Dyslipidemia Pattern Among Newly Diagnosed and Known Type 2 Diabetics: A Comparative Analysis from a Tertiary Care Hospital of Karachi, Pakistan

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Abstract

Objective: To compare the pattern of dyslipidemia among newly diagnosed and known type 2 diabetic patients.

Study design, settings and duration: This retrospective study was conducted at Baqai institute of Diabetology and Endocrinology and Baqai Medical University, (BMU), a tertiary care unit in Karachi, Pakistan from January 2005 to May 2016.

Methodology: Subjects with type 2 diabetes were included and subjects with gestational diabetes and type 1 diabetes were excluded. Medical records were obtained through electronic database (Health Management System).

Results: Out of 12256 subjects, 57.7% were male and 42.3% female. Mean age was 52.46±10.94. Mean body mass index (BMI) was 28.35±5.49, in newly diagnosed individuals BMI was 29±5.79 while 28.2±5.41 in individuals with known diabetes. Overall dyslipidemia was found in 10231 (83.5%) subjects. Among types of dyslipidemia, hyper-cholesterolemia, hyper-triglyceridemia and low HDL was significantly associated with diabetes status and hyper-cholesterolemia, hyper-triglyceridemia, dyslipidemia, high LDL and low HDL was significantly associated with obesity. Logistic regression revealed the significant correlates of dyslipidemia with female gender, age and obesity in newly diagnosed diabetics while female gender, age, obesity and hypertension in known diabetics.

Conclusion: We conclude that majority of the diabetics either newly diagnosed or known both have disturbed lipid parameters. Specifically, the pattern in newly diagnosed cases is alarmingly high. Further larger scale community-based studies are required to ascertain the findings of this study.

Key words: Dyslipidemia, diabetes, hyperglycemia, Pakistani population.

Introduction

Diabetes mellitus has become one of the most prevalent non communicable disease with rapid rise in numbers globally.[1] International Diabetes Federation (IDF) Atlas in 2017 reported a prevalence of diabetes as 8.8% around the globe.[2]

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Authors Contribution

AF & AB conceptualized the project and did drafting, revision of manuscript. NN, AB, ABZ & BT performed the literature search, interpretation of data and writing of manuscript.

Basit *et al.*, reported 26.3% overall weighted prevalence of diabetes in Pakistan in 2018.[3] Numerous studies have demonstrated that the traditional risk factors for cardiovascular disease including hypertension, cigarette smoking, and lipid abnormalities play an important role in development of complications in subjects with diabetes.[4,5] Subjects with type 2 diabetes mellitus affected with macro vascular complications including dyslipidemia suffer 1.5 to 3.6 fold increase in mortality.[6,7] According to the World Health organization (WHO), the prevalence of dyslipidemia is 30.3% in the region of South East Asia, 36.7% in Western Pacific, 53.7% in Europe and 47.7% in America.[8] In general population various types of dyslipidemias were identified in diabetes mellitus. Dyslipidemia includes increased total cholesterol (TC), triglyceride (TG), and low-density lipoprotein cholesterol (LDL-C), and decreased high-density lipoprotein cholesterol (HDL-

C).[9] Globally the prevalence of hyper-cholesterolemia among adults is 37% for males and 40% for females.[10] Frequency of dyslipidemia is on continuous rise in the developing countries including Pakistan.[11] This trend is mostly attributed to unhealthy dietary patterns, obesity, tobacco use, alcohol abuse, reduced physical activity, aging of population and many other co-factors.[9] These behavioral risk factors were responsible for 80% of coronary heart disease and cerebro vascular disease.[12] People with type 2 diabetes showed 2-4 fold increased risk for coronary artery disease due to increase in multiple risk factors and dyslipidemia is one of them.[13] Many epidemiological studies have proven that increased LDL cholesterol and non-HDL cholesterol levels and decreased HDL cholesterol levels are associated with an increased risk of cardiovascular disease in individuals with diabetes.[14,15]

There is immense need of public health measures targeting dyslipidemia and treating individuals especially with added risk factors like obesity, physical inactivity, tobacco use, diabetes mellitus and hypertension.[16] In this regard, the current study was conducted to compare the pattern of dyslipidemia in newly diagnosed and known type 2 diabetics in our local population.

