Study of the pattern of dyslipidemia in urban population of central Madhya Pradesh

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Abstract

Introduction: Increase in the levels of cholesterol, triglycerides and LDL cholesterol (LDL-C) and low HDL Cholesterol (HDL-C) is known to be a risk factor for coronary artery disease (CAD) and myocardial ischaemia. Studies have shown that dyslipidemia in Indians show a unique pattern of low HDL-C, high triglycerides, and high LDL-C but such studies are few and far between. The present study was undertaken in our diagnostic centre with the aim of determining the trends in the lipid values of urban population of Indore and also to determine the gender differences in the cholesterol, HDL-C, LDL-C, Triglycerides values in the study population.

Materials and Methods: This study was carried out on a total of 5857 patients of all ages and both sexes registered in our diagnostic centre for lipid profile test on 22,23 and 24 November 2019. Dyslipidemia was defined as per the National cholesterol education programme (NCEP) and ATPIII criteria. Statistical analysis was performed on all lipid parameters and expressed as mean ± SD and median.

Results: The mean age of females was 49±12.7 years and males was 51±13.9 years with a male to female ratio of 1.34:1. The mean cholesterol value was 167.7±35.8 mg/dl and was highest in 41-50 years age group with a mean of 172.7±34.7 mg/dl.The mean triglycerides value was 140.1±79.8 mg/dl and was highest in 41-50 years of age group. The mean HDL -C was 40.5±9.7 mg/dl. Mean LDL-C was 99.3±29.5 mg/dl. The risk ratio > 4.5 was observed in 2290(39%) patients out of which 1596(47.47%) were males and 694(27.82%) were females

Conclusion: Dyslipidemia is a major risk factor for coronary artery disease and stroke and there is an alarming increase in the incidence of CAD in younger age groups. Large scale, cross sectional, population based Studies on the pattern of dyslipidemia are needed to frame a health care policy which would be more preventive and predictive in future

Keywords: Dyslipidemia, HDL-C, LDL-C, CHD, Hypercholesterolemia, Hypertriglyceridemia.

Introduction

Total lipids in the body are composed of mainly triglycerides, cholesterol and fatty acids. They are a constituent of the cell membrane and also act as precursors to steroid hormone, bile acids and Vitamin D.[1] Triglycerides are an important source of energy storage in the body and are mostly deposited in the fat cells and muscles. Many factors predispose to changes in the lipid content of the body, which is also known as dyslipidemia.

Non communicable diseases(NCD)are the leading cause of morbidity and mortality in the world. According to WHO data, it is estimated that nearly 36 million people died due to NCDs all over the world in 2008. 80%of this burden was noted in the developing countries like India. More than 60% of these deaths are found to be due to cardiovascular diseases (CVD).[2]

Increase in the levels of cholesterol, triglycerides and LDL cholesterol(LDL-C) and low HDL Cholesterol(HDL-C) is known to be a risk factor for coronary artery disease (CAD) and myocardial ischaemia.[3-6] In India, the mortality due to CVD s over the past two decades has shown an alarming increase and accounts for nearly 24% deaths among adults between 25-69 years.[7] It has been observed that Indians develop CAD at a younger age than their Asian counterparts.[8] This may be attributed to lifestyle changes owing to rapid urbanization and resultant change in the epidemiological and nutritional habits of the population[(9)]Studies have shown that dyslipidemia in Indians show a unique pattern of low HDL-C, high triglycerides, and high LDL-C but such studies are few and far between.[10]

India is undergoing a rapid epidemiological shift due to urbanization, economic prosperity and increase in the life expectancy due to better health care facilities. This has resulted in increase in the risk of many lifestyle diseases such as CAD. Dyslipidemia, Smoking, tobacco chewing, and sedentary life style as well as increased consumption of junk food are associated risk factors.[11-13]

The present study was undertaken in our diagnostic centre with the aim of determining the trends in the lipid values of urban population of Indore and also to determine the gender differences in the

cholesterol, HDL-C, LDL-C, Triglycerides values in the study population.

