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The correlation between Red Cell Distribution Width and Serum Lipoprotein in adult men in Parul Sevashram Hospital at Waghodia, Vadodara

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Abstract

Objective: Some disorders linked to metabolic syndromes are the leading causes of mortality and illness. The red blood cell distribution width is a measurement of the size variation of circulating erythrocytes. In human plasma, lipoprotein is a complex particle and a bold risk factor. The objective of this research was to see if there was a link between serum Lp and RDW. In healthy adult men, the possible outcome will be the ability to determine future risk of obesity, hypertension, coronary heart disease (CHD), cerebrovascular disease, atherosclerosis, heart failure, and stroke.
Methods: A total 50 drug-free adult males (Aged-20 to 45 years) were enrolled in the study. They were taken into consideration for this research work. After that physical examination and blood sampling were performed to detect the value of Serum Lp and RDW using auto analyzers and commercial kits.
Results: For statistical analysis, IBM SPSS Statistics 25.0 software was utilized. The mean age of the persons was 22.24 years; RDW-CV was 14.56%; the serum Lp(a) level was 92.89 mg/dL. Here, a bivariate correlation test was performed and there was a highly significant positive correlation between the Lp(a) and RDW-CV (r= -0.091; p=0.531).
Conclusion: In this study, the increase in RDW in correlation with altering the level of Lp(a) is strongly suggested that the patient may have a future risk of CHD and other heart related abnormalities.
Keywords: Coronary Heart Disease; Lipoprotein; Mean corpuscular volume; Red Blood Cells; Red cell distribution width – coefficient of variation.

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1. Introduction

In today's present world, the main causes of mortality and illness are obesity, cancer, stroke, pulmonary diseases, coronary artery disease (CAD) and other pathologies related metabolic syndromes. Some biological markers are also correlated with accumulated risk for these diseases. [1]

The RDW (red blood cell distribution width) is an assessment of circulating erythrocyte size variability. Normally, RDW is evaluated as part of a standard complete blood count (CBC). [2] In human RBCs, the normal reference range for RDW is 11.5 percent to 15.4 percent. Specifically in adult females the RDW range is 12.2% to 16.1% and in adult males it is 11.8% to 14.5%. Increased RDW levels are linked to poor erythropoiesis or erythrocyte breakdown in iron deficiency anemia, folate and vitamin B12 deficiency anemia, and recent haemorrhage.[7] Higher RDW levels have also been linked to an increased risk of cardiovascular death in the general population,[8] as well as an increased risk of cardiovascular morbidity and mortality in patients with known heart failure and coronary artery

disease (CAD).[9] RDW, a newly reported unique risk marker, has been demonstrated to be predictive of morbidity and death in a variety of cardiovascular settings, including heart failure, stable coronary artery disease, and acute myocardial infarction.[3]

RDW is determined by multiplying the standard deviation of the mean corpuscular volume (MCV) by 100 to get a percent value that represents RBC size heterogeneity. There is no universal reference range since different laboratories use different methods for measuring RBC size, instruments, experimenters, laboratory standards, and statistical approaches. RDW reference values of 11–15 percent were most generally mostly used by laboratories. [12]

Along with that elevated serum lipoprotein level is also a bold risk factor for the common community. In human plasma, lipoprotein (Lp) is a complex particle.[4] The structure of Lp(a) is similar to that of LDL but is characterized by the presence of a specific glycoprotein termed apolipoprotein(a) [apo(a)], homologous to plasminogen, which is covalently connected via a disulphide linkage to apolipoprotein B-100.[10] Lp(a) has been stated to exert atherogenic and prothrombotic effects, and excessive Lp(a) degree has been established as an independent, causal chance factor of atherosclerotic issues and CVD in the popular population.[11] The normal range of Lipoprotein is 30 mg/dL. Lipoprotein is a cholesterol-rich plasma protein. Its fat construction is similar to that of LDL-cholesterol but the major protein components are various.[5] High blood levels of Lipoprotein (a) [Lp(a)] have been identified as a risk factor for cerebrovascular disease (CVD), atherosclerosis, thrombosis, and stroke.[1]

It is of significant importance to consider multiple healthy lifestyle factors when investigating the association of lifestyles with blood lipids because different behaviours tend to promote each other. Many people, who drink, for example, also smoke. The confirmation for the protective effects of a combination of healthy lifestyles on serum lipids, on the other hand, is quite limited. [6]

We aimed to explore the viable relation in the middle of the serum lipoprotein (Lp) and red blood cell distribution width (RDW) in drug-free adult men in this study. [1]

2. Materials and methods

This prospective study was performed among drug-free young adult males (Age-20 to 45 years) and participants randomly selected from different departments of Parul University including staff and students. All persons were given informed consent and the study protocol was sanctioned by the Parul University Institutional Ethics Committee for Human Research (PU-IECHR) with approval number: PUIECHR/PIMSR/00/081734/4003.

