Section: Medicine

Original Research Article

NON-FASTING VERSUS FASTING LIPID PROFILES: A COMPARATIVE STUDY

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ABSTRACT

Background: Lipids play a crucial role in energy storage, cell membrane composition, and signaling. Key components of the serum lipid profile, such as total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), and very low-density lipoprotein cholesterol (VLDL-C), are used to assess the risk of cardiovascular and metabolic diseases. Typically, lipid profiles are measured in fasting states, but non-fasting testing has emerged as an alternative for simplicity, especially for components other than triglycerides. This study aims to compare lipid levels in fasting versus non-fasting states and assess any significant differences.

Materials and Methods: A cross-sectional observational study was conducted on 250 patients who visited the Dr. Babasaheb Ambedkar Memorial Central Railway Hospital in Mumbai, India, from October 2020 to May 2022. The study analyzed total cholesterol, triglycerides, HDL-C, LDL-C, and VLDL-C levels in both fasting and non-fasting samples.

Results: The study showed that there were no significant differences in total cholesterol, HDL-C, LDL-C, or non-HDL-C levels between fasting and non-fasting samples. However, triglyceride levels were significantly higher in non-fasting samples ($p<0.0001$). The age group 41-50 years was the most prevalent, with a male-to-female ratio of 1.71:1.

Conclusion: The findings suggest that non-fasting lipid profiles, except for triglycerides, can be used for assessing cardiovascular risk. This supports the current guidelines that recommend non-fasting lipid screening, except in cases of inherited hypertriglyceridemia.

Keywords: Lipid Profile, Fasting, Non-Fasting, Cardiovascular Risk, Triglycerides

INTRODUCTION

Triglycerides (fats and oils), waxes, phospholipids, sphingolipids, glycolipids, lipoproteins, cholesterol and other sterols, fat-soluble vitamins, and other derivatives are all examples of lipids. Lipids function as long-term energy storage molecules, signal transduction molecules, and an important component of cell membranes.1-3 Total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), and very low-density lipoprotein cholesterol comprise the serum lipid profile (VLDL-C). These parameters are useful in determining the risk of cardiovascular disease, certain genetic diseases, and other metabolic diseases.4 Typically, a lipid profile is performed on an overnight fasting blood sample. The term "fasting condition" refers to a complete overnight dietary restriction of 10-12 hours, except for water and medication. Because triglyceride levels remain elevated for several hours after a meal, determining these parameters while fasting is preferred.3 Furthermore, the majority of the reference values for serum lipid profile parameters are established while fasting.5

Furthermore, the National Cholesterol Education Program and European Guidelines both recommend measuring these parameters while fasting in order to

assess cardiovascular risk.6 However, because the concentrations of total cholesterol and HDL-C in fasting and non-fasting specimens are not significantly different, these guidelines allow total cholesterol and HDL-C in non-fasting conditions. Non-HDL cholesterol testing can also be done while the patient is fasting if they are undergoing lipid-lowering treatment.7

To simplify the blood sampling, it has been made to replace the fasting lipid profile test with a non-fasting test, except for the triglycerides. While it has been observed that the concentration of various lipids, lipoproteins, and apoproteins in blood does not differ much in fasting and non-fasting states, the level of triglycerides remains higher in the non-fasting state.8-10 Therefore, the change in concentration of various lipid profile parameters under a non-fasting state needs to be ascertained in various populations. The changed pattern also needs to be investigated in both male and female subjects. The current study was conducted to estimate the levels of total cholesterol, triglycerides, HDL-C, LDL-C, and VLDL-C in fasting and non-fasting serum samples, to compare the lipid profile values of fasting and non-fasting states, and to determine any statistical differences.

Aims and Objectives

Aim: Evaluate the use of non-fasting rather than fasting lipid profiles and to provide guidance for the health practitioners and patients.

Primary objective: To evaluate the changes in the lipid profile status on fasting and non-fasting.

Secondary objective: To evaluate the lipid profile status in all patients who are on statin therapy.