Methodology

This retrospective study was conducted at Baqai institute of Diabetology and Endocrinology and Baqai Medical University, (BMU), a tertiary care unit in Karachi- Pakistan.The duration of study was from January 2005 to May 2016. Known type 2 diabetes mellitus and newly diagnosed type 2 diabetes mellitus patients were included and those with gestational diabetes and type 1 diabetes were excluded. Ethical approval was obtained by Institutional Review Board (IRB) of BIDE. Medical records were obtained from computerized hospital management system (HMS).

Biochemical parameters were measured by standard laboratory test methods. Hyper-cholesterolemia was defined as cholesterol over 200 mg/dl. A triglyceride >150mg/dl was considered to be hyper-triglyceridemia. LDL cholesterol concentration was stated to be abnormal if it was >100 mg/dl. Low HDL was <40 mg/dl for male and <50 mg/dl for female.[17] Dyslipidemia was taken as any one or more than one of the above.

As reported in the (World Health Organization) WHO Asia Pacific Guidelines, overweight was defined as a BMI 23 – 24.9 kg/m^2 and obesity was defined as a BMI ≥ 25 kg/m^2.[18] Whereas central obesity was defined as waist circumference ≥ 90 cm in men and ≥80 in women.[3] HbA1c value of ≤7% and >7% were taken as good and poor control respectively.[19]

Table 1: Anthropometric and clinical characteristics of studied individuals.

Parameters		Overall	Diabetes status			Dyslipidemia		
			Newly Diagnosed DM	Known DM	p-value	No	Yes	p-value
n		12256	2091	10165	-	2025	10231	-
Age (years)		52.46±10.94	48.39±11.45	53.3±10.64	<0.0001	54.43±11.25	52.07±10.84	<0.0001
Gender	Male	7073 (57.7%)	1277 (61.1%)	5796 (57%)	0.001	1391 (68.7%)	5682 (55.5%)	<0.0001
	Female	5183 (42.3%)	814(38.9%)	4369 (43%)		634 (31.3%)	4549 (44.5%)	
Marital status	Single	600 (6.2%)	118 (6.7%)	482 (6%)	0.296	91 (6.3%)	509 (6.1%)	0.769
	Married	9153 (93.8%)	1645 (93.3%)	7508 (94%)		1348 (93.7%)	7805 (93.9%)	
Weight (kg)		73.78±15.26	76.25±16.39	73.21±14.94	<0.0001	72.56±14.82	74±15.34	0.001
Height (cm)		161.44±9.6	162.25±9.61	161.25±9.59	<0.0001	162.42±9.14	161.26±9.68	<0.0001
Body mass index (kg/m^2)		28.35±5.49	29±5.79	28.2±5.41	<0.0001	27.55±5.37	28.5±5.5	<0.0001
Systolic blood pressure (mmHg)		130.16±19.77	125.78±18.16	131.13±19.99	<0.0001	129.45±19.92	130.29±19.75	0.121
Diastolic blood pressure (mmHg)		81.03±10.28	81.07±10.24	81.02±10.29	0.869	80.33±10.23	81.16±10.29	0.004
Smoking Habit	No	9223 (90%)	1637 (88.4%)	7586 (90.4%)	0.012	1420 (90.4%)	7803 (89.9%)	0.545
	Yes	1022 (10%)	214 (11.6%)	808 (9.6%)		150 (9.6%)	872 (10.1%)	
Family history of DM	No	3153 (30.8%)	609 (33%)	2544 (30.3%)	0.022	503 (32%)	2650 (30.6%)	0.249
	Yes	7083 (69.2%)	1235 (67%)	5848 (69.7%)		1067 (68%)	6016 (69.4%)	
HTN	No	4105(40.4%)	904 (49.2%)	3201 (38.5%)	<0.0001	664 (42.4%)	3441 (40.1%)	0.081
	Yes	6047 (59.6%)	934 (50.8%)	5113 (61.5%)		901 (57.6%)	5146 (59.9%)	
Obesity	No	2696 (28.2%)	433 (24.2%)	2263 (29.2%)	<0.0001	525 (35%)	2171 (27%)	<0.0001
	Yes	6856 (71.8%)	1356 (75.8%)	5500 (70.8%)		974 (65%)	5882 (73%)	
HbA1c (%)		9.41±2.25	9.2±2.45	9.46±2.2	<0.0001	8.92±2.12	9.5±2.26	<0.0001
Serum creatinine (mg/dl)		1.11±0.94	0.99±0.44	1.13±1.01	<0.0001	1.07±0.51	1.11±1	0.091

