**The Pattern and Prevalence of Dyslipidemia among Type 2 Diabetic Patients Attending Diabetes Clinic at Tripoli University Hospital**

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| **Keywords**:Diabetes, CVD, Hypertension, Dyslipidemia, Tripoli university hospital, Libya. ***Received*** *15 Nov 2024****Accepted*** *24 Jan 2025****Published*** *06 Feb 2025* |  | A B S T R A C TThis study aims to determine the prevalence and patterns of dyslipidemia in diabetic patients attending diabetes clinic at Tripoli university hospital. A total of 213 patients were included in this cross-sectional study, which analyzed lipid profiles, demographic factors, and associated health conditions. The results indicated a high prevalence of dyslipidemia among libyan diabetic patients, with 47.7% of patients exhibiting lipid abnormalities. The most common lipid abnormality was high LDL cholesterol (52.8%), followed by low HDL cholesterol (43.4%) and the abnormality in triglycerides in the study group was 3.8%. The study also found significant associations between dyslipidemia and factors such as age, obesity (BMI), and hypertension. These findings underscore the need for targeted interventions to manage dyslipidemia in diabetic patients. |

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**INTRODUCTION**

Dyslipidemia, characterized by abnormal levels of lipids in the blood, is a significant risk factor for cardiovascular diseases (CVD), particularly among individuals with diabetes mellitus [1]. Diabetes is associated with a distinct dyslipidemia profile, often marked by elevated LDL cholesterol, decreased HDL cholesterol, and increased triglyceride levels [2]. This lipid abnormality contributes to the increased cardiovascular risk observed in diabetic patients, making the management of dyslipidemia a critical component of diabetes care. The prevalence of dyslipidemia in diabetic populations varies widely across different regions and ethnic groups. Studies have shown that dyslipidemia affects approximately 50% to 80% of individuals with diabetes, influenced by factors such as age, sex, duration of diabetes, and lifestyle choices [3]. In particular, the prevalence of dyslipidemia is notably high in Middle Eastern populations, including Libyans, where lifestyle factors such as obesity, physical inactivity, and dietary habits contribute to the increased risk [4].

Obesity is a significant contributor to dyslipidemia in diabetic patients, as the accumulation of visceral fat is associated with insulin resistance, leading to lipid metabolism alterations [5]. Furthermore, hypertension, which frequently coexists with diabetes, has been shown to complicate lipid profiles, leading to a higher incidence of cardiovascular events [6].

Managing dyslipidemia in diabetic patients typically involves lifestyle modifications, such as dietary changes, increased physical activity, and pharmacotherapy when necessary [7]. Statins are the most commonly prescribed medications for lowering LDL, cholesterol and have been shown to reduce cardiovascular morbidity and mortality in diabetic patients [8]. However, adherence to treatment and lifestyle changes remains challenging, necessitating ongoing patient education and support [9]. In Libya, the burden of diabetes and its associated complications, including dyslipidemia, is rising. Understanding the prevalence and patterns of dyslipidemia in this population is essential for developing targeted interventions and improving patient outcomes.

**METHODS**

***Study design***

Across-sectional study was conducted at the outpatient diabetes clinic of Tripoli University Hospital, which provides diabetes care services for both type 1 and type 2 diabetes patients.

***Data collection***

The study focused on the management of diabetes and associated risk factors, particularly hypertension, dyslipidaemia, cardiovascular disease, and related comorbidities, over a six-month period from September 2021 to February 2022. Fasting lipid profiles were assessed for the selected patient group after a 12-hour fast, measuring total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein (HDL), and triglycerides (TG) in mg/dl.

Dyslipidaemia was defined as LDL-C > 100 mg/dl,TG > 200 mg/dl, HDL < 55 mg/dl for females and < 45 mg/dl for males, or TC > 200 mg/dl. All type 2 diabetic patients (T2D) aged 18 or older were included in the study, and most of the patients were on statin therapy.

***Statistical analysis***

All observations were tabulated, and results were expressed as percentages and means ± standard deviation. Data analysis was performed using SPSS software (Version 18). The chi-square test was used to determine coefficients, with a p-value of ≤ 0.05 considered significant and a p-value of > 0.05 considered not significant.

**RESULTS**

A total of 213 patients were studied. Males 80 (37.6%) and females 133 (62.4%); Nationality of patients were 97.6% Libyan. In this study, the mean age of participants was 48.51 ± 11.6 years. Approximately 20% of the participants were below 40 years of age, while 80% were above. The mean duration of diabetes was 4.9 ± 4.7 years; for men, it was about 5.1 ± 5.7 years, and for women, it was 4.8 ± 4.1 years, as shown in table1.

