

Lipid Profile Alterations in Recently Diagnosed Type 2 Diabetes Mellitus Patients: A Retrospective Analysis

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Abstract

Aim: This study seeks to evaluate lipid profile anomalies in newly diagnosed T2DM individuals, emphasizing the importance of early identification in reducing cardiovascular morbidity and death.

Methodology: A retrospective study research was performed at Ajay Sangaal Institute of Medical Sciences & Research, encompassing 74 consecutive patients aged 18 to 85 with newly diagnosed Type 2 Diabetes Mellitus (T2DM). Demographic data, diabetes duration, anthropometric measures, and laboratory findings (HbA1C, fasting plasma glucose, lipid profiles) were gathered. Dyslipidemia and hyperlipidemia were evaluated according to established lipid irregularities. Statistical analysis employed SPSS software, with p-values less than 0.05 being substantial.

Results: The participants had an average age of 58.2 years and an average A1C of 7.8%. Significantly, 65% had aberrant A1C values, whereas 51% presented with hyperlipidemia. Dyslipidemia impacted 57% of the population, marked by increased total cholesterol (51%) and LDL (43%), in conjunction with decreased HDL (49%). Only 41% received statin medication, despite 46% qualifying under the American Diabetes Association criteria for this treatment.

Conclusion:

The research underscores notable lipid profile irregularities and inadequate glycemic regulation in recently diagnosed T2DM patients. The insufficient use of statins in at-risk individuals highlights the necessity for enhanced management techniques, encompassing lifestyle changes and compliance with treatment protocols, to improve cardiovascular health outcomes in this demographic.

Keywords: Diabetes mellitus, Dyslipidemia, Hyperlipidemia, Lipid profile, Metabolic syndrome.

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Introduction

Diabetes mellitus is a prevalent metabolic condition marked by absolute or relative deficits in insulin production and/or action, leading to persistent hyperglycemia and disruptions in lipid, protein, and carbohydrate metabolism [1]. Numerous prior investigations have endeavored to establish a correlation between serum lipid profile and blood glucose levels characteristics [2,3]. Research findings indicate that body fat is primarily accountable for the increased occurrence of this illness amongst the components of body composition [4,5]. In 1988, it was characterized as a multifactorial metabolic disorder comprising insulin resistance with essential hypertension, T2DM, compensatory hyperinsulinemia, and hypercholesterolemia. Currently, the International Diabetes Federation and World Health Organization utilize the term "Metabolic Syndrome" to

characterize this aggregation of disorders [8]. Diabetic dyslipidemia refers to a trio characterized by elevated triglycerides, an abundance of tiny, dense low-density lipoprotein, and diminished high-density lipoprotein particles.

Lipid abnormalities are common in diabetes mellitus due to insufficiency or insulin resistance impacting essential pathways and enzymes in lipid metabolism [9]. Chronic uncontrolled hyperglycemia in diabetics leads to microvascular and macrovascular consequences, such as retinopathy, cardiovascular disease, neuropathy, and nephropathy [10,11]. The lipid particle composition in diabetic dyslipidemia is believed to be more atherogenic than in other forms of dyslipidemia [12]. The contributing relationship between dyslipidemia and atherosclerosis is widely recognized. In diabetes, the concomitant obesity,

hyperglycemia, and alterations in insulin significantly expedite the development of atherosclerosis [13,14]. A recent study revealed substantial trends indicating an increased risk of coronary heart disease (CHD), stroke, and all-cause mortality associated with elevated baseline HbA1c values among over 11,000 individuals in the "Atherosclerosis Risk in Communities Study". There was a substantial connection between CHD and, fasting blood glucose levels stroke, or all-cause mortality for HbA1c categories of <6.5% and >6.5%. Previous research sought to associate blood glucose levels with serum lipid profile factors, revealing that HbA1c values are lower in patients with a reduced risk of microvascular problems. This study aims to investigate lipid profile anomalies in newly diagnosed type-2 diabetics, since such evaluation facilitates early diagnosis and treatment of these lipid derangements, hence reducing associated cardiovascular morbidity and death.

