International Journal of Research in Medical Sciences
Mandle KS et al. Int J Res Med Sci. 2019 Mar;7(3):790-794
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20190924

Original Research Article

Comparison of fasting and non-fasting serum lipid profile in healthy population

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Received: 18 December 2018
Accepted: 29 January 2019

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ABSTRACT

Background: Serum lipids are routinely used for the assessment of cardiovascular risk. The test is usually performed under fasting condition. However, recently non-fasting lipid profile is also measured in certain cases. The present study was intended to estimate the concentration of total cholesterol (TC), triglyceride (TG), HDL cholesterol (HDL-C), LDL cholesterol (LDL-C) and VLDL cholesterol (VLDL-C) in fasting as well as non-fasting blood samples of a group of normal male and female subjects.
Methods: The study recruited 50 normal healthy male and female subjects within the age group of 12-48 years. The concentration of TC, TG, HDL-C, LDL-C and VLDL-C in serum of these subjects were quantitatively determined using the commercially available kits based on CHOD/POD method.
Results: The mean concentration of non-fasting TC, TG, HDL-C, LDL-C and VLDL-C was found to be 141.20 mg/dl, 132.20 mg/dl, 50.39 mg/dl, 64.30 mg/dl, 26.44 mg/dl respectively. On the other hand, the mean concentration of fasting TC, TG, HDL-C, LDL-C and VLDL-C was found to be 112.37 mg/dl, 100.90 mg/dl, 38.59 mg/dl, 53.59 mg/dl and 20.18 mg/dl respectively. The concentration of fasting lipid profile parameters was significantly low from the respective parameters of non-fasting lipid profile.
Conclusions: The present study reveals that there was an increase in the levels of TC, TG, HDL-C, LDL-C, and VLDL-C in non-fasting state compared to the fasting state. Measuring the lipid profile parameters under non-fasting state cannot be usually considered for assessment of cardiovascular risk and for other clinical purposes.

Keywords: Cholesterol, Fasting, Lipid profile, Non-fasting, Triglyceride

INTRODUCTION

Lipids are a heterogenous group of organic substances which includes triglycerides (fats and oils), waxes, phospholipids, sphingolipids, glycolipids, lipoproteins, cholesterol and other sterols, fat soluble vitamins and other derivatives. Lipids serve as long-term storage form of energy, as signal transduction molecules and as important constituent of cell membranes.[1] Serum lipid profile includes total cholesterol (TC), triglyceride (TG), high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C) and very low-density lipoprotein cholesterol (VLDL-C). These parameters serve as an important screening tool to determine the risks for cardiovascular diseases, certain genetic diseases and other metabolic diseases.[2] Lipid profile is usually performed in overnight fasting blood sample. Fasting condition refers to complete overnight

dietary restriction for 10-12 hours, except the intake of water and medication. Determination of these parameters are preferred under fasting condition as triglyceride levels remain elevated for several hours after intake of meal.[3] Also, most of the reference values for serum lipid profile parameters are established in fasting condition.

Moreover, the National Cholesterol Education Program and European Guidelines also recommend the determination of these parameters under fasting condition for assessment of cardiovascular risk.[4] However, these guidelines permit total cholesterol and HDL-C in non-fasting condition because the concentrations of these lipids are not much different in fasting and non-fasting specimens. The non-HDL cholesterol may also be done in fasting condition in patients undergoing lipid lowering treatment.[5]

To simplify the blood sampling, it has been attempted to replace the fasting lipid profile test with that of non-fasting test except 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 state, the level of triglycerides remains higher in non-fasting state.[6]

Therefore, the change in concentration of various lipid profile parameters under 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 present study has been carried out 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 state and to find out the statistical differences if any.

METHODS

The present study was carried out in Centre for Genetic Diseases and Molecular Biology, Department of Biochemistry, Pt. J. N. M. Medical College, Raipur, India from June 2017 to November 2017. Due permission for the study was obtained from the concerned authority for the present study. The purpose of study was clearly explained to every patient before enrolling them. The study included both male and female subjects of age groups ranging from 18 to 54 years.

