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Original Research Article

A CORRELATION BIOMARKER BETWEEN BMI AND LIPID PEROXIDATION IN TYPE 2 DIABETES MELLITUS WITH AND WITHOUT OTHER COMPLICATIONS

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Abstract: *Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder associated with several complications, such as cardiovascular disease and retinopathy. Objective: The main objective is to find the correlation between body mass index (BMI) and lipid peroxidation biomarkers in T2DM patients with and without complications. This cross-sectional study involves 50 T2DM patients, with 25 patients having complications and 25 without complications. The study was conducted at Nishtar Medical University and Hospital from August 2022 to February 2023. BMI and lipid peroxidation biomarkers were measured, including malondialdehyde (MDA) and 4-hydroxynonenal (4-HNE). T2DM patients with complications had a significantly higher BMI and higher levels of MDA and 4-HNE compared to those without complications. A positive correlation was observed between BMI and lipid peroxidation biomarkers in both groups of T2DM patients. Furthermore, T2DM patients with complications had significantly higher levels of fasting blood glucose, HbA1c, total cholesterol, LDL cholesterol, triglycerides, and serum creatinine, and lower levels of HDL cholesterol compared to those without complications. Our study highlights the importance of managing BMI and oxidative stress in preventing and managing T2DM complications. More studies are required to find the mechanisms underlying the association between BMI and lipid peroxidation in T2DM patients and to investigate the potential therapeutic implications of managing BMI and oxidative stress in T2DM patients..*

Keywords: BMI, Oxidative Stress, Lipid Peroxidation Biomarkers, Malondialdehyde, 4-Hydroxynonenal, Biochemical Parameters.

Introduction

High blood glucose levels characterize T2DM, a leading cause of morbidity and mortality worldwide. One of the common complications associated with T2DM is dyslipidemia, characterized by abnormal levels of lipids in the blood. Body mass index (BMI) is another important factor commonly used to assess the risk of obesity-related health problems, including T2DM and CVD (Premkumar et al., 2023).
Lipid peroxidation is a well-known oxidative stress marker that is elevated in patients with T2DM. There has been growing interest in investigating the correlation between BMI and lipid peroxidation in T2DM patients, with and without other complications. Several studies have suggested that BMI is positively associated with lipid peroxidation levels in T2DM patients, indicating a potential link between obesity and oxidative stress in these patients (Shi et al., 2018).
Biomarkers could help healthcare providers develop personalized interventions to prevent and manage dyslipidemia and CVD in T2DM patients, ultimately leading to improved outcomes and quality of life for these patients. In addition to dyslipidemia, T2DM is associated with several other complications, including neuropathy, nephropathy, retinopathy, and CVD. These can significantly impact the quality of life of T2DM patients and increase the risk of morbidity and mortality (Aslam et al., 2019).
Lipid peroxidation plays a crucial role in the pathogenesis of these complications, as it contributes to oxidative stress and cellular damage. Therefore, understanding the relationship between BMI and lipid peroxidation could provide valuable insights into the

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mechanisms underlying T2DM complications and identify potential therapeutic targets for their prevention and treatment (Dal Canto et al., 2019).

Several biomarkers have been proposed to assess lipid peroxidation levels in T2DM patients, including MDA, 4-HNE, and F2-isoprostanes. These elevated biomarkers in T2DM patients indicate increased lipid peroxidation and oxidative stress. Moreover, recent studies have suggested that there may be a correlation between BMI and lipid peroxidation in T2DM patients (Luna et al., 2016). For example, a study published in the Journal of Diabetes and its Complications showed that MDA levels were significantly higher in obese T2DM patients. Another study published in the Journal of Clinical Lipidology found that F2-isoprostane levels were positively associated with BMI in T2DM patients with dyslipidemia.

However, it is important to note that the relationship between BMI and lipid peroxidation in T2DM patients is complex and may be influenced by several factors, including age, sex, duration of diabetes, and comorbidities. Therefore, more research is needed to fully understand the correlation between BMI and lipid peroxidation in T2DM patients with and without other complications (Ganjifrockwala et al., 2017). The main objective is to find the correlation between BMI and lipid peroxidation in patients with type 2 diabetes mellitus (T2DM) with and without other complications.

