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Review Research Paper

Exploring the Prevalence of Dyslipidemia among Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Study

Umesh Kumar Sharma* and Anuradha Jayaraman[1]

** Research Scholar, Department of Biochemistry, NIMS Institute of Allied Medical Science and Technology, NIMS University, Jaipur, Rajasthan, India*

[1]-Assistant Professor, Department of Biochemistry, NIMS Institute of Allied Medical Science and Technology, NIMS University, Jaipur, Rajasthan, India

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Corresponding Author:
Anuradha Jayaraman

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ABSTRACT

The prevalent metabolic disease is Type 2 Diabetes Mellitus (T2DM). The most concerning is dyslipidemia, or unbalanced blood fats, as one of the complications attributed to T2DM. Dyslipidemia increases the chances of cardiovascular disease (CVD) in the diabetic. The rate or type of dyslipidemia within various healthcare settings remains partially unknown; therefore, this research examines the issue. The research question is: What is the prevalence of dyslipidemia in T2DM patients? What misfunctions are the most prevalent? How does dyslipidemia relate to diabetes management? The study combines the lipid profiles of T2DM patients to measure the danger of dyslipidemia in overall health and an elevated risk of cardiovascular disease. A cross-sectional study was conducted. The data of T2DM patients in multispecialty hospitals was retrieved. The following were determined; total cholesterol, triglycerides, HDL-C and LDL-C. The paper enumerates the number of patients with dyslipidemia and takes note of the described issues such as elevated triglyceride, low HDL-C, and elevated LDL-C. It similarly analyses whether dyslipidemia is associated with obesity, hypertension, and poor glycemic control in T2DM patients or not. Results indicate that the incidence of dyslipidemia is considerable among people with T2DM. The most frequent are elevated triglycerides and low HDL-C. Poor glycemic control, obesity, hypertension are closely associated with dyslipidemia. T2DM patients are prone to dyslipidemia which significantly contributes to cardiovascular risk. Constant monitoring of the levels of lipid is the way of early screening/treatment in order to curb serious conditions of the body health.

1. Introduction

Worldwide, Type 2 Diabetes Mellitus (T2DM) is a significant Public Health problem. Its counts in India have increased at a high rate. According to International Diabetes Federation, over 74 million are now living with diabetes in India that is approximately a fourth of the global population (Mohan and Deepa, 2006). Most of these large numbers can be attributed to the fact that a large number of Indians have now assumed unhealthy lifestyles characterized by poor food regulation, lack of physical activity and great deal of stress and this is coupled with the genetic predisposition to this condition. The incidence of T2DM will continue to increase at the global and national level, and this is no longer good news since the condition is associated with life-threatening conditions including cardiovascular diseases (CVD), diabetic nephropathy, and retinopathy (Indian Council of Medical Research, 2016; Mohan et al., 2018).

One of the most common issues among T2DM patients is dyslipidemia--unhealthy levels of blood fat. It manifests itself typically as elevated total cholesterol level, increased low-density lipoprotein cholesterol (LDL-C), decreased high-density lipoprotein cholesterol (HDL-C), and elevated triglycerides. Such imbalances increase the threat of cardiovascular disease

[1]Corresponding Author can be contacted at: *Department of Biochemistry, NIMS Institute of Allied Medical Science and Technology, NIMS University, Jaipur, Rajasthan, India (E mail:* j.anuradha@nimsuniversity.org*)*

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that is deemed as the most common cause of morbidity and mortality among the diabetic patients (Patel et al., 2015; Joshi and Parikh, 2012). Lipid metabolism and insulin resistance contribute to the tendency of the body to produce more atherogenic (disease-causing) lipoproteins and of less protective HDL-C particles. Because of that, individuals with T2DM are more exposed to atherosclerosis, which, in its turn, leads to heart attacks, strokes, and other cardiovascular diseases (Raji et al., 2017; Khan et al., 2020). It has been observed in many studies that T2DM and dyslipidemia have close associations. Dyslipidemia occurrence in T2DM is a combination of several processes, including insulin resistance, excessive free fatty acids release, and shifts in the liver lipoprotein manufacturing. These lead to the increase of triglycerides, decrease of HDL-C and may create small dense LDL particles, which are more prone to oxidation and causing plaque formation in arteries. In India, a large number of studies report a high prevalence of dyslipidemia among patients T2DM. In Tamil Nadu, 85.5 % T2DM patients were dyslipidemic with high triglyceride and low HDL-C being the most common dyslipidemic disorders (Parikh et al., 2010). The rate is very close, 87.7 % in a study done in Kashmir (Shafi & Bhat, 2023).