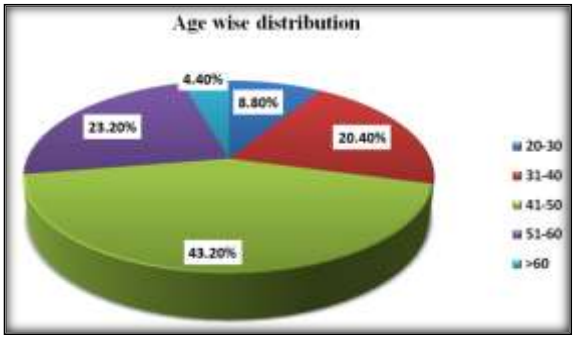
MATERIALS AND METHODS

The study was conducted at the Department of Medicine, Dr. Babasaheb Ambedkar Memorial Central Railway Hospital, Mumbai, Maharashtra, from October 2020 to May 2022, after receiving approval from the Institutional Ethics Committee. A total of 250 patients who visited the OPD or were admitted to the hospital during this period were included in the study after obtaining informed consent. The study design was a cross-sectional, observational, non-blinded study. The inclusion criteria consisted of IPD and OPD patients aged over 18 years, while critically ill patients and those unwilling to participate were excluded. Data collection involved recording personal details such as name, age, sex, and residence, along with body mass index (BMI) and comorbidities. Laboratory investigations included collecting venous blood samples for lipid profile analysis, one after 8 hours of overnight fasting and the second 2 hours post-lunch. The lipid parameters measured were serum total cholesterol, triglycerides, HDL cholesterol, LDL cholesterol-C, and non-HDL-C cholesterol. For statistical analysis, qualitative data were presented as percentages, and quantitative data were analyzed using mean ± SD or median with range. An unpaired T-test was used for normally distributed data, while the Chi-Square test was applied for proportions. For non-parametric data, the Kruskal-Wallis test with post hoc Dunn's multiple comparisons was used. Data analysis was performed using MS Office 2017 and IBM SPSS version 22.0, with a p-value of <0.05 considered statistically significant. The sample size was calculated to be 159, but 250 patients were included in the study for more robust results.

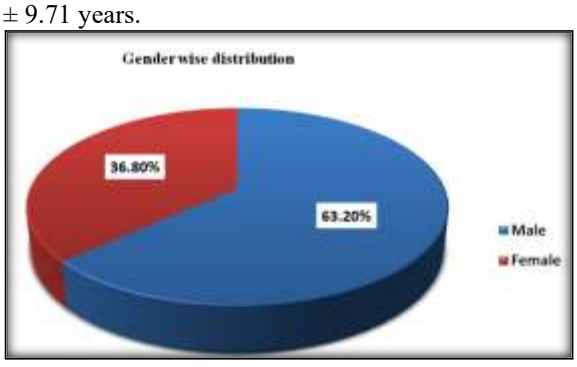
$$n = \frac{\left(\sigma_1^2 + \sigma_2^2\right) \times \left(z_{1-\alpha/2} + z_{1-\beta}\right)^2}{D^2}$$

The study was carried out according to the Good Clinical Practice Guidelines formulated by the Ethical Committee of Dr.Babasaheb Ambedkar Memorial Central Railway Hospital, Byculla, Mumbai.

RESULTS



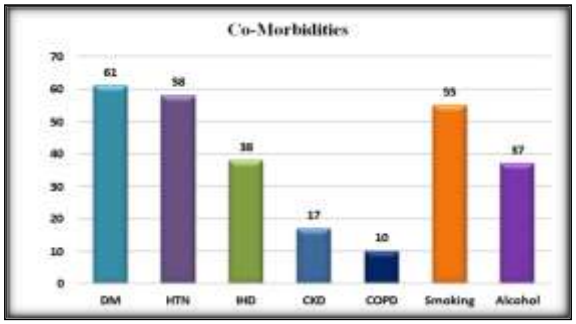
In the present study, it was observed that the incidence of patients in the age group 41-50 years was 108 (43.2%), age group 51-60 years was 58 (23.2%). The calculated mean age was 44.81 ± 9.71 years.



