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Original Research Article

Study of Serum Adiponectin and Leptin Levels in Diabetic Patients in Rural Maharashtra

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Abstract:

Type 2 diabetes mellitus (T2DM) is a global health problem characterized by insulin resistance and metabolic dysfunction. Adiponectin and leptin, two key adipokines, play a crucial role in energy homeostasis, glucose metabolism, and insulin sensitivity. This study aimed to evaluate serum adiponectin and leptin levels in T2DM patients and compare them with healthy controls. A case-control study was conducted with 100 participants, including 50 T2DM patients and 50 healthy controls. Serum adiponectin and leptin levels were measured using ELISA kits, and their correlations with metabolic parameters such as fasting blood glucose (FBG), HbA1c, and body mass index (BMI) were analyzed. The results showed significantly lower adiponectin and higher leptin levels in T2DM patients compared to controls ($p<0.05$). Additionally, adiponectin showed a negative correlation with FBG and HbA1c, while leptin levels correlated positively with BMI and insulin resistance. The findings suggest that adiponectin deficiency and leptin excess contribute to insulin resistance and metabolic dysregulation in T2DM patients. These adipokines could serve as potential biomarkers for assessing diabetes risk and complications. Further research is required to explore therapeutic interventions targeting adipokine modulation for improved glycemic control.

Keywords: Adiponectin, Diabetes, Leptin.

Introduction

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by insulin resistance, hyperglycemia, and progressive β-cell dysfunction. The global prevalence of T2DM has increased significantly, mainly due to sedentary lifestyles, obesity, and genetic predisposition [1]. The dysregulation of adipokines, particularly adiponectin and leptin, plays a crucial role in the pathophysiology of diabetes and its associated complications [2].

Adiponectin is an insulin-sensitizing adipokine secreted primarily by adipocytes. It has anti- inflammatory, anti-atherogenic, and insulin- sensitizing properties, making it a key regulator of glucose metabolism [3]. Low adiponectin levels are commonly observed in T2DM and obesity, which contribute to insulin resistance and cardiovascular risk [4]. Adiponectin enhances glucose uptake by muscles, suppresses hepatic gluconeogenesis, and promotes fatty acid oxidation [5]. Several studies indicate a negative correlation between adiponectin and insulin resistance, making it a potential therapeutic target for diabetes management [6].

Leptin, another key adipokine, is responsible for regulating energy balance and appetite control. It is secreted in proportion to body fat mass and acts on the hypothalamus to suppress hunger [7]. However, in obesity and T2DM, leptin resistance develops, leading to hyperleptinemia and persistent metabolic dysregulation [8]. High leptin levels are associated with inflammation, endothelial dysfunction, and insulin resistance, making it a potential biomarker for T2DM progression [9].

The adiponectin-leptin ratio is considered an indicator of insulin sensitivity, with lower ratios predicting higher metabolic risk [10]. Understanding the role of adipokines in T2DM could provide insights into potential therapeutic strategies aimed at modulating their levels. This study aims to evaluate serum adiponectin and leptin levels in T2DM patients and analyze their correlations with glucose metabolism and obesity-related markers. The study was designed to evaluate serum adiponectin and leptin levels in patients with Type 2 diabetes mellitus and compare them with healthy controls.

Objectives

1. To assess serum adiponectin and leptin levels in T2DM patients and healthy individuals.

2. To analyze the correlation between adiponectin, leptin, and metabolic parameters such as fasting blood glucose, HbA1c, and BMI.

Materials and Methods

This case-control study was conducted at a tertiary care hospital of ACPM Medical College, Dhule Maharashtra. A total of 100 participants were recruited, including 50 diagnosed T2DM patients and 50 healthy controls. Diagnosis of T2DM was based on ADA 2022 criteria (Fasting Blood Glucose ≥126 mg/dL or HbA1c ≥6.5%). Serum adiponectin and leptin levels were measured using ELISA kits. Other parameters, including FBG, HbA1c, and BMI, were recorded.