Materials and Methods

This study was conducted on a total of 5857 patients of all ages and both sexes, irrespective of their medical status, registered in our diagnostic centre for lipid profile testing on 22,23 and 24 November 2019 at different locations of the city. The patients were divided into < 20 years, 21-30, 31-40, 41-50, 51-60, 61-70, 71-80 and > 80 years of age groups in both genders. Samples were collected by standards protocols in red top tubes and processed within one hour on fully automated robotic, integrated biochemistry and immunoassay analyser Atellica (Siemens). The tests were run after running quality control sera by BIO-RAD. Freidwald's formula was used to calculate LDL-C when triglycerides were below 400 mg/dl. Direct LDL-C was performed when Triglycerides were above 400 mg/dl.

Dyslipidemia was defined as per the National cholesterol education programme (NCEP) and ATPIII criteria.[14]

1. Hypercholesterolemia- cholesterol ≥200 mg/dl
2. Hypertriglyceridemia- triglycerides ≥150 mg/dl
3. Low HDL-C – HDL-C ≤ 40 mg/dl
4. High LDL-C – LDL-C ≥ 100 mg/dl
5. High cholesterol/HDL –C: Ratio ≥ 4.5

Statistical analysis was performed on all lipid parameters and expressed as mean ± SD and median. The data generated was also classified according to age and gender and results were also expressed as percentages.

Results

This study was carried out on a total of 5857 patients of all ages and both sexes registered in our diagnostic centre for lipid profile test on 22,23 and 24 November 2019. The patients ranged from under 20 years of age to above 80 years with the youngest patient being 7 years of age and the oldest was 99 years. The mean age of females was 49±12.7 years with a median age of 49 years. The mean age of males was 51±13.9 years with a median of 50 years. There were 3362 (57.4%) males and 2495(42.6%) females with a male to female ratio of 1.34:1.Majority of the patients were in 41-50 years of age, accounting for 26.45% (n= 1549), out of which 855(14.6%) were males and 694(11.85%) were females. This was followed by 1394(23.8%) patients in 51-60 years of age with 13.15%males and 10.65% females, followed by 1101(18.8%) patients in 31-40 years of age group with 10.02% males and 8.78% females. In 61-70 years age group, there were 1014(17.31%) patients with 11.10% males and 6.21% females. There were 374(6.39%) patients in 21-30 years age group, comprising of 3.38% males and 3.0% females, 69(1.18%) patients under 20 years of age with 0.73%males and 0.44% females. Above 80 years of age, there were only 37(0.63%) patients with 0.46% males and 0.17% females. (Table 1).

Cholesterol

The mean cholesterol value was 167.7±35.8 mg/dl with a median value of 166 mg/dl. The cholesterol level was highest in 41-50 years age group with a mean of 172.7±34.7 mg/dl, followed by 172.3±36.6 mg/dlin 51-60 years age group. The median value of cholesterol in these age groups was 172mg/dl and 171 mg/dl respectively. This was followed by a mean value of 167.7±37.6 mg/dlin 61-70 years age group, 162.5±39.0 mg/dl in 71-80 years of age, 159.7±34.7 mg/dl above 80 years of age. In the younger age group, the mean cholesterol value was 150.3±28.4 mg/dlin 21-30 years of age and lowest below 20 years of age with a mean value of 135.9±35.8 mg/dl. The peak cholesterol value were observed in 41-60 years of age (Table 2,3,4)

Cholesterol value > 200 mg/dl was observed in 17.15% patients with 549(16.33%) mals and 456(18.28%) females. Maximum patients(299)were in 41-50 years age group, followed by 276 in 51-60 years age group,198 in 61-70 years,153 in 31-40 years, 20 in 21-30 years age group, 5 patients above 80 years of age and only one female patient below 20 years of age (Table 5)

Triglycerides

The mean triglycerides value was 140.1±79.8 mg/dl with a median value of 123 mg/dl. Triglyceride levels were highest in 41-50 years of age group with a mean of 148±84.1 mg/dl, followed by 146.3±80.6 mg/dl in 51-60 years of age,143.3±80.5 mg/dl in 61-70 years

age group. The triglyceride values were low in younger age group with a mean of 90.0±37.9 mg/dl below 20 years of age, 115.3±69.9 mg/dl in 21-30 years group and 133.4±78.6 mg/dl in 31-40 years of age group. (Table 2,3,4)

