Original Article

Seven-Year Trend Analysis Of Dyslipidemia Among Patients Reporting To Tertiary Care Hospital In Rawalpindi, Pakistan

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Abstract

Objective: Dyslipidemia is a noticeable cause of morbidity and mortality. The purpose of the study was to analyse the cholesterol and triglyceride levels of patients presenting for lipid profile.

Methods: A total of 9989 participants presenting to Benazir Bhutto Hospital, Rawalpindi, for the Lipid profile assessment were enrolled in this study. The participants were included irrespective of age and gender. Data was retrieved from HMIS for the last 7 years (2015-2022). Enzymatic colourimetric techniques were used to examine the serum levels of total cholesterol and triglycerides. Dyslipidemia was defined based on standard guidelines by the National Cholesterol Education Program Adult Treatment Panel III.

Results: Out of the total of 9989 presented with signs and symptoms of dyslipidemia, 401(4%) were subjects under 19 years of age. Among the adult patients, 4283(44 .7%) were males and 5305 (55.3%) were females. Females have significantly high concentrations of cholesterol median (min-max), 203.25(48-1157) as compared to males, 196.95 (2-924). Mann Whitney, p value= 0.0001. Significant. difference was not observed for the concentrations of triglycerides in both genders (p=0.761) Substantial difference in concentrations of cholesterol and triglycerides was observed in different age groups. Kruskal Wallise H 145.09 p –value 0.0001, Kruskal Wallise H 171 51 .09 p –value 0.0001 , respectively.

Conclusion: Highest number of patient with dyslipidemia were observed in age group between 40-52 years. Mean cholesterol level in females were significantly higher as compared to males. Prevalence of isolated hypercholesterolemia and isolated hypertriglyceridemia in our study was 50.3% and 59.9% respectively.

Keywords: Dyslipidemia, lipid profile, Hypercholesterolemia and triglyceride levels.

Introduction

Dyslipidemia has been described as disorders in lipid metabolism, initiating changes in the serum levels of circulating lipids and lipoproteins.[1] These metabolic derangements is regarded as either isolated or a combination of raised levels of total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), and triglycerides (TG) or reduced levels of high-density lipoprotein cholesterol (HDL-C).[2] A lipid profile is a panel of blood tests that is needed for screening of dyslipidemia.[3]

Dyslipidemia can be differentiated into two types: primary and secondary dyslipidemia. Whereas the former is the outcome of a genetic predisposition, the latter is concomitant with an underlying medical disorder or associated with environmental, nutritional, and behavioural factors. Around 4.32 million fatalities were observed in 2017 as a consequence of raised low-density lipoprotein cholesterol (LDL-C).[4] Dyslipidemia, essentially high levels of LDL-C, is a potential risk factor for cardiovascular disease (CVD), while hypertriglyceridemia is associated with non-alcoholic fatty liver disease and acute pancreatitis.[5] The commonest form of dyslipidemia is hypercholesterolemia (cholesterol level above 5,0mmol/L or 190mg/L). Globally, hypercholesterolemia is the reason for one-third of ischemic heart diseases.[6] Lipid deposition, along with endothelial dysfunction, leads to initiation, growth and progression of atherosclerotic plaques in the wall of the arteries.[7] Clinically, arteriosclerosis manifests as coronary artery disease, peripheral vascular occlusive diseases and ischemic stroke.[6]

The prevalence of dyslipidemia has risen in the last three decades, especially in developing countries and among the elderly population.[5, 8] This reflects an increased health burden globally.[5] World Health Organisation (WHO) has reported that 39% of the adult population has hypercholesterolemia, women having a higher prevalence (40%) than men (37%). A survey conducted by the World Health Organisation in Saudi Arabia (2019) revealed raised serum cholesterol in 42% and 47% of the urban and rural population, respectively.[4] Different types of dyslipidemia have been related to gender and patients' age groups. Type 2 Diabetes Mellitus, hypertension and obesity were also found to be risk factors for dyslipidemia.[9] Two major contributing factors in this regard are diet and lifestyle. Variable results are reported based on age, sex, dietary habits, level of physical activities and various genetic polymorphisms.[7] Management of dyslipidemia includes lifestyle modification and pharmacotherapy.[4]

Contributions:
WO - Conception, Design
AW - Acquisition, Analysis, Interpretation
WO, HA, AN, MU - Drafting
HA, AN, MU - Critical Review

All authors approved the final version to be published & agreed to be accountable for all aspects of the work.