A total of 50 healthy subjects reporting to the institute for their regular health check-up were recruited for the study of serum lipid profile under fasting and non-fasting state. The fasting subjects are those who had not taken any diet for last 10-12 hours. The non-fasting blood samples were collected from the same subjects on the same day after 2-3 hours of their meal. Of the total 50 subjects studied, 28 were male and 22 were female subjects. The personal information, physical characteristics, habits and other relevant information of the patients were obtained through pre-prepared questionnaire. Three ml of venous blood was collected from each subject using disposable syringe. The blood samples were collected in plane vacutainers (without EDTA) and allowed to clot at room temperature for 30 min. The clotted blood was centrifuged at 3000 rpm for 10 min using REMI R-8C Laboratory centrifuge. The serum obtained was then collected in eppendorf tubes and stored at 4ºC until the time of analysis. Samples showing hemolysis were discarded.

Serum total cholesterol (TC), serum triglycerides (TG), HDL cholesterol (HDL-C) were analyzed by enzymatic methods using test kits obtained from Beacon Diagnostics Pvt. Ltd. (India). The LDL-C was calculated by Friedewald formula, according to which LDL-C =Total cholesterol - (HDL-C + VLDL-C). VLDL-C was calculated as Triglycerides/5.

The data have been presented as mean±SD for all the parameters. The SD was calculated using MS-Excel, 2010. The differences in mean concentration of all the above lipid profile parameters that were observed under fasting and non-fasting condition were analyzed using student's t-test.

RESULTS

A total of 50 healthy individuals were recruited for the study for determination of fasting and non-fasting lipid profile from the serum. The study group comprises of 28 (56%) males and 22 (44%) females. The male and female participants included in this study were between 18-54 years and 18-50 years respectively. The distribution of subjects is shown in Figure 1.

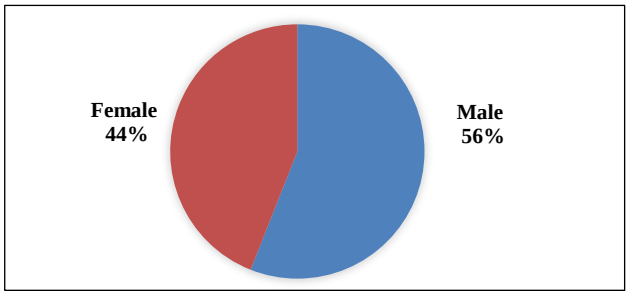


Figure 1: Distribution of male and female subjects.

The mean age of male subjects was 25.15 years where as the mean age of female subjects was 24.94 years. The mean height of the male and female subjects was measured as 162.46 cm and 160.45 cm respectively.

The respective mean weight of these subjects was 67.11 kg and 66.33 kg respectively. The BMI of these subjects were calculated as 25.56 kg/m^2 and 25.79 kg/m^2 respectively. The mean blood pressure of male and female subjects was 128.24/77.23 mmHg and 125.68/74.56 mmHg respectively. Different physical characteristics of study subjects is shown in Table 1.

In this study, five lipid profile parameters were determined both in male and female subjects before (fasting) and 2-3 hour after the meal (non-fasting) on the same day. These parameters included total cholesterol, triglycerides, HDL-C, LDL-C and VLDL-C.

The mean fasting and non-fasting cholesterol concentration in male subjects were determined as 113.29 mg/dl and 142.16 mg/dl respectively. It was observed that there was about 25% increase in non-fasting cholesterol concentration compared to that of the fasting level in male subjects and this increase was found to be statistically significant. The mean fasting and non-fasting cholesterol concentration in female subjects were determined as 112.74 mg/dl and 141.27 mg/dl respectively. As in male subjects, in female subjects also, an increase of approximately 25% non-fasting cholesterol was observed as compared to fasting cholesterol concentration.