After that, all persons were inspected physically very carefully. Age, Height, Weight, Alcohol intake, Smoking status, and Blood pressure are all these parameters recorded in this study. After a full night's fast, 5 ml of peripheral venous blood samples were taken from each participant between 8:00 and 10:00 a.m. [Sampling collection method: SRS(Simple Random Sampling)] The blood samples were allotted into EDTA (purple cap tube) and plain tubes(red cap tubes) in appropriate volumes. To get the serum, plain tubes were incubated for 30 minutes at room temperature of 37 degrees Celsius and after that coagulation of blood, they were centrifuged at the speed of 3500 rpm/min for 10 minutes. After that, all samples were tested for serum lipid profile including serum cholesterol test and serum triglyceride in a biochemistry laboratory. We used the Erba kit to evaluate the serum lipid profile. Along with that, all EDTA samples are used for complete blood count (CBC) reports. CBC report reported using MINDRAY 6 PARTS BC6200 named haematology analyzer. RDW-CV values were obtained from all CBC reports. After assembling all reports, we compare the values of RDW-CV and serum lipoprotein and started analysing the data.

3. Results

For statistical analysis, IBM SPSS Statistics 25.0 (SPSS stands for Statistical Package for the Social Sciences) software was utilized. As a Statistics, the mean and standard deviation of parametric variables are used here. The mean of the physical parameters like age of the persons was 22.24 years; the weight of the persons was 63.76 kg; the height of the persons was 167.34 cm and the pulse of the persons was 80.04 b/m. The mean of the pathology parameters from CBC like RDW-CV was 14.56%; RBC count was 5.26 10^12/L; total WBC count was 6881.4/cmm and platelets count was 325080/microliter. The mean of serum Lp(a) level was 92.89 mg/dL. The mean and standard deviation (SD) of all the parameters is given below (Table I).

Table I: Mean & standard deviation of all parameters

Parameters	*MEAN ± SD*
Age(Years)	22.24 ± 1.835
Weight (kg)	63.76 ± 11.020
Height (cm)	167.34 ± 7.536
Pulse(b/m)	80.04 ± 9.862
RBC Count(10^12/L)	5.26 ± 0.636
Total WBC Count (/cmm)	6881.4 ± 1678.645
Platelets Count (/Microliter)	325080 ± 76735.123
RDW-CV (%)	14.56 ± 1.250
Serum Total Cholesterol (mg/dl)	162.74 ± 37.366
Serum Triglycerides (mg/dl)	115.6 ± 47.216
Serum HDL (mg/dl)	47.18 ± 7.536
Serum VLDL (mg/dl)	23.12 ± 9.443
Serum LDL (mg/dl)	92.89 ± 32.687
Cholesterol/HDL Ratio (mg/dl)	3.47 ± 0.649
LDL/HDL Ratio (mg/dl)	1.97 ± 0.579

The associations between the parametric variables were then tested using the Bivariate correlation test and Pearson correlation analysis. Here, bivariate correlation test is performed in SPSS and there was a highly significantly positive correlation between the Lp(a) and RDW-CV (r= -0.091; p=0.531). (Figure I).