Data presented as mean±SD, *p*-value <0.05 considered to be statistically significant

Table 2 The serum lipid concentrations and frequency of dyslipidemia by diabetes status.

Parameters	Newly diagnosed DM (n)	Known DM	p-value	Overall (n)
	2091	10165	-	12256
Cholesterol (mg/dl)	185.75±48.19	175.63±48.45	<0.0001	177.36±48.55
Triglyceride (mg/dl)	180.93±148.19	175.43±134.35	0.001	176.36±136.79
HDL (mg/dl)	38.03±9.3	37.38±9.73	0.009	37.49±9.66
LDL (mg/dl)	114.11±35.61	105.88±36.72	<0.0001	107.27±36.67
Hyper-cholesterolemia	669 (33.2%)	2725 (27.7%)	<0.0001	3394 (28.7%)
Hyper-triglyceridemia	937 (49.7%)	4343 (46.7%)	0.017	5280 (47.2%)
Low HDL cholesterol	1356 (73.9%)	6922 (76%)	0.049	8278 (75.7%)
High LDL cholesterol	604 (31.7%)	2310 (24.6%)	<0.0001	2914 (25.8%)
Dyslipidemia	1745 (83.5%)	8486 (83.5%)	0.973	10231 (83.5%)

Data presented as mean±SD, *p*-value <0.05 considered to be statistically significant
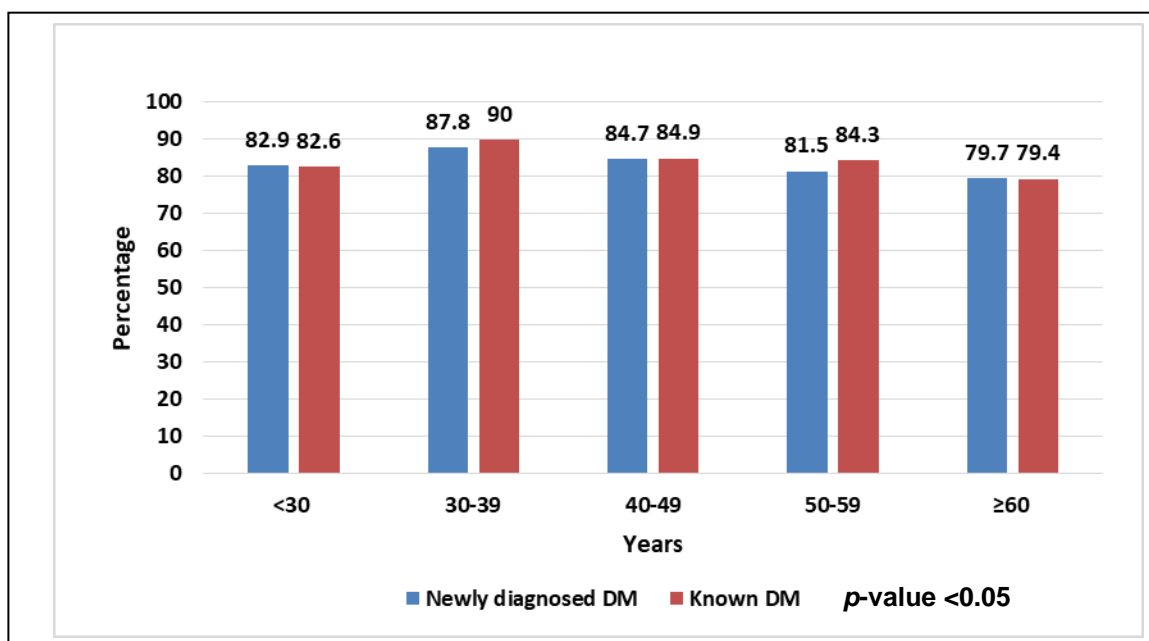

