Non-HDL Cholesterol and Health status – A hospital based study

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Abstract:

Background: The non-high-density-lipoprotein cholesterol (non-HDL-C) is known to be a better marker of cardiovascular risk assessment than low-density-lipoprotein cholesterol. **Aim:** To find out the pattern of non-HDL-C distribution in subjects with normal and abnormal lipid profile as well as among groups based on individual lipid components and categorize them into different groups according to their serum non-HDL levels. **Methods:** A cross sectional time bound hospital-based study was conducted among OPD subjects whose samples were screened for lipid profile for 3 months. Based on history and serum non-HDL-C levels the subjects were divided in to two groups each I. Normal health status. II. Subjects with dyslipidemia and Individuals with non-HDL-C < 130 mg/dL, > 130 mg/dL and all other lipid parameters were compared between the groups. **Results:** The mean non-HDL-C and LDL levels were found to be 140 ± 42 mg/dL and 128 ± 42 respectively. Among 500 subjects, 213 had dyslipidemia (43%) and. 287 (57%) had normal lipid levels. When compared, non-HDL (< 130) and Non-HDL (> 130) groups showed significant ($p<0.001$) difference in DM and also in the lipid parameters TC, TG, LDL, TC/ HDL and VLDL. **Conclusion:** Non-HDL-C was not affected by plasma triglycerides status thus serve as a better indicator of dyslipidemia even among individuals with normal triglycerides hence can be considered for routine screening of patients with predisposed risk factors for coronary artery diseases.

Keywords: Non-HDL-C, dyslipidemia, LDL, cardiac risk

Introduction:

The non-high-density-lipoprotein cholesterol (non-HDL-C) which is obtained by simple calculation (Total cholesterol – High Density Lipoprotein cholesterol) has been reported as a better marker of cardiovascular risk assessment than the low-density-lipoprotein cholesterol (LDL-C). It includes cholesterol from all forms of lipoproteins namely LDL, IDL, VLDL, chylomicrons with their remnants and LP(a) According to Bitter (2007) National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) has proposed that in a scenario of hypertriglyceridemia (> 200 mg/dL) LDL-C level is not reliable for therapeutic monitoring of coronary artery disease (CAD). It has also specified Non-HDL-C as the therapeutic target at that level of TG as it is independent of plasma triglyceride levels as per Pasterkamp and Falk(2000); Kumar et al(2009); Ghosh et al(2006). Both the European and American Cardiological Societies guidelines underlined the importance of Non-HDL-C in the appraisal of atherosclerosis risk and coronary heart disease.

Cui et al(2001) reported that Lipid Research Clinics prevalence study, rise in non-HDL-C by 30 mg/dl was associated with a cumulative increase in risk of cardiovascular death NCEP Program Evaluation Project Utilizing Novel E-Technology (NEPTUNE) II Survey data also support the concept of non-HDL-C would lead to the appropriate treatment intensification in patients with CAD or its risk equivalents such as diabetes, dyslipidemia and hypertension was reported by

Hoenig(2008). Despite all the advantages, the use of non-HDL-C in routine clinical/laboratory practice for cardiac risk prediction/stratification is still controversial. Hence the present study is designed to find out the pattern of non-HDL-C distribution in subjects with normal and abnormal lipid profile and categorize them into different groups according to their serum non-HDL levels as well as based on individual lipid components.

Methods:

This is a cross sectional time bound study conducted in Tertiary care Hospital. All the OPD patients / subjects getting their lipid profile test done at central lab during the study period of three months were included in the study.

Institutional ethics committee approval and informed consent duly signed by the subjects were obtained prior to the conduct of the study. Basic demographic data and patient history regarding their health status, medication if any, previous history of illness were recorded.

Serum lipid profile was estimated by Roche COBAS-600 modular system as per the manufacturer's instructions. Atherogenic Index of Plasma (AIP) was calculated with Dobiasova M calculator [Log (TG/HDL - C)][reference range: risk indicator > 0.5] as per the study done by Dobiášová and Frohlich(2001). LDL / HDL ratio was mathematically derived. Concentration of sd-LDL was estimated from the lipid measures of non–HDL-C and LDL (calculated and direct) using the below equation adopted from Srisawasdiet al(2011).

SD-LDL (mg/dL) = 0.580 (non–HDL) + 0.407 (direct - LDL) – 0.719 (calculated- LDL) – 12.05.

Based on the data obtained, the study population was divided in to the following categories.