Triglycerides above 150 mg/dl was observed in 1897(32.3%) patients out of which 36.85% were males and 26.37% were females Maximum patients (564) were in 41-50 years age group with 362 males and 203 females.This was followed by 502 patients in 51-60 years group with 306 males and 196 females. 344 patients were in 61-70 years age group with 230 males and 114 females.(Table 5)

HDL Cholesterol

The mean HDL -C was 40.5±9.7 mg/dl with a median value of 39.2 mg/dl. The HDL -C was highest in 71-80 years of age group with a mean value of 42.8±10.7 mg/dl and lowest under 20 years of age with a mean value of 37.1±7.4 mg/dl. In all other age groups the mean HDL -C did not show much variation. (Table 2,3,4)

HDL –C < 40 mg/dl was observed in 3101 (52.9%) patients, out of which 2170 were males and 931 were females. Majority of the patients (n=832) were in 41-50 years of age group, followed by 706 in 51-60 years, 637 in 31-40, 509 in 61-70 and 213 patients in 21-30 years of age group.46 patients were below 20 years of age. (Table 5)

LDL Cholesterol

Mean LDL-C was 99.3±29.5 mg/dl with a median value of 98.5 mg/dl. The LDL-C was highest in 41-50 years age group with a mean value of 103±28.5 mg/dl. The LDL-C was lowest in younger age group below 20 years with a mean value of 80±33.0 mg/dl and in 21-30 years age group with a mean of 88.0±22.6 mg/dl. In all other age groups the mean LDL-C was almost same.(Table 2,3,4)

LDL-C value > 100 mg/dl was observed in 2811 patients (47.9%) out of which 47.35% were males and 48.86% were females. Maximum patients (n=828) were in 41-50 years of age group, followed by 738 patients in 51-60 years, 499 in 31-40 years group, 484 in 61-70 years group and lowest(n=13) below 20 years of age. (Table 5)

Cholesterol/HDL-C (Risk Ratio)

The risk ratio > 4.5 was observed in 2290(39%) patients out of which 1596(47.47%)were males and 694(27.82%)were females. Maximum patients (n=698) were in 41-50 years age group,followed by 547 in 51-60 years age group,452 in 31-40 years, and 369 in 61-70 years age group. There were 11 patients with a risk ratio of > 4.5 below 20 years of age. (Table 5)

Table 1: Demographic data of patients

S. No.	Age (Yrs)	Male	%	Female	%	Total	%
1	<20	43	0.73%	26	0.44%	69	1.18%
2	21 - 30	198	3.38%	176	3.00%	374	6.39%
3	31 - 40	587	10.02%	514	8.78%	1101	18.80%
4	41 - 50	855	14.60%	694	11.85%	1549	26.45%
5	51 - 60	770	13.15%	624	10.65%	1394	23.80%
6	61 - 70	650	11.10%	364	6.21%	1014	17.31%
7	71 - 80	232	3.96%	87	1.49%	319	5.45%
8	>80	27	0.46%	10	0.17%	37	0.63%
	Total	**3362**	**57.40%**	**2495**	**42.60%**	**5857**	

Table 2: Lipid profile of patients in different age groups

S. No.	Age (Yrs)	Cholesterol mg/dl		Triglycerides mg/dl		HDL-C mg/dl		LDL-C mg/dl	
		Mean ± SD	Median	Mean ± SD	Median	Mean ± SD	Median	Mean ± SD	Median
1	**<20**	135.9±35.8	130	90.0±37.9	79.0	37.1±7.4	37.0	80.8±33.0	73.7
2	**21 - 30**	150.3±28.4	149	115.3±69.9	98.0	39.5±9.1	38.2	88.0±22.6	86.9
3	**31 - 40**	164.3±32.5	161	133.4±78.6	113.0	39.3±8.9	38.1	98.5±26.8	97.4
4	**41 - 50**	172.7±34.7	172	148±84.1	129.0	40.3±9.3	39.2	103±28.5	102.4
5	**51 - 60**	172.3±36.6	171	146.3±80.6	128.0	41.0±9.9	39.8	102.3±30.7	102.7