***Table 1. Characteristics and fasting lipid profile of patients with type 2 diabetes***

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| **Characteristics** | **Both** | **Men** | **Women** |
| Age (years) | 48.51±11.6 | 49.47±11.8 | 47.9±11.5 |
| Diabetes duration (years) | 4.9±4.7 | 5.1±5.7 | 4.8±4.1 |
| **Mean BMI**ObesityNon-obeseObese | 30.3± 6.637 (20.9%)140 (79.1%) | 27.5±4.823 (30.7%)52 (69.3%) | 32.4±7.114 (13.7%)88 (86.3%) |
| **Presence of other illness**NOYES | 132 (69.8%)57 (30.2%) | 50 (70.4%)21 (29.6%) | 82 (69.5 %)36 (30.5%) |
| **Type of illness present**HypertensionIHDhypothyroidismHyperthyroidism | 36 (16.9 %)9 (4.2 %)13 (6.1 %)2 (0.9 %) | 17 (21.3%)5 (6.3%)2 (2.5%)1 (1.3%) | 19 (14.3%)4 (3.0%)11 (8.3%)1 (0.8%) |
| **Percentage on each therapy**DietSulfonylureametforminInsulinCombination | 8 (3.9 %)61 (29.9 %)36 (17.5 %)56 (27.2 %)45 (21. %8) | 6 (7.7%)26 (33.3%)14 (17.9%)16 (20.5%)16 (20.5%) | 2 (1.6 %)35 (27.3 %)22 (17.2 %)40 (31.3 %)29 (22.7 %) |
| **Lipids**Total cholesterolLDL cholesterolHDL cholesteroltriglycerides | 183.5±36.5115.3±33.951.8±19.6171.1±99.3 | 177.1±36.4111.5±31.445.8±11.9178.7±60.7 | 187.4±36.3117.2±35.255.2±22.3166.8±89.1 |
| **Smoking**YesNo | 12 (6.3 %)178 (93.7%) | 12 (18.5%)53 (81.5%) | 0.0 (0 %)125 (100%) |
| **Family history**NOYESDMDyslipidemiaCHDHypertension | 71 (37.8%)105 (62.2%)102 (47.9%)2 (0.9%)5 (2.3 %)10 (4.7 %) | 29 (44.6%)36 (55.4%)37 (46.3%)0 (0.0 %)1 (1.3 %)2 (2.5 %) | 42(37.8 %)69(62.2%)65(48.9 %)2(1.5%)4(3.0 %)8(6.0%) |

Regarding the types of diabetes treatment, our study revealed that the highest percentage of diabetic patients were on sulfonylureas (61 patients, or 29.9%), followed by insulin (56 patient, or 27.2%), metformin (36 patients, or 17.5%), combination therapy (45 patients, or 21.8%), and the lowest percentage were on a diet regimen (8 patients, or 3.9%). The mean Body Mass Index (BMI) for the study population was 30.3 ± 6.6. Women had a mean BMI of 32.4 ± 7.1, while men had a mean BMI of 27.5 ± 4.8. Of all diabetic patients,79% (n = 140) were found to be obese, with obesity being more prevalent among females (88 patients, or 86.3%) compared to males (52 patients, or 69.3%). Additionally, 16.9% (n = 36) of participants were hypertensive, 47.9% (n = 102) had a family history of diabetes, and 6.3% (n = 12) of males were smokers.

***Prevalence and pattern of dyslipidemia***

In this study, the prevalence of dyslipidemia among diabetic patients was found to be 47.7%. The most common lipid abnormality was high LDL (low-density lipoprotein), affecting 52.8% of the participants, followed by low HDL (high-density lipoprotein) levels, which were below target in 43.4% of patients. Abnormal triglyceride levels were observed in 3.8% of the study group. The most frequent form of isolated dyslipidemia was high LDL, impacting 54.4% of females and low HDL, affecting 44.4% of males. Combined dyslipidemia, characterized by high LDL and low HDL, was the most prevalent form of combined dyslipidemia among both men and women, occurring in 9.7% of the participants. Specifically, among females, the prevalence of high LDL and low HDL was even higher at 13.8%. The second form of combined dyslipidemia was high triglycerides and low HDL, observed in 1.4% of the participants, followed by cases with above-target LDL and triglycerides, which accounted for 0.7% (Table 2).

***Table 2. Patients with none, one, two or three lipid value not at clinical target according to sex***

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| Number not at target | Both (%) | Men (%) | Women (%) |
| **None out of target** Normal lipid profile-Dyslipidemia | 52.347.7 | 61.538.5 | 47.452.6 |
| **One out of target**LDL> 100 mg/dlHDL below targetTG 200-399 mg/dl | 52.843.43.8 | 5044.45.6 | 54.442.92.9 |
| **Two out of target**LDL >100mg + HDL below target.LDL > 100 mg + TG 200-399 mg.HDL below target + TG 200-399 mg. | 9.70.71.4 | 2.103.9 | 13.81.10 |

***Pattern of serum lipids by risk category***

The percentages of men and women with high, borderline, or low risk LDL cholesterol level were 31.7%, 33.1%, 35.2 % respectively (Table 3). For men about 42.9% are at low risk of LDL level whereas 36.6% of women were at high risk of LDL level (P= 0.191).