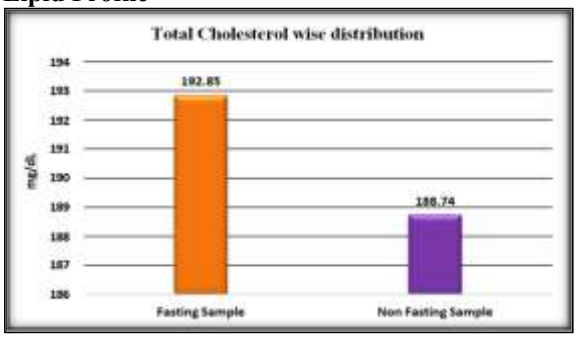
In the present study, it was observed that male patients were 158 (63.2%) predominantly higher than female patients, 92 (36.8%). In addition, the male: female ratio was 1.71:1.

In the present study, it was observed that the majority of patients had Diabetes Mellitus 61 (24.4%) and Hypertension 58 (23.2%), followed by ischemic heart disease 38 (15.2%). 17 (6.8%) patients and 10 (4.0%) had a previous history of CKD and COPD, respectively.

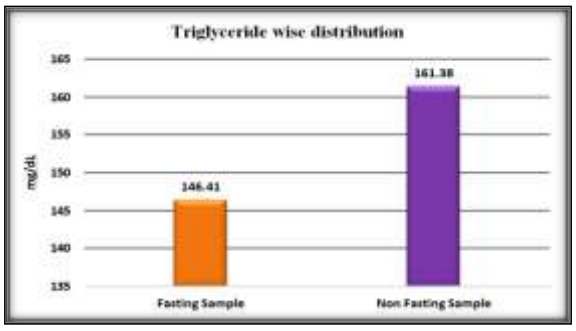
The risk factors, like the habit of smoking, were present in 55 (22.0%) patients, and 37 (14.8%) patients were alcoholic.



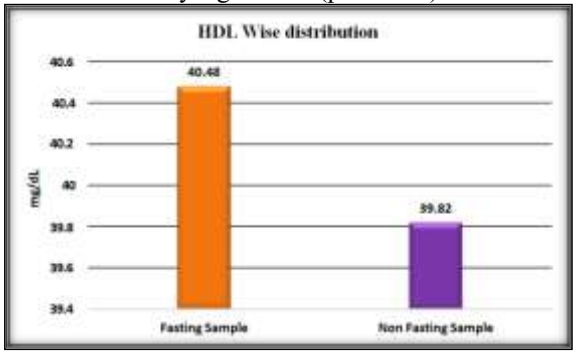
Lipid Profile



In the present study, it was observed that total cholesterol between fasting and non-fasting sample of patients was comparable (192.85 ± 41.02 mg/dL vs 188.74 ± 42.26mg/dl), as it was found statistically insignificant (p=0.3056).

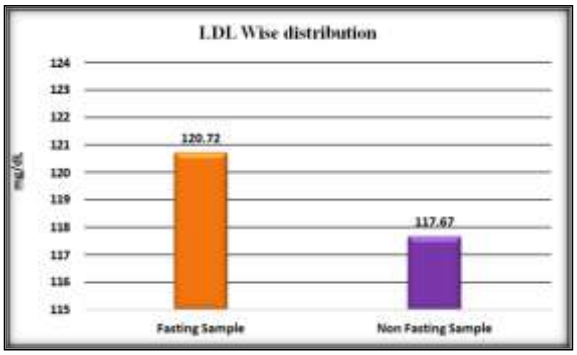


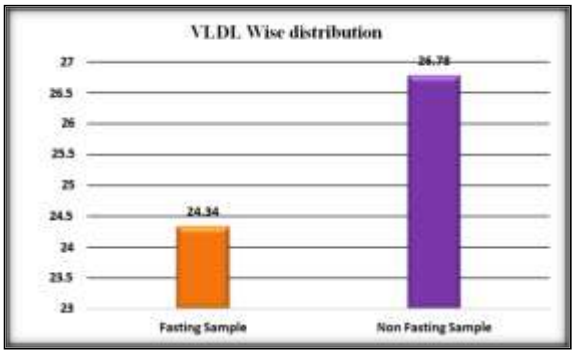
In the present study, it was observed that the triglyceride levels between fasting and non-fasting samples of patients was non-comparable (146.41 ± 62.84 mg/dL vs 161.38 ± 44.92 mg/dL), as it was found statistically significant (p<0.0001).