6	**61 - 70**	167.7±37.6	166	143.3±80.5	126.0	41.4±10.3	39.9	98.0±31.1	97.8
7	**71 - 80**	162.5±39.0	163	129.8±61.3	115.0	42.8±10.7	41.3	93.9±32.6	91.8
8	**>80**	159.7±34.7	159	127.4±55.0	123.0	41.6±10.6	38.7	92.7±30.6	92.9
	Average	**167.7±35.8**	**166**	**140.1±79.8**	**123**	**40.5±9.7**	**39.2**	**99.3±29.5**	**98.5**

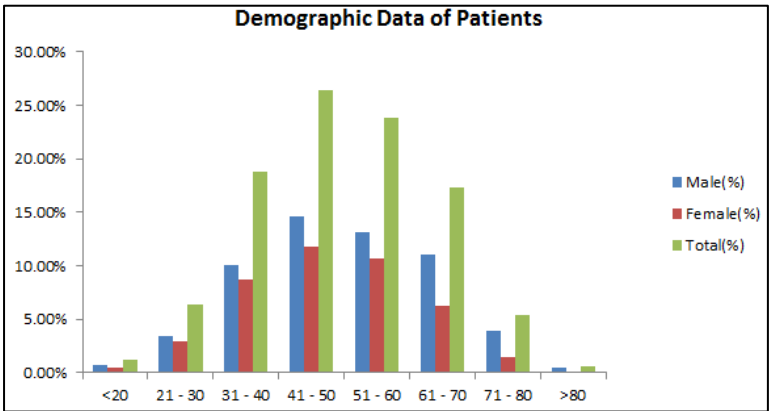

Fig. 1: Showing demographic data of patients

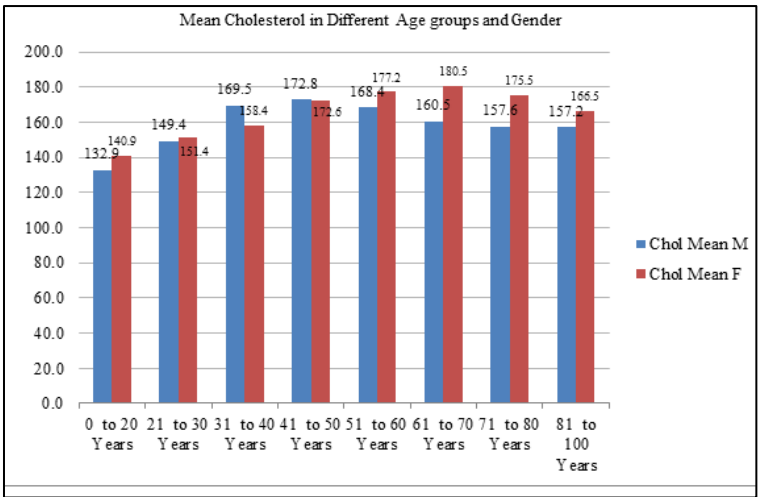

Fig. 2: Showing mean cholesterol value in different ages and both genders

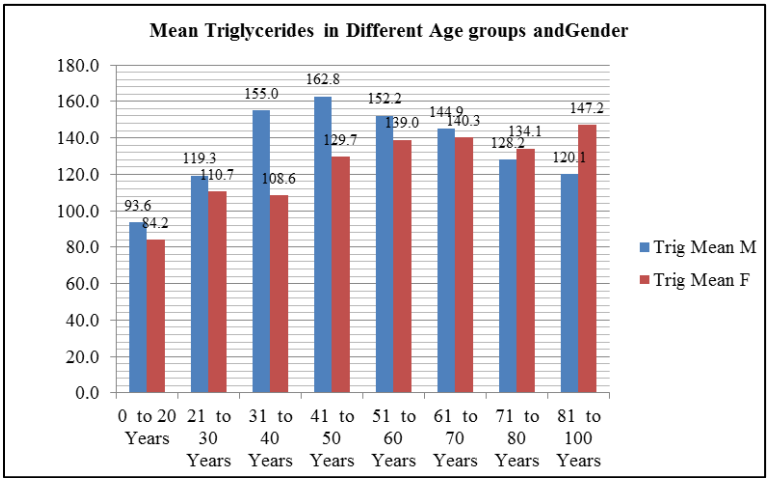

Fig. 3: Showing mean triglyceride values in different ages and gender

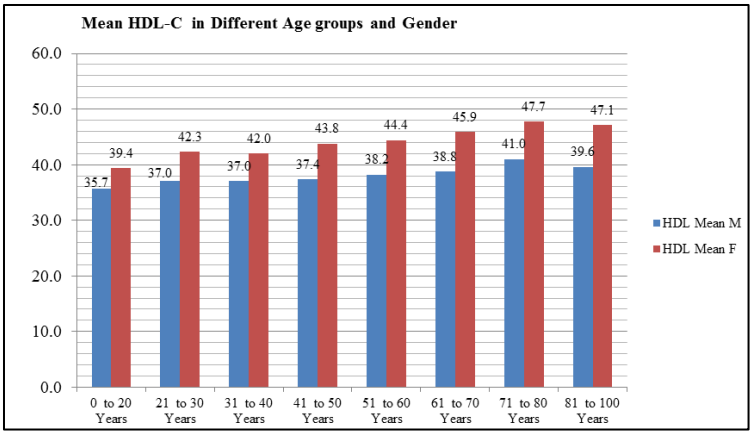

Fig. 4: Showing mean HDL-C value in different age groups and gender

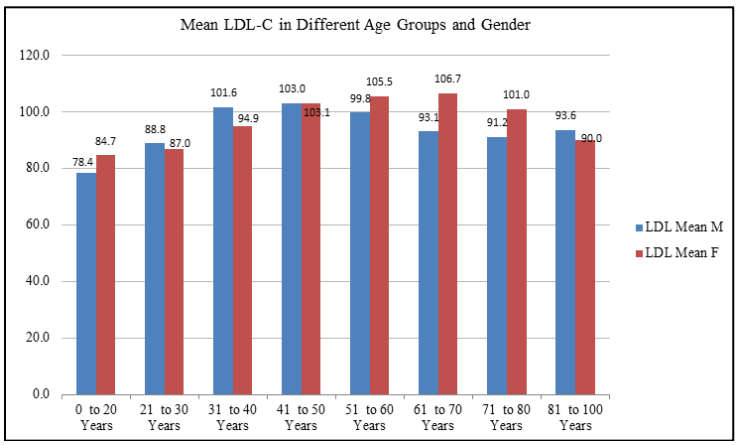

Fig. 5: Mean LDL-C in different age groups and gender