1. Normal health status
2. Subjects with dyslipidemia and
3. Groups based on serum non-HDL status

Non-HDL-C < 130 mg/dL and > 130 mg/dL - **reference range 110 - 130 mg/dL**

Groups based on individual lipid components
TC >200 vs< 200, TG > 150 vs< 150, HDL < 40 vs> 40 and LDL < 100 vs>100

Statistical Analysis:

The statistical analysis was done using Statistical package SPSS vers.20.0. Group comparisons were done by Student independent t-test. Categorical variables were analyzed using Chi-square test. Results were expressed as Mean ± SD/SE. p <0.05 was considered as significant.

Results:

Among the 500 subjects, 212 (118 men vs 94 women) had dyslipidemia (42%) and 288 (158 men vs 130 women) revealed normal lipid profile (58%). Between the two groups, the lipid parameters are almost comparable but there was a significant difference in age, prevalence of hypertension and duration of dyslipidemia. (Table 1)

Table 1: Comparison of demographic and biochemical parameters between the groups

Parameters	Dyslipidemia (Present) n =212	Dyslipidemia (Absent) n = 288	p-value
Age	57±11.62	51±13.43	**<0.001**
Male:Female	117:95	158:130	0.89
HTN (Y/N)	97:115	52:236	**<0.001**
CAD HISTORY(Y/N)	30:182	27:261	0.12
Dyslipidemia Duration	4.78±5.13	-	**<0.001**

TC	181±48	187±40	0.15
TG	155±70	144±78	0.11
HDL	47±25	45±13	0.18
LDL	125±44	131±39	0.14
TC/HDL	5±6.49	4.75±2.85	0.55
Non-HDL-C	137±46	142±39	0.22
VLDL	33±43	30±20	0.32

All results are expressed as Mean± SD, $p<0.05$ is considered significant

Comparison of clinical and biochemical parameters between Non-HDL (< 130) and Non-HDL (> 130) groups showed significance ($p\leq0.01$) in age, duration of dyslipidemia, prevalence of dyslipidemia, diabetes and hypertension. Except for HDL, there was a significant difference ($p<0.001$) in all other lipid parameters. (Table 2)

Table 2: Comparison of clinical and Biochemical parameters between Non-HDL groups

Parameters	Group 1 (n = 222)	Group 2 (n = 278)	p-value
Age	55±13	51±13	0.001
Dyslipidemia duration	1.64±3.89	2.55±4.28	0.01
Male/Female	123/99	151/127	0.86
DM history (Y/N)	92/130	65/213	<0.001
Dyslipidemia history (Y/N)	110/112	101/177	0.003
HTN history (Y/N)	82/140	67/211	0.002
CAD history (Y/N)	28/194	29/249	0.53
TC	148±24	213±32	<0.001
TG	122±57	170±81	<0.001
HDL	46.41±16	45.7±21	0.67
LDL	94±21	156±33	<0.001
TC/HDL	4±5.51	6±4	<0.001
VLDL	25±12	37±40	<0.001

All results are expressed as Mean± SD, $p<0.05$ is considered significant

Group -1 = Non-HDL-C< 130, Group – 2 = Non-HDL-C> 130

The lipid ratios when compared between the categories of individual lipid components, namely TC < 200 vs> 200, HDL < 40 vs> 40, TGs < 150 vs> 150 and LDL < 100 vs> 100 showed significant difference in the order of LDL/HDL > non-HDL-C > TC/HDL > AIP respectively. There was no significant difference in Sd-LDL across the groups. (Tables 3 and 4).

Table 3: Comparison of demographic and biochemical parameters between the groups

Groups	TC < 200	TC > 200	p-value	HDL < 40	HDL > 40	p-value
parameters	n = 332	n = 168	-	n = 191	n = 309	-
TC_HDL	4.39±1.52	6.23±2.32	0.001	6±0.47€	4±0.16€	<0.001
LDL_HDL	2.62±0.97	3.92±1.26	<0.001	4±1.3	2.6±0.9	< 0.001
Non_HDL	117.26±26.18	185.59±29.44	<0.001	144±44	137±41	0.08
AIP	0.16±0.20	0.20±0.21	0.05	0.35±0.20	0.07±0.11	< 0.001
Sd_LDL	43.6±1.65€	43.6±1.42€	0.98	44±1.1€	43.5±1.8€	0.85
AGE	53±13	53±13	0.7	51±14	54±12	0.01
Gender	205/127	71/97	<0.001	129/62	146/163	< 0.001

