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THE DUAL CHALLENGE: EXPLORING THE ASSOCIATION BETWEEN DYSLIPIDEMIA AND THYROID HORMONE IMBALANCE IN TYPE-II DIABETIC PATIENTS.

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ABSTRACT

BACKGROUND: Diabetes Mellitus (DM) is a major worldwide public health issue. The thyroid hormone, including T3 and T4, controls how the body utilizes energy. It is also crucial in managing your weight, body temperature, muscle strength, and mood. **METHODOLOGY:** This cross-sectional analysis encompassed 190 participants, utilizing a non-probability convenience sampling method to categorize them into three groups: healthy individuals, those with thyroid disorders, and individuals with Type 2 Diabetes Mellitus (T2DM). Recruitment occurred in the Medicine department of Jamshoro/Hyderabad, where participants were selected based on a pre-designed form and provided both verbal and written informed consent. Data analysis involved the use of ANOVA Post hoc (Tukey test) for group comparisons ($P<0.05$) and the Chi-square test for assessing frequency data. **RESULTS:** Significant alterations were observed in the lipid profiles, fasting blood glucose, and HbA1c levels across both genders when compared to the control group, with a notable difference ($p<0.001$). In a study examining thyroid hormone levels, the differences in T3, T4, and TSH levels among normal healthy males, obese individuals, and those with Type 2 Diabetes Mellitus (T2DM) were found to be statistically significant. Specifically, T3 levels were 1.44±0.44 nmol/l for healthy males compared to 1.46±0.49 and 1.54±0.39 nmol/l for obese and T2DM subjects, respectively ($P<0.05$). T4 levels showed a similar pattern, with healthy males at 7.95±3.7 µg/dl versus obese and T2DM males at 9.6±4.4 µg/dl and 9.92±4.3 µg/dl, respectively ($p<0.05$). Additionally, TSH levels were 3.67±1.10 mIU/l for the control group compared to 2.56±2.9 and 2.68±3.8 mIU/l for the case groups, again showing significant difference ($p<0.05$). **CONCLUSIONS:** This study found that cholesterol and LDL levels were adversely affected in individuals with T2DM and those with thyroid conditions. However, no link was found between thyroid dysfunction and variations in insulin levels or blood sugar profiles. It was determined that dyslipidaemia plays a role in the development of T2DM and thyroid issues.

Key Words: BMI, Obesity, thyroid, HbA1c, T2DM.

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INTRODUCTION

Diabetes Mellitus (DM) is one of the important public health issues worldwide.[1] The global incidence of Type-II Diabetes Mellitus (T2DM) is on the rise, with the economic burden of diabetes reaching USD 850 billion in 2017 and projected to climb to USD 958 billion by 2045.[2] Individuals with T2DM are at a higher risk of developing thyroid disorders, and insulin resistance is a significant factor in the onset of hypothyroidism within this demographic[3]. The presence of hypothyroidism in diabetic

individuals exacerbates complications such as dyslipidemia, hypertension, and cardiovascular diseases, making the identification and treatment of hypothyroidism in diabetic patients critical for mitigating these adverse effects.[4] A simple blood test, which is widely available and can be conducted by primary care providers, facilitates the diagnosis of hypothyroidism.[5] Prompt management of thyroid dysfunction can aid in stabilizing blood sugar levels and improving lipid profiles in diabetic patients. Moreover, diabetic individuals with subclinical hypothyroidism face a heightened risk of nephropathy and cardiovascular diseases.[6] Complications specific to diabetes, such as retinopathy and neuropathy, may also deteriorate due to the dyslipidemia associated with hypothyroidism.[7] Dyslipidemia in T2DM, indicated by lipoproteins, is a known risk factor for both macrovascular and microvascular complications, with reduced HDL levels increasing the risk of cardiovascular diseases and strokes.[8] Compared to Type 1 Diabetes Mellitus (T1DM), T2DM patients show lower levels of total cholesterol, triglycerides (TAGs), and HDL.[10] Previous research has linked cholesterol, TAGs, HDL, and LDL levels with Body Mass Index (BMI).[11-13] The aim of current study to reaffirms the intricate connections between lipid abnormalities, thyroid health, and metabolic diseases such as T2DM. It highlights the critical need for integrated care approaches that encompass regular screening and comprehensive management strategies to address the multifaceted challenges posed by these interrelated conditions.