Table 3: Demographic trends of lipid profile in males

S. No.	Age (Yrs)	Cholesterol mg/dl		Triglycerides mg/dl		HDL-C mg/dl		LDL-C mg/dl	
		Mean ± SD	Median	Mean ± SD	Median	Mean ± SD	Median	Mean ± SD	Median
1	**<20**	132.9±27.0	130	93.6±43.0	80.0	35.7±6.9	36.5	78.4±21.1	75.4
2	**21 - 30**	149.4±29.1	146.5	119.3±72.2	104.5	37±8.6	35.7	88.8±23.2	87.4
3	**31 - 40**	169.5±33.9	166.0	155.0±84.6	138.0	37±8.1	35.9	101.6±28.6	100.5
4	**41 - 50**	172.8±35.5	173.0	162.8±93.3	139.0	37.4±8.0	36.8	103±30.0	103.3
5	**51 - 60**	168.4±37.0	167.0	152.2±82.9	133.0	38.2±8.6	36.5	99.8±31.7	100.5
6	**61 - 70**	160.5±36.3	158.0	144.9±84.7	126.0	38.8±9.0	37.6	93.1±30.9	92.4
7	**71 - 80**	159.6±38.7	158.0	128.2±62.9	115.0	41±10.0	40.1	91.2±33.4	89.8
8	**>80**	157.2±33.5	155.0	128.2±50.7	112.0	39.6±8.7	38.7	93.1±29.1	91.2

