INTRODUCTION

An acute myocardial infarction (MI) or acute coronary syndrome (ACS) is produced by lipoprotein coronary disease (LCD) in which the inner lining of coronary arteries which supply oxygenated blood supply to cardiac muscle, is deposited an atherosclerotic plaque that is actually a form of ischemic heart disease (IHD). Dyslipidemia was considered the major risk factor of IHD, identified through various studies on conventional, non-traditional and novel risk factors of IHD. Seven million deaths were reported within Asian and Middle-Eastern regions due to IHD in 2010; out of which, 38% were females while 46% were males. There is 3.6 to 9.5% prevalence rate of IHD within Pakistan. Worldwide, one-third of people suffering from IHD was attributable to elevated cholesterol globally; and due to this reason, 2.6 million deaths occurred worldwide in 2008. IHD is the most important threat for LCD in Pakistan with the prevalence of hyper-cholesterolemia of 30.6%, hyper-triglyceridemia of 30.1%, and low HDL-cholesterol of 48.6%.

The screening test for hyperlipidemia traditionally requires a lipid profile, which is considered as the initial routine test that comprises of total cholesterol (TC), high density lipoprotein-cholesterol (HDL-C), and triglycerides measured by direct enzymatic colorimetric method by Modular p-800®. Low density lipoprotein-cholesterol (LDL-C) was calculated by Friedewald's formula, but when triglyceride was greater than 4.5 mmol/l, then LDL-C was measured directly by homogenous enzymatic colorimetric method. Non-HDL-C was calculated by simple equation, i.e. TC-HDL-C.

RESULTS: Non-fasting lipid profile had 93% specificity, 51% sensitivity, 49% positive predictive value and 49% negative predictive value; and 65% accuracy with 7.28 positive likelihood ratio and 0.52 negative likelihood ratio. Non-fasting TC and non-HDL-C were significantly higher than fasting TC and non-HDL-C by mean difference of 0.2 mmol/l each with p=0.001 and p=0.004, respectively. Fasting and non fasting LDL-C are comparable to each other with mean difference of 0.01 mmol/l (p=0.745). Receiver operating curve (ROC) of non-fasting non-HDL-C showed 0.804 (95%CI (0.738-0.870), (p=0.000) area under the curve (AUC) indicating that it was a significant test for ruling out hyperlipidemia. Bland-Altman plot showed a significant difference between non-fasting, non-HDL-C and fasting LDL-C and non-fasting, non-HDL-C -0.087540 with bias -0.00109; therefore, these cannot be alternative to each other.

CONCLUSION: Diagnostic accuracy of non-fasting lipid profile was found significantly higher than fasting lipid profile (p=0.004) for the assessment of lipoprotein coronary risk on the basis of non-HDL-C, which seemed to be significant test for ruling out hyperlipidemia.

Key Words: Non-Fasting lipid profile. Lipoprotein coronary risk. High Density Lipoprotein Cholesterol (HDL-C). Non-HDL-C.
TC-HDL-C. Non-HDL-C includes LDL-C, VLDL-C and IDL-C. Therefore, non-HDL is considered as a family of villains, which fight with a hero known as HDL.12,13

The objective of the present study was to find out the accuracy of non-fasting lipid profile for the assessment of coronary risk for IHD.

METHODOLOGY

After approval by the ethical review board of the institute, 175 adults were selected from the Department of Chemical Pathology and Endocrinology, Armed Forces Institute of Pathology (AFIP), Rawalpindi from July to December 2014. Samples were collected by non-probability, consecutive sampling. Adults of either gender, aged 18 - 80 years, were included in the study while indoor patients, pregnant ladies, patients on anti-cholesterol treatment, and with acute and chronic illnesses were excluded.

Blood samples were collected in gel tubes for lipid profile from all subjects. Subjects were called the next day for non-fasting sample for lipid profile. The tubes were properly labelled and the specimens were transported to the processing room within half an hour. Lipid profiles were performed within 2 hours of sample collection. Specimens were allowed to clot at room temperature. Serum was then separated by centrifugation at 3000 RPM for 3 minutes.

All biochemical parameters like TC, TG, and LDL-C were measured by direct enzymatic colorimetric assay on Modular p800. HDL-C was measured directly by elimination/catalase method on Advia 1800. Non-HDL-C was calculated by: TC-HDL-C.

All data were entered and analysed by using SPSS (statistical package for social sciences) version 22. For descriptive statistics, quantitative variables like age, TC, HDL-C, Non-HDL-C, LDL-C and triglycerides were summarised as mean ± standard deviation (SD). Qualitative variables like gender, true positive, true negative, false positive, and false negative were expressed as frequency and percentage.

For inferential statistics, 2 x 2 table was constructed between fasting and non-fasting lipid profile. Specificity (TN/TN+FP), sensitivity (TP/TP+FN), positive predictive value (TP/TP+FP), negative predictive value (TN/TN+FN), and accuracy (TP + TN) / (TP + FP + FN + TN) of non-fasting lipid profile were calculated. Positive likelihood ratio (1-sensitivity/specificity) and negative likelihood ratio (1-sensitivity/specificity) of non-fasting parameters were calculated.

Paired t-test was carried out to find out significant difference between fasting and non-fasting parameters considering p < 0.05 as statically significant. Receiver operating characteristic (ROC) curve was constructed for checking the validity of non-HDL-C, considering p < 0.05 with 95% confidence interval (CI) while Bland’s Altman difference plot was drawn for visualising the statistical difference between fasting LDL-C and non-fasting non-HDL-C, and fasting TG with non-fasting non-HDL-C.

RESULTS

A total of 175 subjects were calculated in this study. Out of these, 125 (71%) were males and 50 (29%) were females. Mean age was 46 ±11.6 years (range: 18 - 78 years). Among these, 38% belonged to 40-50 years age group. The baseline biochemical characteristics of the overall study population are shown in Table I.