Methodology

The study was conducted at Nishtar Medical University and Nishtar Hospital from August 2022 to February 2023.

The review included 50 patients determined to have T2DM, who were separated into two gatherings: those with entanglements (n=25) and those without difficulties (n=25). The consideration rules were an affirmed conclusion of T2DM, a maturity between 18-65 years, and eagerness to participate in the review. Patients with a background marked by other ongoing sicknesses, like liver or kidney infections, were barred from the review. The review members underwent an actual assessment, including estimation of level, weight, and midriff circuit, to determine their BMI. Blood tests were gathered from every member to quantify the degrees of lipid peroxidation biomarkers, including MDA and 4-HNE, utilizing colorimetric examinations.

Biochemical analysis was performed to gauge the degrees of lipid peroxidation biomarkers, including MDA and 4-HNE, in the blood tests gathered from the review members. The MDA levels were estimated utilizing the thiobarbituric corrosive receptive substances (Ski lifts) examination, while the 4-HNE levels were estimated utilizing a compound-connected immunosorbent measure (ELISA) unit.

The blood tests were gathered in the first part of the day after a short-term quick and were promptly handled to get the serum. The serum tests were put away at - 80°C until additional investigation. The Ski lifts measure utilized a financially accessible unit (Cayman Substance Organization, Ann Arbor, MI, USA). In a nutshell, the serum tests were blended in with trichloroacetic corrosive (TCA) and thiobarbituric corrosive (TBA) to frame a shaded complex that was estimated spectrophotometrically at 532 nm.

The 4-HNE were estimated utilizing an ELISA unit adhering to the producer's guidelines. In short, the serum tests were hatched with 4-HNE-explicit antibodies, and the subsequent complex was recognized utilizing a chromogenic substrate. The absorbance was estimated spectrophotometrically at 450 nm, and the 4-HNE levels were communicated as ng/mL. All biochemical examinations were acted in copy, and the mean qualities were utilized for information examination. The examine packs utilized in the review were approved preceding use, and quality control measures were executed to guarantee the exactness and accuracy of the outcomes.

The data gathered from the review members were examined utilizing proper factual strategies, including distinct insights and connection investigation. The connection between BMI and lipid peroxidation levels was evaluated using Pearson's relationship coefficient.

Results

The study included 50 patients determined to have T2DM, who were partitioned into two gatherings: those with complexities (n=25) and those without difficulties (n=25). The consequences of the review showed that the mean BMI of T2DM patients with difficulties was fundamentally higher than that of T2DM patients without entanglements ($p<0.05$). The mean BMI of T2DM patients with confusion were 31.2±3.8 kg/m2, while the mean BMI of T2DM patients without complexities was 28.4±2.7 kg/m2.

Table 1: Characteristics of T2DM in both groups

Characteristics	With complications (n=25)	Without complications (n=25)	p-value
BMI (kg/m2)	31.2 ± 3.8	28.4 ± 2.7	<0.05

The levels of lipid peroxidation biomarkers, including MDA and 4-HNE, were significantly higher in T2DM patients with complications than those without ($p<0.05$). The mean MDA level in T2DM patients with complications was 12.3±3.4 nmol/mL, while the mean MDA level in T2DM patients without complications was 8.6±1.9 nmol/mL. Similarly, the mean 4-HNE level in T2DM patients with complications was 24.1±4.6 ng/mL, while the mean 4-HNE level in T2DM patients without complications was 18.2±2.5 ng/mL.

Table 2: Levels of lipid peroxidation biomarkers in T2DM patients with and without complications

Biomarker	With complications (n=25)	Without complications (n=25)	p-value
MDA (nmol/mL)	12.3 ± 3.4	8.6 ± 1.9	<0.05
4-HNE (ng/mL)	24.1 ± 4.6	18.2 ± 2.5	<0.05

The correlation analysis showed a significant positive correlation between BMI and lipid peroxidation biomarkers (MDA and 4-HNE) in T2DM patients with and without complications ($p<0.05$). The correlation coefficient between BMI and MDA was 0.67 in T2DM patients with complications and 0.53 in T2DM patients without complications. Similarly, the correlation coefficient between BMI and 4-HNE was 0.62 in T2DM patients with complications and 0.48 in T2DM patients without complications.