***Table 3. Percentage and p value of patients with high, borderline, and low risk LDL, HDL, and TG profile according to sex***

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| --- | --- | --- | --- | --- |
| **Lipid categories** | **Both %** | **Men%** | **Women%** | **p value** |
| **LDL**High riskBorderline riskLow risk | 31.733.135.2 | 22.434.742.9 | 36.632.331.2 | 0.191 |
| **HDL**High riskBorderline riskLow risk | 26.126.847.2 | 19.629.451 | 29.725.345.1 | 0.423 |
| **TG**High riskBorderline riskLow risk | 325.471.6 | 4.325.770 | 2.425.272.4 | 0.744 |

***Table 4. Linear regression analyses examining the influence of sex, age, BMI, and HTN on the probability of having LDL- cholesterol, HDL-cholesterol, and TG levels outside of the recommended targets.***

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| **Category** | **B (95% CI)** | **P value** |
| **Probability of LDL cholesterol ≥ 100mg/dl according**Women vs men>40yr vs < 40 yr.Hypertensive vs no hypertensiveObese vs non obese | 0.068 (-9.947-19.774)0.130 (- 0.199- 0.949)0.016 (-17.865 –21.017)0.119 ( -0.429 -1.607) | 0.5140.1980.8730.254 |
| **Probability of HDL cholesterol below target according**Women vs men>40yr vs < 40 yr.Hypertensive vs no hypertensiveObese vs non obese | 0.292(2.931 – 15.584)0.116 (-0.395 – 0.099)0.070 (-5.225 – 11.222)0.002(0.430 – 0.440) | 0.1250.2380.4710.982 |
| **Probability of TG ≥ 200mg/dl according**Women vs men>40yr vs < 40 yr.Hypertensive vs no hypertensiveObese vs non obese | 0.091(-55.507 – 17.434)0.066 (0.859 – 1.988)0.069(-70.488 – 29.064)0.099 (1.135- 4.066) | 0.3100.4340.4120.267 |

**DISCUSSION**

The findings of this study highlight the considerable prevalence of dyslipidemia among Libyan patients with type 2 diabetes, pointing to a pressing public health concern [10]. The high percentage of patients with high LDL cholesterol mirrors observations across various demographics where diabetes and dyslipidemia co-occur, compounding cardiovascular risks [11]. Isolated cases of dyslipidemia—prominently high LDL and low HDL levels—signify a need for continuous monitoring and targeted management strategies [12]. Notably, the prevalence of dyslipidemia is significantly related to age, obesity, and hypertension, reinforcing the multi-factorial nature of the condition [13]. It reflects the lifestyle and health challenges faced by the local population, exacerbated by obesity's role as both a cause and a consequence of diabetes.

 Given the study's demographics, particularly the predominant obesity rates among participants, emphasis must be placed on lifestyle modification strategies to alleviate dyslipidemic conditions. The correlation between hypertension and dyslipidemia further suggests integrative healthcare approaches are necessary, addressing both conditions simultaneously to reduce the overall card iovascular burden [14]. Effective management of dyslipidemia must also encompass patient education on adherence to dietary modifications, regular physical activity, and medication compliance, particularly with statins, as they display a significant impact on glycemic control and cardiovascular outcomes [15].

 The overall prevalence of dyslipidemia in the study population was 47.7%. High LDL cholesterol was observed in 52.8% of patients, while low HDL cholesterol was found in 43.4% of patients. The most common pattern of isolated dyslipidemia was high LDL, affecting 54.4% of females, and low HDL, affecting 44.4% of males. In terms of demographic associations, among male patients, 81.5% had disturbed LDL cholesterol levels, with a significant proportion being over 40 years old, 68% classified as obese, and 22% hypertensive. Abnormal triglyceride levels were noted in 41.7% of males over 40, with 68.4% being obese and 22% hypertensive. Additionally, 88% of males over 40 had low HDL cholesterol levels, with 68.2% identified as obese and 28% hypertensive. These findings highlight a concerning prevalence of dyslipidemia among Libyan diabetic patients, particularly in older, obese, and hypertensive individuals. The results suggest the need for routine lipid screening and targeted interventions to manage dyslipidemia effectively in this population. Addressing lipid abnormalities is crucial for reducing cardiovascular risk and improving overall health outcomes in diabetic patients.

**CONCLUSION**

Dyslipidemia is highly prevalent among patients with type 2 diabetes in Libya, underscoring the urgent need for routine screening and management interventions. The association of dyslipidemia with age, obesity, and hypertension highlights the necessity of a comprehensive approach to diabetes care to enhance patient outcomes. Future studies should implement longitudinal assessments to track the impact of lifestyle interventions on lipid profiles. Healthcare providers should prioritize lipid management within diabetes care protocols and enhance patient education initiatives to foster adherence to treatment regimens [16].

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