AN ATTEMPT TO ASSESS THE 10-YEAR RISK FOR ATHEROSCLEROTIC CARDIOVASCULAR DISEASE FROM TOTAL CHOLESTEROL TO HIGH-DENSITY LIPOPROTEIN RATIO AMONG A GROUP OF HEALTH AND ADMINISTRATIVE STAFF OF UNIVERSITY HOSPITAL-KDU.

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Abstract:

Background: Cardiovascular disease (CVD) is the most common cause of death worldwide. Identifying risk factors for CVD is crucial for risk assessment, and preventing adverse outcomes. The Atherosclerotic Cardiovascular Disease (ASCVD) risk estimator has been developed to reduce the 10-year predicted ASCVD risk and guide for primary prevention.

Objectives: To assess the predictability of a 10-year risk for ASCVD from total cholesterol to high-density lipoprotein ratio **(**TC: HDL) using the ASCVD risk estimator.

Method: A total of 65 volunteer participants of the health and administrative staff of UH-KDU between ages 40-70 years were selected for the study. The "ASCVD-Risk-Estimator-Plus-Mobile and Web-App-American College of Cardiology" was used for the estimation of ASCVD risk. The lipid profile parameters of the participants were performed manually. The TC:HDL was grouped into three; Group-01:TC:HDL<3.5, Group-02:3.5≤TC:HDL<5.0, Group-03:TC:HDL≥5.0. Statistical analysis was performed using IBM-SPSS_V26. First, the data were tested for the normalization. Since none of the parameters followed the normal distribution, a non-parametric Mann-Whitney U test was applied for sub-group-wise analysis. Finally, the Kruskal-Wallis Test was used to determine the statistically significant mean difference of the three sub-groups of non-parametric data. The non-parametric Spearman bivariate analysis was performed for the two sets of data to get significant correlations.

Results: Mean values of ASCVD_10 and Low-Density Lipoprotein (LDL) were continuously increased from Group-01 to Group-03 (ASCVD_10: Group-01:1.933, Group-02:4.362, Group-03:6.595; LDL: Group-01:93.64, Group-02:126.99, Group-03:158.64). The Kruskal-Wallis Test showed a significant difference ($p=0.00$) in mean values for ASCVD_10 and LDL, based on all three TC: HDL groups. In the sub-group-wise analysis by Mann-Whitney U Test, the ASCVD_10 and LDL still showed significant ($p<0.05$ & $p<0.01$) differences among all groups. In the Spearman

bivariate analysis, both the ASCVD_10 and LDL showed significant ($p<0.00$) moderate correlations ($r=0.462$) with the whole group data of TC: HDL.

Conclusion: These results indicate significant relationships between the TC: HDL and ASCVD_10 and also between the TC: HDL and LDL. The initial findings provide evidence for the potential predictability of ASCVD_10, but additional research is required to establish the more strengthen relationships to improve the accuracy of the predictions.

Key Words: TC: HDL, 10-year ASCVD risk, LDL
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INTRODUCTION: The term "cardiovascular disease" refers to any disease that affects the heart or blood vessels. It is frequently linked to fatty deposits in the arterial walls (atherosclerosis) and an elevated risk of thrombosis.[1] Cardiovascular disease (CVD) is the most common cause of death worldwide.[2] Identifying risk factors for CVD is crucial for the risk assessment, further preventing adverse CVD outcomes. In clinical practices use of "cardiovascular risk prediction models" are very important aspect in the identification, prevention, and staging of the severity of CVDs.[3] The Atherosclerotic Cardiovascular Disease (ASCVD) Risk Estimator has been developed to reduce the 10-year predicted ASCVD risk and guide for primary prevention.[4]

METHODOLOGY: Ethical clearance was granted by the Ethical Review Committee of General Sir John Kotelawala Defence University (ERC No: RP/S/2022/11). A total of 65 volunteer participants of the health and administrative staff of UH-KDU between 40 to 70 years were selected for the study. The blood samples for the Lipid profile test were collected into plain tubes by a qualified nurse. The ASCVD risk was estimated by the "ASCVD Risk Estimator Plus- Mobile and Web App" developed by the American College of Cardiology and the American Heart Association.[3] Lipid profile parameters of the participants were performed manually (Spectrum Diagnostics and Healthcare, Bangalore, India) using a spectrophotometer (Double Beam UV/Vis Spectrophotometer CT-2300), and the internal quality controls and the standards were performed using the quality control and standard reagents purchased with the same reagent kit. The TC: HDL was grouped into three Group-01: TC: HDL <3.5, Group-02: 3.5≤ TC: HDL <5.0, Group-03: TC: HDL ≥5.0. The statistical analysis was performed using IBM SPSS_V26. First, the data were separately tested for the normalization. The Kolmogorov-Smirnov test was applied to observe the normality of overall data (n>50), and the Shapiro-Wilk test was applied to check the normality of grouped data (n<50). For grouped data, non-parametric Mann-Whitney U Test was applied. Finally, the Kruskal-Wallis Test was performed to observe the significance of the overall data.[5] The non-parametric Spearmen bivariate analysis was applied for the overall data set for the observation of any significant correlations.

RESULTS AND DISCUSSION:

Both the overall data and grouped data were checked for normality. Kolmogorov-Smirnov test was used when the data; was n>50 and the Shapiro-Wilk test was used when the data; was n<50. Data normalization using SPSS (Descriptive Statistics Explore) is shown in Table 1 & 2.

The Kolmogorov-Smirnov test was applied to observe the normality of overall data (n>50).