MATERIAL AND METHODS:

The current cross-sectional comparative study involved 190 participants and took place at the Institute of Biotechnology and Genetic Engineering (IBGE), University of Sindh, Jamshoro, Pakistan. To determine the study's sample size, Rao software was utilized, calculating a need for 159 subjects based on a 11.77% T2DM prevalence, a 95% confidence interval, and a 5% margin of error. A non-probability convenience sampling method was employed, dividing the subjects into three groups: Group A consisted of 50 normal healthy individuals serving as the control group, further split by gender into A1 (25 females) and A2 (25 males); Group B included 75 obese individuals, also divided by gender into B1 (35 females) and B2 (35 males); and Group C comprised 75 individuals with Type 2 Diabetes Mellitus (T2DM), similarly subdivided into C1 (35 females) and C2 (35 males). Selection was based on Body Mass Index (BMI) criteria for the Asian population, with ranges defining normal weight, overweight, and obese categories. T2DM patients were recruited from the Medicine Department of LUMHS, Jamshoro/Hyderabad, Sindh, whereas obese and healthy individuals were recruited from university staff and the community. The study, lasting six months from July to December 2023, included individuals aged 30-70 years, excluding those with Type 1 Diabetes, cardiovascular conditions, hypertension, pregnant women, and those on medication. It was divided into two phases: initial participant recruitment involving history taking and measuring anthropometric parameters, followed by the collection and analysis of blood samples for, fasting blood sugar (FBS), HbA1c, and lipid profiles and thyroid profile. Blood processing involved centrifugation at 3000 rpm for ten minutes. Data analysis was performed using SPSS 23.0, applying ANOVA Post hoc (Tukey test) to compare the groups based on lipid profiles, FBS levels, and HbA1c. Ethical approval was obtained from the Ethical Review Committee of IBGE, University of Sindh, Jamshoro, ensuring adherence to ethical standards.

RESULTS:

This study highlights several critical findings in the relationship between Type 2 Diabetes Mellitus (T2DM), obesity, and various health markers. In females with T2DM, average fasting blood sugar levels were increased significantly among other groups, a difference underscored by a ($p < 0.001$). Additionally, the study found a distinct elevation in HbA1c levels for T2DM patients, with Group C (T2DM patients) exhibiting an average of 8.15%, compared to 5.36% in obese females and 4.84% in healthy females, marking a significant statistical discrepancy represent in Figure-1 and 2.

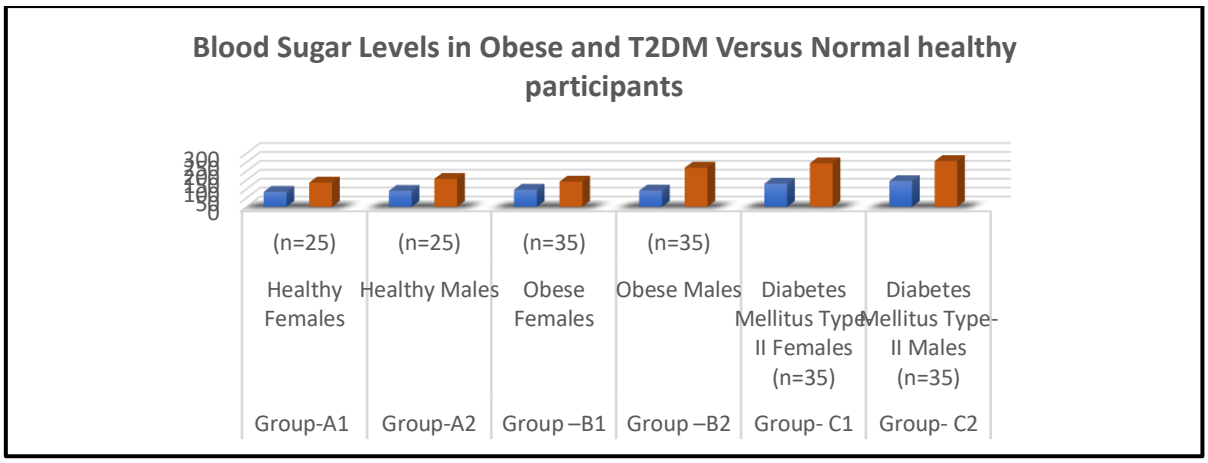


Figure-1: Comparison of Blood Sugar Profile of male's and female study participants

