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Exploring the Relationship between Glycemic Control and Lipid Profiles in Lean and Obese Individuals with Type 2 Diabetes Mellitus, Stratified by BMI

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Abstract

Objective: This cross-sectional research's goal was to look into the relationships between lipid profile characteristics and glycemic management in people with type 2 diabetes mellitus (T2DM), stratified by body mass index (BMI).

Methods: 100 participants with T2DM were included in the trial from November 2020 to March 2022, which spanned an 18-month period. Glycated haemoglobin (HbA1c) levels were used to determine glycemic management, and measurements of total cholesterol, low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), and triglycerides were made for the lipid profile. Lean participants (BMI 25 kg/m2) and obese participants (BMI 30 kg/m2) were divided into two groups. Within each BMI group, statistical analyses, such as t-tests and regression analyses, were carried out to assess the relationships between lipid profile and glycemic control.

Results: In comparison to their obese counterparts (8.5%±1.0%), lean T2DM patients had better glycemic control and lower HbA1c levels (7.2%±0.8%). Lean people, in contrast to obese T2DM patients, had less favourable lipid profiles, as seen by greater levels of total cholesterol and LDL-C but lower levels of HDL-C.

Conclusion: In conclusion, this investigation highlights the nuanced interactions between lipid profiles, glycemic management, and BMI in T2DM patients. Personalised management strategies, considering both glycemic control and lipid profiles, are crucial for optimising the care of T2DM patients, taking into account their BMI. While lean T2DM individuals demonstrated better glycemic control, they also exhibited a potentially higher cardiovascular risk due to less favourable lipid profiles.

Keywords: Type 2 diabetes mellitus, glycemic control, lipid profile, body mass index, cross-sectional research

Introduction

The complex metabolic condition known as type 2 diabetes mellitus (T2DM) is characterised by high blood glucose levels and decreased insulin action. With a prevalence that is frighteningly on the rise, it constitutes a significant and expanding global health burden [1]. T2DM contributes significantly to morbidity and mortality worldwide since it is linked to a number of consequences, including as retinopathy, neuropathy, renal disease, and cardiovascular disease [2].

Obesity, which is characterised by an abnormal buildup of adipose tissue and is frequently measured using the BMI is a crucial component in the onset and progression of T2DM. It is acknowledged that obesity is a significant risk factor for the emergence of insulin resistance and T2DM [3]. In people with T2DM, the link between BMI, glycemic control, and lipid profile is complex and has been the subject of continuous research and discussion.

Since it is strongly related to the prevention of both acute and long-term problems, glycemic control is a key component of T2DM therapy. HbA1c levels are a crucial therapeutic objective in the treatment of T2DM and a reliable indicator of long-term glucose control. Reduced risk of microvascular consequences such diabetic retinopathy and nephropathy is linked to lower HbA1c levels [4]. Therefore, one of the key objectives in the management of T2DM is to achieve and maintain optimum glycemic control.

On the other hand, dyslipidemia is another typical metabolic disorder in T2DM. It is characterised by decreased levels of HDL-C and increased levels of triglycerides, LDL-C and total cholesterol. The higher risk of "atherosclerotic cardiovascular disease (ASCVD)" seen in people with T2DM is mostly attributed to dyslipidemia [5]. The management of lipid profiles together with glycemic control is crucial for lowering cardiovascular risk because ASCVD is the main cause of mortality in T2DM patients [6-10].

Given the complexity of T2DM, it is essential to look at the relationship between lipid profiles and glycemic management, especially in people with different BMIs. Compared to their obese counterparts, lean people with T2DM may have different metabolic profiles and treatment demands. The goal of this research is to clarify the connection between lipid profile and glycemic management in T2DM patients while taking BMI into account.

The interaction between adipose tissue, insulin resistance, and lipid metabolism is what makes this relationship complex. Adipose tissue is an active endocrine organ that secretes a variety of adipokines, such as adiponectin and leptin, which can influence insulin sensitivity and lipid metabolism [7]. It is not only a passive energy storage depot. Therefore, glycemic control and lipid profiles in T2DM patients may be affected differently depending on the distribution and amount of adipose tissue, as indicated by BMI.

Furthermore, it's critical to recognise the possibility that treatment approaches may have an impact on both lipid profiles and glycemic control. The lipid-related side effects of T2DM medications might vary, and lifestyle changes including dietary adjustments and increased physical activity can affect both glycemic control and lipid metabolism. Therefore, it is

crucial for clinical practise to grasp the dynamic interaction between these variables in lean and obese T2DM patients.

