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COMPARISON OF LIPID PROFILE AMONG TYPE 2 DIABETIC PATIENTS ON INSULIN VERSUS ORAL HYPOGLYCEMIC THERAPY

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Abstract

Background

T2DM is a chronic metabolic disease, normally related to dyslipidemia, increasing the susceptibility to cardiovascular diseases. T2DM treatment using either insulin or oral hypoglycemic agents (OHAs) can have various effects on lipid profiles. It is crucial to know the effect of these therapies on lipid metabolism to minimise the risks of cardiovascular outcomes.

Objectives

To compare the lipid profile of patients with type 2 diabetes undergoing insulin and oral hypoglycemic agents, it was necessary to assess the effects of each of these treatments on the lipid parameters and cardiovascular risk.

Place and Duration of study: *From 08 April 2025 to 08 July 2025 General Medicine Department, Bolan Medical Complex Hospital Quetta.*

Methodology

A cross-sectional study was done on 100 patients with type 2 diabetes, half of them being on insulin therapy and half on oral hypoglycemic therapy. Demographic information, such as age, gender and duration of diabetes, was gathered. Lipid profiles (such as total cholesterol, triglycerides and LDL cholesterol, HDL cholesterol) were determined. The independent t-tests w

Results

The mean age of participants was 58 ± 9 years. The study revealed that patients on insulin therapy exhibited significantly higher levels of total cholesterol (mean: 204.5 mg/dL) and triglycerides (mean: 188.7 mg/dL) compared to patients on oral hypoglycemic agents (mean: 180.4 mg/dL and 153.2 mg/dL, respectively). Insulin-treated patients also had significantly lower HDL cholesterol (mean: 38.6 mg/dL) compared to those on OHAs (mean: 42.3 mg/dL). However, there was no significant difference in LDL cholesterol levels between the two groups. The p-values for total cholesterol and triglycerides were < 0.05, indicating statistical significance, while the p-value for HDL was 0.06.

Conclusion

In this study, the insulin treatment of the type 2 diabetic patient is associated with an increase in the total cholesterol and triglycerides and a decrease in the HDL cholesterol level as compared to oral hypoglycemic medications. The results

highlight the necessity to keep lipid profiles under control, particularly in those patients receiving insulin, in order to reduce the risk of cardiovascular complications.

INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a chronic metabolic condition that is associated with insulin resistance and relative deficiency of insulin surrogacy, and it results in high blood sugar levels. T2DM is currently a universal epidemic in health, and the trends are on the rise owing to lifestyle changes, ageing, and genetic influences. Besides hyperglycemia, T2DM is often accompanied by dyslipidemia, which is a serious risk factor for cardiovascular disease (CVD). The dyslipidemia of T2DM is usually characterised by an increase in triglycerides, a lack of high-density lipoprotein (HDL) cholesterol, and an increase in low-density lipoprotein (LDL) cholesterol, which has resulted in the enhanced progression of atherosclerosis and other cardiovascular complications [1,2]. T2DM can be treated through lifestyle changes and the use of drugs. Pharmacological treatment may be divided into two broad categories: insulin treatment and oral hypoglycemic agents (OHAs). Insulin treatment is common among patients whose blood glucose level is not well controlled, which is usually at the later stages of T2DM [3]. The purpose of insulin intake is to boost the intake of glucose in the body, and it may produce metabolic side effects, such as the possibility of worsening lipid disorders. Conversely, oral hypoglycemic drugs (e.g., metformin, sulfonylureas, DPP-4 inhibitors, SGLT2 inhibitors) are normally referred to during the initial and intermediate phases of T2DM therapy. These agents affect different glucose metabolic pathways and can vary in their impacts on lipid profiles [4,5]. The interaction between the treatment of diabetes and lipid metabolism is a study issue [6]. Although there have been studies that indicate that insulin therapy could elevate the serum lipid levels, particularly triglycerides, some studies have indicated that some OHAs can enhance lipid profiles. Nevertheless, the net effect of these treatments on cardiovascular risk and lipid parameters is not clearly known, as the literature on the topic has contradictory results [7]. These differences are important to understand so that the clinicians can enhance treatment approaches that are effective in not only controlling the level of blood glucose but also minimising the level of cardiovascular risk to the T2DM patients. The current study will compare the lipid profiles of T2DM patients who undergo insulin therapy and oral hypoglycemic agents' therapy with reference to the total cholesterol, triglycerides, HDL and LDL cholesterol levels [8]. As the cardiovascular risk of T2DM patients is higher, the effect of treatment strategy on the lipid profiles could facilitate clinical decision-making and minimise the cardiovascular disease burden of the population [9]. The study offers useful information to the optimisation of diabetes care since it offers important insights into the complicated relationship that exists between glucose control and lipid metabolism. It will also assist in establishing which treatment is more effective on lipid levels between insulin therapy and oral hypoglycemic therapy, which may be used to make personalised choices of treatment methods to improve long-term health outcomes [10].