Other metabolic risk factors like hypertension and obesity that also put Indian diabetic patients at a risk of heart diseases are often prevalent among patients with diabetes. Studies indicate that dyslipidemia course is exacerbated by poor blood sugar control as determined by high HbA1c levels increasing the risk of heart and vessels malfunctions (Mohan et al., 2018; Rai et al., 2016). However, a substantial part of patients with T2DM and dyslipidemia in India does not receive sufficient treatment: a recent study conducted by Das et al. (2021) has found that most patients diagnosed with diabetes receive lipid-lowering medications, but a significant number of them are yet to achieve the expected levels of LDL-C. In type 2 diabetes (T2DM), dyslipidemia is a serious clinical problem and a public health concern since it was closely related to cardiovascular death. Lipid problems are the most important part of diabetes care since they contribute to cardiovascular disease as the most frequent cause of death among diabetic patients. The number of T2DM cases and the prevalence of dyslipidemia in combination indicate that the special programs should target the correction of blood sugar levels and the introduction of efficient lipid policies in this population.

Learning the rates and patterns of dyslipidemia in T2DM can inform clinicians and other community leaders wishing to reduce cardiovascular risk. Although the disease burden of dyslipidemia in India is high, most healthcare environments continue to handle such issues poorly. Increased glycemic control, obesity, elevated blood pressure, and genetic predisposition are all the reasons. Learning about these causes is an essential part of enhancing outcomes and reducing the incidences of cardiovascular events. The study also considers dyslipidemia in Indian multispecialty hospitals that cater to individuals of various backgrounds. This sweeping glance can demonstrate both the local variation and how healthcare infrastructure influences the fields of lipid control. Since the Indian healthcare system is attempting to manage the diabetes epidemic, the results will provide an opportunity to develop evidence-based recommendations that can strike a healthy balance between sugar management and lipid management. They can also serve as a guideline to policy makers who would like to structure prevention programmes and therapies to the at-risk individuals, particularly in the rural settings and underserved communities where the provision of healthcare is quite low.

The study verifies the prevalence of dyslipidemia in individuals within the type-2 diabetes (T2DM) population in multispeciality hospitals within India. It observes the most frequent lipid issues which are high triglycerides, classical low levels of HDL-cholesterol and small dense low-density LDL. Another inference made by the study is the establishment of the relationship between these problems with lipids and such risk factors as poor glycaemic control, obesity, and hypertension, which is prevalent among the Indian diabetic population. Through analysis of these patterns, the study would like to present a complete picture of which lipid abnormalities are associated with T2DM and able to influence clinical directions geared towards promoting such treatment measures to reduce cardiovascular risk within this high-risk population.

2. Review of Literature

Research in India indicates that dyslipidemia prevails in individuals diagnosed with Type 2 Diabetes Mellitus (T2DM). According to a new study published by Sharma et al. (2024), 78 % of patients with T2DM had dyslipidemia with elevated triglycerides (the most common) and decreased HDL-C being most common. Such finding demonstrates the significance of specific individualized lipid management strategies on this population. The systematic review conducted by Kumar et al. (2023) tried to quantify the prevalence of dyslipidemia in individuals with T2D in Africa. It discovered that dyslipidemia is prevalent with 37.4 % of the cases being characterised by elevated triglycerides and 52.7 % in people with increased levels of low-density lipoprotein cholesterol (LDL-C). It was higher in females than in males. The paper emphasized screening, early diagnosis, and treatment as a way of lowering cardiovascular risks among the population. According to Reddy et al. (2023), the prevalence of the Metabolic Syndrome (MetS) among the urban population under investigation was 45.8 %. Hypertension and dyslipidemia were more frequent among some groups and there were differences that were evident in males and females. The study gives the initial estimate of the MetS rates in a T2DM in an urban population and demonstrates the necessity of targeted interventions.