This research intends to shed light on the relationship between lipid profile and glycemic control in T2DM patients, stratified by BMI. By analysing how BMI affects these variables, this research can more effectively modify treatment plans to meet the unique requirements of lean and obese T2DM patients. The results of this research add to the expanding body of knowledge on the personalised management of T2DM and highlight how crucial it is to address both lipid profiles and glycemic control in order to achieve the best possible outcomes for overall health.

Materials and Methods

Research Design: From November 2020 to March 2022, an 18-month period, this cross-sectional research was carried out. The main goal was to look at the relationship between lipid profile and glycemic management in people with T2DM with a focus on the impact of BMI. This research were able to take a quick look at these associations in a wide range of T2DM patients because to the research design.

Participants: 100 T2DM patients in total were enlisted for this investigation based on the most recent diagnostic standards [1]. To guarantee adherence to ethical standards and data protection laws, informed consent was sought from every participant and institutional review board (IRB) approval was obtained.

HbA1c levels, which offer a trustworthy indicator of long-term glucose control, were used to measure glycemic control. After an overnight fast, blood samples were taken, and HbA1c levels were assessed using established laboratory procedures.

Lipid profile measurements were made for total cholesterol, LDL-C, HDL-C, and triglycerides in this investigation. Using recognised laboratory assays and procedures, lipid profiles were found in fasting blood samples.

BMI**:** Based on their BMI, participants were divided into two separate groups. The obese group comprised people with a BMI of 30 kg/m2 or more, while the lean group included people with a BMI of less than 25 kg/m2. The following formula was used to determine BMI: BMI = weight (kg) / (height (m))2.

Statistical Analysis: To evaluate the associations between glycemic control and lipid profile parameters within each BMI category, statistical analysis was carried out using the relevant software SPSS ver 25.

Comparative Analysis: To identify variations in HbA1c levels and lipid profile parameters between lean and obese T2DM patients, comparative statistical tests, such as independent t-tests or Mann-Whitney U tests, were used. Regression analysis were also carried out to investigate associations and potential confounding variables.

Results

The baseline characteristics of the research population, stratified by BMI category, are listed in Table 1. The research involved a total of 100 people with T2DM 50 of whom were lean (BMI 25 kg/m2) and 50 of whom were obese (BMI 30 kg/m2).

The demographic and clinical details of the research participants are shown in (Table 1). The average age of the lean group was 55.2 years (±7.1), whereas the average age of the obese group was 59.6 years (±6.5). In both groups, the gender distribution was largely balanced.

The stark contrast in glycemic control between the two BMI groups is shown in (Table 2). In comparison to the obese group, which had a mean HbA1c level of 8.5% (± 1.0%), lean T2DM patients had a noticeably lower mean HbA1c level of 7.2% ((±0.8%), indicating improved glycemic control.

The variations in the lipid profiles between the two BMI groups are shown in (Table 3). In comparison to their obese counterparts, lean T2DM patients showed greater levels of total cholesterol, LDL cholesterol, and HDL cholesterol. In addition, the triglyceride levels in the lean group were somewhat higher.

Table 1: Baseline Characteristics of T2DM Patients Stratified by BMI

Characteristic	**Lean Group**	**Obese Group**
Age (years)	55.2 ± 7.1	59.6 ± 6.5
Gender (Male/Female)	24/26	29/21
Duration of T2DM (years)	8.3 ± 3.6	10.7 ± 4.2
HbA1c (%)	7.2% ± 0.8%	8.5% ± 1.0%

Table 2 provides an overview of glycemic control parameters in lean and obese T2DM patients.

Glycemic Parameter	**Lean Group**	**Obese Group**
HbA1c (%)	7.2% ± 0.8%	8.5% ± 1.0%

Table 3 presents lipid profile parameters in lean and obese T2DM patients.

Lipid Parameter	**Lean Group**	**Obese Group**
Total Cholesterol (mg/dL)	190.4 ± 20.1	176.8 ± 18.6
LDL Cholesterol (mg/dL)	116.2 ± 15.9	105.4 ± 14.3

HDL Cholesterol (mg/dL)	40.5 ± 6.2	47.2 ± 5.7
Triglycerides (mg/dL)	150.8 ± 22.4	138.6 ± 20.3

Discussion

The results of this cross-sectional research shed light on the intricate link between lipid profiles, BMI and T2DM patients' glycemic management and BMI. The discussion section seeks to offer a thorough interpretation of these findings, taking into account their clinical importance and relevance in light of the body of prior research.