Figure: Frequency of dyslipidemia by different age groups and diabetes status.

Results

From the 12256 participants involved in the study, 57.7% were male and the rest were female. Mean age was 52.46±10.94%. Mean body mass index (BMI) was 28.35±5.49, 29±5.79 in newly diagnosed individuals and 28.2±5.41 in individuals with known diabetes. Around 60%of the participants were found to be hypertensive, prevalence of hypertension was 50.8% in individuals with newly diagnosed diabetes and 61.5% in known diabetes group. Mean obesity was found in 71.8% of the participants. Newly diagnosed diabetes group showing higher prevalence of obesity 1356 (75.8%) as compared to known diabetes group 5500 (70.8%). Dyslipidemia was found in 83.5% of individuals with both groups sharing the exact same prevalence of 83.5%, and has shown significant association with age, gender, height, BMI, obesity and HbA1c (*p* <0.0001) (Table-1).

Table-2 represents the lipid level and frequency of dyslipidemia in newly diagnosed and known diabetes mellitus. Overall frequency of dyslipidemia was found 83.5% in both groups. In individual with newly diagnosed diabetes mellitus frequency of hyper-cholesterolemia, hyper-triglyceridemia, low HDL and high LDL were 33.2%, 49.7%, 73.9% and 31.7% respectively. While in known diabetes mellitus group same frequencies were 27.7%, 46.7%, 76% and 24.6% respectively.

As shown in Figure, significant differences were found in different age groups (*p* <0.05), the peak prevalence of dyslipidemia in both groups was between 30-39 years, and then declined gradually. Frequency of dyslipidemia was significantly higher in known diabetes mellitus group between age 50 - 59 years.

Table 3: Dyslipidemia according to comorbidities.

Comorbidity	Hypercholesterolemia	Hypertriglyceridemia	Low HDL	High LDL	Dyslipidemia
Newly diagnosed DM	669 (33.2%)	937 (49.7%)	1356 (73.9%)	604 (31.7%)	1745 (83.5%)
Known DM	2725 (27.7%)	4343 (46.7%)	6922 (76%)	2310 (24.6%)	8486 (83.5%)
O.R (95% CI)	0.77 (0.69-0.85)	0.88 (0.80-0.97)	1.12 (1.0-1.25)	0.70 (0.63-0.78)	1.0 (0.88-1.13)
p-value	<0.0001	0.017	0.049	0.702	0.973
Non-hypertensive	1094 (27.7%)	1720 (45.4%)	2817 (75.8%)	995 (25.8%)	3441 (83.8%)
Hypertensive	1712 (29.2%)	2636 (47.4%)	4226 (77.5%)	1479 (26.3%)	5146 (85.1%)
O.R (95% CI)	1.07 (0.98-1.18)	1.08 (1.0-1.18)	1.09 (0.99-1.21)	1.02 (0.93-1.12)	1.10 (0.98-1.22)
p-value	0.097	0.051	0.063	0.62	0.081
Non-obese	677 (26%)	959 (38.6%)	1764 (72.3%)	637 (25.2%)	2171 (80.5%)
Obese	2048 (31%)	3248 (51.6%)	4787 (77.6%)	1763 (27.7%)	5882 (85.8%)
O.R (95% CI)	1.27 (1.15-1.41)	1.69 (1.53-1.86)	1.32 (1.19-1.47)	1.13 (1.01-1.25)	1.46 (1.29-1.64)
p-value	<0.0001	<0.0001	<0.0001	0.021	<0.0001

Data presented as n(%) and Odd ratio (95% confidence interval)
p-value <0.05 considered to be statistically significant

Table 4: Logistics regression analysis for predictors of dyslipidemia.