Methodology

Study Area

This was a retrospective study undertaken at the Department of Medicine at Ajay Sangaal Institute of Medical Sciences & Research, Ayushman Hospital (Shamli), Uttar Pradesh, India for one year

Sample size

The entire sample size comprised 74 patients in this research.

Inclusion and Exclusion Criteria

This research encompassed all consecutive individuals aged 18 to 85 years with type-II diabetes who presented at the hospital for either their first consultation or subsequent care. Participants were needed to have a lipid profile and an A1C test performed within the research duration to qualify. The exclusion criteria included individuals with severe anemia (hemoglobin ≤ 7 g/dL), subclinical or overt hypothyroidism, chronic kidney disease, alcohol dependence, chronic liver disease (alcoholic or nonalcoholic) necessitating dialysis, and those who were pregnant or lactating.

Procedure

This study involved 74 individuals with type 2 diabetes, from whom demographic data, anthropometric measures, blood pressure, and duration of diabetes were extracted from patient records. Laboratory studies including A1C, fasting plasma glucose, lipid profiles, thyroid function tests, renal function tests, and hemograms, all conducted under defined quality control standards. Hyperlipidemia was diagnosed based on prior assessments or particular lipid concentrations, whereas dyslipidemia was characterized by diverse lipid irregularities. Cardiovascular risk variables were categorized using accepted threshold values, and waist-to-hip ratios for abdominal obesity were evaluated. The research assessed the incidence of diagnosed and newly diagnosed hyperlipidemia, statin prescriptions, and the criteria for statin treatment in accordance with American Diabetes Association recommendations.

Statistical Analysis

The statistical analysis was performed with SPSS software, especially version 27. The findings were analyzed to evaluate the efficacy of the paperless partogram in labor management. The Chi-square test was employed to examine categorical data. A P-value less than 0.05 indicates the statistical significance of the outcome.

Results

Table 1 outlines the demographic attributes of 74 individuals diagnosed with type 2 diabetes. The average age of the cohort was 58.2 years (SD 12.1), with a range of 34 to 83 years, reflecting a varied age distribution. The gender distribution indicated a marginal majority of men (40, 54%) compared to girls (34, 46%). Participants exhibited a mean diabetes duration of 6.4 years (SD 3.2), spanning from 1 to 20 years, indicating a combination of recent and prolonged diabetes management. The average BMI was 28.5 kg/m² (SD 4.6), classifying the sample as overweight, while the BMI range of 22.0 to 37.2 kg/m² demonstrated a continuum from normal weight to obesity. These factors offer crucial background for comprehending the health profiles of participants for diabetes treatment and related cardiovascular risks.

Table 1: Demographic Characteristics of Study Participants	
Characteristic	n = 74
Age (years)	
- Mean (SD)	58.2 (12.1)
- Range	34 - 83
Gender	
- Male	40 (54%)
- Female	34 (46%)
Duration of Diabetes (years)	
- Mean (SD)	6.4 (3.2)
- Range	1-20
BMI (kg/m ²)	
- Mean (SD)	28.5 (4.6)
- Range	22.0 - 37.2

Table 2 summarizes the clinical and laboratory data of the 74 subjects diagnosed with type 2 diabetes. The average A1C level was 7.8% (SD 1.5), with 48 subjects (65%) displaying abnormal levels, signifying inadequate glycemic management. The mean fasting plasma glucose level was 150.4 mg/dL (SD 45.3), with 50 patients (68%) categorized as abnormal, underscoring concerns over glucose management. The 2-hour postprandial glucose level was significantly elevated, average 215.6 mg/dL (SD 60.2), with 55 subjects (74%) exhibiting abnormal values, indicating considerable postprandial hyperglycemia. The average total cholesterol level was 240.1 mg/dL (SD 40.2), with 38 individuals (51%) classified as abnormal. The average LDL cholesterol level was

