

Impact of Statin Therapy on Lipid Profile and Glycemic Control in Patients with Type 2 Diabetes Mellitus

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Abstract

Background: Type 2 diabetes mellitus is strongly associated with atherogenic dyslipidemia and increased cardiovascular risk. Statins remain the cornerstone pharmacological therapy for lipid control and prevention of cardiovascular events, but their influence on glucose metabolism requires careful interpretation in diabetic patients.

Objective: To evaluate the effect of statin therapy on triglycerides, cholesterol, and blood glucose levels in patients with type 2 diabetes mellitus.

Methods: This prospective clinical study involved 70 subjects with type 2 diabetes mellitus. The principal biochemical domains assessed were triglycerides, cholesterol, and blood glucose levels in relation to statin therapy. The interpretation focused on lipid response, glycemic response, and the clinical balance between cardiovascular protection and metabolic monitoring.

Results: The study framework demonstrated the expected pharmacological benefit of statin therapy on lipid parameters, particularly cholesterol control, while also emphasizing the need for parallel glycemic surveillance. The overall interpretation is that statins provide essential cardiovascular protection in diabetes, but require monitoring of blood glucose because of their potential diabetogenic tendency.

Conclusion: The dissertation concludes that statin therapy significantly improves lipid parameters in patients with type 2 diabetes mellitus, supporting its role in cardiovascular risk reduction. However, its possible effect on glycemic control highlights the need for regular monitoring and individualized treatment.

Keywords: Type 2 diabetes mellitus; Statin therapy; Triglycerides; Cholesterol; Blood glucose; Diabetic dyslipidemia; Cardiovascular risk.

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Introduction

Type 2 diabetes mellitus (T2DM) constitutes a metabolic syndrome of epidemic proportions, fundamentally defined by a triad of peripheral insulin resistance, impaired pancreatic β -cell secretory capacity, and chronic hyperglycemia. [1] A critical hallmark of T2DM is "diabetic dyslipidemia," a pro-atherogenic profile characterized by elevated triglycerides (TG), reduced high-density lipoprotein cholesterol (HDL-C), and a predominance of small, dense low-density lipoprotein (sdLDL) particles. [1] Statin therapy, acting via competitive inhibition of 3-hydroxy-3-methylglutaryl-coenzyme A (HMG-

CoA) reductase, serves as the pharmacological cornerstone for cardiovascular risk reduction in this population. [2] The clinical importance of lipid management in T2DM arises from the fact that cardiovascular disease is one of the most frequent and serious long-term complications of diabetes. Hyperglycemia, insulin resistance, endothelial dysfunction, inflammation, and abnormal lipoprotein metabolism act together to accelerate atherosclerosis. Therefore, lipid-lowering therapy in diabetes is not merely a biochemical intervention but a preventive cardiovascular strategy aimed at reducing morbidity and mortality. Diabetic

dyslipidemia is metabolically distinct from simple hypercholesterolemia. It often presents with increased triglyceride-rich lipoproteins, reduced HDL-C, raised non-HDL cholesterol, and altered LDL particle quality. Although low-density lipoprotein cholesterol (LDL-C) may not always appear markedly elevated, the predominance of small dense LDL particles increases atherogenic potential. This pattern justifies early pharmacological attention, particularly among patients with additional cardiovascular risk factors. Statins are widely used because they reduce hepatic cholesterol synthesis, upregulate LDL receptor activity, and lower circulating atherogenic cholesterol. Beyond lipid lowering, statins may also exert pleiotropic effects related to endothelial function, plaque stabilization, inflammation, and oxidative stress. These benefits are especially relevant in T2DM, where vascular risk is driven by multiple interacting metabolic and inflammatory mechanisms. [3]

Despite their strong cardiovascular benefit, statins have attracted clinical attention because several studies have reported a small but measurable association between statin use and deterioration of glycemic indices or incident diabetes. In patients who already have T2DM, the issue is not whether statins should be avoided, but how lipid benefit and glycemic monitoring should be balanced. This creates the central pharmacological trade-off that the present dissertation addresses: statins are cardioprotective, yet they require awareness of metabolic consequences.

The current research problem is therefore clinically relevant to routine pharmacology and medicine practice. Patients with T2DM frequently receive long-term statin therapy, and clinicians regularly monitor lipid profile and blood glucose values.

Evidence generated from local clinical settings helps clarify how biochemical outcomes are reflected in actual patient populations and supports rational therapeutic decision-making.

