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LIPIDS LEVELS COMPARISON OF DIABETIC AND NON-DIABETIC INDIVIDUALS: A RETROSPECTIVE STUDY AT A SECONDARY CARE HOSPITAL

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ABSTRACT

Background of the Study: Diabetes mellitus, a chronic metabolic disorder is linked with various consequences among which cardiovascular diseases tops the list. Dyslipidemia is one of the most common conditions signifying the level of risk of cardiovascular events. Understanding the differences in different profiles of lipid can not only provide insight but will also help in designing new protocols for rehabilitation interventions and management of risk factors using such interventions. Thus, the aim is to compare the comparison of lipid levels between diabetic and non-diabetic individuals at a secondary care hospital in Karachi, Pakistan.

Methodology: The study included total 158 patients. We divided them into two groups on the basis of diabetes. There were 103 diabetic patients with mean HbA1C 12.2% ± 23.8. The control group which was non-diabetic had 55 subjects with mean HbA1C of 5.3% ± 0.26. Lipid profile results were evaluated.

Results: The results showed that the diabetic group had mean values for Total cholesterol (TC) was 188.8 ± 50.1, Triglycerides (TG) was 213.4 ± 183.1, High-Density Lipoprotein Cholesterol (HDL-C) was 39.8 ± 9.56 Low Density Lipoprotein Cholesterol (LDL-C) was 123.4 ± 46.9, whereas control group had the mean values for TC as 178.5 ± 37.5, TG as 161.1 ± 77.5, HDL-C as 43.8 ±10.6 and LDL-C as 117.7±33.8.

Conclusion: The study shows the elevated lipids in group with diabetes in comparison to the group with healthy individuals. Between the groups, there is a noticeable variation in the mean TG levels but slight difference in other lipids levels in both groups are alarming and indicating future risk of these non-diabetic individuals in getting diabetes and CVDs as well. Our findings are showing extreme need of education for lifestyle modifications and healthy diet plans in our society.

Keywords: *Metabolic diseases, diabetes mellitus, dyslipidemias, lipids, glycated hemoglobin, healthy lifestyle.*

Introduction

Diabetes mellitus, attributed by chronic hyperglycemia, which, either is, glucose is underutilized or over produced [1,2]. Inadequate secretion, action, or combination of both of insulin, ultimately results in hyperglycemia[2]. Insulin's significance as an anabolic hormone leads to abnormalities in the metabolism of proteins, lipids, and carbohydrates[3]. The root cause of inadequacy of Insulin action on target tissues is abnormalities in the metabolizing carbohydrates, fats, and protein in subjects with diabetes [3,4]. Profound hyperglycemia manifests as polyuria polydipsia, weight loss