In the present study, it was observed that HDL between fasting and non-fasting sample of patients was comparable (40.48 ± 7.65 mg/dL vs 39.82 ± 7.99 mg/dL), as it was found statistically insignificant (p=0.3459)

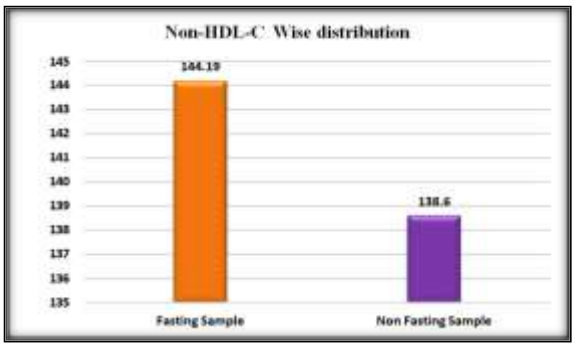
In the present study, it was observed that LDL between fasting and non-fasting sample of patients was comparable (120.72 ± 32.24 mg/dL vs 117.67 ± 31.26 mg/dL), as it was found statistically insignificant (p=0.2834).





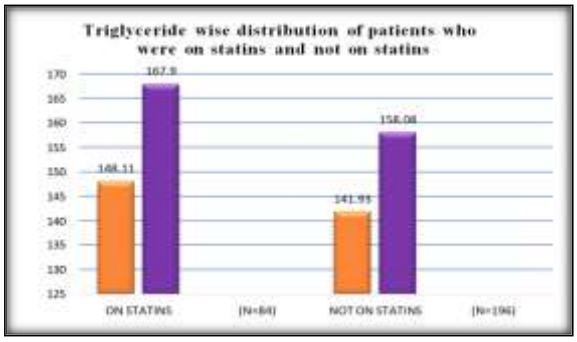
In the present study, it was observed that VLDL between fasting and non-fasting sample of patients was non-comparable (24.34 ± 10.44 mg/dL vs 26.78 ± 12.34 mg/dL), and it was found statistically significant (p=0.0174).

In the present study, it was observed that Non-HDL-C between fasting and non-fasting sample of patients was comparable (144.19 ± 41.34 mg/dL vs 138.6 ± 41.07mg/dL), as it was found statistically insignificant (p=0.1300).



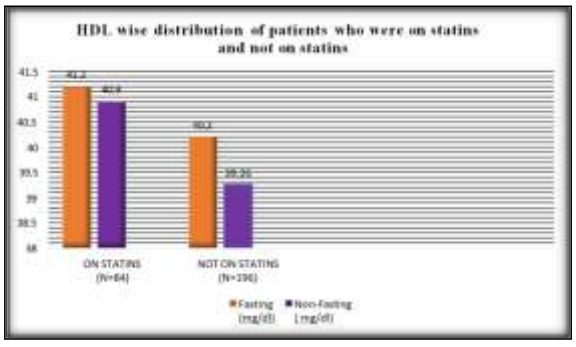
In the present study, it was observed that total cholesterol between fasting and non-fasting sample

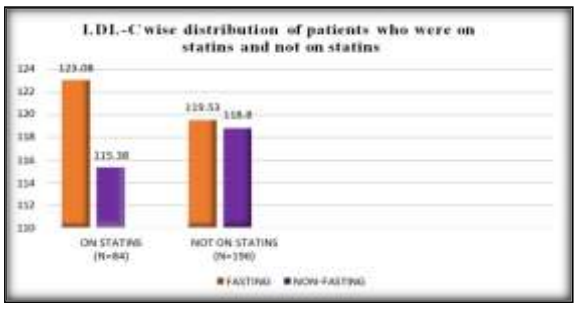
of patients who were on statin therapy (198.58 ± 41.4mg/dL vs 189 ± 42.6 mg/dl) and not on statin therapy (189.46 ± 40 mg/dL vs 188 ± 42.2 mg/dL) were comparable. It was found statistically insignificant with a P value of 0.091 and 0.856, respectively.