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Dyslipidemia is also reported to be prevalent in South Asia. This region is more susceptible to having increased total cholesterol, TG and HDL-C levels.[3] Data regarding the trends of dyslipidemia are currently limited in our part of the world. This emphasises the importance of investigating the trends and patterns of dyslipidemia in our local population. Identifying the associated risk factors can later facilitate the establishment of prevention strategies. This study, therefore, aims to analyse the pattern of dyslipidemia among participants reporting for lipid profile assessment in a tertiary care hospital for a period of last seven years.

Materials And Methods

A retrospective observational study was conducted by retrieving the data for the last seven years, 2015-2022, from the Hospital management information system, Benazir Bhutto Hospital, Rawalpindi. Consecutive Non-Probability Sampling was done, and a total of 9989 participants reporting to the Clinical Chemistry lab of the Hospital, referred for lipid profile analysis, were included irrespective of age, gender and medical history. This study protocol was ethically approved by the Institutional Review Board (IRB). Informed consent from the study participants was waived due to the retrospective design of the study. The confidentiality of patient data was protected, and medical records were password-protected.

The electronic medical records of the included participants were reviewed. Socio-demographics, clinical variables, and laboratory findings were extracted from the electronic medical records. Samples were collected after a minimum of 12-14 hours of overnight fasting. About 2 mL of venous blood sample was taken in a gel tube and allowed to clot. The sample was transported immediately to the lab without delay. Serum Total Cholesterol and triglycerides were measured by Beckman Coulter AU Clinical Chemistry analysers (Beckman Coulter, Inc., 250 S. Kraemer Blvd., Brea, CA 92821, USA) using enzymatic methods. Dyslipidemia was defined based on standard guidelines by the National Cholesterol Education Program Adult Treatment Panel III.

All analyses were performed with SPSS Statistics, version 22.0 (IBM SPSS Inc., Chicago, IL) and \ GraphPad Prism 7. Patients were stratified by gender and age for analysis. Descriptive analyses were presented as Tables (Frequencies, Percentages), Statistical Figures (Histogram)**.** Mann-Whitney U and Kruskal-Wallis tests were applied to test the difference between both genders and different age groups. A two-tailed p-value of less than 0.05 was considered statistically significant.

Results

A total of 9989 participants (4500 males and 5489 females) from the previous 7 years (2015-2022) who reported to the hospital for lipid profile were analysed in this study. Figure 1 represents the gender distribution of participants in the study. Patients were also divided according to their age groups. Figure 2 represents the number and frequency of patients in each age group. The highest number of patient (35.3%) were observed in the age group of between 40-52 years. A relatively very small number of patients reported for lipid profile in both extremes of age. (Figure 2)

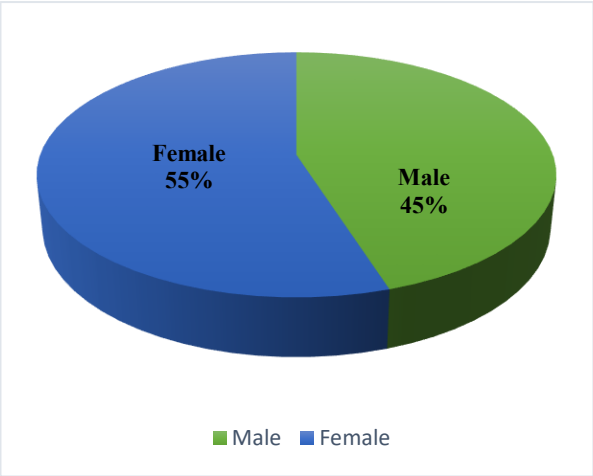

Figure 1: Gender-wise distribution of patients presented for lipid profile

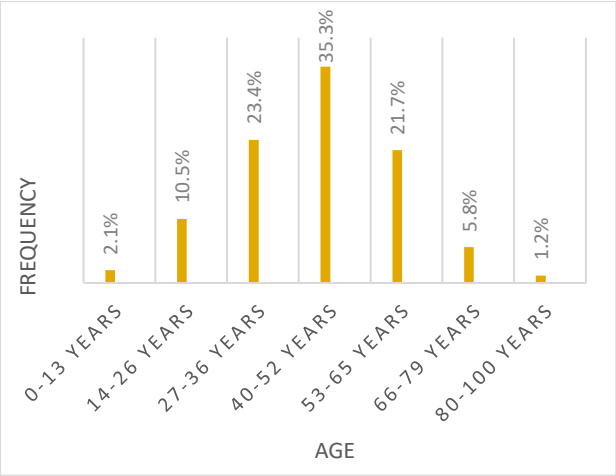

Figure 2: Age-wise distribution of patients presented for lipid profile

Table 1 represents the mean values of Cholesterol and Triglycerides in different age groups. In adults, the highest mean values of Cholesterol and Triglycerides were seen in people 40- 52 years of age (Table 1). A Kruskal-Wallis H test exhibited significant differences in both mean cholesterol and triglyceride levels between age groups.