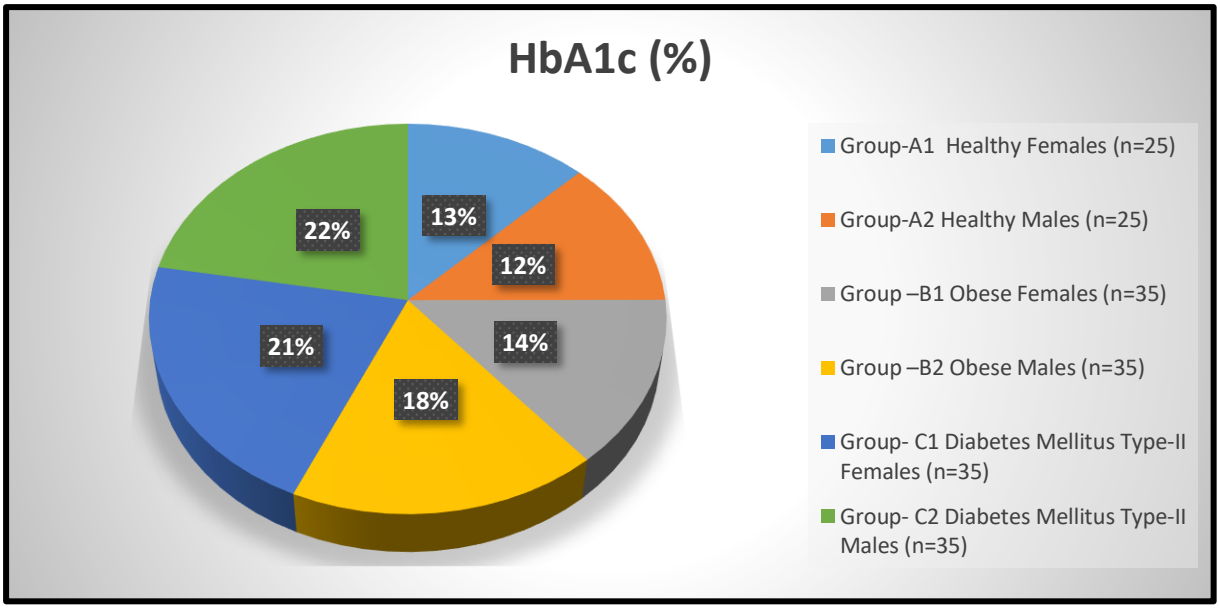


Figure-2: Comparison of HbA1c% of male's and females study participants

In obese males, fasting blood sugar levels also differed significantly from those in healthy males, emphasizing the heightened risk associated with T2DM, represent in figure-3

