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Comparison of measured LDL cholesterol with calculated LDL-cholesterol using the Friedewald and Martin-Hopkins formulae in diabetic adults at Charlotte Maxeke Johannesburg Academic Hospital/NHLS Laboratory

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ABSTRACT

Background

National Cholesterol Education Programme Adult Treatment Panel III (NCEP ATP III) and the European Society of Cardiology recommends using low-density lipoprotein cholesterol (LDL-C) as a treatment target for cholesterol lowering therapy. The Friedewald formula underestimate LDL-C in non-fasted and hypertriglyceridemia patients. This study aimed to compare measured LDL-C to calculated LDL-C in diabetic patients using the Friedewald and Martin-Hopkins formulae.

Methods

The data of 1 247 adult diabetes patients were retrospectively evaluated, and included triglycerides (TG), LDL-C, total cholesterol, and high-density lipoprotein cholesterol that were measured on the Roche Cobas® c702. Passing-Bablok regression analysis was used to determine the degree of agreement between measured LDL-C and calculated LDL-C using both formulae. The Bland-Altman plots were used to assess the bias at medical decision limits based on the 2021 European Society of Cardiology (ESC) guidelines on cardiovascular disease prevention in clinical practice.

Results

Both formulae showed a good linear relationship against measured LDL-C. However, the Martin-Hopkins formula outperformed the Friedewald formula at LDL-C treatment target <1.4mmol/L. The Friedewald formula and the Martin-Hopkins formula had 14.9% and 10.9% mean positive bias, respectively. At TG-C ≥1.7 mmol/L, the Martin-Hopkins formula had a lower mean positive bias of 4.2 % (95 % CI 3.0-5.5) compared to the Friedewald formula, which had a mean positive bias of 21.8 % (95 % CI 19.9-23), which was higher than the NCEP ATP III recommended total allowable limit of 12%.

Conclusion

The Martin-Hopkins formula performed better than the Friedewald formula at LDL-C of 1.4 mmol/L and showed the least positive bias in patients with hypertriglyceridemia.

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KEYWORDS

Calculated low density lipoprotein; Diabetes mellitus; Direct low density lipoprotein; Friedewald formula; Martin-Hopkins formula

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