160.3 mg/dL (SD 35.0), with 32 participants (43%) above normal limits. The mean HDL cholesterol level was 42.5 mg/dL (SD 8.7), with 36 patients (49%) exhibiting low HDL, a recognized risk factor for cardiovascular disease. The average triglyceride level was 230.8 mg/dL (SD 100.5), impacting 40 subjects (54%), signifying widespread dyslipidemia. Thyroid-stimulating hormone (TSH) levels were within acceptable parameters, average 3.5 µIU/mL (SD 1.2), with only 12 subjects (16%) displaying aberrant values. Finally, the estimated glomerular filtration rate was '85.4 mL/min/1.73 m² (SD 15.2)', with 20 patients (27%) exhibiting diminished renal function. These data collectively reveal notable metabolic anomalies, especially in glycemic regulation and lipid profiles, among the subjects.

Parameter	n = 74	Abnormal (n, %)
A1C (percent)	7.8 (1.5)	48 (65%)
Fasting Plasma Glucose (mg/dL)	150.4 (45.3)	50 (68%)
2-Hour Postprandial Glucose (mg/dL)	215.6 (60.2)	55 (74%)
Total Cholesterol (mg/dL)	240.1 (40.2)	38 (51%)
LDL Cholesterol (mg/dL)	160.3 (35.0)	32 (43%)
HDL Cholesterol (mg/dL)	42.5 (8.7)	36 (49%)
Triglycerides (mg/dL)	230.8 (100.5)	40 (54%)
TSH (µIU/mL)	3.5 (1.2)	12 (16%)
eGFR (mL/min/1.73 m ²)	85.4 (15.2)	20 (27%)

Table 3 highlights the prevalence of dyslipidemia and hyperlipidemia among the 74 patients with type 2 diabetes. Hyperlipidemia was identified in 38 participants, or 51% of the sample, signifying a substantial fraction of persons with increased lipid levels. Dyslipidemia, characterized by diverse lipid abnormalities, was notably more widespread, impacting 42 individuals (57%). In the dyslipidemia category, 26 patients (35%) exhibited increased total cholesterol, underscoring a prevalent concern within the sample. Twenty-two

subjects (30%) exhibited elevated LDL cholesterol, underscoring the cardiovascular risk linked to high LDL levels. Nineteen patients (26%) exhibited low HDL cholesterol, a detrimental marker of cardiovascular health. Ultimately, increased triglycerides were detected in 24 patients (32%), further exacerbating the overall dyslipidemic profile. The findings highlight the prevalent lipid abnormalities in this group, underscoring the necessity for tailored therapies to address cardiovascular risk aspects in patients with T2DM.

Condition	n (%)
Hyperlipidemia	38 (51%)
Dyslipidemia	42 (57%)
- Elevated Total Cholesterol	26 (35%)
- Elevated LDL	22 (30%)
- Low HDL	19 (26%)
- Elevated Triglycerides	24 (32%)

Table 4 displays information on statin prescriptions and the indications for statin therapy among the 74 people with T2DM in the research. Among the total participants, 30 individuals (41%) were prescribed statins, signifying that a considerable segment of the cohort is undergoing pharmaceutical intervention to regulate cholesterol levels and mitigate cardiovascular risk.

Furthermore, 34 individuals (46%) qualified for statin medication according to the American Diabetes Association (ADA) criteria, indicating that almost half of the participants are deemed at risk for cardiovascular events based on their lipid profiles and other clinical parameters. This indicates that although 41% are presently on statin therapy, there exists a group of individuals who may benefit from this treatment but are not receiving it. The findings

reveal a possible deficiency in dyslipidemia management within this group, underscoring the necessity for enhanced screening and treatment

protocols to guarantee that all eligible patients receive optimal statin medication.