Aim and Objectives

Aim: To evaluate the effect of statin therapy on triglycerides, cholesterol, and blood glucose levels in patients with type 2 diabetes mellitus.

- To assess the effect of statin therapy on lipid parameters, especially triglycerides and cholesterol, in patients with T2DM.
- To examine the effect of statin therapy on blood glucose levels and interpret its clinical significance in diabetic metabolic management.

Materials and Methods

This prospective clinical study was conducted among 70 subjects with type 2 diabetes mellitus receiving statin therapy. The study design focused on biochemical evaluation of lipid and glycemic parameters. The key outcome domains were triglycerides, cholesterol, and blood glucose levels. Citations are arranged in Vancouver style with superscript in-text numbering in chronological order.

The study population consisted of patients diagnosed with T2DM who were considered for statin therapy according to clinical need. Patients were evaluated for relevant biochemical parameters and therapeutic response. Data interpretation emphasized the clinical meaning of lipid reduction as well as the importance of monitoring blood glucose during therapy. The central pharmacological question was whether the cardiovascular advantages of statins remain dominant despite possible glycemic effects. The principal variables included serum triglycerides, cholesterol-related measures, and blood glucose values. Triglycerides and cholesterol represented lipid-related outcomes, while blood glucose represented the glycemic outcome. Descriptive interpretation was used to present the metabolic direction of effect. The clinical discussion was framed around the dual impact of statin therapy in diabetic patients: lipid benefit and glycemic caution. Standard clinical and ethical principles were applicable to the study. Patient confidentiality, clinical record privacy, and institutional academic requirements were maintained. Since the study involved routine biochemical parameters, the research emphasis remained observational and analytical rather than interventional beyond standard therapeutic practice.

Table 1. Manuscript summary of study design and principal variables.

Item	Description
Study title	Effect of Statin Therapy on Triglycerides, Cholesterol, and Blood Glucose Levels in Patients with Type 2 Diabetes Mellitus
Study type	Prospective clinical study
Sample size	70 subjects
Study population	Patients with type 2 diabetes mellitus receiving statin therapy
Primary biochemical domain	Triglycerides and cholesterol-related lipid parameters
Secondary biochemical domain	Blood glucose levels
Core pharmacological issue	Cardiovascular risk reduction balanced against glycemic monitoring

Results

The prospective analysis involved 70 subjects with T2DM. The results were interpreted across two major biochemical domains: lipid response and glycemic response.

The lipid response domain focused on triglycerides and cholesterol, while the glycemic response domain focused on blood glucose levels. The central finding pattern supports the clinical role of

statin therapy as an effective lipid-lowering strategy in diabetic patients while requiring careful blood glucose monitoring. The following two consolidated tables combine the most important result tables from the thesis.

Table 1 merges the biochemical outcome tables for glycemic and lipid changes, while Table 2 merges the key risk-association and predictor tables for worsening glycemia.

Table 2: Combined biochemical outcomes before and after 3 months of statin therapy

Domain	Parameter	Baseline Mean ± SD	3 Months Mean ± SD	Mean Difference / % Change	t-statistic	p-value
Glycemic profile	FPG (mg/dL)	133.37 ± 16.48	148.12 ± 18.25	+14.75 mg/dL	5.12	< 0.001*
Glycemic profile	PPG (mg/dL)	199.14 ± 35.42	212.45 ± 32.78	+13.31 mg/dL	4.88	< 0.001*
Glycemic profile	HbA1c (%)	6.97 ± 0.95	7.34 ± 1.02	+0.37%	6.45	< 0.001*
Lipid profile	Total cholesterol (mg/dL)	208.45 ± 28.51	165.23 ± 25.08	-20.73%	12.34	< 0.001*
Lipid profile	Triglycerides (TG) (mg/dL)	248.12 ± 165.40	202.45 ± 145.20	-18.41%	8.12	< 0.001*
Lipid profile	LDL cholesterol (mg/dL)	118.54 ± 22.42	82.34 ± 19.78	-30.54%	14.56	< 0.001*
Lipid profile	HDL cholesterol (mg/dL)	44.12 ± 10.18	41.87 ± 9.42	-5.10%	2.14	0.036 [#]

Interpretation: Statin therapy produced a clear lipid-lowering effect, particularly for LDL cholesterol and triglycerides. At the same time, fasting plasma glucose, postprandial plasma glucose and HbA1c increased significantly, showing the need for glycemic monitoring during treatment. *Significant increase[#]Mild significant reduction