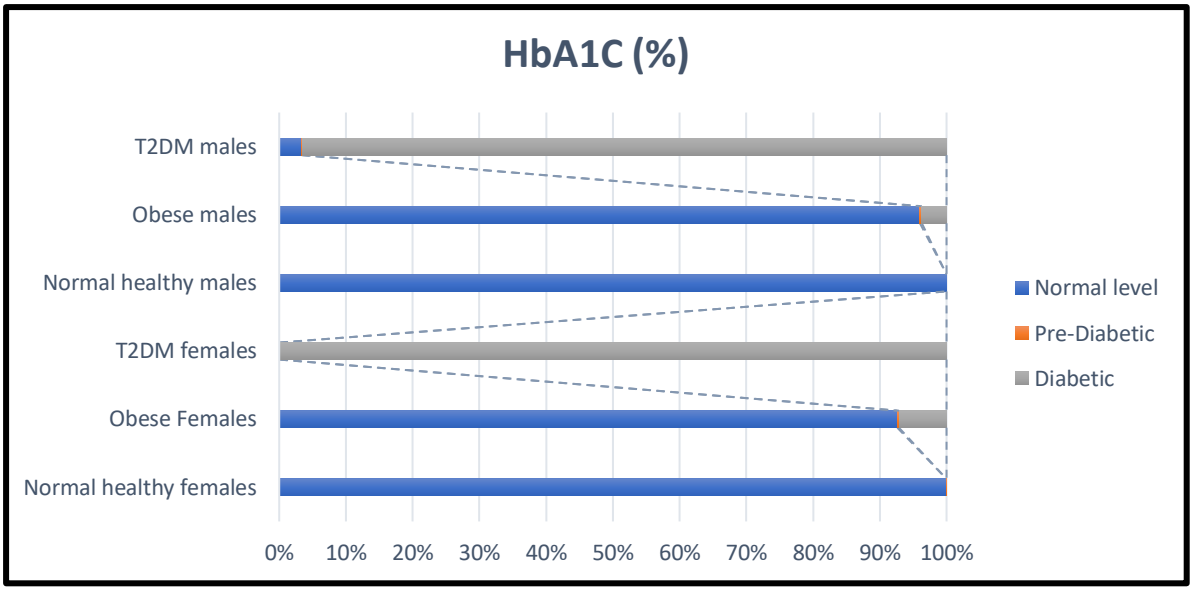
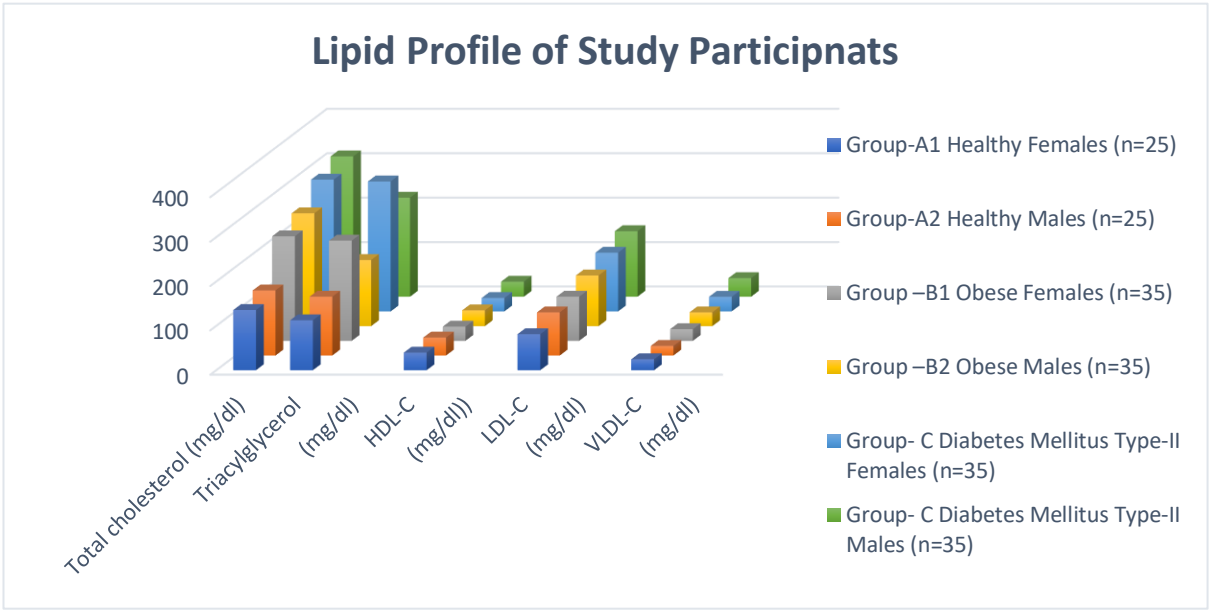


Figure- 3 Distribution of HbA1c (%) Levels among Study Participants

The study also compared serum cholesterol levels across different groups, finding that both diabetic and obese patients had significantly higher cholesterol levels than healthy controls. This trend was consistent across various cholesterol types, except for low-density lipoprotein cholesterol (LDL-C), where no significant difference was found. However, very low-density lipoprotein cholesterol (VLDL-C) levels were notably higher in diabetic females, again stressing the metabolic complications associated with T2DM represent in Figure-4.