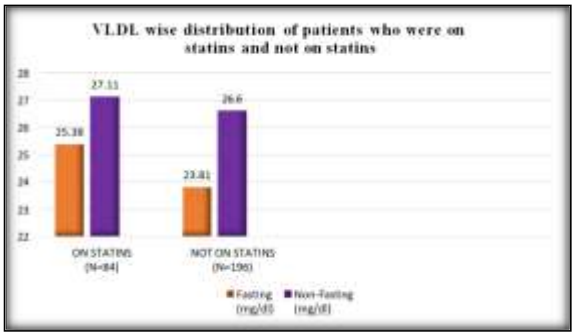
In the present study, it was observed that triglyceride between fasting and non-fasting sample of patients who were on statin therapy (148.11 ± 41.1mg/dL vs 167.9 ± 47.9 mg/dl) and not on statin therapy (141.93 ± 401.6 mg/dL vs 158.08 ± 43.1 mg/dl) were not comparable, as it was found statistically significant P value <0.001 for both.

In the present study, it was observed that HDL between fasting and non-fasting sample of patients who were on statin therapy (41.2 ± 8.13mg/dL vs 40.9 ± 8mg/dl) and not on statin therapy (40.2 ±7.34 mg/dL vs 39.26 ± 8 mg/dL) were comparable. It was found statistically insignificant with a P value of 0.802 and 0.346, respectively.

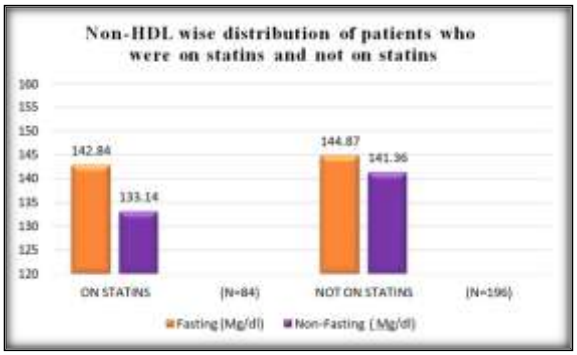




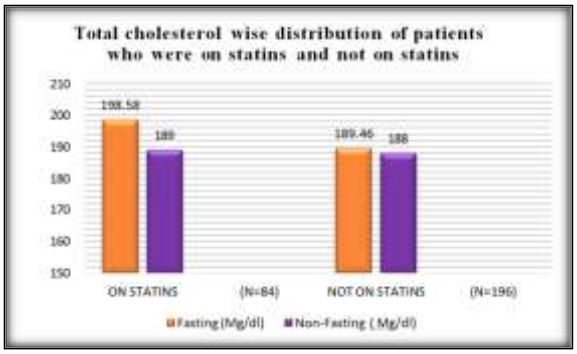
In the present study, it was observed that LDL-C between fasting and non-fasting sample of patients who were on statin therapy (123.08 ± 29.9mg/dL vs 115.38 ± 28.5 mg/dl) and not on statin therapy (119.53 ±33.30 mg/dL vs 118.8 ± 32.7 mg/dL) were comparable. It was found statistically insignificant with P value 0.088 and 0.874 respectively.



In the present study, it was observed that VLDL between fasting and non-fasting sample of patients who were on statin therapy (25.38 ± 11.6 mg/dL vs 27.11 ± 12.61 mg/dl) and not on statin therapy (23.81 ±10.1 mg/dL vs 26.6± 12.2 mg/dL) were comparable. It was found statistically insignificant with P value 0.431 and 0.071 respectively



In the present study, it was observed that non-HDL between fasting and non-fasting sample of patients who were on statin therapy (142.84 ± 39.5 mg/dL vs 133.14± 35.67 mg/dl) and not on statin therapy (144.87 ±42.34 mg/dL vs 141.36 ± 43.4 mg/dL) were comparable. It was found statistically insignificant with P value 0.096 and 0.543 respectively.