All results are expressed as Mean± SD, p<0.05 is considered significant

€ - expressed as Mean± SE

Table 4: Comparison of demographic and biochemical parameters between the groups

Groups	TG < 150	TG > 150	p-value	LDL < 100	LDL > 100	p-value
parameters	n =306	n = 194	-	n =135	n = 365	-
TC_HDL	4.35±2.32	5.65±2.75	0.001	4.18±2.12	5.1±2.32	0.15
LDL_HDL	2.67±0.99	3.67±1.34	< 0.001	2±0.73	3.45±1.16	<0.001
Non_HDL	130±39.57	156.33±41.4	< 0.001	94.76±20.95	156.79±35.31	<0.001
AIP	0.05±0.08	0.38±0.17	< 0.001	0.17±0.21	0.18±0.20	0.94
sd_LDL	42.5±1.09€	45.4±2.57€	0.3	45.3±3.63€	43±0.94€	0.54
AGE	54±13	52±13	0.04	58±11	52±13	< 0.001
Gender	156/150	119/75	0.02	82/53	193/172	0.09

All results are expressed as Mean± SD, p<0.05 is considered significant

€ - expressed as Mean± SE

Discussion:

This study was intended to find out the pattern of non-HDL-C distribution in subjects with normal and abnormal lipid profile as well as among groups based on individual lipid components and categorizes them into different groups according to their serum non HDL levels.

Among non-HDL-C < 130 (group 1) and non-HDL-C >130 (group 2) individuals in group I had greater and significant DM, hypertension, dyslipidemia. But group 2 individuals showed significantly higher levels of TC, TG, LDL, TC/ HDL and VLDL compared to group I. This is in accordance with a study conducted by Lu W et al (2003).

The current study done by Ciffone and Copple (2019) also looked at the possibility of non-HDL-C (<130 mg/dl and >130 mg/dl) as a metric of quality of care in cardiovascular diseases, dyslipidemia, hypertension and DM. Thus as per the guidelines of the recent NCEP, the non-HDL-C (total cholesterol – HDLC) should be calculated to assist risk stratification in individuals with moderately elevated TG (200 to 500 mg/dL), diabetes, and/or established coronary artery diseases.

A case controlled study done by Liu et al (2017) observed the relationship with Non-HDL-C and analyzed its related factors in prediabetes, where Non-HDL-C correlated positively with HOMA-IR, and significantly showed elevated Non-HDL-C in adults with pre-diabetic. Another study conducted by Si aLiu (2019) determine the relationship between blood lipids & arterial stiffness in hypertension, where 380 subjects were grouped into 4 Groups.(Group A,B,C &D).The study concluded that dyslipidemia or/and hypertension may be risk factors for arterial stiffness. Carr et al (2019) suggested that Non-HDL-C and Apo B are superior to LDL-C in predicting Atherosclerotic Cardiovascular disease risk (ASCVD).

In this study, the non-HDL-C was found to be elevated even in the groups with triglycerides < 150 mg/dL and HDL > 40 mg/dL. This suggests that non-HDL-C measurement could provide a better picture on dyslipidemia as it is independent of serum triglyceride levels. Normolipidemic is characterized by total cholesterol and triglyceride values within reference ranges according to Oravec et al (2012). The presence of an atherogenicnormolipidemic enlarges the proportion of the population at increased risk for a cardiovascular event. In such a scenario non-HDL-C estimation might eliminate the risk of premature atherosclerosis development.

The present study had certain limitations like; it could not ascertain usage of statins as a preventive measure of all cardiovascular events. Adoption of non HDL as an indicator of quality care in coronary diseases needs to be correlated with other atherogenic markers such as apo B and small dense LDL estimation. The other potential risk factors where an elevated level of non HDL-C isobserved could not be established.

Conclusion:

This study categorically substantiates non-HDL cholesterol as an indicator of quality of care in cardiovascular diseases, dyslipidemia, hypertension and DM. The measurement is easier by simple calculation and does not require fasting to know the lipid status hence can be considered for routine screening of patients with predisposed risk factors for coronary artery diseases.

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The data available is stated in the manuscript.

Author's contribution:

Shivangi Rajput- Acquisition and analysis of dataRukmini MS- Concept and design of the study, Drafting of the article, DurgaraoYalla- Interpretation of the data, PoornimaAManjrekar- Critical Revision of the content

Conflict of interest:

None declared

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Ethical approval:

This study was approved by Institute Ethics Committee, Kasturba Medical College, Mangalore with protocol no. IECKMCMLR-04-17/76.

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