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(occasionally accompanied by polyphagia), and blurred vision. Uncontrolled diabetes may lead to acute, potentially fatal consequences such as hyperglycemia with ketoacidosis or non-ketotic hyperosmolar syndrome. Debate on the long-term effects confirms the presence of retinopathy, leading to blindness; nephropathy, causing renal failure; peripheral neuropathy, resulting in foot ulcers, amputations, and Charcot joints; and autonomic neuropathy, showing symptoms related to the gastrointestinal tract, genitourinary system, cardiovascular system, and sexual function. [4]. Diabetes patients are more likely to develop peripheral arterial, cerebrovascular, and atherosclerotic cardiovascular diseases. People with this disease frequently have hypertension and abnormalities in lipoprotein metabolism which is known as "Diabetic dyslipidemia"[4,6]. The term dyslipidemia is defined as a lipid metabolism disorder which is characterized by any of the following irregularity: increased TC, TG, and LDL-C or decreased HDL-C[7]. Primary dyslipidemias comprise a diverse range of illnesses with either a genetic, mono, or polygenic etiology, while secondary dyslipidemias arise from the correlation of risk factors with other pathologies or external factors[8,9]. Diabetic dyslipidemia, specifically type 2 Diabetes Mellitus (t2DM), include hypertriglyceridemia and reduced HDL-C while LDL-C are transformed into small dense LDL, which are smaller and potentially more atherogenic lipoproteins[10]. This can result in stroke, acute myocardial infarction (AMI), or sudden cardiac death [11]. Since dyslipidemia is affecting more recent patient subgroups, lipid guidelines are still being developed. However, ethnic and regional demographic data dictate these guidelines[12]. The prevalence of cardiovascular disease (CVD) is higher in people with type 1 or type 2 diabetes. However, the exact nature of the relationship between diabetes and atherosclerosis remains unclear. Disturbances in the production and clearance of plasma lipoproteins are among the metabolic abnormalities that frequently coexist with diabetes[10].CVD is a significant cause of disability and death in both developed and developing nations[14]. Cardiovascular (CV) morbidity and mortality can be increased either by dyslipidemia on its own or in combination with additional risk factors like age and gender, physical inactivity, genetics, cigarette smoking, t2DM, hypertension, metabolic syndrome (MetS), hormonal changes in women (polycystic ovarian syndrome [PCOS] and post-menopause), and obesity[15].Regardless of its types, Diabetes status is monitored by a dual marker i.e. HbA1C (glycated hemoglobin) levels[16]. Mostly physicians prefers this test because it is not affected by sudden variations in blood glucose levels and it displays the average plasma glucose levels over the previous two to three months. Furthermore, compared to the plasma glucose level, it has less intra-individual biological variability (within 2%). which adds on it as a choice of interest in monitoring glycemic control[17]. HbA1c could be used as a predictive biomarker for dyslipidemia and cardiovascular disease according to some studies[18]. A study has showed a positive relationship between HbA1c and high Triglycerides, aids in its predictive property for diabetic patients in acquiring CVD[8]. But more studies are needed to be conducted accurately about its predictive nature[17]. A study quoted that more than 70% of patients with DM die due to CVDs[19]. Dyslipidemia and type 2 diabetes are alterable risk elements for the development CVD and stroke. Early diagnosis and effective management can reduce the disease burden[7]. Diet and physical activity for at least 30 to 60 minutes each day form the cornerstone of the treatment plan[20,22]. A study concluded that the dyslipidemia treatment can reduce the risk of CVDs by & 30% over a 5-year period[23].This study has been done to compare the difference between diabetic and non-diabetic individuals in terms of their lipids status and to raise awareness regarding its management.

Methodology

The investigation was carried out on total 158 patients out of which 94 were males and 64 were females, came from January 01, 2023 to August 31, 2023 at a secondary care hospital in Karachi. The data was collected by reviewing the electronic record of patients. Subjects were divided into two groups on the basis of diabetes i.e. diabetic and control group (non-diabetic). Biochemical tests data such as HbA1C and Lipid profile including Total Cholesterol (TC), Triglycerides (TG), High Density Lipoproteins cholesterol (HDL-C) and Low Density Lipoproteins cholesterol (LDL-C) along with age and gender were taken from electronic record of patients.

Based on the standards set by the American Diabetes Association, established in 2007, the patients were selected in diabetic group on the basis of HbA1C ≥ 6.5%. HbA1c and lipid profile tests had run on COBAS C-311, completely automated Random access Clinical chemistry analyzer.There were 103 diabetic patients (61 male and 42 females) with mean age of 52 years. The diabetic group has mean HbA1C 12.2% ± 23.8. The control group had 33 males and 22 females with 48 years as the mean age. The average hemoglobin A1C of control group was 5.3% ± 0.26

Study design

A retrospective study, carried out on total 158 patients came to OPD from January 01, 2023 to August 31, 2023 at a secondary care hospital in Karachi, Pakistan. We enrolled 158 individuals in which there were 94 males and 64 females on the basis of diabetes.

Inclusion criteria

According to the American Diabetes Association criteria, established in 2007, the patients were selected in diabetic group on the basis of HbA1C ≥ 6.5%.

Biochemical tests

HbA1c and lipid profile tests had run on COBAS C-311, completely automated Random access Clinical chemistry analyzer. Biochemical tests data such as HbA1C and Lipid profile including Total Cholesterol (TC), Triglycerides (TG), High Density Lipoproteins cholesterol (HDL-C) and Low Density Lipoproteins cholesterol (LDL-C) along with age and gender were taken from electronic record of patients. The diabetic group had mean HbA1C 12.2% ± 23.8. The mean HbA1C of control group was 5.3% ± 0.26.

