameters	Hyperthyroid	Hypothyroid	Normal	P-Value
TSH	7.5 (2.7)	7.0 (2.05)	7.5 (2.2)	0.7630
T3	7.4 (2.0)	6.8 (0.9)	7.8 (2.5)	0.2483
T4	-	7.6 (2.2)	7.4 (2.1)	0.3222

Demographic Associations with TSH Abnormalities:-

Significant associations were found between TSH abnormalities and hospital code ($p < 0.0001$), occupation ($p = 0.0002$), BMI ($p < 0.0001$), and hypertension status ($p = 0.0266$). Hyperthyroidism was exclusively observed in patients from KAH, while hypothyroidism was exclusive to KAH-PHC. Overweight status was predominant among hyperthyroid individuals, and hypothyroid patients had a higher prevalence of hypertension. No significant associations were found with gender, location, age, nationality, marital status, or duration of T2DM as in Table 5

Table 5: Comparing TSH abnormalities with demographics:

Criteria	Hyperthyroid	Hypothyroid	Normal	P-Value
Hospital Code				<0.0001
1. KAH	28 (100%)	0	90 (48.13%)	
2. KAH-PHC	0	28 (100%)	97 (51.87%)	
Gender				0.1259
1. Male	7 (25%)	14 (50%)	63 (33.69%)	
2. Female	21 (75%)	14 (50%)	124 (66.31%)	
Location				0.3360*
1. Rural	0	1 (2.57%)	14 (7.49%)	
2. Urban	28 (100%)	27 (96.43%)	173 (92.51%)	
Age				0.7035
1. 30-39	2 (7.14%)	5 (17.86%)	15 (8.02%)	
2. 40-49	3 (10.71%)	4 (14.29%)	35 (18.72%)	
3. 50-59	8 (28.57%)	8 (28.57%)	48 (25.67%)	
4. 60-69	8 (28.57%)	8 (28.57%)	54 (28.88%)	
5. 70-79	7 (25%)	3 (10.71%)	35 (18.72%)	
Nationality				0.7962
1. Saudi	28 (100%)	27 (96.43%)	182 (97.33%)	
2. Non-Saudi	0	1 (3.57%)	5 (2.67%)	
Occupation				0.0002
1. Unemployed	13 (46.43%)	1 (3.57%)	47 (25.13%)	
2. Employed	8 (28.57%)	25 (89.29%)	103 (55.08%)	
3. Retired	7 (25%)	2 (7.14%	37 (19.79%)	
Marital status				0.3860

1.	Married	27 (96.43%)	27 (96.43%)	162 (86.63%)	
2.	Unmarried	1 (3.57%)	1 (3.57%)	24 (12.83%)	
3.	Missing response	0	0	1 (0.53%)	
Duration of T2DM					0.3417
1.	< 1 year	0	3 (10.71%)	8 (4.28%)	
2.	1-5 years	3 (10.71%)	1 (3.57%)	20 (10.70%)	
3.	> 5 years	25 (89.29%)	24 (85.71%)	159 (85.03%)	
Body Mass Index					<0.0001*
1.	Underweight	1 (3.57%)	0	0	
2.	Normal	3 (10.71%)	5 (17.86%)	14 (7.49%)	
3.	Obese	0	13 (46.43%)	62 (33.16%)	
4.	Overweight	24 (85.71%)	10 (35.17%)	111 (59.36%)	
Hypertension					0.0266
1.	Yes	19 (67.86%)	24 (85.71%)	112 (59.89%)	
2.	No	9 (32.14%)	4 (14.29%)	75 (40.11%)	

Demographic Associations with T3 Abnormalities:-

T3 abnormalities showed a significant association with BMI (p = 0.0198). Overweight individuals were more likely to exhibit T3 abnormalities. No significant associations were found with hospital code, gender, location, age, nationality, occupation, marital status, duration of T2DM, or hypertension.Fisher's exact test was used to compute the p-value in this table 6

Table 6: Comparing T3 abnormalities with demographics:

Criteria		Hyperthyroid	Hypothyroid	Normal	P-Value*
Hospital Code					0.1746
1.	KAH	54 (93.10%)	4 (100%)	60 (100%)	
2.	KAH-PHC	4 (6.90%)	0	0	
Gender					0.8561
1.	Male	12 (20.69%)	1 (25%)	15 (25%)	
2.	Female	46 (79.31%)	3 (75%)	45 (75%)	
Location					1.
1.	Rural	1 (1.72%)	0	2 (3.33%)	
2.	Urban	57 (98.28%)	4 (100%)	58 (96.67%)	
Age					0.6691
1.	30-39	9 (15.52%)	0	3 (5%)	
2.	40-49	10 (17.24%)	1 (25%)	13 (21.67%)	
3.	50-59	14 (24.14%)	2 (50%)	19 (31.67%)	
4.	60-69	16 (27.59%)	1 (25%)	17 (28.33%)	
5.	70-79	9 (15.52%)	0	8 (13.33%)	
Nationality					0.2004
1.	Saudi	55 (94.83%)	4 (100%)	60 (100%)	
2.	Non-Saudi	3 (5.17%)	0	0	
Occupation					0.4656
1.	Unemployed	2 (50%)	28 (48.28%)	27 (45%)	
2.	Employed	1 (25%)	25 (43.10%)	22 (36.67%)	
3.	Retired	1 (25%)	5 (8.62%)	11 (18.33%)	
Marital status					0.9416
1.	Married	49 (84.48%)	4 (100%)	52 (86.67%)	
2.	Unmarried	8 (13.79%)	0	8 (13.33%)	
3.	Missing response	1 (1.72%)	0	0	
Duration of T2DM					0.5137

1.	< 1 year	1 (1.72%)	0	2 (3.333%)	
2.	1-5 years	8 (13.79%)	1 (25%)	5 (8.33%)	
3.	> 5 years	49 (84.48%)	3 (75%)	53 (88.33%)	
Body Mass Index					0.0198
1.	Underweight	0	0	1 (1.67%)	
2.	Normal	1 (1.72%)	1 (25%)	4 (6.67%)	
3.	Obese	6 (10.34%)	0	0	
4.	Overweight	51 (91.67%)	3 (75%)	55 (91.67%)	
Hypertension					0.3959
1.	Yes	24 (41.38%)	3 (75%)	28 (46.67%)	
2.	No	34 (58.62%)	1 (25%)	32 (53.33%)	

Demographic Associations with T4 Abnormalities:-

No statistically significant associations were found between T4 abnormalities and any demographic variables. However, trends indicated that hypothyroid patients were more likely to be retired and hypertensive. All hypothyroid cases were among Saudi nationals and urban residents.Fisher's exact test was used to compute the p-value in this table 7

Table 7: Comparing T4 abnormalities with demographics:

Criteria		Hypothyroid	Normal	P-Value*
Hospital Code				0.4809
1.	KAH	5 (62.50%)	94 (46.77%)	
2.	KAH-PHC	3 (37.50%)	107 (53.23%)	
Gender				0.4656
1.	Male	4 (50%)	72 (35.82%)	
2.	Female	4 (50%)	129 (64.18%)	
Location				1.
1.	Rural	0	12 (5.97%)	
2.	Urban	8 (100%)	189 (94.03%)	
Age				0.3982
1.	30-39	0	18 (8.96%)	
2.	40-49	0	35 (17.41%)	
3.	50-59	4 (50%)	52 (25.87%)	
4.	60-69	3 (37.50%)	60 (29.85%)	
5.	70-79	1 (12.50%)	36 (17.91%)	
Nationality				1.
1.	Saudi	8 (100%)	196 (97.51%)	
2.	Non-Saudi	0	5 (2.49%)	
Occupation				0.0806
1.	Unemployed	1 (12.50%)	52 (25.87%)	
2.	Employed	3 (37.50%)	114 (56.72%)	
3.	Retired	4 (50%)	35 (17.41%)	
Marital status				1.
1.	Married	8 (100%)	181 (90.05%)	
2.	Unmarried	0	19 (9.45%)	
3.	Missing response	0	1 (0.50%)	
Duration of T2DM				1.
1.	< 1 year	0	10 (4.98%)	
2.	1-5 years	0	18 (8.96%)	
3.	> 5 years	8 (100%)	173 (86.07%)	
Body Mass Index				0.8761
1.	Underweight	0	1 (0.50%)	