Table 1: Normality testing of the overall data of TC: HDL, LDL & ASCVD_10.

Parameters	Sig
TC: HDL	0.200
LDL	0.200
ASCVD_10	0.000

The Shapiro-Wilk test was applied to check the normality of grouped data (n<50).

Table 2: Normality testing of the grouped data of TC: HDL & ASCVD_10.

Parameters	Sig.
TC: HDL Group-01	0.153
TC: HDL Group-02	0.300
TC: HDL Group-03	0.090
ASCVD_10 Group-01	0.108
ASCVD_10 Group-02	0.000
ASCVD_10 Group-03	0.000

According to the Kolmogorov-Smirnov test, out of overall data, the TC: HDL & LDL showed a normal distribution (p>0.05) while the ASCVD_10 did not show a normal distribution (p<0.05). When considering the grouped data, as the Shapiro-Wilk test shows, out of 3 groups all the TC: HDL groups and ASCVD_10 group-01 follow normal distribution (p>0.05), but the groups 2 & 3 of ASCVD_10 do not follow a normal distribution (p<0.05). Therefore, for further analysis, the non-parametric tools had to be used.
First, the mean and Standard deviation values of the groups were obtained in parallel to the results that were used in normalization and the Mean & Standard deviation of TC: HDL groups are shown in Table 3.

Table 3: Mean & Standard deviation of TC: HDL groups.

Parameters	N	Mean	Std. Deviation
TC: HDL Group-01	18	2.985	0.359
TC: HDL Group-02	26	4.222	0.431
TC: HDL Group-03	21	5.972	0.758

Mean and standard deviation of ASCVD_10 groups are shown in Table 4.

Table 4: Mean & Standard deviation of ASCVD_10 groups

Parameters	N	Mean	Std. Deviation
ASCVD Group-01	18	1.933	1.1566
ASCVD Group-02	26	4.362	4.2742
ASCVD Group-03	21	6.595	5.9398

The Mean and standard deviation of LDL groups are shown in Table 5.

Table 5: Mean & Standard deviation of LDL groups

Parameters	N	Mean	Std. Deviation
LDL Group-01	18	93.640	18.159
LDL Group-02	26	126.998	27.537
LDL Group-03	21	158.641	25.736

Mean values of TC: HDL, ASCVD_10, and LDL were continuously increased from Group-01 to Group-03.

The non-parametric Kruskal-Wallis Test was applied to find the mean difference of the overall data based on the three TC: HDL groups. The results are shown in Table 6.

Table 6: Kruskal-Wallis Test applied based on three TC: HDL groups

	Group	Mean Rank
LDL	1	14.08
	2	32.81
	3	49.48
ASCVD_10	1	20.31
	2	32.42
	3	44.80

It showed an overall significance (p=0.000) for ASCVD_10 and also LDL based on all three TC: HDL groups.

In the sub-group-wise analysis, the Mann-Whitney U Test was applied and the results are shown in Table 7-9.

Table 7: Mann-Whitney U Test based on TC: HDL group 1 & 2

	Group	Mean Rank
LDL	1	13.78
	2	28.54
ASCVD_10	1	17.61
	2	25.88

Table 8: Mann-Whitney U Test based on TC: HDL group 2 & 3

	Group	Mean Rank
LDL	2	17.77
	3	31.71
ASCVD_10	2	20.04
	2	28.90

Table 9: Mann-Whitney U Test based on TC: HDL group 1 & 3

	Group	Mean Rank
LDL	1	9.78
	3	26.76
ASCVD_10	1	12.19
	3	26.69

The ASCVD_10 and LDL still showed significant ($p<0.05$ & $p<0.01$) differences among all the groups in the Mann-Whitney U Test.

For the observation of the correlations of the data, the non-parametric Spearmen bivariate analysis was applied to establish the correlations with ASCVD_10 by TC: HDL and LDL. The results are shown in Table 10.

Table 10: Spearmen bivariate analysis of ASCVD_10 with TC: HDL and LDL.

Parameter	TC: HDL	LDL	ASCVD_10
TC: HDL	1.000	0.761**	0.527**
LDL	0.761**	1.000	0.462**
ASCVD_10	0.527**	0.462**	1.000

**Correlation is significant at the level 0.01(2-tailed)

In the Spearmen Correlation analysis, the overall data of TC: HDL shows significant ($p<0.000$) moderate correlations with both the ASCVD_10 and LDL.

Certain research groups attempted the predictive ability of TC: HDL on CVDs.[6,7] Moreover, separate studies have been conducted based on different CVD risk estimators, to predict the 10-year CVD risk of different populations.[4,8] If ASCVD_10 could be predicted using TC: HDL_ratio, it would be an advantage in the detection and management of CVDs in the absence of the data of ASCVD_10.

CONCLUSION: The results indicate a significant relationship between the TC: HDL and ASCVD_10, as well as between the TC: HDL and LDL. This is an important finding as an individual's TC: HDL, which is derived through routinely performed laboratory investigations, enables the predicted risk of ASCVD for 10-years. Further analysis is needed to determine the extent to which of these variables can predict each other. The initial findings provide evidence for potential predictability, but additional research is required to establish the strength and direction of the relationships and to assess the accuracy of the predictions.

RECOMMENDATIONS:

The conventional TC: HDL could be used as an alternative for ASCVD_10 due to its easy accessibility, rapid analysis, and personalized risk assessment. It is also a conveniently measured tool for risk assessment as it can avoid other factors such as age, gender, race, and blood pressure levels. Therefore, this should widely be studied with different associated conditions of the patients.

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