Normal Ranges

Cholestrol: <200 desirable, 200-239 borderlines,>240 high
Triglycerides: <150
Hdl: >35 male, >45 female
Ldl: <100 optimal, 100-129 near optimal, 130-159 borderline, 160-189 high

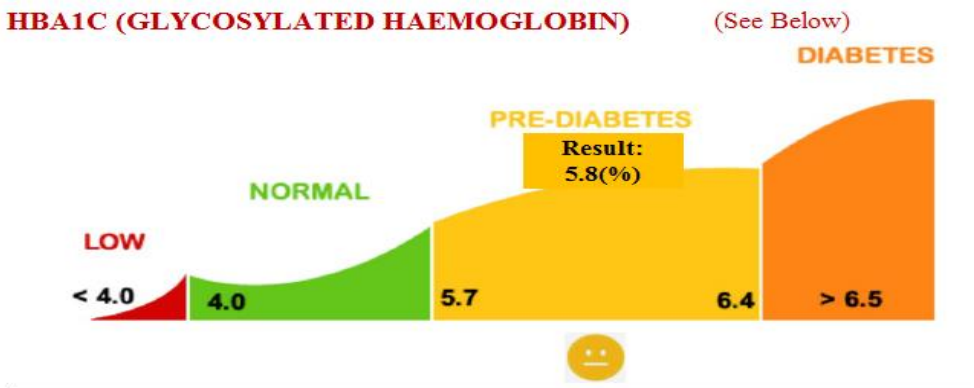

Fig 01: Classification of HBA1C

StatisticalAnalysis

SPSS was used to analyze the data. Categorical variables were characterized as percentage. Continuous variables were expressed as an average. The findings are presented as mean ± SD. Assuming a p-value of less than 0.05 indicated statistical significance.

Result

The sum of 103 diabetic Patients were chosen for the study with a mean age of 52 years, comprising 61 men and 42 women. The results of serum lipids showed that the diabetic group had

mean values for total cholesterol (TC) was 188.8 ± 50.1, triglyceride (TG) was 213.4 ± 183.1, high density lipoprotein cholesterol (HDL-C) was 39.8 ± 9.56 and low density lipoprotein cholesterol (LDL-C) was 123.4 ± 46.9 . The control group had the mean values of serum lipids levels as total cholesterol (TC) was 178.5 ± 37.5, triglyceride (TG) was 161.1 ± 77.5, high density lipoprotein cholesterol (HDL-C) was 43.8 ±10.6 and low density lipoprotein cholesterol was (LDL-C) 117.7±33.8

Parameters	**Diabetic Mean ± SD (N= 103)**	**Control group Mean ± SD (N= 55)**	***p*-value**
Age (years)	52 ± 11.0	48 ± 12.6	0.001
HbA1C (%)	9.9 ± 7.7	5.3 ± 0.2	0.001
TC (mg/dl)	188.8 ± 50.1	178.5 ± 37.5	0.001
Triglycerides (mg/dl)	197.9 ± 93.7	161.1 ± 77.5	0.001
HDL-C (mg/dl)	39.8 ± 9.5	43.8 ± 10.6	0.001
LDL-C (mg/dl)	123.4 ± 46.9	117.7 ± 33.8	0.001

Table 01: Comparison of parameters between diabetic and non-diabetic patients

Abbreviations: TC, Total Cholesterol; HDL-C, High Density Lipoproteins-Cholesterol; LDL-C, Low Density Lipoproteins-Cholesterol