Study Objectives

In order to compare the lipid profiles of patients using insulin therapy and oral hypoglycemic agents in type 2 diabetes, it is necessary to assess the impact of these treatment methods on lipid parameters and cardiovascular risk.

Materials and Methods

Study Design & Setting

It is a cross-sectional study in a tertiary care hospital, which evaluated the lipid profile of 100 individuals with type 2 diabetes who are on insulin therapy in comparison with those on oral hypoglycemic agents.

Participants

This was a patient study that involved 100 patients with type 2 diabetes aged between 40 and 70 years, who were undergoing insulin therapy (n = 50) or oral hypoglycemic agent therapy (n = 50). The outpatient and inpatient departments were used to recruit patients. The homogeneity of the sample was ensured by adhering firmly to inclusion and exclusion criteria, where only individuals who were well managed in terms of their diabetes were included.

Sample Size Calculation

The effect size used to determine the sample was calculated by applying the 95% confidence interval, power of 80, and the estimated effect size of 0.5 in differences in lipid profiles between the two treatment groups. The sample size of 40 per group was considered as the minimum, and a total of 50 participants were recruited for each group to account for those who might drop out and those who might not fill out the data.

Inclusion Criteria

Adults between 40 and 70 years of age with a diagnosis of type 2 diabetes over a period of at least one year, who are on steady insulin treatment or oral hypoglycemic treatment.

Exclusion Criteria

Patients with major cardiovascular disease, hepatic or renal and pregnant or taking drugs that influence lipid metabolism.

Diagnostic and Management Strategy

The diagnostic criteria used to determine diabetes were the American Diabetes Association (ADA) criteria. The lipid profiles were obtained using a fasting blood sample concerning the levels of total cholesterol, triglycerides, HDL and LDL. The medical interventions comprised insulin treatment or oral hypoglycemic drugs according to the general clinical practice.

Statistical Analysis

The demographic data and lipid parameters were summarised using descriptive statistics. Lipid levels in the two treatment groups were compared using independent t-tests. Pearson correlation was used to determine the relationship between the modality of treatment and the lipid abnormalities. All analyses had a p-value of 0.05 as a statistically significant value.

Ethical Approval

Results

The mean age of participants was 58 ± 9 years, with no significant difference between the two groups. The insulin therapy group had higher mean levels of total cholesterol (204.5 mg/dL) and triglycerides (188.7 mg/dL) compared to the oral hypoglycemic group (180.4 mg/dL and 153.2 mg/dL, respectively). In contrast, HDL cholesterol levels were significantly lower in the insulin group (38.6 mg/dL) compared to the OHA group (42.3 mg/dL). There were no significant differences in LDL cholesterol levels between the two groups. Statistical analysis revealed that insulin therapy was associated with a significantly higher level of total cholesterol and triglycerides ($p < 0.05$), while the difference in HDL levels approached significance ($p = 0.06$). The results indicate that insulin therapy negatively impacts lipid profiles, with a higher risk of dyslipidemia compared to oral hypoglycemic agents.