Table 4: Demographic trends of lipid profile in females

S. No.	Age (Yrs)	Cholesterol mg/dl		Triglycerides mg/dl		HDL-C mg/dl		LDL-C mg/dl	
		Mean ± SD	Median	Mean ± SD	Median	Mean ± SD	Median	Mean ± SD	Median
1	**<20**	140.9±46.4	129.5	84.2±26.5	77.0	39.4±7.5	38.0	84.7±46.1	73.1
2	**21 - 30**	151.4±27.5	150.5	110.7±66.9	92.5	42.3±8.8	41.6	87±21.9	86.0
3	**31 - 40**	158.4±29.8	157.0	108.6±62.7	95.5	42±9.1	40.9	94.9±24.0	93.1
4	**41 - 50**	172.6±33.6	170.0	129.7±66.8	114.0	43.8±9.7	42.9	103.1±26.6	101.0
5	**51 - 60**	177.2±35.6	176.5	139±77.1	124.0	44.4±10.3	43.9	105.5±29.0	104.4
6	**61 - 70**	180.5±36.6	180.0	140.3±72.4	126.0	45.9±10.8	44.4	106.7±29.5	106.0
7	**71 - 80**	175.5±36.5	174.0	134.1±56.4	118.0	47.7±11.0	45.8	101±29.1	98.7
8	**>80**	166.5±37.2	159.5	147.2±61.2	146.0	47.1±13.2	41.1	90.0±34.3	89.5

Table 5: Demographic trends of dyslipidemia in different age groups

S.No.	Age (Yrs)	Cholesterol (>200)mg/dl		Triglycerides (>150)mg/dl		HDL-C (<40)mg/dl		LDL-C (>100)mg/dl		Risk Ratio (>4.5)	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
1	<20	0.0(0.0%)	1(3.85%)	4(9.30%)	2(7.69%)	29(67.44%)	17(65.38%)	8(18.60%)	5(19.23%)	8(18.60%)	3(11.54%)
2	21-30	12(6.06%)	8(4.55%)	36(18.18%)	34(19.32%)	139(70.20%)	74(42.05%)	58(29.29%)	45(25.57%)	79(39.90%)	33(18.75%)
3	31-40	107(18.23%)	46(8.95%)	241(41.06%)	73(14.20%)	410(69.85%)	227(44.16%)	301(51.28%)	198(38.52%)	339(57.75%)	113(21.98%)
4	41-50	169(19.77%)	130(18.73%)	362(42.34%)	203(29.25%)	572(66.90%)	260(37.46%)	470(54.97%)	358(51.59%)	480(56.14%)	218(31.41%)
5	51-60	132(17.14%)	144(23.08%)	306(39.74%)	196(31.41%)	490(63.64%)	216(34.62%)	386(50.13%)	352(56.41%)	358(46.49%)	189(30.29%)
6	61-70	93(14.31%)	105(28.85%)	230(35.38%)	114(31.32%)	399(61.38%)	110(30.22%)	268(41.23%)	216(59.34%)	255(39.23%)	114(31.32%)
7	71-80	33(14.22%)	20(22.99%)	55(23.71%)	31(35.63%)	114(49.14%)	23(26.44%)	89(38.36%)	42(48.28%)	65(28.02%)	21(24.14%)
8	>80	3(11.11%)	2(20.00%)	5(18.52%)	5(50.00%)	17(62.96%)	4(40.00%)	12(44.44%)	3(30.00%)	12(44.44%)	3(30.00%)
	Total	**549**	**456**	**1239**	**658**	**2170**	**931**	**1592**	**1219**	**1596**	**694**
	%	**16.33%**	**18.28%**	**36.85%**	**26.37%**	**64.54%**	**37.31%**	**47.35%**	**48.86%**	**47.47%**	**27.82%**