Discussion

The global burden of all types of diabetes mellitus, particularly type 2, is estimated as the number of diabetic patients will increase by 55% by 2035[16]. International Diabetes Federation (IDF) statistics data revealed the worldwide burden of diabetes mellitus in adults is about 425 million and by 2045, the number of affected adults with diabetes will be 629 million[18]. World Health Organization (WHO) estimated dyslipidemia, particularly high TG is accountable for about 2.6 million fatalities yearly and Disability adjusted life years (DALYs) of 29.7 million worldwide[7]. Hypercholesterolemia itself is a primary risk factor for CVDs with the estimated global burden of 4.0 million deaths and 88.7 million disability-adjusted life years[14]. In the South-East Asia Region (SEAR), hypercholesterolemia has accounted for 6.6% of deaths overall[24]. The last 30 years have seen an almost twofold increase in CVD deaths in Asia, from 5.6 million to 10.8 million[25]. Two prospective studies had been done recently in Finland which concluded linear correlation of glycemic control in individuals with type 2 diabetes who are at risk for CVDs[26]. Variations exists in lipids levels according to ethnicity, economic levels and access to health care facilities[6]. Increased lipid levels can be the result of different health behaviors such as tobacco consumption, physical inactivity, nutrition, and obesity. In particular, consuming a lot of saturated fats but little fruits, vegetables, or other nuts, or seeds is the nutrition risk factor[11]. Genetic disorders may also be the cause of dyslipidemia. When familial hypercholesterolemia occurs in LDL receptors, it is primarily due to mutations that are autosomal dominant that raise LDL-C levels. Other mutations in the cholesterol pathway have also been discovered, albeit they are less common[11]. Reports have been prepared by The National Cholesterol Education Program's series of Adult Treatment Panel (ATP) to aware healthcare professionals about recommendations for diagnosing and managing dyslipidemia[23]. A study suggested on the basis of its predictive modeling, that approximately 8,000 deaths annually (aged: <80 years) could prevented for every 10% increase in the number of people receiving treatment who have elevated LDL-C[27]. Effective management includes patient's life style modifications as changing dietary habit to a reduced fat consumption and elevated polyunsaturated fat ratio or monosaturated fatty acids to saturated fatty acids, and of course by stepping up your physical activity[14].Changes in lifestyle are necessary for the initial management of dyslipidemia. A diet that emphasizes consuming fruits, vegetables, and whole grains while staying within a reasonable calorie range should be part of this strategy. A minimum of 40 minutes a week of moderate-to-intense aerobic physical activity is recommended for adults, three to four

times a week[11]. The first dietary interventions for hypertriglyceridemia are to increase the intake of fish (high in ω–3) and decrease sugar intake. Less than 10% of saturated fat, 1% of trans fat, and less than 300 mg of cholesterol should make up the remaining 30%–35% of calories. Carbohydrates should make up 50%–60% of total calories, and proteins should make up 10%–15%[28,29]. Increasing the proportion of whole grains, fruits, and vegetables to the amount of fat consumed (proteins by 15%–20% of total calories, carbohydrates by 55%, and fats by 25%–30%) is the foundation of the recommended diet[30]. Statins that block HMG-CoA reductase, also known as 3-hydroxy-3methylglutaryl-coenzyme A, are the first-line treatment for dyslipidemia. Numerous studies have shown that the risk of cardiovascular events, mortality from all causes as well as cardiovascular death has been dramatically decreased with the use of statins and appropriate dyslipidemia treatment [11].It is possible to effectively manage and control high LDL-C through medication, lifestyle modifications, or a combination of these strategies. LDL-C levels may drop by as much as 20%–30% by putting lifestyle changes into practice, such as eating a low-fat, high-fiber diet, increasing physical activity, and controlling weight[27,31]. A holistic strategy incorporating enhanced clinical care, as well as increased affordability, sustainability, and accessibility to healthcare, is required to raise LDL-C control levels. Control of elevated LDL-C may be enhanced by a standardized patient care system that includes registries, automated reminders for practitioners, and electronic health records[27].The primary goal of this research was to increase awareness. The system should prioritize regular patient follow-up. Improved patient adherence to prescribed regimens may also be achieved by lowering cost, streamlining the medication regimen, and involving Allied health professionals who provide direct patient care include nurses, dietitians, health educators, pharmacists, and others[27.]

Conclusion

Our study showed the elevated lipids levels in diabetic group in contrast to the non-diabetic group. There was a marked association of HbA1C with triglycerides in the diabetic group but no significant results were found with TC, LDL-C and HDL-C among diabetic individuals. Insignificant difference of lipid levels except TGs among diabetic and non-diabetic patients are alarming as they are showing the future risk of non-diabetic patients, as they could get diabetes as well as CVDs. Our findings are showing extreme need of education for lifestyle modifications and healthy diet plans in our society. Also longitudinal and more accurate studies are needed to be done for preparing predictive values of diabetes and CVDs and acquiring data regarding the affecting factors and its management with proper educational awareness programs strategies.

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The following authors have made substantial contributions to the manuscript as under:
Conception or Design: Tehreem Shirazi
Acquisition, Analysis or Interpretation of Data: Tehreem Shirazi, Rooma Sikander
Manuscript Writing & Approval: Tehreem Shirazi, Rooma Sikander
All authors acknowledge their accountability for all facets of the research, ensuring that any concerns regarding the accuracy or integrity of the work are duly investigated and resolved.

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