Table 1: Mean value of Cholesterol and Triglycerides among different age groups

Variables	Age groups (Years)							$\chi 2$ value	p-value
	0-13	14-26	27-39	40-52	53-65	66-79	80-100		
	N=207	N=1044	N=2335	N=3529	N=2168	N=583	N=123		
Mean Cholesterol mg/dl	227.05	194.31	208.06	209.66	206.58	195.26	188.32	124.233	0.0001
Mean Triglycerides mg/dl	234.77	175.31	207.73	212.07	206.95	193.84	180.29	117.13	0.0001

Average cholesterol levels in men and women were found to be 203.1169 and 208.8669 mg/dl, and average triglyceride levels in men and women were 206.7403 and 203.7927mg/dl, respectively. (Figure 3). Mann-Whitney U Test was applied to compare TG and cholesterol in both genders, a significant difference in concentrations of cholesterol between both genders was observed=0.000. The lipid profiles of patients were also stratified according to the year of presentation. An increasing trend was noticed in the latest year after 2016, with the highest number of participants reporting in 2018 (Figure 4).

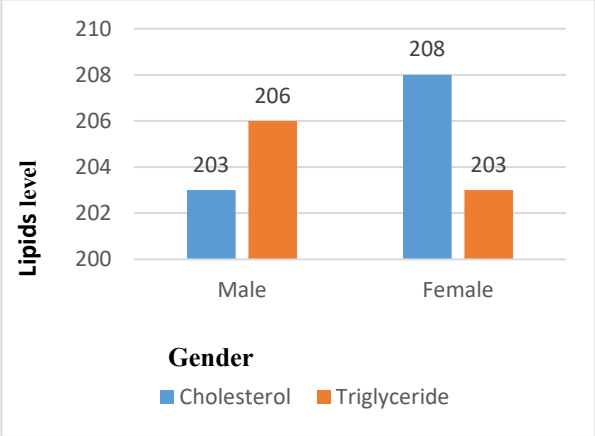

Figure 3: Bar Chart showing the mean values of Cholesterol and Triglycerides in both genders

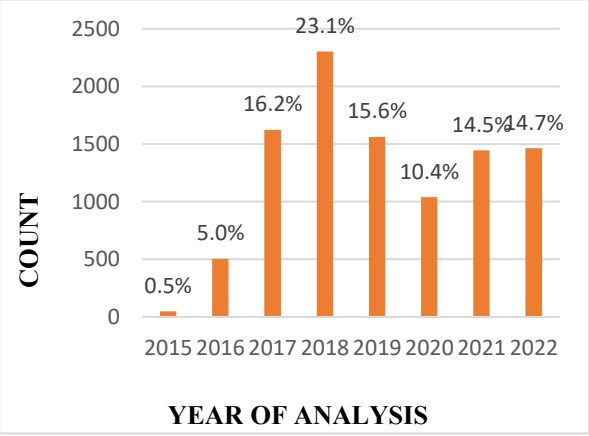

Figure 4: Bar chart showing the year-wise distribution of patients presented for lipid profile

Table 2: Dunnett T-test to compare TG and cholesterol concentration in different years

Dependent Variable	(I) Year of analysis	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
Cholesterol	2015	9.14209	.636	-36.7196	11.5196
	2016	3.21851	.092	-16.2333	.7495
	2017	2.24641	.000*	-16.2044	-4.3510
	2018	2.08284	.000*	-20.1283	-9.1380
	2019	2.26680	.009*.	-13.2411	-1.2801
	2020	2.52788	.234	-1.6254	11.7132
	2021	2.31038	.995	-4.8468	7.3442
Triglyides	2015	20.41448	.993	-42.1203	65.5989
	2016	7.18699	.979	-13.9120	24.0109
	2017	5.01629	1.000	-13.2712	13.1977
	2018	4.65102	.820	-17.4539	7.0877
	2019	5.06180	.033	-27.4672	-.7581
	2020	5.64480	.785	-21.4957	8.2897
	2021	5.15913	.717	-20.1557	7.0670