According to a study conducted by Singh et al. (2025), T2DM and subsequent complications including dyslipidemia are very expensive to the healthcare system. This study demands cheap means of alleviating such financial pressure. As Patel et al. (2023) report, dyslipidemia involves 85 percent of patients with T2DM. The most widespread issues are elevated triglycerides and low HDL-C. Poorly controlled blood sugar is a natural accompaniment to these issues and thus it is

important to have integrated management. Gupta et al. (2023) emphasize that lifestyle changes can be used to deal with dyslipidemia in T2DM. Better lipid level is achieved through diet, increased exercise, and control of weight. According to Sharma et al. (2023), 60 percent of the sample with T2DM experience hyper LDL-c, and half of them experience low HDL-c. They highlight the importance of frequent lipid testing to help counter such issues in their early stages.

As revealed by Kumar et al. (2023), 70 percent and 40 percent of type 2 diabetes mellitus (T2DM) patients had elevated levels of triglycerides and low levels of HDL-C, respectively. The study emphasized the fact that timely diagnosis and intervention is an essential requirement in avoiding heart and blood-vessels complications in this population. So as depicted in Singh et al. (2023) 75 percent of patients with T2DM had elevated total cholesterol levels, and 65 percent had elevated LDL-C. This research recommended aggressive management strategies in reducing the lipids and reducing cardiovascular risk in T2DM patients. According to Gupta et al. (2023), dyslipidemia in patients with T2DM occurs in 80 percent of cases, and the most frequent issues are high triglyceride levels and low HDL-C. The research indicated that the aspect of engaging wide-ranging care plans that encompass lifestyle interventions and medicines is important in order to moderate lipid levels.

3. The prevalence of dyslipidemia in Type 2 Diabetes Mellitus (T2DM)

The prevalence of dyslipidemia in Type 2 Diabetes Mellitus (T2DM) is usually analyzed since it increases the likelihood of heart and blood vessels disease which is a significant concern of individuals who have diabetes. High total cholesterol, high triglycerides and low high-density lipoprotein (HDL) are the characteristics of dyslipidemia, which is widespread in T2DM patients (Mohan et al., 2007; Ghosal et al., 2020). It is enormous in India. The recent studies reported by Sharma et al. (2023) indicated that in nearly 80 % of T2DM patients there was a lipid issue with the elevated triglycerides (TG) and low HDL-C being the most prevalent. These abnormalities are important, as they increase the risk of developing cardiovascular disease (CVD), such as heart attack, stroke and peripheral artery disease (Mohan et al., 2018). In one of the studies conducted in rural Tamil Nadu was found that 85 percent of diabetic adults had dyslipidemia with triglycerides being raised in 55 percent and HDL-C being low in 52 percent (Parikh et al., 2010). According to Singh et al. (2021) in a North India study, the percentage of T2DM patients with dyslipidemia was also 78 % but with specific gender variations. The highest LDL-C and triglycerides were shown by men whereas a greater percentage of women had low HDL-C (Singh et al., 2021). Such widespread prevalence is likely a result of several factors, including insulin resistance, increased production of VLDL (very-low-density lipoprotein), and altered lipid metabolism associated with T2DM (Joshi et al., 2015). Insulin resistance leads to excess fat accumulation in adipose tissue, which releases fatty acids into the bloodstream. These fatty acids are then metabolized by the liver, leading to an overproduction of VLDL, which is subsequently broken down into LDL, exacerbating lipid abnormalities (Sharma et al., 2020). These findings indicate a persistent and alarming trend where the majority of T2DM patients in India suffer from dyslipidemia. This highlights the need for systematic screening of lipid profiles in diabetic populations to help identify those at greater risk of cardiovascular diseases. Furthermore, this knowledge can aid in designing targeted intervention programs, including lifestyle modifications and pharmacotherapy, to address these lipid abnormalities effectively. In India, high levels of blood lipids exist among many diabetics. This tendency seems to be caused by multiple factors: impaired sensitivity to insulin, increased-than-normal insulin production of VLDL (very-low-density lipoprotein), and other alterations in the metabolism of lipids caused by T2DM (Joshi et al., 2015). Fat is more difficult to break down in insulin resistance. The additional fat is stored in adipose tissue and spills fatty acids into the blood stream. These fatty acids are, in turn, converted to VLDL by the liver. Then VLDL is transformed into LDL, further aggravating the issue of the lipid (Sharma et al., 2020).

Such findings indicate that dyslipidemia is also prevalent among most patients with T2DM in India. It is due to this need that it is vital to monitor lipid profiles among all diabetic groups. In this manner, health employees will be capable of identifying people at greater risks of heart ailment at an early stage. This enables them to develop specific programs like lifestyle modifications and the treatment of the drug to manage these lipid problems effectively.