Inclusion Criteria

- Adults aged 30–65 years.
- Diagnosed T2DM patients (≥5 years duration).
- Healthy, age- and sex-matched controls.

Exclusion Criteria

- Type 1 diabetes or gestational diabetes.
- Patients on lipid-lowering oranti-inflammatory drugs.
- Individuals with chronic kidney disease, liver disorders, or malignancies.

Observation: The study was conducted over a period of 12 months from January 2024 to January 2025. The participants did not show any statistically significant differences in gender, age or demographic parameters. The levels of adiponectin among groups of patients and controls showed a statistically significant variation. The levels of circulating levels were significantly lower. In contrast the levels of leptin were significantly higher in the diabetic group. (Table 1)

Table 1: Serum Adiponectin and Leptin Levels in T2DM Patients and Controls

Parameter	T2DM Patients (Mean ± SD)	Controls (Mean ± SD)	p-Value
Adiponectin (µg/mL)	3.4 ± 1.2	7.8 ± 2.1	<0.001
Leptin (ng/mL)	19.6 ± 5.3	9.2 ± 3.1	<0.001

The table 2 presents the correlation coefficients (r-values) between two key adipokines, adiponectin and leptin and three important metabolic parameters: fasting blood glucose (FBG), glycated hemoglobin (HbA1c), and body mass index (BMI)**.** The observed correlations offer insights into the distinct physiological roles played by these adipokines in metabolic regulation. Adiponectin demonstrated a moderate negative correlation with all three parameters. Specifically, its levels were inversely related to FBG (r = -0.42), HbA1c (r = -0.48), and BMI (r = -0.35), with statistically significant p-values (< 0.05 for FBG and < 0.01 for HbA1c and BMI). These findings suggest that higher adiponectin levels are associated with better glycemic control and lower body mass, supporting its role as a protective adipokine in metabolic health. Conversely, leptin showed a positive correlation with the same parameters, most notably with BMI (r = 0.51), indicating a stronger association with adiposity. Positive correlations were also observed with FBG (r = 0.36) and HbA1c (r = 0.39), both reaching statistical significance. These findings align with the established understanding of leptin as a hormone whose circulating levels rise in obesity and metabolic dysregulation. Overall, the data reflect contrasting profiles of adiponectin and leptin: while adiponectin appears to confer a beneficial effect on metabolic parameters, leptin levels correlate with worsening metabolic indices. These patterns underscore the potential of adipokines as biomarkers for metabolic risk and targets for therapeutic intervention in disorders such as type 2 diabetes and obesity.

Table 2: Correlation Between Adipokines and Metabolic Parameters

Parameter	Adiponectin (r-value)	Leptin (r-value)	p-Value
FBG (mg/dL)	-0.42	0.36	<0.05
HbA1c (%)	-0.48	0.39	<0.01
BMI (kg/m²)	-0.35	0.51	<0.01

Discussion

This study confirms that adiponectin levels are significantly lower and leptin levels are higher in T2DM patients compared to healthy controls. Low adiponectin levels contribute to insulin resistance, poor glycemic control, and increased cardiovascular risk [11]. Hyperleptinemia, indicative of leptin resistance, further exacerbates metabolic dysfunction in T2DM [12]. The negative correlation between adiponectin and glycemic markers (FBG, HbA1c) suggests that adiponectin deficiency worsens insulin sensitivity [13]. Similarly, the positive correlation of leptin with BMI and insulin resistance aligns with previous studies linking leptin resistance to obesity-induced metabolic dysfunction [14]. Interventions targeting adiponectin enhancement and leptin modulation could help improve insulin sensitivity and metabolic outcomes in T2DM [15].

Conclusion

This study confirms that T2DM patients exhibit lower adiponectin and higher leptin levels, both of which contribute to insulin resistance and metabolic dysregulation. These findings highlight the potential role of adipokines as biomarkers for assessing diabetes risk. Future studies should explore adipokine-targeted therapies for improving glycemic control and metabolic health.

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