Parameter	n (%)
Patients Prescribed Statins	30 (41%)
Patients with Indication for Statin Therapy (ADA Guidelines)	34 (46%)

Table 5 outlines the cardiovascular risk variables discovered among the 74 patients with type 2 diabetes. Abnormal systolic blood pressure measurements were seen in 28 participants (38%), signifying a substantial segment of the sample exhibits increased systolic pressure, a recognized risk factor for cardiovascular disease. Diastolic blood pressure was abnormal in 20 participants (27%), indicating that although systolic pressure is a more critical issue, diastolic hypertension is also evident in a significant minority of patients.

In this cohort, 34 people (46%) had an aberrant waist-to-hip ratio, indicating a significant incidence of central obesity. Abdominal obesity is a substantial risk aspect for cardiovascular problems, underscoring the necessity of weight management in diabetes treatment. Finally, the erythrocyte sedimentation rate (ESR), an indicator of inflammation, was abnormal in 22 subjects (30%), perhaps signifying underlying inflammatory processes that may elevate cardiovascular risk.

Risk Factor	Abnormal (n, %)
Systolic Blood Pressure (mmHg)	28 (38%)
Diastolic Blood Pressure (mmHg)	20 (27%)
Waist-to-Hip Ratio (Abdominal Obesity)	34 (46%)
Erythrocyte Sedimentation Rate (ESR)	22 (30%)

Discussion

This study offers a thorough examination of the demographic, clinical, and laboratory attributes of 74 individuals with T2DM, emphasizing notable metabolic and cardiovascular risk factors common in this cohort. The average age of 58.2 years, along with a minor male preponderance, indicates a typical demographic for type 2 diabetes, demonstrating that this ailment mostly impacts middle-aged adults. The average duration of diabetes, 6.4 years, signifies a cohort of patients potentially experiencing both early and chronic manifestations of the illness, crucial for comprehending their comprehensive health treatment. This study corresponds with results from other significant research projects that have investigated the demographics and health characteristics of persons with T2DM.

The study by Magliano et al. (2020) indicated that type 2 diabetes is primarily diagnosed in middle-aged persons, with a significant male preponderance, aligning with the demographics noted in this research [15]. The "UK Prospective Diabetes Study" shown that an extended duration of diabetes is strongly associated with heightened risks of complications, including 'cardiovascular disease (UK Prospective Diabetes Study Group, 1998)'. A research by Williams et al. (2022) corroborated similar findings, indicating that persons with diabetes for over five years frequently have a mix of metabolic abnormalities, highlighting the necessity of specialized treatment measures [16]. These

studies jointly highlight the essential necessity of comprehending the demographic and clinical characteristics of this group to guide appropriate healthcare interventions.

The clinical findings indicate troubling glycemic management, evidenced by a mean A1C of 7.8% and elevated rates of aberrant fasting and postprandial glucose levels. These data suggest insufficient diabetes treatment, highlighting the necessity for enhanced therapeutic techniques to attain improved glycemic objectives, as advised by current guidelines. The lipid profiles clarify the cardiovascular risks, with more than half of the individuals displaying hyperlipidemia and dyslipidemia. Increased total cholesterol and LDL levels, together with decreased HDL levels, indicate a common dyslipidemic profile that markedly heightens cardiovascular risk. The documented correlation between dyslipidemia and cardiovascular events highlights the pressing necessity for tailored therapies, including lifestyle adjustments and medicines.