Newly diagnosed DM							
Lipid/Predictors	Female	Age	Married	Hypertension	Obesity	Smoker	Positive family history
Hyper-cholesterolemia	1.22	0.99	1.31	1.04	1.43	0.89	0.96
	(0.98-1.52)	(0.99-1)	(0.85-2.03)	(0.84-1.28)	(1.11-1.86)	(0.63-1.27)	(0.77-1.2)
p-value	0.077	0.231	0.222	0.73	0.006	0.531	0.719
Hyper-triglyceridemia	0.8	0.98	0.98	1.08	1.43	1.32	1
	(0.64-1)	(0.97-0.99)	(0.63-1.51)	(0.88-1.33)	(1.11-1.83)	(0.94-1.86)	(0.8-1.25)
p-value	0.05	<0.0001	0.917	0.453	0.005	0.114	0.99
Low HDL	3.42	0.97	1.66	1.07	1.09	1.38	0.89
	(2.56-4.58)	(0.96-0.98)	(1-2.76)	(0.84-1.37)	(0.82-1.45)	(0.94-2.04)	(0.68-1.17)
p-value	<0.0001	<0.0001	0.05	0.588	0.547	0.1	0.396
High LDL	1.44	0.99	1.17	1.05	1.38	0.8	0.91
	(1.15-1.81)	(0.98-1)	(0.75-1.83)	(0.84-1.31)	(1.06-1.81)	(0.55-1.18)	(0.72-1.15)
p-value	0.002	0.156	0.496	0.666	0.018	0.262	0.443
Dyslipidemia	1.43	0.98	1.7	1.26	1.51	0.83	1.07
	(1.07-1.93)	(0.97-0.99)	(1.04-2.79)	(0.96-1.66)	(1.12-2.03)	(0.55-1.25)	(0.8-1.43)
p-value	0.017	<0.0001	0.035	0.091	0.006	0.379	0.637
Known DM							
	Female	Age	Married	Hypertension	Obesity	Smoker	Positive family history
Hyper-cholesterolemia	1.48	0.98	1.12	1.16	1.07	1.4	0.96
	(1.32-1.65)	(0.98-0.99)	(0.89-1.39)	(1.04-1.29)	(0.95-1.21)	(1.17-1.68)	(0.86-1.08)
p-value	<0.0001	<0.0001	0.337	0.01	0.268	<0.0001	0.485
Hyper-triglyceridemia	1.21	0.98	0.97	1.17	1.61	1.29	1.09
	(1.09-1.34)	(0.97-0.98)	(0.79-1.19)	(1.05-1.29)	(1.45-1.8)	(1.09-1.53)	(0.98-1.22)
p-value	<0.0001	<0.0001	0.755	0.003	<0.0001	0.004	0.106
Low HDL	2.96	0.99	1.22	1.01	1.07	1.28	0.93
	(2.58-3.38)	(0.98-0.99)	(0.95-1.57)	(0.9-1.14)	(0.94-1.22)	(1.05-1.56)	(0.82-1.06)
p-value	<0.0001	<0.0001	0.126	0.847	0.321	0.013	0.265
High LDL	1.35	0.99	1.06	1.07	0.96	1.21	0.93
	(1.2-1.51)	(0.98-0.99)	(0.84-1.33)	(0.96-1.2)	(0.84-1.08)	(1-1.46)	(0.83-1.05)
p-value	<0.0001	<0.0001	0.628	0.245	0.458	0.054	0.265
Dyslipidemia	1.79	0.98	1.12	1.04	1.17	1.44	0.96
	(1.55-2.06)	(0.98-0.99)	(0.85-1.47)	(0.91-1.19)	(1.02-1.35)	(1.14-1.83)	(0.83-1.11)
p-value	<0.0001	<0.0001	0.434	0.584	0.026	0.003	0.569

Data presented as Odd ratio (95% confidence interval)
p-value <0.05 considered to be statistically significant

Calculations of the prevalence of dyslipidemia on the basis of co-morbidities, with odds ratios and 95% confidence intervals is reported in Table-3. Among types of dyslipidemia, hyper-cholesterolemia, hyper-triglyceridemia and low HDL were significantly associated with diabetes status and hyper-cholesterolemia, hyper-triglyceridemia, dyslipidemia, high LDL and low HDL was significantly associated with obesity.