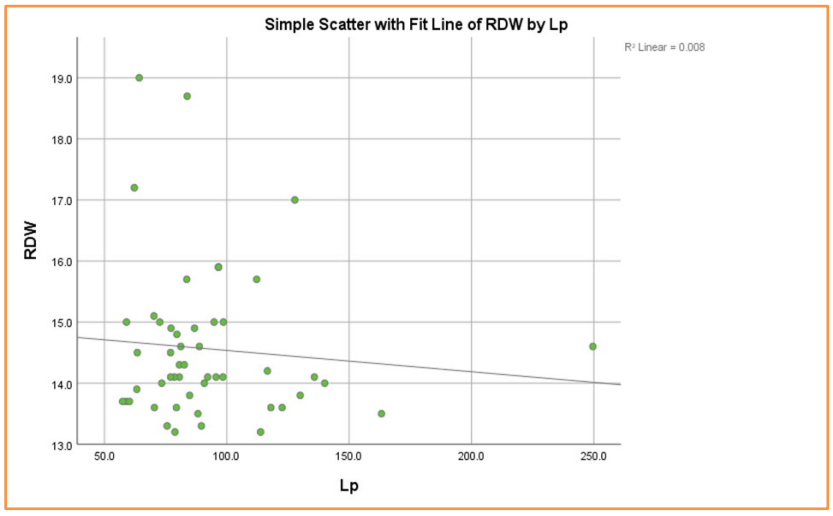

Figure I: Correlation between lipoprotein (a) and red cell distribution width

If the r value is negative, it means that as one variable rises, the other falls; they are inversely connected. (Here, in my study RDW increases in comparison to lipoprotein.) High P-values means sample results are consistent with a true null hypothesis. Along with that, Correlations between Lipo(a) and hematologic parameters are also given below. (Table II)

Table II: Correlations between Lipo(a) and hematologic parameters

Parameters		Total WBC Count (/cmm)	RBC Count (10^12/L)	RDW-CV (%)	Platelets Count (/Microliter)	Serum LDL (mg/dl)
Age (Years)	**r**	-0.252	0.277	0.350	-0.057	-0.250
	p	0.077	0.052	0.013	0.694	0.079
Total WBC Count (/cmm)	**r**	-	0.177	-0.051	0.225	0.064
	p	-	0.218	0.723	0.116	0.660
RBC Count (10^12/L)	**r**	-	-	0.342	0.138	0.056
	p	-	-	0.015	0.341	0.698
RDW-CV (%)	**r**	-	-	-	0.163	-0.091
	p	-	-	-	0.259	0.531
Platelets Count (/Microliter)	**r**	-	-	-	-	0.143
	p	-	-	-	-	0.321

4. Discussion

RDW is a powerful predictor of future cardiovascular risk events because it is a basic morphological marker of red blood cell size heterogeneity. Multiple potential confounding factors, such as anaemia, dietary factors, haemoglobin A1c, and renal function, have no effect on this connection. Numerous studies have investigated the association between Lp(a) and atherosclerotic complications and CV mortality. Lp(a) has been unequivocally identified as an independent prognostic factor for CV events in the general and CKD population.[4] Our findings show that blood Lp(a) levels and RDW-CV levels have a highly positive significant correlation. There is research that shows a link between Lp(a) and RDW in healthy adult men, to the best of our knowledge.

Higher RDW suggests that the bone marrow is producing larger, immature red blood cells. RDW has been shown to play a function in predicting cardiovascular risk in previous research. The acceleration of RBC proliferation is linked to a higher RDW value. Some pathophysiological circumstances, such as B12 Folate deficiency, which causes macrocytic anaemia, cause RBC synthesis to speed up, resulting in the releasing of bigger reticulocytes into circulation. Furthermore, even in the absence of anaemia, increasing RDW should be investigated because it could be the first sign of an underlying pathology.[13]

Lp(a) carries cholesterol and proinflammatory degraded phospholipids, which attract inflammatory cells to artery walls and stimulate smooth muscle cell proliferation, leading to atherosclerosis.[14]

Our data from 50 drug-free adult men reveals a strong positive association between blood Lipoprotein (Lp) and Red Blood Cell Distribution Width (RDW) levels, but it does not reveal temporary features or active interplay between the two parameters. We only looked at the relationship between RDW and Lp(a), no other lipid characteristics. Only a substantial connection with Lp(a) was found as a result. According to prior research, a positive connection can detect future risk of obesity, hypertension, coronary heart disease (CHD), arrhythmias, cerebrovascular disease (CVD), atherosclerosis, thrombosis, heart failure, and stroke in healthy adult men.[1] Hence , in this study , the increase in RDW in correlation with alter level of Lp(a) is strongly suggested that patient may have future risk of coronary heart disease (CHD) and other heart related abnormalities like stroke, heart failure and heart attack. Since, Increased Red Cell Distribution Width (RDW) could be an indication of Nutrient deficiency like iron deficiency, folate deficiency and vitamin B12 deficiency which causes Macrocytic Anaemia (It means body does not produce normal red blood cells and produces red blood cells larger than normal). Anaemia causes Cardiac Dysfunction because unhealthy red blood cells does not carry enough oxygen to the organs of the body.[3] So, Red cell distribution width (RDW) is a biomarker to predict the future risk of coronary heart disease (CHD) in the participants selected for the study such as students and faculties.

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