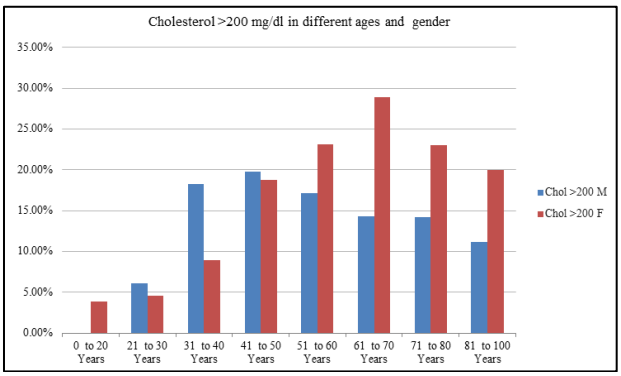

Fig. 6: Showing Cholesterol > 200 mg/dl in different age groups and gender

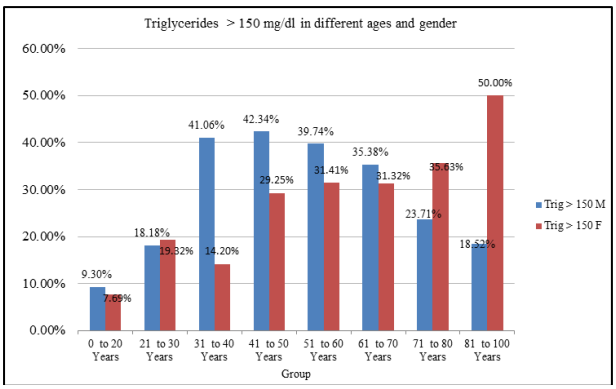

Fig. 7: Showing Triglycerides> 150 mg/dl in different age groups and gender

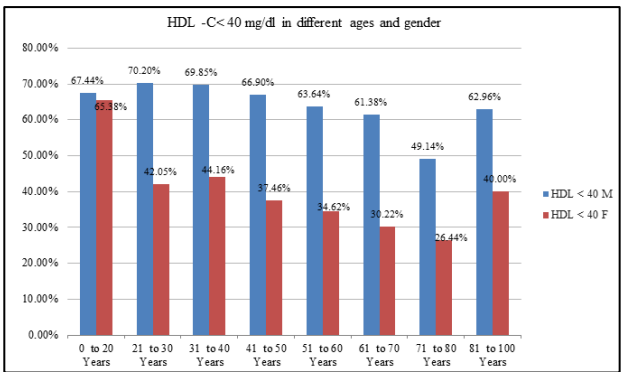

Fig. 8: showing HDL-C less than 40 mg/dl in different age groups and gender

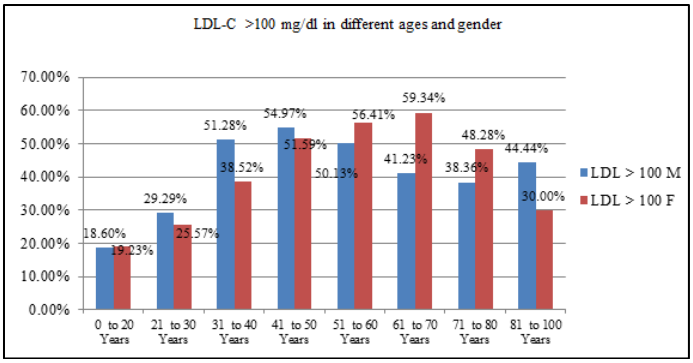

Fig. 9: Showing LDL-C more than 100 mg/dl in different age groups and gender

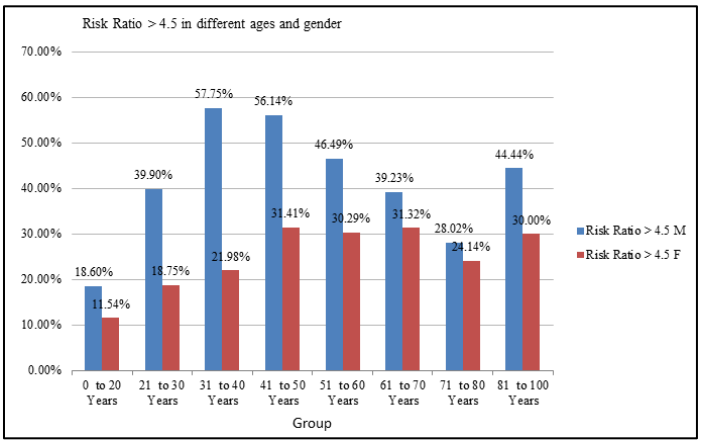

Fig. 10: Showing Risk ratio> 4.5 in different age groups and gender

Discussion

Dyslipidemia which includes high total cholesterol, high triglycerides, high LDL-C and low HDL-C is an important risk factor for coronary artery disease. A raised LDL-C is a strong predictor of progression of coronary atherosclerosis.[15] Epidemiological studies of dyslipidemia are necessary as these help in planning and developing strategies for prevention of CHD. However, limited data are available on large scale population based studies in India.[16-18]