4. Impact of Dyslipidemia on Cardiovascular Health in T2DM Patients

Dyslipidemia has a strong association with cardiovascular diseases (CVD) among individuals with diabetes type 2 and this epidemic burden is a national health concern in India. Regardless of the specifics, it is always indicated that diabetics and lipid sufferers have a significantly increased risk of atherosclerosis and other cardiovascular incidents such as heart attacks and strokes (Ghosal et al., 2020; Jadhav et al., 2022). In diabetes, extreme levels of dyslipidemia are associated with high risk of atherosclerosis. Increased LDL-C (and in particular in case of small dense LDL particles) most probably leads to atherosclerosis that in this case can be defined as the occurrence of plaques in the arteries. Such small but dense LDL is more susceptible to oxidation, which contributes to the formation of plaque and the narrowing of the arteries (Bari et al., 2019).

A report by Mohan et al (2017) on Southern India revealed that diabetic patients who presented with dyslipidemia risk had coronary artery disease (CAD) 2.5 times as much as diabetic patients without a lipid issue. Elevated levels of triglycerides with low HDL-C were found to be associated with increasing atherosclerosis and could raise CAD risk independently (Mohan et al., 2017). T2DM patients are at risk of dyslipidemia that can cause serious damage to blood vessels. This damage results in an endothelial dysfunction and therefore the blood vessels no longer dilate to the same extent. Owing to this, the risk of hypertension increases and the arteriosclerosis occurs more rapidly.

Elevated triglycerides/low HDL-C combined in T2DM patients also increase the risk of stroke in India by half (Bari et al. 2019). These findings were again reproduced by a national study by Jadhav et al. (2022) that showed diabetic dyslipidemia was predictive of ischemic heart disease (IHD) and peripheral vascular disease (PVD). High triglyceride concentration and low HDL-C levels were associated with a two-fold increase in the risk of IHD and 1.8-fold increase in the risk of PVD than patients who did not show lipid deviations (Jadhav et al. 2022). Since dyslipidemia has extremely impactful effects on cardiovascular health, it must be managed timely in T2DM patients. Treatment of dyslipidemia using lifestyle modification and drugs would benefit in reducing the CVD risk among Indians with T2DM.

5. Management of Dyslipidemia in T2DM Patients: Challenges and Approaches

The effective treatment of dyslipidemia among T2DM patients is hard to manage and particularly in India where incidences of diabetes and its sequelae are escalating. Even though the guidelines are there to follow regarding lipid load in T2DM, some areas, in particular, rural ones, continue to flout them (Parikh et al., 2010; Ghosal et al., 2020). Initially, health professionals prescribe the following: lifestyle changes: diet/exercise/weight reduction. Singh et al. (2021) note that these changes continue to be the primary form of treatment. Decreases in saturated and trans-saturated fat consumption and fiber supplementation of the diet are of fundamental importance. However, exercise leads to a reduction in triglyceride levels of approximately 15-20 and an increase of 5-10 in HDL-C (Singh et al., 2021). Although it seems quite clear that following the recommendations is beneficial, a lot of T2DM patients in India have difficulties in adhering to the recommendations due to socioeconomic problems, the food habits of the country and lack of awareness regarding the necessity of lipid control. To this end, physicians usually have to supplement with medication. The most popular of them is a statin that reduces LDL-C by up to 50 percent according to research conducted by Bari et al. (2019) (Bari et al., 2019).

Statins reduce the level of LDL-C which is the bad cholesterol. However, Ghosal et al. (2020) discovered that most patients with type 2 diabetes that use statins experience negative results such as muscle pain and liver enzyme elevation. Due to the issues, some patients discontinue taking them. Researchers thus propose alternative medications like ezetimibe and PCSK9 inhibitors instead of statins to those patients who cannot bear the treatments (Ghosal et al., 2020). More modern treatment is also under investigation. There is saroglitazar, which is a drug of a specific kind which acts on two types of proteins (PPARalpha and PPARGamma). Gupta et al. (2023) found that saroglitazar reduces the levels of triglycerides and increases the levels of HDL-C in individuals with type 2 diabetes. It demonstrates that it could be a useful strategy to treat dyslipidemia (Gupta et al., 2023). In conclusion, management of dyslipidemia in diabetes type 2 requires a combination of measures simultaneously: a change in lifestyle and drugs. Even when it comes to the new kind of drugs, adherence to good habits, medication side effects, and access to adequate healthcare are major obstacles in India.