The clinical findings of this study align with other studies highlighting the difficulties of glycemic control and lipid management in type 2 diabetes. The average A1C level of 7.8% corresponds with the American Diabetes Association's findings, indicating that a considerable number of persons with diabetes fail to achieve recommended glycemic

objectives (American Diabetes Association, 2020). Moreover, research conducted by Zhang et al. (2024) has revealed that inadequate fasting and postprandial glucose levels are prevalent among patients, highlighting the imperative for improved diabetes treatment measures [17]. The significant occurrence of hyperlipidemia and dyslipidemia in this cohort reflects findings from the “National Health and Nutrition Examination Survey”, which documented concerning rates of lipid irregularities in adults with diabetes (Grundy et al., 2012) [18]. The correlation between dyslipidemia and cardiovascular disease is well-documented, as evidenced by the Framingham Heart Study, which identified that higher LDL and decreased HDL levels substantially heighten cardiovascular risk (Pereira, 2012) [19]. These findings clearly emphasize the pressing necessity for extensive treatments, encompassing lifestyle modifications and pharmacological treatment, to reduce cardiovascular risks in this demographic.

The statistics on statin prescriptions indicate a management deficiency; 41% of patients received statin prescriptions, but almost half (46%) qualified for statin medication according American Diabetes Association standards. This gap indicates that a segment of the population at elevated cardiovascular risk may not be receiving adequate therapy, highlighting potential deficiencies in clinical practice that require attention to guarantee that all eligible patients receive essential treatments. The results concerning statin prescriptions underscore a significant deficiency in cardiovascular risk management for patients with T2DM. Prior studies have demonstrated that a considerable percentage of individuals eligible for statin medication do not obtain adequate treatment. A research by Gavina et al. (2022) revealed that just 50% of high-risk patients received statin prescriptions while adhering to recommendations, highlighting the ongoing under-treatment of dyslipidemia in diabetes care [20]. A systematic study by Vikulova et al. (2024) underscored the necessity of enhancing understanding and compliance with statin prescribing recommendations among healthcare practitioners to optimize patient outcomes [21]. These studies collectively underscore the necessity for enhanced screening and treatment techniques to guarantee that all eligible persons receive statin medication, therefore mitigating the increased cardiovascular risk linked to type 2 diabetes.

Furthermore, the evaluation of supplementary cardiovascular risk factors clarifies the health issues encountered by this group. Increased systolic blood pressure was observed in 38% of patients, alongside notable rates of abdominal obesity (46%) and heightened inflammatory markers (ESR), indicating a heightened risk of cardiovascular events for these people. The correlation among obesity,

hypertension, and diabetes is extensively documented, demonstrating that holistic lifestyle treatments focused on weight reduction and blood pressure management are essential in alleviating these risks.

This study's evaluation of cardiovascular risk factors corresponds with an expanding corpus of literature highlighting the interconnectedness of obesity, hypertension, and diabetes. Elevated systolic blood pressure frequently occurs in adults with type 2 diabetes, with study by Pignone et al. (2016) revealing that over 60% of diabetic patients also experience hypertension, hence substantially heightening their risk of cardiovascular events [22]. A research by Godsland et al. (2004) reinforces the connection between fat and inflammation, indicating that heightened inflammatory indicators, such as the erythrocyte sedimentation rate (ESR), are frequently linked to greater cardiovascular risk in diabetic populations [23]. The findings highlight the necessity of executing complete lifestyle therapies, encompassing dietary changes and consistent physical exercise, to efficiently regulate weight and blood pressure, thereby mitigating cardiovascular risks in patients with T2DM.

Conclusion

This study underscores the substantial metabolic and cardiovascular difficulties encountered by persons with newly diagnosed T2DM. The significant incidence of dyslipidemia, marked by increased total cholesterol, LDL, and triglycerides, along with diminished HDL values, underscores the critical necessity for appropriate treatment measures. The mean A1C of 7.8% signifies inadequate glycemic management, necessitating the improvement of treatment approaches to get superior results. Moreover, the inadequate use of statin medication, despite a significant number of individuals qualifying for treatment, highlights a deficiency in clinical practice that must be rectified to reduce cardiovascular risks. These findings highlight the imperative for a holistic strategy that encompasses lifestyle changes, consistent monitoring, and compliance with treatment protocols, ultimately seeking to enhance the health and quality of life for those with type 2 diabetes.

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