Our study is the first large scale population based study of Central Madhya Pradesh where dyslipidemia was studied in 5857 patients.Our study reveals the prevalence of hypercholesterolemia, hypertriglyceridemia, high LDL-C and low HDL-C in all age groups. In The India Heart Watch Study total cholesterol was ≥200 mg/dl in 25% males and 24.9% females, LDL-C ≥ 100 mg/dl was present in 49.5% males and 49.7% females.[19] In a study by ICMM-INDIA B, where the prevalence of dyslipidemia was studied in three states of Tamil Nadu, Maharashtra and Jharkhand,13.9% had hypercholesterolemia, 29.5% had hypertriglyceridemia, 72.3%had low HDL-C, 11.8% had high LDL-C.79.0% had abnormalities in one or more lipid parameters.[20]

A study conducted in USA on the migrant Asian Indian population observed a prevalence rate of 43.5%for hypercholesterolemia, 42.3% for hypertriglyceridemia.26.4% had low HDL-C and 41.4% had high LDL-C.[21]An ICMR surveillance project reported that 37.5% patients between 15-64 years of age had dyslipidemia.[22] In a study conducted in Delhi on 200 patients above 18 years of age,34% patients were found to have high cholesterol,,40% had high triglycerides, 42% had low HDL-C and 38% had high LDL-C.[23] Gupta et al in their study population of Rajasthan observed high cholesterol levels in adults above 20 years of age.[24] Mishra et al, Parikh et al, Joshi et al had similar findings in their study population.[25-27]

In the present study, cholesterol ≥ 200 mg/dl was observed in 16.33%males and 18.28% females. Triglycerides ≥ 150 mg/dl was observed in 36.85%

males and 26.37% females. HDL-C ≤40 mg/dl was observed in 64.54% males and 37.3% females. LDL-C ≥ 100 mg/dl was found in 47.35% males and 48.86% females and a risk ratio ≥ 4.5 was observed in 47.47% males and 27.82% females. In our study we found that dyslipidemia in females showed an increasing trend with age, which is similar to other studies done globally.[28,29]

It is observed that men between 20-55 years tend to have higher cholesterol levels but after this age, specially after menopause, females have higher cholesterol levels. Females have high HDL-C levels as compared to males, which is similar to other studies.

Increased prevalence of high cholesterol, triglycerides, LDL-C and low HDL-C in patients between 30-50 years in our study is a major cause of concern as it has been observed in various studies that as compared to Western population, Indians are more prone to develop CAD at a much lower cholesterol level.[30] In a study conducted at Chennai, it was observed that about 75% patients presenting with myocardial infarction had cholesterol levels below 200 mg/dl, which supports the fact that the threshold is low for Indians.[31] High triglycerides in our study population may be due to the diet being rich in carbohydrates.[32] High triglyceride levels have been found to be a risk factor for atherosclerosis.[33] In a study conducted by Enas et al, it was observed that only 4% of Asian Indian males and 5% of Asian Indian females had optimal HDL-C levels.[34]

Our study, however, had certain limitations. We did not have any data regarding the medical status such as body mass index, history of diabetes, hypertension or CAD or any surgery and treatment history of patients, whether on any lipid lowering drugs which may have an effect on the data analysis. Similarly, the fasting status of the patients was not known which may affect the triglyceride values.However, the strength of our study lies in a big sample size. The results of our study are quite promising, despite these limitations and correlate well with majority of the studies conducted in India and abroad.

Conclusion

Dyslipidemia is a major risk factor for coronary artery disease and stroke and rapid urbanization, sedentary life styles and change in the food habits of the population has resulted in an alarming increase in the incidence of CAD in younger age groups. Large scale, cross sectional, population based Studies on the pattern of dyslipidemia are needed to frame a health care policy which would be more preventive and predictive in future.

Conflict of Interest

None.

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