Figure-4 Comparison of Lipid Profile of female's and Males participants

TSH levels indicates the thyroid function, and it revealed that the majority of participants had normal TSH levels, though a significant number showed deviations indicative of hypo- or hyperthyroidism represent in Figure-5.



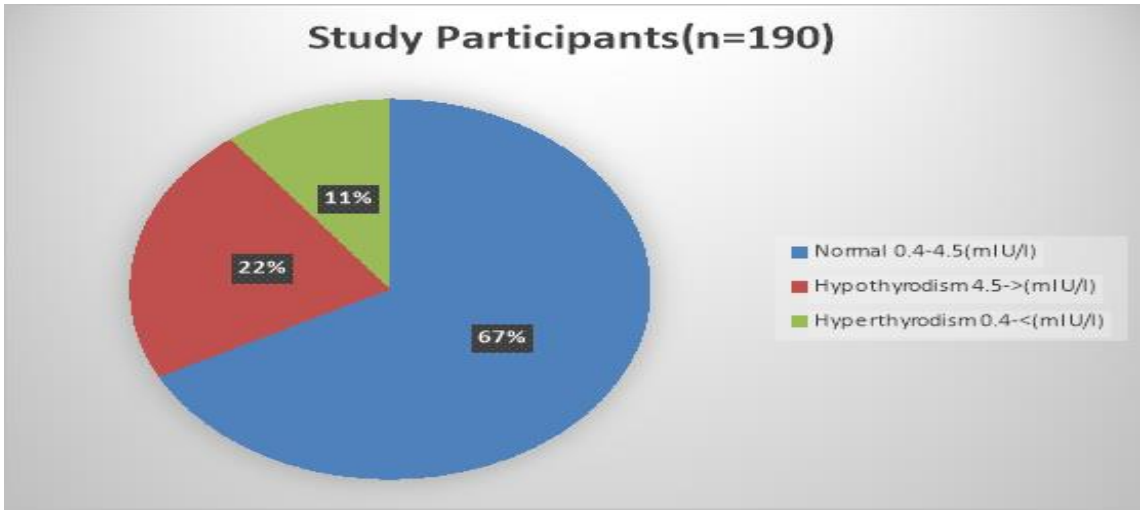
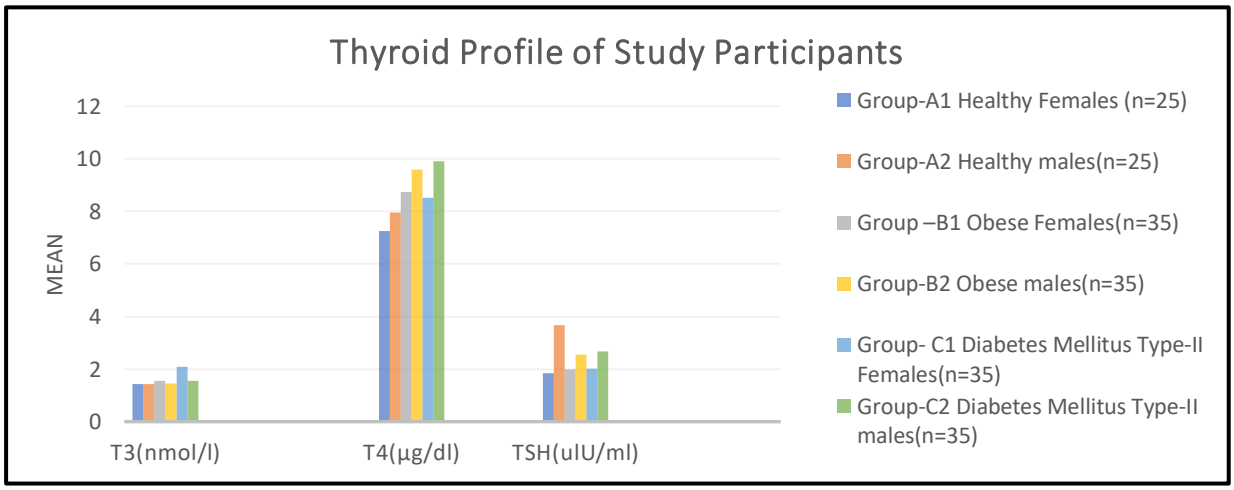