2.	Normal	0	19 (9.45%)	
3.	Obese	2 (25%)	62 (30.85%)	
4.	Overweight	6 (75%)	119 (59.20%)	
Hypertension				0.0527
1.	Yes	8 (100%)	128 (63.68%)	
2.	No	0	73 (36.32%)	

Discussions:-

This study investigated the prevalence and clinical implications of thyroid dysfunction among patients with type 2 diabetes mellitus (T2DM), as well as its association with demographic and clinical factors. Thyroid abnormalities were identified in 23% of the cohort, with equal proportions of elevated and suppressed TSH levels (11.5% each), indicating both hypothyroid and hyperthyroid states. These findings are consistent with previous reports and support the importance of routine thyroid function screening in diabetic care (Biondi et al., 2019).Thyroid function assessment primarily relied on TSH and free T4, which are recognized as sensitive and reliable indicators in most clinical settings. T3 measurements were limited and have reduced diagnostic utility, as levels may remain within the normal range even in cases of significant dysfunction. The predominance of normal T4 levels in this cohort suggests that many detected abnormalities were likely subclinical, meaning they may not present with overt symptoms despite potential metabolic effects (Bianco, 2011)(Chaker et al., 2017).Correlation analysis revealed a significant inverse relationship between TSH and T3, and a weaker negative association with T4, consistent with normal physiological feedback mechanisms. However, no statistically significant association was observed between thyroid hormone levels and HbA1c, suggesting that thyroid dysfunction may have a limited direct impact on long-term glycemic control or may be influenced by other metabolic and clinical factors(Biondi et al., 2019)(Safari et al., 2024).

Although no significant differences in HbA1c were found across thyroid dysfunction groups, patients with hypothyroidism demonstrated a non-significant trend toward lower HbA1c levels, possibly reflecting reduced metabolic activity. Thyroid dysfunction was significantly associated with several patient characteristics, including BMI, hypertension, employment status, and healthcare site. Overweight individuals were more likely to exhibit hyperthyroidism, whereas obesity was more commonly associated with hypothyroidism. Additionally, hypertension was more prevalent among patients with hypothyroidism (Radaideh, 2004)(Biondi et al., 2019).Our findings are consistent with prior evidence indicating a considerable burden of thyroid dysfunction among patients with T2DM. In this cohort, the prevalence of thyroid dysfunction was 23.6%, with hypothyroidism representing the most common abnormality. These findings underscore the importance of routine thyroid function assessment in patients with T2DM(S et al., 2025). Furthermore, a recent systematic review and meta-analysis reported a pooled prevalence of 20.2% and identified obesity as a significant factor associated with thyroid dysfunction among individuals with T2DM(Hadgu et al., 2024). These findings support our observation that thyroid dysfunction is closely associated with metabolic comorbidities, particularly increased BMI and hypertension. Collectively, the available evidence suggests that thyroid abnormalities are common in patients with T2DM and reinforces the value of targeted screening strategies, especially among individuals with additional cardiometabolic risk factors.

In the subgroup with T3 and T4 abnormalities, BMI remained significantly associated with T3 variations, while all cases of reduced T4 occurred in patients with hypertension, suggesting a potential link between overt hypothyroidism and increased cardiovascular risk (Rodondi, 2010). Overall, these findings highlight the multifactorial nature of thyroid dysfunction in T2DM, particularly its association with metabolic comorbidities such as obesity and hypertension. Despite the lack of a direct relationship with glycemic control, the relatively high prevalence of thyroid abnormalities supports the need for routine screening, especially in high-risk populations(Biondi et al., 2019). The study's strengths include a relatively large sample size and comprehensive clinical profiling. However, its retrospective design limits causal inference. Additional limitations include incomplete T3 data and the absence of information on thyroid medication use, autoimmune markers, and clinical symptoms, which restricted differentiation between subclinical and overt dysfunction.

