Advanced Research Journal of Biochemistry and Biotechnology: Vol. 1(3): pp 014-017, May, 2014.

Full Length Research Paper

Evaluation between estimated and calculated plasma low density lipoproteins

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Accepted 30th May, 2014

Increased LDL level is one of the major causes of heart disease including arteriosclerosis. Hence an accurate and timely measure of LDL can prevent the incidence of cardiac disorders. In the present study we compared the results between directly measured plasma LDL and calculated LDL. The LDL level was measured by colorimetric method and the calculation was done using friedwald's equation in hyperlipidemic patients and healthy populations. We aimed to measure the accuracy of colorimetric method and fridwald's equation in the estimation of plasma LDL in hyperlipidemic patients and healthy populations and assess if there is correlation between cholesterol level and LDL level thereby prevent false diagnosis due to false or inaccurate results . 2.5ml of blood was taken in lithium heparin container from 50 hyperlipidemic and normal populations, then centrifuged at 4000r.p.m for 3mins, the plasma was separated. Estimation of cholesterol, triglyceride and LDL was done using the routine reagents. Control sera (normal and pathologic) were used for every patch, after incubation the reaction color was read in a colorimeter (JENWAY 6051), beer's and lambert's law was used to measure the concentrations of the samples. Then for the same samples the Fridwald's equation was used to calculate the LDL level. Mean value of 139.5 mg/dl, and a standard deviation of 37.44 was found for the hyperlipidemic patient's LDL level by direct measurement and a mean of 136.5 mg/dl, and a standard deviation of 43.90 was found by using the Fridwald's equation. The p value was found equal to 0.624, which is statistically insignificant. Also a mean of 73.6 mg/dl, and a standard deviation of 17.65 was found for the normal subjects LDL level by direct measure, and a mean of 71.2 mg/dl and a standard deviation of 22.50 was found by using the equation. The p value was found equal to 0.60 which is statistically insignificant. A moderate correlation of 0.48 was found between patient's cholesterol and LDL levels. Also a moderate correlation of 0.49 was found between normal subject's cholesterol and LDL level. We conclude that both Fridewald's equation and direct colorimetric method can be used for routine LDL levels because it gives acceptable results. Moreover there is a correlation between cholesterol level and LDL level.

Key words: Hyperlipidemia, LDL, cholesterol, colorimetric method, Fridewald's equation.

INTRODUCTION

Lipoproteins are transporters of the water insoluble lipids in the blood stream. They are spherical in shape with a surface and a core (Lund, 2003). They are classified according to the size and density established by the ultracentrifugation and electrophoresis technique. Low Density Lipoproteins (LDL) are formed as a consequence of the lipolysis of Very Low Density Lipoproteins (VLDL) (Gruffat, 1996). They are readily taken up by the cells due to the LDL receptors present in the liver and peripheral cells (Copper, 1997). Additionally, because LDL particles are significantly smaller than VLDL and chylomicrons, they can infiltrate into the extracellular space of vessel wall where they can be oxidized and taken up by macrophages (Gruffin, 1994). Arteriosclerosis is the deposition of lipids in artery walls. The deposition of lipids eventually leads to

obstruction of blood flow into the heart's coronary artery which leads to myocardial infarction (MI). The various causes of MI include increase lipid intake, smoking, lack of exercise, secondary to diabetes, genetic abnormality, LDL (Ginsberg, 1994). Tighe and Ockene (2006) reported that there is a significant difference between calculated and directly measured LDL. Also Ahmadi and Boroumand (2008) opined that Friedewald's equation may over estimate low density lipoprotein cholesterol concentration and it should be either directly assayed or be calculated by a modified Friedewald's equation.

Further, another research done by Amayo (2004) found that there is lack of agreement between the Friedewald's folmula and the Abbott direct LDL-C assay. If the two methods are used interchangeably, there may be confusion in the classification and control of lipid lowering medication for patients with hyperlipidemia . In the study report of Caio el al (2004) the Friedewald formula did not have a homogeneous performance for estimating LDL-C levels in samples with different triglyceride levels as compared with that of the direct method, which could launch doubts on patient's classification of the risk of developing coronary artery disease. The objective of this study was to compare between the results of directly measured plasma LDL level by colorimetric method and calculated LDL.

MATERIALS AND METHODS

Study Population

This study was conducted in Yastabshroon hospital, Omdurman, Kharţum, Sudan during the period from October 2011 to April 2012 to compare between the results of direct measuring LDL level and calculated LDL level in the plasma of hyperlipedemic patients and healthy individuals. Group of hyperlipedimic patients were enrolled in this study with cholesterol concentration of > 200 mg/dl and a group of normal population with cholesterol concentration of < 200 mg/dl to evaluate the LDL level. This study was a case control hospital based comparative study. The variables estimated in this study were cholesterol, triglycerides, HDL and LDL (Michel , 2010).

Inclusion criteria

Known hyperlipedimic patients with cholesterol >200 mg/dl and healthy population with cholesterol < 200 mg/dl and Triglyceride < 400mg/dl (Kritchevsky, 1988).

Sampling

A total of one hundred samples (fifty hyperlipidemic patients and fifty healthy individuals) were collected for this study. Under aseptic condition (using 70% alcohol as disinfectant) a two and a half ml of fasting blood sample was collected in lithium heparin anticoagulant and centrifuged at 3000 r.p.m for 3 mins and the plasma was separated and the biochemical parameters indicated above were measured. All variables in this study were estimated by colorimetric methods and LDL was also calculated by Friedewald's equation (Friedewald, 1972).