Table 3: Combined glycemic-worsening risk profile by dose, frequency and regression predictors

Panel / Factor	Group or predictor	Worsening glycemia: Yes	Worsening glycemia: No	Total or OR (95% CI)	Statistic	p-value
A. Dose association	10 mg dose	18 (46.2%)	21 (53.8%)	Total = 39	$\chi^2 = 4.32$	0.037
A. Dose association	20 mg dose	22 (71.0%)	9 (29.0%)	Total = 31	$\chi^2 = 4.32$	0.037
A. Dose association	Overall	40 (57.1%)	30 (42.9%)	Total = 70	-	-
B. Dosage frequency	Once daily	34	28	Total = 62; worsening = 54.8%	-	-
B. Dosage frequency	Twice daily	6	2	Total = 8; worsening = 75.0%	-	-
B. Dosage frequency	Overall	40	30	Total = 70; worsening = 57.1%	-	-
C. Logistic regression	Dose: 20 mg vs 10 mg	-	-	OR = 2.85 (1.12-7.24)	-	0.028
C. Logistic regression	Altered baseline glycemic control	-	-	OR = 4.92 (1.76-13.78)	-	0.002
C. Logistic regression	BMI per unit	-	-	OR = 1.18 (1.02-1.36)	-	0.025
C. Logistic regression	Statin type: Atorvastatin	-	-	OR = 1.65 (0.62-4.41)	-	0.315

Interpretation: The merged risk table shows that the 20 mg dose had a higher glycemic-worsening rate than the 10 mg dose, and twice-daily dosing showed a higher worsening trend than once-daily dosing. Logistic regression further confirmed altered baseline glycemic control, higher statin dose and BMI as significant predictors of glycemic worsening.

In relation to triglycerides, statin therapy was pharmacologically relevant because triglyceride elevation is a key component of diabetic dyslipidemia. Improvement in triglyceride control contributes to reduction of atherogenic remnant particles and overall cardiometabolic risk. In relation to cholesterol, statin therapy remains the

strongest evidence-based pharmacological class for reducing atherogenic cholesterol burden and preventing major vascular events in high-risk populations such as patients with diabetes. [4] In relation to blood glucose, the interpretation was more cautious. Statin therapy is associated in the literature with a small increase in diabetes risk and may influence glycemic parameters in susceptible individuals. [5]

In patients already diagnosed with T2DM, this does not outweigh the cardiovascular benefits of statin therapy, but it makes glycemic follow-up important. Thus, the result pattern supports continuation of statin therapy with regular monitoring rather than therapeutic avoidance.

Table 4: Outcome domains used for interpretation of statin effect.

Outcome domain	Parameter	Clinical interpretation
Lipid profile	Triglycerides	Reduction or improved control indicates favorable effect on diabetic dyslipidemia and atherogenic remnant burden.
Lipid profile	Cholesterol	Improved cholesterol control supports cardiovascular risk reduction in T2DM.
Glycemic profile	Blood glucose	Requires monitoring because statins may show mild diabetogenic or glycemic effects in susceptible patients.

Discussion

The findings of this dissertation should be understood through the concept of pharmacological balance. In patients with T2DM, statins are not optional supportive drugs; they are central agents for preventing cardiovascular events. Diabetes itself creates a high-risk vascular environment. When this environment is combined with diabetic dyslipidemia, the probability of macrovascular complications increases substantially. Therefore, lipid-lowering therapy has direct implications for survival, morbidity, hospitalization, and long-term health-care burden.

The improvement in cholesterol-related parameters is consistent with the mechanism of statins. By inhibiting HMG-CoA reductase, statins reduce hepatic cholesterol synthesis, enhance LDL receptor-mediated clearance, and reduce circulating atherogenic lipoproteins. This mechanism explains why statins are the preferred drug class for cardiovascular risk reduction. In diabetes, the target is not only lowering a laboratory number but reducing atherosclerotic progression.

The triglyceride component is also important. Although statins are primarily recognized for LDL-C lowering, they may reduce triglycerides to varying degrees, especially when baseline triglyceride levels are elevated. In diabetic dyslipidemia, triglycerides contribute to the formation of small dense LDL particles and are associated with remnant lipoproteins. Therefore, any favorable effect on triglycerides adds to the overall anti-atherogenic impact of therapy.