Table 1: Physical characteristics of the study subjects.

	Male (n=28)		Female (n=22)	
Physical characteristics	**Mean±SD**	**Range**	**Mean±SD**	**Range**
Age (years)	25.15±9.39	18-54	24.94±9.57	18-50
Height (cm)	162.46±9.45	145-180	160.45±8.77	149-162
Weight (kg)	67.11±12.16	55-110	66.33±13.10	45-90
BMI (kg/m^2)	25.56±4.91	19.03-40.53	25.79±4.81	19.05-40.53
Blood pressure (mmHg)	128.24±14.7/77.23±10.2	110/70-140/90	125.68±12.3/74.56±8.4	110/70-140/90

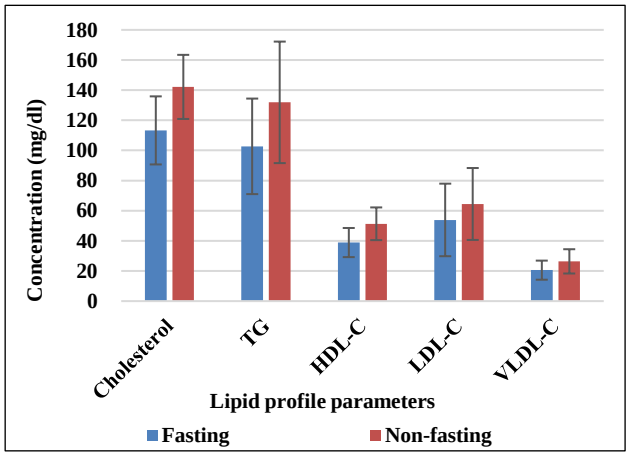
Table 2: Lipid profile parameters in male and female subjects under fasting and non-fasting state.

Parameters	**Subjects**	**Fasting**		**Non-fasting**		**P value**
		Mean±SD	**Range**	**Mean±SD***	**Range**	
Cholesterol (mg/dl)	Male (n=28)	113.29 ±22.59	36.82-229.35	142.16 ±21.27	49.58-322.85	<0.001
	Female (n=22)	112.74 ±23.35	76.03-164.56	141.27 ±23.04	94.29-179.94	
Triglyceride (mg/dl)	Male (n=28)	102.72 ±31.70	21.85-59.58	131.90 ±40.32	34.13-78.19	
	Female (n=22)	99.51 ±34.06	36.82-229.35	131.61 ±43.35	49.58-322.85	
High density lipoprotein (mg/dl)	Male (n=28)	38.86 ±9.66	6.66-104.49	51.32 ±10.85	21.67-108.84	
	Female (n=22)	37.15 ±9.38	21.85-59.58	47.94 ±9.49	34.13-67.20	
Low density lipoprotein (mg/dl)	Male (n=28)	53.88 ±24.08	7.36-45.87	64.46 ±23.87	9.91-64.57	
	Female (n=22)	55.68 ±23.70	6.66-104.49	67.0 ±23.88	22.32-108.84	
Very-low density lipoprotein (mg/dl)	Male (n=28)	20.54 ±6.34	14.29-179.94	26.38 ±8.06	3.03-77.87	
	Female (n=22)	19.90 ±6.81	7.36-45.87	26.32 ±8.67	9.91-64.57	

The mean fasting triglyceride concentration in male was determined as 102.72 mg/dl and non-fasting as 131.90 mg/dl. An increase of 28% non-fasting triglyceride concentration over the fasting concentration has been noticed in male subjects. The fasting triglyceride concentration in female subjects was determined as 99.51 mg/dl whereas the non-fasting triglyceride level in these subjects was 131.61 mg/dl. An increase of 32% in non-fasting triglyceride was observed compared to fasting triglyceride in female subjects and the difference was statistically significant. The mean fasting HDL-C concentration in male was determined as 38.86 mg/dl and the non-fasting HDL-C concentration as 51.32 mg/dl. An increase of about 32% in non-fasting HDL-C concentration in male subjects was observed over that of fasting condition. The difference in fasting and non-fasting HDL-C concentration in male subjects was statistically significant. The mean fasting HDL-C

concentration in female was determined as 37.15 mg/dl and non-fasting HDL-C concentration was observed as 47.94 mg/dl. Like male subjects, in female subjects also there was about 30% increase in non-fasting HDL-C concentration as compared to that of fasting HDL-C concentration.