Conclusions:-

This study highlights the notable prevalence of thyroid hormone abnormalities among patients with type 2 diabetes mellitus (T2DM), particularly in T3 and TSH levels. Despite these abnormalities, no significant association was found between thyroid status and glycemic control as measured by HbA1c, suggesting that thyroid dysfunction may not directly influence long-term glucose regulation in this population.However, significant correlations were observed between thyroid abnormalities and key demographic and clinical factors, including body mass index, hypertension, occupation, and hospital site. These findings underscore the importance of considering institutional and metabolic contexts when evaluating endocrine comorbidities in diabetic care.Routine screening for thyroid dysfunction, especially in overweight or hypertensive individuals may aid in early detection and holistic management of T2DM. Future longitudinal studies are warranted to explore causal relationships and assess the impact of thyroid hormone regulation on diabetes outcomes over time.

Limitations:-

Although our findings offer valuable insights, we must acknowledge a few limitations. First, the retrospective design restricts our ability to confirm direct cause-and-effect relationships. Second, missing hormonal data limited our capacity to map deeper biochemical connections. Finally, we did not track concurrent thyroid treatments, as evaluating thyroid management fell outside our primary scope. However, we recognize that missing details on medication types or dosages could influence these outcomes. Further Prospective studies capturing complete hormonal profiles and treatment histories are needed to build on these findings.

Ethical approval:-

Ethical approval has been granted from the King Abdullah Medical Research Center (KAIMRC) with IRB Approval No.: 00000140225 and Study No# NRA25/014/2. The requirement for written consent was waived because of the retrospective study design. We conducted the study in accordance with the ethical guidelines of KAIMRC.

Availability of data and material: The data that support the findings of this study can be made available by the corresponding author upon reasonable request.

Acknowledgement: We would like to thank Ms.Seham Adnan Khashwayn, Biostatistician (KAIMRC) for supporting us in doing the data analysis. We appreciate all our family and friends for their support.

Declarations of interest: None

Consent for publication: Not applicable.

Funding: This research project received no funds.

References:-

1. Alqahtiani, N. M., Alramadhan, Z. T., Redha, M., Kurdi, A. N., &Alhelal, A. A. (2020). Hypothyroidism in Saudi Arabia ;Prevalence , risk factors , and its relation with Diabetes Mellitus. 11(3), 56–62.
2. Alyahya, A., AlNaim, A., AlBahr, A. W., Almansour, F., &Elshebiny, A. (2021). Knowledge of Thyroid Disease Manifestations and Risk Factors Among Residents of the Eastern Province, Saudi Arabia. Cureus, 13(1), 1–9. https://doi.org/10.7759/cureus.13035
3. Bianco, A. C. (2011). Hypothyrodisis. Encyclopedia of Clinical Neuropsychology, 390(10101), 1290–1290. https://doi.org/10.1007/978-0-387-79948-3_3710
4. Binjawhar, D. (2024). The determinants of leptin, angiopoietin like 8, and thyroid hormones levels in Saudi females with type 2 diabetes mellitus. 1–7.
5. Biondi, B., Kahaly, G. J., & Robertson, R. P. (2019). Thyroid Dysfunction and Diabetes Mellitus : Two (Number June 2018). https://doi.org/10.1210/er.2018-00163
6. Bukhari, S. I., Ali, G., Memom, M. Y., Sandeelo, N., Alvi, H., Talib, A., Ahmed, I., Lal, H., Asghar, M. S., & Naseer, U. (2022). Prevalence and predictors of thyroid dysfunction amongst patients with Type 2 diabetes mellitus in Pakistan. 2739–2743. https://doi.org/10.4103/jfmpc.jfmpc
7. Chaker, L., Bianco, A. C., Jonklaas, J., & Peeters, R. P. (2017). Hypothyroidism. The Lancet, 390(10101), 1550–1562. https://doi.org/10.1016/S0140-6736(17)30703-1
8. Cochran, W. G. (1963). Sampling Technique. (2nd Editio). John Wiley and Sons Inc., New York.