The glycemic effect of statins forms the second side of the clinical argument. Evidence has shown that statin therapy can be associated with incident diabetes, particularly with intensive-dose therapy in high-risk individuals. [6] However, this risk must be interpreted against the much larger reduction in cardiovascular events achieved through statin therapy. For a patient with T2DM, the appropriate response is not discontinuation of statin therapy but better glycemic follow-up, lifestyle reinforcement, and individualized therapeutic review.

This is why the dissertation conclusion describes statin therapy as a "dual-edged sword." The expression does not imply that statins are harmful in diabetes. Rather, it highlights that the same therapy that provides strong vascular protection may require additional metabolic vigilance. A balanced pharmacological approach recognizes benefit, monitors risk, and avoids simplistic interpretation. The clinician must protect the patient from cardiovascular disease while also preventing deterioration of glycemic control.

The study also supports the importance of patient education. Patients with T2DM should understand why statins are prescribed even when they do not feel symptoms of dyslipidemia. They should also be informed that blood glucose monitoring remains necessary.

Explaining this balance improves adherence and reduces confusion when patients hear that statins may affect glucose values. Proper counseling can prevent unnecessary discontinuation and improve long-term compliance. The clinical relevance of

this study lies in its routine applicability. In tertiary care and outpatient settings, physicians frequently encounter diabetic patients with dyslipidemia. The study reinforces the need for baseline lipid and glucose evaluation, periodic monitoring, and individualized interpretation.

International evidence also supports that the cardiovascular benefit of statin therapy generally outweighs the glycemic risk when used appropriately in high-risk patients. [7]

Table 3: Clinical interpretation of the pharmacological trade-off.

Therapeutic aspect	Benefit	Clinical caution
Cholesterol lowering	Reduces atherogenic cholesterol burden and cardiovascular risk.	Monitor adherence, liver enzymes where clinically indicated, and lipid response.
Triglyceride control	Improves diabetic dyslipidemia pattern and may reduce remnant-related risk.	Persistent hypertriglyceridemia may need lifestyle correction or additional therapy.
Blood glucose effect	Does not negate statin benefit in high-risk diabetic patients.	Periodic fasting/post-prandial glucose or HbA1c monitoring is required.
Long-term management	Supports prevention of vascular complications.	Requires individualized dose, patient counseling, and follow-up.

Clinical Implications: The study supports continued use of statin therapy in patients with T2DM when indicated for cardiovascular risk reduction. It also supports routine monitoring of lipid profile and glucose parameters. The most practical clinical implication is that lipid control and glucose control should be treated as parallel goals rather than competing goals. A patient receiving statin therapy should not be monitored only for cholesterol response; blood glucose monitoring should also be integrated into follow-up.

For pharmacology practice, the study reinforces rational drug use. Statins should be prescribed with clear indication, appropriate dose selection, awareness of adverse effects, and continued biochemical review. For diabetic care, the study emphasizes that cardiovascular prevention is a core part of metabolic management, not a separate specialty concern. Current diabetes standards also recommend comprehensive cardiovascular risk management as part of diabetes care. [8]

Limitations

The study is limited by its single-centre design and sample size of 70 subjects. Long-term cardiovascular outcomes were not directly assessed, and interpretation was focused on biochemical parameters rather than clinical endpoints such as myocardial infarction, stroke, hospitalization, or mortality.

Further multicentre studies with longer follow-up may provide stronger evidence regarding lipid benefit and glycemic effects of different statin intensities in diabetic patients.

Conclusion

The dissertation entitled "Effect of Statin Therapy on Triglycerides, Cholesterol, and Blood Glucose Levels in Patients with Type 2 Diabetes Mellitus" concludes that while statin therapy remains the

cornerstone of cardiovascular risk reduction, it functions as a "dual-edged sword" in the metabolic management of diabetic patients. This prospective study of 70 subjects successfully navigated its primary and secondary objectives, providing a comprehensive analysis of the pharmacological trade-offs inherent in modern dyslipidemia management.

Overall, statin therapy should be understood as a highly valuable cardioprotective intervention in T2DM. Its favorable effect on lipid parameters supports its continued clinical use, while its possible glycemic influence demands monitoring rather than avoidance. The rational conclusion is that statin therapy should be individualized, monitored, and integrated into comprehensive diabetes care.

Declarations

Ethical approval: The study was approved by the Institutional Human Ethics Committee (IHEC), Hind Institute of Medical Sciences, Safedabad, Barabanki (UID # HIMS/IHEC/65-2025/Faculty/Dr. Ankit Kumar Singh).

Consent: Written informed consent should be reported as obtained from participants as per the thesis protocol.

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