Glycemic Control in Obese and Lean Type 2 Diabetes Patients:

The substantial disparity in glycemic control between lean and obese T2DM patients is one of the research's main findings. HbA1c values were lower in lean T2DM patients (7.2% (± 0.8%) compared to obese patients (8.5%(± 1.0%), indicating improved glycemic management. This result is consistent with other studies that indicated slim T2DM patients typically have lower levels of insulin resistance, making them more receptive to glucose-lowering treatments [1, 2, 5, 10].

This variation in glycemic control has important ramifications. A lower risk of microvascular consequences, such as diabetic retinopathy and nephropathy, is linked to improved glycemic management [2]. As a result, compared to T2DM patients who are obese, lean people may have a lower risk of developing these problems. Glycemic control is only one part of managing diabetes, it's crucial to remember that, and to take cardiovascular risk and lipid profiles into account as well.

Lipid Profiles in Obese and Lean Type 2 Diabetes Patients:

Additionally, the research showed that lean and obese T2DM individuals had different lipid profile patterns. In comparison to their obese counterparts, lean people with T2DM had lower levels of HDL cholesterol but greater levels of total and LDL cholesterol. According to these results, although thin T2DM patients may have better glycemic control, they may also be more susceptible to cardiovascular problems because of their unhealthy lipid profiles.

Since total cholesterol and LDL cholesterol are known cardiovascular risk factors, it is alarming that lean T2DM individuals have increased levels of these lipids [3, 11, 12]. These findings highlight the significance of thorough cardiovascular risk assessment and therapy in T2DM patients, especially in lean patients. Their treatment approaches may be absolutely dependent on methods for decreasing lipid profiles, like cholesterol-lowering drugs and lifestyle adjustments.

The HDL cholesterol, which is thought to be protective against cardiovascular disease, was higher in the obese T2DM group. This finding is in line with the "obesity paradox" in T2DM theory, according to which obese people with T2DM may have better lipid profiles but worse

glycemic control [4,11-15]. Further research is needed to determine the processes behind these variations in lipid profiles among T2DM patients with different BMIs.

Individualised management and clinical implications:

This research's conclusions have a number of significant clinical ramifications. First and foremost, healthcare professionals should acknowledge that T2DM is a heterogeneous disorder and that the therapeutic strategy should be individualised based on patient factors, such as BMI. Therapies that primarily focus on glycemic control while also addressing lipid profiles may be beneficial for lean T2DM patients. In contrast, obese T2DM patients might need a more all-encompassing strategy that targets cardiovascular risk factors in addition to glycemic management.

Second, this research highlights the necessity of routinely monitoring lipid profiles and glycemic management in all T2DM patients. HbA1c level analysis by alone might not give a clear picture of their total cardiovascular risk. To optimise lipid profiles, doctors should think about prescribing cholesterol-lowering drugs or, where appropriate, suggesting lifestyle changes including dietary adjustments and increased physical activity.

Future Directions and Restrictions:

It is important to recognise this research's limitations. In order to confirm these relationships over time, longitudinal studies are required because the cross-sectional design restricts our capacity to demonstrate causation. Furthermore, the findings' generalizability may have been impacted by the sample size, which was rather small. It is necessary to conduct additional research with larger cohorts to fully understand these links.

Additionally, this research did not thoroughly look at potential confounding variables such dietary practises, levels of physical activity, and medication use, which might affect both lipid profiles and glycemic management. These elements should be taken into account in future studies to provide a more complex explanation of the connections found.

Conclusion

This cross-sectional research concludes by emphasising the complex interaction between glycemic management, lipid profiles, and BMI in people with T2DM. In comparison to their obese counterparts, lean T2DM patients typically display better glycemic control but less favourable lipid profiles. These results highlight the value of individualised treatment plans that take into account the variability of T2DM. Clinicians should give managing lipid profiles and glycemic control first priority, particularly in slim T2DM patients who may have higher cardiovascular risk due to poor lipid profiles. These subtleties should be taken into account in future studies and therapeutic recommendations in order to improve the results and care of T2DM patients with a range of BMI categories.

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