Table I: Baseline biochemical characteristics of the study population.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Fasting lipid profile (Mean ± SD)</th>
<th>Non-fasting lipid profile (Mean ± SD)</th>
<th>Paired correlation</th>
<th>p-value</th>
<th>Paired mean difference</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC (mmol/l)</td>
<td>4.8 ±1.09</td>
<td>5.0 ± 1.08</td>
<td>0.802</td>
<td>0.000</td>
<td>-0.172</td>
<td>0.001</td>
</tr>
<tr>
<td>HDL-C (mmol/l)</td>
<td>1.18 ±0.46</td>
<td>1.17 ± 0.44</td>
<td>0.424</td>
<td>0.000</td>
<td>0.012</td>
<td>0.745</td>
</tr>
<tr>
<td>Non-HDL-C (mmol/l)</td>
<td>3.6 ±1.15</td>
<td>3.8 ±1.16</td>
<td>0.738</td>
<td>0.000</td>
<td>0.2</td>
<td>0.004</td>
</tr>
</tbody>
</table>

Table II: Table between gold standard fasting lipid profile and non-fasting lipid profile.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-fasting lipid profile</td>
<td>Fasting lipid profile</td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>TP (60)</td>
<td>FP (4)</td>
</tr>
<tr>
<td>Negative</td>
<td>FN (57)</td>
<td>TN (54)</td>
</tr>
</tbody>
</table>
was drawn for checking the significance of non-fasting, non-HDL-C which showed statically significant AUC 0.804, p < 0.0001 at 95% CI, indicating that it was a good test to discriminate patients with and without dyslipidemia. Coordinates of curve indicate that at 4.2 mmol/l cut off of non-HDL-C, it has 51% sensitivity and 93% specificity.

Bland-Altmann’s difference plot was plotted which showed a significant difference (p < 0.0001) between non-fasting, non-HDL-C and fasting LDL-C by mean difference of -0.087540 with bias (-0.00109); therefore, they do not seem to agree with each other and cannot be alternative to each other (Figure 2).

DISCUSSION
This study provides estimates of non-fasting lipid profile status in representative sample of our adult population and reports its diagnostic accuracy for assessment of lipoprotein coronary risk. It has revealed several significant findings:

First, non-fasting lipid profile is 93% specific and 51% sensitive and predicting the lipoprotein coronary risk with 94% PPV. It is 65% accurate with 7.28% positive likelihood ratio indicating the moderate increase in the likelihood of lipoprotein coronary disease in screening of dyslipidemia, similar to the findings of Craig et al.13

Second, non-fasting TC is greater than fasting TC with mean difference of 0.2 mmol/l and non-fasting HDL-C is lower by 0.01mmol/l from fasting level, which was similar to that reported by Sidhu and Naugler.11

Thirdly, curve of non-fasting non HDL-C showed AUC of 0.8, indicating that it is a good test which can be used for screening hyperlipidemic population. Coordinates of curve indicate that at 4.2 mmol/l cut off of non-HDL-C, it has 51% sensitivity and 85% specificity.

Our study corroborates the findings of previous studies.6-10 Fasting for routine lipid profile presents an inconvenience for patients and may discourage compliance with this routine screening test. Fasting lipid profile is generally performed in the morning with a large number of phlebotomies required for accomplishment of lipid screening. To the best of our knowledge, no supplementary evidence demonstrates that fasting lipid levels can be superior to non-fasting levels for cardiovascular risk prediction. It is, therefore, reasonable to review the opinions used in favour of fasting versus non-fasting lipid measurements, because the fasting requirement possibly makes blood sampling difficult for millions of peoples worldwide.

However, our data demonstrate that by using non-fasting lipid profile consisting of TC, HDL-C and non-HDL-C, which does not require fasting for predicting increased risk of cardiovascular events according to The National Cholesterol Education Program (NCEP). Therefore, it is appealing to take a stance that the main reasons for measuring lipid levels in the fasting rather than the non-fasting state are simply a custom worldwide; and due to this, the fasting requirement has been applied in almost all randomised lipid-lowering trials.15,16

The benefit of non-HDL-C less in its cost effectiveness, as it can be calculated from a standard lipid panel without any additional expense. It is conclusively superior to LDL-C for prediction of risk. Non-HDL-C level is strongly related to cardiovascular risk in persons of various ages, among both sexes, among diabetics and non-diabetic patients, and in persons with and without documented cardiovascular disease. Currently available lipid-lowering agents can significantly reduce non-HDL-C levels and these reductions associate with declines in subsequent cardiovascular morbidity and mortality.17-20
Some laboratories and physicians have been slow for adopting to report and use non-HDL-C in clinical practice, despite the length of time since the NCEP ATP III guidelines. This may be due to ambiguity surrounding the significance of non-HDL-C. By creating awareness about non-HDL-C (in non-fasting state), it may eventually replace all fasting lipid profiles from dyslipidemia screening.

The study has several limitations. Due to a lack of patient outcome data, the predictive value of fasting versus non-fasting levels on adverse cardiovascular outcome cannot be assessed. The study sample consisted of all individuals presenting to the laboratory for cholesterol testing; it was not a random sample from the population. Our clinical data were limited to measurements commonly taken as part of screening.

Further studies addressing these limitations will provide more authenticity for these findings and may guide clinical practice towards non-fasting lipid profiles in the future.

**CONCLUSION**

Diagnostic accuracy of non-fasting lipid profile was found significantly higher than fasting lipid profile for the assessment of lipoprotein coronary risk on the basis of non-HDL-C, which seemed to be significant test for ruling out hyperlipidemia.

**REFERENCES**