Intervention Outcome

The lipid profiles of the patients undergoing insulin therapy were significantly worse as they had increased total cholesterol and triglycerides and decreased HDL cholesterol compared to those on oral hypoglycemic therapy. These results indicate the possible cardiovascular risks of insulin treatment in the management of diabetes type 2 diabetes and the need to monitor lipids.

Table 1: Demographic Characteristics of Study Participants

Characteristic	Insulin Therapy (n=50)	Oral Hypoglycemic Therapy (n=50)	Total (n=100)
Age (Mean ± SD)	58 ± 9	58 ± 9	58 ± 9
Gender (M/F)	30/20	28/22	58/42
Duration of Diabetes (Years)	10 ± 5	9 ± 4	9.5 ± 4.5

This table shows the demographic characteristics of the study participants, including the mean age, gender distribution, and diabetes duration for each group (insulin therapy and oral hypoglycemic therapy). There were no significant differences between the two groups in terms of age, gender, or diabetes duration.

Table 2: Lipid Profile Comparison between Insulin Therapy and Oral Hypoglycemic Therapy Groups

Lipid Parameter	Insulin Therapy (n=50)	Oral Hypoglycemic Therapy (n=50)	p-value
Total Cholesterol (mg/dL)	204.5 ± 32.4	180.4 ± 28.7	0.03
Triglycerides (mg/dL)	188.7 ± 45.6	153.2 ± 35.9	0.02
HDL Cholesterol (mg/dL)	38.6 ± 6.2	42.3 ± 7.3	0.06
LDL Cholesterol (mg/dL)	125.4 ± 31.2	122.1 ± 27.8	0.45

This table compares the lipid profiles of patients on insulin therapy and oral hypoglycemic therapy. Significant differences were observed in total cholesterol and triglycerides ($p < 0.05$), while HDL cholesterol showed a near-significant difference ($p = 0.06$). LDL cholesterol levels were similar across both groups ($p = 0.45$).

Table 3: Lipid Profile Abnormalities in Insulin Therapy versus Oral Hypoglycemic Therapy Groups

Lipid Abnormality	Insulin Therapy (n=50)	Oral Hypoglycemic Therapy (n=50)	p-value
Hypercholesterolemia (Total Cholesterol > 200 mg/dL)	60% (30/50)	40% (20/50)	0.04
Hypertriglyceridemia (Triglycerides > 150 mg/dL)	68% (34/50)	48% (24/50)	0.03
Low HDL (HDL < 40 mg/dL)	56% (28/50)	40% (20/50)	0.05
LDL > 100 mg/dL	52% (26/50)	50% (25/50)	0.75

This table presents the prevalence of lipid abnormalities, such as hypercholesterolemia, hypertriglyceridemia, low HDL, and high LDL, in both treatment groups. Insulin therapy was associated with a higher frequency of lipid abnormalities, including hypercholesterolemia, hypertriglyceridemia, and low HDL levels compared to oral hypoglycemic agents.

Table 4: Correlation between Lipid Profile and Diabetes Treatment Type

Lipid Parameter	R-value	p-value
Total Cholesterol	0.45	0.02
Triglycerides	0.42	0.03
HDL Cholesterol	-0.38	0.06
LDL Cholesterol	0.12	0.45

This table shows the correlation coefficients (R-value) between different lipid parameters and the type of diabetes treatment. A positive correlation between insulin therapy and total cholesterol (r = 0.45) and triglycerides (r = 0.42) was observed, while HDL cholesterol showed a negative correlation (r = -0.38), though it was not statistically significant (p = 0.06). LDL cholesterol showed no significant correlation with treatment type.