Table 2 represents the Dunnett T-test to compare TG and cholesterol concentration in different years. A significant p-value has been observed in cholesterol concentration in the years 2017-2019. Dunnett t-tests treat one group(2022) as a control and compare all other groups against it. (Table2) Out of a total of 9989 patients tested for dyslipidemia 38 .4 % and 22.7% of patients had

higher levels of triglyceride and serum cholesterol. While 21.5% and 27.6% were exhibiting borderline high levels of these two parameters. (Table 3)

Table 3. Frequency and number of patients with different levels of serum cholesterol and triglyceride levels

Variables		Number of participants(n)	Frequency (%)
Triglycerides	Normal	4011	40.2
	Borderline	2145	21.5
	Raised	3833	38.4
Cholesterol	Normal	4953	49.5
	Borderline	2765	27.6
	Raised	2270	22.7

Discussion

The growing prevalence of dyslipidemia is related to several factors, many of which are amendable and depend on different socioeconomic, ethnic and cultural characteristics.[10] Dyslipidemia is a vital pathogenic risk factor for conditions like atherosclerosis and cardiovascular disease (CVD). Most of the cardiovascular incidents reported are usually concomitant with uncontrolled dyslipidemia.[11] Recent surveys in China indicated that controlling the individual lipid profile significantly reduces the incidence of ischemic CVD, thus decreasing the mortality and morbidity associated with this condition.[12] The major apprehension of dyslipidemia is its asymptomatic nature, therefore, primary screening and preventive measures are imperative in controlling it.[13] A survey of the National Health and Nutrition Examination conducted from 2003 to 2006 in the United States (U.S.) stated that almost 53% of the U.S. adult population suffers from at least one abnormality in lipid profile.[14] Similar findings were exhibited in China, revealing dyslipidemia in approximately 41.9% of the local population.[15] Our study findings are consistent with previous studies in our local population, showing almost similar prevalence of dyslipidemia in our region.[3] The prevalence of dyslipidemia escalates with age, but it can also affect younger adults.[16] Our study showed that the highest mean values of cholesterol and triglyceride were observed in their 4th and 5th decade of life. Similar findings were also noted in a study conducted by the China National Stroke Screening and Prevention Project.[2] Young adults with abnormal levels of lipids are therefore more prone in their later life to develop cardiovascular complications, such as coronary heart disease.

In this present study, the prevalence of dyslipidemia was found to be higher in women (55%) as compared to men (45%). The primary factors responsible for these differences could be overweight and central obesity.[10] A study conducted in Iran endorsed our study observation with 55.4% incidence of dyslipidemia for females as compared to 37.4% for males.[17] However, immense literature provides evidence of higher prevalence of dyslipidemia in men than women. This was displayed by Pan et al in their cross-sectional study reporting 41.92% prevalence of dyslipidemia in males, while 32.47% of females were affected.[18] Similarly, the Chinese national nutrition and health survey conducted in 2002 concluded 22.2% and 15.9% prevalence of dyslipidemia in Chinese adults' males and females respectively. [19]

The prevalence of isolated hypercholesterolemia and isolated hypertriglyceridemia in our study population was 50.3 % and 59.9%, respectively. Pan et al.'s study reported this prevalence as 2.9% and 11.9%, respectively.[18] Extensive surveys in conducted in China from 2002 to 2010 discovered that hypertriglyceridemia and low levels of HDL-C were two major types of dyslipidemia in Chinese adults' population. [20] A meta-analysis by Huang et al reinforced this observation.[21] However, different trends in western countries were observed where high cholesterol and high LDL-C levels were more common forms of dyslipidemia. [22] A community-based survey of the local population concluded that the total prevalence of dyslipidemia to be 96%, which was significantly higher in urban areas in comparison to rural areas.[23]

The initial detection of dyslipidemia is vital to implement management strategies for it so that these strategies reduce the risk of cardiovascular diseases manifesting later in life. Individuals with abnormal lipid profiles can effectively be treated with lifestyle modifications and lipid-lowering drugs.

Conclusions

The initial detection of dyslipidemia is vital to implement management strategies for it so that these strategies reduce the risk of cardiovascular diseases manifesting later in life. Individuals with abnormal lipid profiles can effectively be treated with lifestyle modifications and lipid-lowering drugs.

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