DISCUSSION

Lipid profiles are routinely measured to assess and prevent atherosclerotic-related diseases, with fasting blood samples traditionally used for accurate lipid

assessment. However, researchers have explored non-fasting blood samples as a simpler alternative. While fasting lipid profiles are commonly preferred to reduce the influence of postprandial lipidaemia, this study compares fasting and non-fasting lipid profiles, revealing important findings.

In the present study, significant differences were observed in triglyceride (TG) and VLDL-C levels between fasting and non-fasting samples. However, there was no significant difference in total cholesterol (TC), HDL-C, LDL-C, and non-HDL-C between the two groups. This is consistent with findings from various studies, including those by Duggal A et al. and Shetty S et al. [12], who found that non-fasting lipid profiles, especially for TC, HDL-C, LDL-C, and non-HDL-C, were comparable to fasting profiles. This suggests that non-fasting samples can be used effectively to assess cardiovascular risk, as postprandial lipidaemia has minimal impact on these parameters.

The study's demographic data indicated that the mean age of participants was 44.81 years, with a higher proportion of males (63.2%) compared to females (36.8%). This demographic distribution aligns with similar studies by Sarkar KK et al. [13], who also reported a higher prevalence of male participants. The study population had a notable prevalence of comorbidities, with diabetes mellitus (24.4%), hypertension (23.2%), and ischemic heart disease (15.2%) being the most common conditions. This is in line with other studies, such as Sarkar KK et al., which reported similar comorbidity patterns.

The lipid profile comparisons revealed that total cholesterol levels were comparable between fasting and non-fasting samples in the present study ($p=0.3056$), similar to findings in other studies like Duggal A et al. [11] and Shetty S et al [12]. The triglyceride levels, however, were significantly higher in non-fasting samples ($p<0.0001$), as observed in several studies, including those by Duggal A et al. [11] and Sarkar KK et al. This increase in triglyceride levels postprandially can be attributed to the impact of food intake, which elevates lipoproteins rich in triglycerides. The HDL-C levels were slightly lower in non-fasting samples, but the difference was not statistically significant ($p=0.3459$). This result aligns with studies by Ghildiyal S et al. and Duggal A et al. [11], who reported comparable HDL-C levels in fasting and non-fasting states. The LDL-C levels, too, showed no significant difference ($p=0.2834$), supporting the idea that non-fasting LDL-C values can be used interchangeably with fasting levels in routine lipid screening. Interestingly, the VLDL levels were significantly higher in non-fasting samples ($p=0.0174$), consistent with findings from Shetty S et al. [12] and Vitthal BG et al., who also reported elevated VLDL levels after food consumption. Non-HDL-C levels, another important lipid parameter, showed no significant difference between fasting and non-fasting samples in this study ($p=0.1300$), which is consistent with the findings by Duggal A et al. [11] and Sarkar KK et al [13].

Additionally, when comparing the lipid profiles of patients on statin therapy with those not on statins, the results were comparable to the overall study population. For triglycerides, significant differences were observed between fasting and non-fasting samples in both statin and non-statin groups, while total cholesterol, HDL-C, LDL-C, and non-HDL-C levels remained statistically insignificant.

CONCLUSION

To sum up, TC, HDL, LDL, and Non-HDL-C fasting and non-fasting values did not show statistically significant differences; therefore, non-fasting lipid profiles can be concluded to be sufficient for assessment of cardiovascular risk. Nevertheless, there was a significant difference in fasting and non-fasting TG and VLDL, and non-fasting TG was determined to be a better predictor of cardiovascular risk. This study endorses the guidelines from the Lipid Association of India to consider non-fasting lipid profiles as the default for routine dyslipidemia screening, except for cases aimed at the diagnosis of inherited hypertriglyceridemia.

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