Ethical consideration

All the enrolled subjects were informed about the targets of this research and their consent was taken, before the beginning of the sampling. Appropriate approval letter was obtained from the competent authority of the institute where the research was carried out.

Data analysis

Statistical analysis was performed using statistical package for social science (SPSS) software version 12. Mean values of normally distributed continuous data were compared using student's't' test. P value of 0.00 was considered significant at 95% confidence limit.

RESULTS

The LDL level in hyperlipidemic patients (case) was 139.5 when measured colorimetrically and upon calculation using Friedewald's equation method it was 136.5 (Figure 1). In normal healthy persons the levels of LDL were 73.6 and 71.2 by colorimetric and Friedewald's methods respectively (Figure 2). The difference was non-significant.

DISCUSSION

The results of this study show that there is insignificant difference between the direct measured LDL level and calculated LDL level in both hyperlipidemic cases and normal group. This difference may be due to the cholesterol and triglyceride levels which may affect the LDL level when using the equation.

The significant difference between calculated and directly measured LDL values reported by Tighe and Ockene (2005) is in contradiction with this study. Further a study done by Ahmadi and Boroumand (2008) found that the friedewald equation may over estimate low density lipoprotein cholesterol concentration and it should be either directly assayed or be calculated by a modified friedewald equation.

In an another study done by Amayo (2004) found that there is lack of agreement between the directly measured LDL and the calculated. If the two methods are used interchangeably, there may be confusion in the classification and control of lipid lowering medication for patients with hyperlipidaemia. Another study done by Caio et al, (2004) found that the friedewald formula did

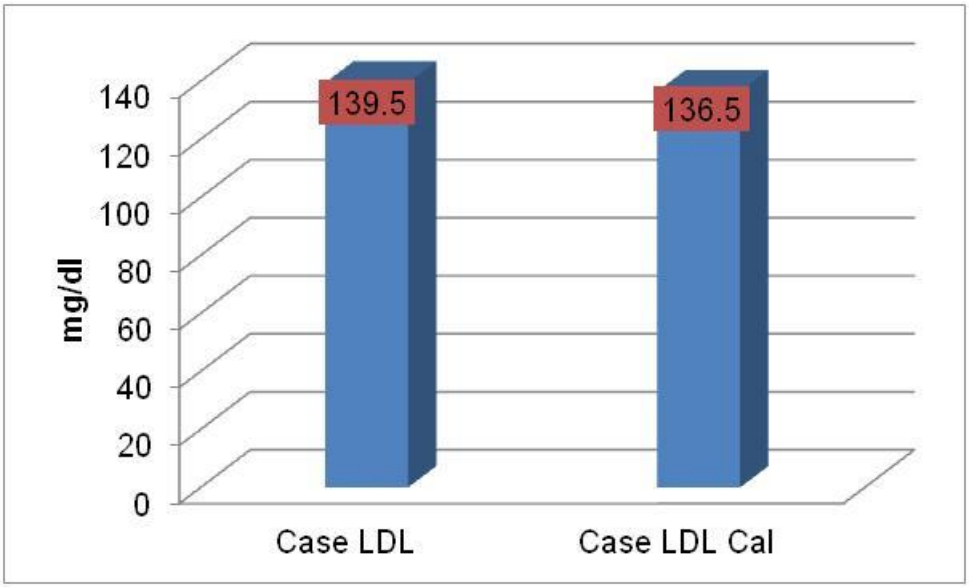

Figure 1: comparison between cases LDL level by direct and calculated measuring**.**

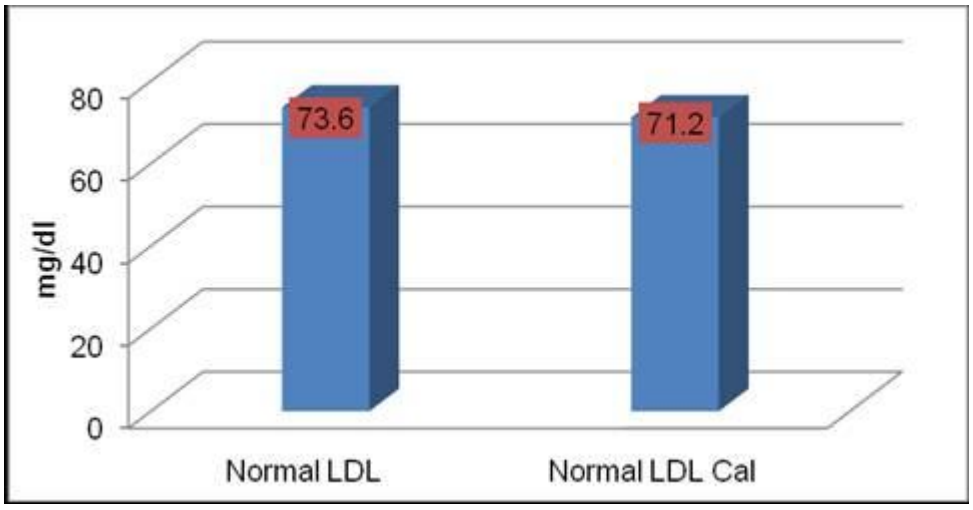

Figure 2: comparison between direct measuring and calculated LDL level in healthy population. (p.value = 0.60)

not have a homogeneous performance for estimating LDL-C levels in the samples with different TG levels as compared with the direct method, what could launch doubts on patient's classification on the risk of developing coronary artery disease and this study agree with these two studies.

CONCLUSION

Both the direct measuring LDL level and the friedewald equation give acceptable results and can be used for routine measuring of LDL level. There is a moderate correlation between the cholesterol level and the LDL level.

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