A logistic regression analysis was performed for significant predictors (Table-4). Age was a significant predictor for hyper-triglyceridemia, low HDL, and dyslipidemia in individuals with newly diagnosed diabetes mellitus and all types of

dyslipidemias in individuals with known diabetes mellitus. Female gender was a significant predictor for all types of dyslipidemias in known diabetes mellitus group while in newly diagnosed diabetes mellitus group low HDL, high LDL, hyper-triglyceridemia and dyslipidemia were significantly associated with female gender.

Obesity was found significant for all types of dyslipidemias except low HDL in newly diagnosed and all except hyper-cholesterolemia, low HDL and high LDL in individuals with known diabetes mellitus. Smoking was found significantly associated with all types of dyslipidemias except high LDL in individuals with known diabetes mellitus and was not associated with any dyslipidemia significantly in newly diagnosed group.

Data analysis were perform using SPSS version 20. T-test or Mann Whitney test were used as appropriate after checking for normality. Multiple logistic regression for significant predictors were performed. Level of significance was set to be <0.05. Total frequency in some columns may vary due to missing data from certain variables.

Discussion

An important and alarming finding of our study is that, the frequency of dyslipidemia was found in more than eighty percent of diabetic individuals which was higher than the similar type of studies done on diabetic population in India[1] and much higher than the normal and pre diabetic population of Asia.[20] Though significant association of dyslipidemia with age, gender, height, HbA1c, obesity and BMI was the finding which is in consensus with same study of India. Elevated LDL being major risk factor for cardiovascular disease[21] was one of the most important type of dyslipidemia tested in our study and it showed that 25.8% of the subjects had raised LDL levels as compared to 83.5% frequency of overall dyslipidemia. These results were comparable to the data from Kennady *et al.*,[22] who found that 45% of those with diabetic dyslipidemia have their LDL within target range.

Another important finding shared by both groups is low HDL being the most common type of dyslipidemia in diabetic population which is in correspondence with results obtained by Singh et al. in 2015 showing that HDL-Cholesterol was significantly lower in diabetic subjects.[23]

Furthermore, a significant influence of age on dyslipidemia with highest frequency between 30-39 and declined at ≥60 are the findings which were comparable with previous study reported dyslipidemia peaking at 30 to 39.[24]

Khader*et al* reported a higher frequency of raised triglycerides and total cholesterol levels and low HDL levels in overweight and obese subjects in Arab population.[25] Our study reported similar type of findings with hyper-triglyceridemia, hyper-cholesterolemia, low HDL and dyslipidemia being significantly associated with obesity.

A study published in 2008 from Pakistan showed that 41.2% of the study participants have got raised LDL levels[26] which was significantly higher than the frequency of raised LDL levels in this study. This finding may be highlighting the gradual improvement in the health care system of the country. An alarming finding of our study is the same frequency of dyslipidemia in newly diagnosed and known diabetes mellitus group, emphasizing the need to target the cholesterol levels as soon as diabetes mellitus is diagnosed.

We conclude that majority of the diabetics were either newly diagnosed or known have disturbed lipid parameters. Specifically, the pattern in newly diagnosed subject was alarmingly high. Further larger scale community-based studies are required to ascertain the findings of this study.

Diabetes as a cardiovascular risk equivalent with very high mortality and morbidity reported leading to macrovascular complications, it would be pertinent to check lipid profile for every type 2 diabetic patient at the time of first reporting and then annually. Early screening and effective management can improve secondary prevention level.

Conflict of interest: None declared.

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