Figure-5 Frequency distribution of hypothyroidism and hyperthyroidism in study population

The study underscores the complex interplay between thyroid function and metabolic disorders, with significant differences in T3 and T4 hormone levels among different groups, thereby highlighting the nuanced effects of obesity and T2DM on thyroid health shown in Figure-6.

Figure-6 Thyroid profile of study participants



DISCUSSION

The global incidence of Type-II Diabetes Mellitus (T2DM) is on the rise, with the economic burden of diabetes reaching USD 850 billion in 2017 and projected to climb to USD 958 billion by 2045.[2] Individuals with T2DM are at a higher risk of developing thyroid disorders, and insulin resistance is a significant factor in the onset of hypothyroidism within this demographic.[15] we found similar results. Kiran M et al., [16] reported that the Hypothyroidism in diabetic individuals exacerbates complications such as dyslipidemia and hypertension, making the identification and treatment of hypothyroidism in diabetic patients critical for mitigating these adverse effects. In current study we are found dyslipidemia in obese and diabetic patients. Our study's findings indicate a notable increase in TSH levels and a decrease in T4 and T3 levels, consistent with previous research. Additionally, we observed significantly higher levels of total cholesterol (TC) and low-density lipoprotein (LDL), aligning with findings from other studies.[17-19]Talwalkar et al.,[20] reported that he has linked cholesterol, TAGs, HDL, and LDL levels with obesity, the results were consistent with our finding. A perspective study [20,21] indicates that patients with obesity could be identified by subclinical hypothyroidism as like present study we found also thyroid dysfunction individuals with obese and diabetic groups. Wu Z., and coworkers[22] reveal that an independent link between

subclinical hypothyroidism and the new onset of metabolic syndrome in male adults under 50 years of age but we found thyroid dysfunction in man above 50 years of age.

It is recommended that diabetic patients undergo annual thyroid function tests to identify any asymptomatic thyroid dysfunction, which is more prevalent among the diabetic population.

CONCLUSION: This study extensively examined the correlation between dyslipidemia, thyroid dysfunction, and their prevalence in individuals with Type 2 Diabetes Mellitus (T2DM) and obesity. Results emphasize dyslipidemia's significant role in cardiovascular disease development and diabetes complications, particularly noting the adverse impact of reduced HDL and altered total cholesterol and triglyceride levels. While significant lipid parameter differences were observed among obese and T2DM patients compared to healthy controls, LDL levels showed a distinct pattern, indicating a complex relationship between lipid profiles and metabolic conditions requiring further investigation.

Moreover, the study highlighted the prevalence of thyroid dysfunction, predominantly hypothyroidism, within the T2DM and obese populations. These findings emphasize the importance of routine thyroid function monitoring in diabetic and obese patients to detect and manage potential complications associated with concurrent thyroid dysfunction effectively.

FURTHER RECOMMENDATION: This study reaffirms the intricate connections between lipid abnormalities, thyroid health, and metabolic diseases such as T2DM. It highlights the critical need for integrated care approaches that encompass regular screening and comprehensive management strategies to address the multifaceted challenges posed by these interrelated conditions. By fostering a deeper understanding of these dynamics, healthcare providers can better support the overall well-being of individuals suffering from or at risk of these health issues, potentially mitigating the associated morbidity and mortality rates.

ETHICS APPROVAL: The ERC gave ethical review approval.

CONSENT TO PARTICIPATE: written and verbal consent was taken from subjects and next of kin.

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AUTHORS' CONTRIBUTIONS: All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated in the work to take public responsibility of this manuscript. All authors read and approved the final manuscript.

CONFLICT OF INTEREST: No competing interest declared.

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