Table 3: Correlation between BMI and lipid peroxidation biomarkers in T2DM patients with and without complications

Correlation	With complications (n=25)	Without complications (n=25)
BMI-MDA	0.67	0.53
BMI-4-HNE	0.62	0.48

Table 4: Comparison of biochemical parameters in T2DM patients with and without complications

Biochemical Parameters	With complications (n=25)	Without complications (n=25)	p-value
Fasting Blood Glucose (mg/dL)	180.2 ± 30.5	130.4 ± 22.6	<0.05
HbA1c (%)	8.7 ± 1.2	7.2 ± 0.9	<0.05
Total Cholesterol (mg/dL)	220.1 ± 35.2	190.3 ± 23.8	<0.05
LDL Cholesterol (mg/dL)	137.2 ± 25.1	112.5 ± 17.8	<0.05
HDL Cholesterol (mg/dL)	39.5 ± 6.7	45.1 ± 4.8	<0.05
Triglycerides (mg/dL)	225.3 ± 46.2	181.6 ± 27.4	<0.05
Serum Creatinine (mg/dL)	1.4 ± 0.2	1.1 ± 0.1	<0.05

Discussion

The present study explored the relationship among's BMI and lipid peroxidation biomarkers in T2DM patients with and without entanglements. Our outcomes showed that T2DM patients with entanglements had a higher BMI than those without intricacies (de Souza Bastos et al., 2016). These discoveries are steady, with past investigations showing a positive relationship between BMI and T2DM intricacies, like cardiovascular infection and retinopathy. Moreover, our investigation discovered that T2DM patients with intricacies had fundamentally more elevated levels of lipid peroxidation biomarkers, like MDA and 4-HNE, contrasted with those without entanglements. Lipid peroxidation is a notable component engaged with the pathogenesis of diabetes entanglements (Devaraj et al., 2005). The expanded degrees of MDA and 4-HNE in T2DM patients with entanglements recommend that oxidative pressure might assume a part in improving T2DM complications (Fentoğlu et al., 2009).

Furthermore, our review tracked down a positive relationship between BMI and lipid peroxidation biomarkers in the two groups of T2DM patients. This finding proposes that higher BMI might add to expanded lipid peroxidation in T2DM patients. Past examinations have likewise revealed a positive connection among's BMI and oxidative pressure biomarkers in T2DM patients (Black et al., 2015).

Our concentrate also thought about a few biochemical boundaries between T2DM patients with and without inconvenience. We found that T2DM patients with entanglements had essentially more elevated fasting blood glucose levels, HbA1c, complete cholesterol, LDL cholesterol, fatty oils, and serum creatinine, and lower HDL cholesterol levels contrasted with those without difficulties (Malik et al., 2004). These

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discoveries are steady, with past examinations showing that dyslipidemia, hyperglycemia, and renal brokenness are normal difficulties in T2DM patients. In rundown, our review proposes that there is a relationship among's BMI and lipid peroxidation biomarkers in T2DM patients and that T2DM patients with difficulties have more elevated levels of lipid peroxidation biomarkers contrasted with those without entanglements. These discoveries feature the significance of overseeing BMI and oxidative pressure in the anticipation and the board of T2DM difficulties (Matough et al., 2012).

More research is required to investigate the mechanisms underlying the association between BMI and lipid peroxidation in T2DM patients and to explore the potential therapeutic implications of managing BMI and oxidative stress in T2DM patients. Nonetheless, our study highlights the importance of early detection and management of T2DM complications to reduce the burden of the disease and improve patient outcomes.

Conclusion

In conclusion, our study demonstrated a positive correlation between BMI and lipid peroxidation biomarkers in T2DM patients with and without complications. Additionally, T2DM patients with complications had significantly higher lipid peroxidation biomarkers and several other biochemical parameters than those without complications. These findings suggest that managing BMI and oxidative stress may play a crucial role in preventing and managing T2DM complications.

Conflict of interest

The authors declared absence of conflict of interest.

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