9. Elsayed, N. A., Aleppo, G., Aroda, V. R., Bannuru, R. R., Brown, F. M., Bruemmer, D., Collins, B. S., Hilliard, M. E., Isaacs, D., Johnson, E. L., Kahan, S., Khunti, K., Kosiborod, M., Leon, J., Lyons, S. K., Murdock, L., Perry, M. Lou, Prahalad, P., Pratley, R. E., … Gabbay, R. A. (2023). 2. Classification and Diagnosis of Diabetes: Standards of Care in Diabetes—2023. Diabetes Care, 46, S19–S40. https://doi.org/10.2337/dc23-S002
10. Gauthier, B. R., Cáliz-molina, A. S. M. Á., Isabel, P., Nadia, L., & Martin-montalvo, A. (2020). Thyroid hormones in diabetes ,cancer , and aging. (July), 1–25. https://doi.org/10.1111/acel.13260
11. Ghimire, S., Sangroula, P., Indu, K. C., Deo, R. K., Ghimire, S., &Dhonju, K. (2022). Spectrum of Thyroid Disorders in Patients with Type-2 Diabetes Mellitus. 20(4), 922–927. 1
12. Hadgu, R., Worede, A., &Ambachew, S. (2024). Prevalence of thyroid dysfunction and associated factors among adult type 2 diabetes mellitus patients, 2000–2022: a systematic review and meta-analysis. Systematic Reviews, 13(1), 1–16. https://doi.org/10.1186/s13643-024-02527-y
13. IDF Diabetes Atlas. (2023). No Title. International Diabetes Federation (2023) IDF Diabetes Atlas, 10th Edition. International Diabetes Federation., 10th Editi.
14. Khassawneh, A. H., Al-Mistarehi, A. H., Alaabdin, A. M. Z., Khasawneh, L., Alquran, T. M., Kheirallah, K. A., Saadeh, N. A., Yonis, O. B., Shawkat, M., & Obeidat, N. (2020). Prevalence and predictors of thyroid dysfunction among type 2 diabetic patients: A case–control study. International Journal of General Medicine, 13, 803–816. https://doi.org/10.2147/IJGM.S273900
15. Macvanin, M. T., Gluvic, Z. M., Zaric, B. L., Essack, M., Gao, X., &Isenovic, E. R. (2023). New biomarkers : prospect for diagnosis and monitoring of thyroid disease. (July), 1–15. https://doi.org/10.3389/fendo.2023.1218320
16. Majeed, S., Hussein, M., &Abdelmageed, R. M. (2021). The Relationship Between Type 2 Diabetes Mellitus and Related Thyroid Diseases. 13(12), 10–14. https://doi.org/10.7759/cureus.20697
17. Radaideh, A.-R. M. (2004). Thyroid dysfunction in patients with type 2 diabetes mellitus. Saudi Med Journal, 25(8), 1046–1050. https://doi.org/10.26611/10211429
18. Rodondi, N. (2010). NIH Public Access. JAMA, 304(12), 1365–1374. https://doi.org/10.1001/jama.2010.1361.Subclinical
19. Rong, F., Dai, H., Wu, Y., Li, J., Liu, G., Chen, H., & Zhang, X. (2021). Association between thyroid dysfunction and type 2 diabetes : a meta-analysis of prospective observational studies. 1–13.
20. S, V. K., Chakravarthy, S., S, S., & S, V. H. (2025). Thyroid Dysfunction in Type 2 Diabetes Mellitus: A Cross-Sectional Study in a Tertiary Care Centre. European Journal of Cardiovascular Medicine, 15(07), 382–386. https://www.healthcare-bulletin.co.uk/article/thyroid-dysfunction-in-type-2-diabetes-mellitus-a-cross-sectional-study-in-a-tertiary-care-centre-3812/
21. Safari, F., Nabavizadeh, A., &Vardanjani, H. M. (2024). The association between thyroid function and insulin resistance as measured by the metabolic score for insulin resistance (METS- IR): insights from NHANES 2007 – 2012.
22. Sakyi, S. A., Ameyaw, B., Laing, E. F., Anthony, R., Ephraim, R. K. D., Effah, A., Kwayie, A. A., Senu, E., Anto, E. O., Acheampong, E., Afranie, B. O., Amoani, B., & Opoku, S. (2023). Thyroid dysfunction and glycaemic control among Type 2 diabetes mellitus patients in Ghana: A comparative cross-sectional study. Endocrinology, Diabetes and Metabolism, 6(6). https://doi.org/10.1002/edm2.447