6. Conclusion

It is critical to study dyslipidemia as it damages the heart and circulatory system directly when it is elevated in persons with Type 2 Diabetes Mellitus (T2DM). India is among the countries experiencing the highest rates of growth in T2DM and cardiovascular diseases (CVD) rates. Dyslipidemia, which is confirmed by elevated triglyceride level, reduced levels of high-density lipoprotein cholesterol (HDL-C), and increased levels of low-density lipoprotein cholesterol (LDL-C) is not unusual and frequently unnoticed in T2DM. The rate of this condition is so rampant that it demonstrates why medical providers need to implement a very powerful strategy to manage lipid issues among the sicker diabetes cases. Reviews of the studies demonstrate that not only is dyslipidemia common in T2DM patients in India, but also an imminent risk factor in the development of CVD as an independent risk factor. Most studies in the past have revealed that majority of T2DM patients possess at least one lipid issue, the most common being elevated triglyceride levels and low HDL-C. India reports indicate clearly that a big proportion of T2DM patients experiences lipid changes that increase their cardiovascular risk, hence the need to manage it by the caregivers at the top of the research agenda. The connection between dyslipidemia and risk of cardiovascular diseases in T2DM is highly established. The research indicates that atherosclerosis, coronary artery disease, and stroke are aggravated by lipid abnormalities. A characteristic profile of the diabetic dyslipidemia (high triglycerides and low HDL-C) is a major ingredient of arterial plaque. Such imbalances of the lipids also aggravate the endothelial dysfunction as well, which, in turn, increases blood pressure and accelerates the hardening of the arteries and proliferation of the plaque.

Due to a combination of cardiovascular risks, dyslipidemia can cause heart disease in individuals with type 2 diabetes, and lipid abnormalities regulation plays a great role in preventing the heart disease. Any plan is built on the foundation of lifestyle modifications better food choices, increased exercise and weight control, but the goal of achieving the most excellent outcomes very often requires the utilization of drugs. Statins, which are the prescriptions doctors may offer to decrease the level of bad LDL-C, have demonstrated their efficacy in prevention of cardiovascular events among T2DM patients. However, not all people can use statins or inconsiderably experience side effects, and the alternative medications such as ezetimibe, fibrates, and PCSK9 inhibitors can assist in such instances. Recently, there have been new developments of agents including saroglitazar that activate both PPARa and PPARg pathways and their early results have been positive in ameliorating lipid patterns in T2DM patients. These agents create a fresh avenue in the treatment space. However, until they become widely used, it requires these to be done on larger and longer time scales to ascertain not only their safety but also their efficacy. The second large problem is that lipid management guidelines are poorly applied in clinics, particularly in rural areas and underserved areas of India. Adherence to lipid-lowering therapy is inadequate due to cost, knowledge and low access to health care facilities despite viable treatment options. Results of both the studies by Parikh et al. (2010) and Ghosal et al. (2020) say that more patient education, improved healthcare accessibility and improved

primary healthcare infrastructure is needed to further manage dyslipidemia cases in T2DM patients. Individuals with type 2 diabetes (T2DM) should receive frequent checks by lipid profile. This will assist the health providers to detect and manage the high cholesterol and other issues in its early stages. Prevention arrests or slows down the development of the cardiovascular disease (CVD), lightening the burden on healthcare system. Health practitioners are supposed to monitor these test results whenever attending to a patient with diabetes. The analysis reveals that T2DM causes dyslipidemia which can be effectively controlled using lifestyle modifications and medication in combination. T2DM is so widespread in India that the healthcare services should be prepared to deal with the peculiarities of the problem in question. Essential public health initiatives to educate about the dangers of elevated cholesterol levels, promote the adoption of healthy behaviors and use medicine and care more conveniently are essential. In conclusion, dyslipidemia among T2DM patients is a very critical problem that must be addressed promptly. These cardiovascular risks are minimized with rapid screening, evidence-based therapy and proper lifestyle. The rise in cases of diabetes in India is increasing rapidly, and thus the prevention of dyslipidemia should become a priority of medical institutions, government agencies, and the population. This measure will reduce CVD, enhance the life of the diabetic person and save life.

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