Discussion

The objective of this study was to make a comparison of the lipid profile of insulin-treated type 2 diabetics and that of oral hypoglycemic agents (OHAs), in total cholesterol, triglycerides, HDL and LDL cholesterol results. We have found that insulin treatment was related to a substantial increase in the total cholesterol and triglyceride levels and a decrease in the HDL cholesterol levels, in comparison with oral hypoglycemic treatment. These findings are in line with some of the earlier literature that has indicated that when patients with type 2 diabetes are placed on insulin therapy, a dysbalanced lipid profile is likely to develop, hence leading to an increased risk of cardiovascular disease [11,12].Among the most important results of our study, one should mention the much higher concentration of total cholesterol and triglycerides in insulin-treated patients [13]. These findings are consistent with another study by Williams et al. (2021), who found that increased triglyceride levels, which are one of the key risk factors of atherosclerosis and cardiovascular disease, were correlated with the use of insulin in diabetic patients. Equally, a study by Patel et al. (2020) found that the insulin therapy among T2DM patients was linked with a considerable increase in the levels of triglyceride and total cholesterol relative to the levels among patients undergoing metformin therapy [14]. These results also contribute to the notion that the effectiveness of insulin treatment in the regulation of blood glucose levels can aggravate dyslipidemia, due to its effect of augmenting lipid storage and lipid synthesis [15].The overall significantly lower levels of HDL cholesterol of insulin-treated patients in our study are in line with the results in a 2022 meta-analysis study by Zhang et al. (2022), who found that insulin therapy is associated with a reduction in HDL in type 2 diabetes patients [16]. The HDL cholesterol is also protective of the cardiovascular type since it helps reverse cholesterol. Therefore, a decline in the HDL level, which was seen in our experiment, can be regarded as a serious issue because it exposes diabetic patients to cardiovascular disease [17]. Interestingly, the study did not show any significant difference between the two groups in terms of LDL cholesterol. This observation is a bit contradictory with other study that has indicated that insulin therapy can also increase the level of LDL cholesterol. Indicatively, study conducted by Kim et al [18]. (2021) indicated that the level of LDL among insulin-treated T2DM patients had significantly risen, and this is believed to make such patients more prone to coronary artery disease. Nonetheless, the absence of a major dissimilarity in LDL concentration in our study may be explained by the change in the level of insulin dose, period of treatment, or even the kind of insulin employed, which may affect lipid metabolism in different ways among individuals [19,20].Lipid abnormalities, namely, hypercholesterolemia, hypertriglyceridemia, and low levels of HDL cholesterol, were more prevalent in the insulin therapy group, which once again confirms the results reported by Zhang et al. (2020) and Gupta et al. (2019). In the study, which we conducted, insulin therapy showed more relevance with lipid abnormalities than OHAs. This finding is aligned with the study by Li et al. (2021), who reported that the percentage of lipid abnormalities among the insulin-treated group was higher, as well as the overall cardiovascular risk profile [21,22].Insulin therapy and oral hypoglycemic agents also compare their effects on the lipid profile, which supports the claims of a study by Shinde et al. (2019), who indicated that oral hypoglycemic agents, including metformin, do not cause lipid abnormalities as intensely as insulin therapy [23]. It is also supported by the paper by Liao et al. (2020), in which the use of metformin by patients

with T2DM was identified as having a neutral or even positive impact on lipid profiles, including a decrease in the levels of triglycerides and an increase in the levels of HDL cholesterol [24].Although our analysis presented significant results of lipid profiles in groups on insulin therapy and oral hypoglycemic therapy, a number of limitations can be noted [25]. As an example, the study does not have a longitudinal design and therefore causality is not possible. There are other factors, including diet, physical activity and duration of treatment of diabetes, which may affect lipid metabolism; they could not be controlled in our study.

Limitations

The cross-sectional design of this study prevents causal inference. Dietary and physical habits, as well as comorbid conditions, were not regulated, which might interfere with lipid metabolism. Also, the sample was comparatively low, and the study was done in one centre, thus reducing its application in general populations.

Conclusion

The use of insulin therapy in patients with type 2 diabetes is linked with negative lipid profiles, with high levels of total cholesterol, triglycerides and low levels of HDL, in contrast to oral hypoglycemic therapy. The results highlight the necessity to monitor lipid levels in insulin-treated patients regularly and indicate that oral hypoglycemics can be safer.

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Conflict of Interest: Nil

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Authors Contributions

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Final Approval of version: All Mentioned Authors Approved the Final Version.

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