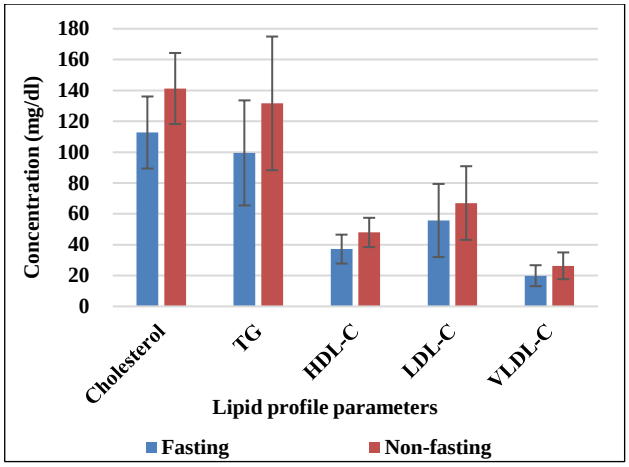
The mean fasting LDL-C concentration in male was determined as 53.88 mg/dl and the mean non-fasting LDL-C concentration as 64.46 mg/dl. The non-fasting LDL-C concentration was higher by 20% than the LDL-C concentration under fasting condition in male subjects. The mean fasting LDL-C concentration in female was determined as 55.68 mg/dl and non-fasting as 67.01 mg/dl. The non-fasting LDL-C concentration increased by 20% over the fasting LDL-C concentration in female subjects. The VLDL-C concentration in fasting condition in male subjects was measured as 20.54 mg/dl and under non-fasting condition was determined as 26.38 mg/dl respectively. An increase of about 28% LDL-C concentration in non-fasting condition was observed compared to that of fasting condition in the male subjects. The fasting VLDL-C concentration in female was determined as 19.90 mg/dl and the non-fasting LDL-C concentration was determined as 26.32 mg/dl. About 26% increase in non-fasting LDL-C concentration was noticed compared to the LDL-C concentration in fasting condition in the female subjects.



The values are presented as mean value of the parameters. Error bars represent ± SD. All the above mentioned non-fasting lipid profile parameters are significantly different from that of fasting state at P value <0.001.

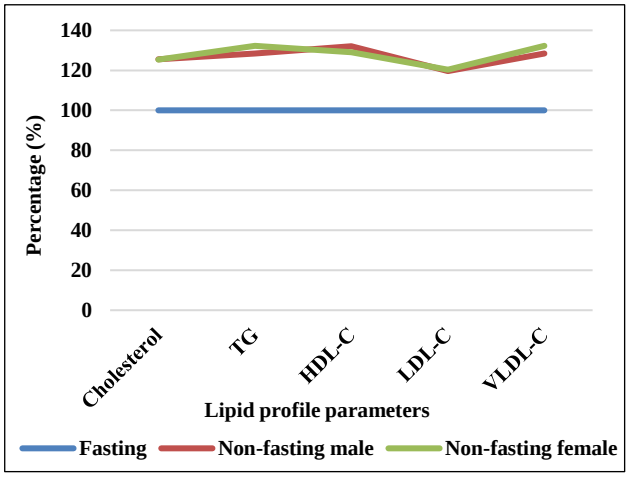
Figure 2: Comparison of lipid profile parameters under fasting and non-fasting state in male subjects.

The level of cholesterol, triglyceride, HDL-C, LDL-C and VLDL-C in fasting and non-fasting state of both male and female subjects have been presented in Table 2. Comparative lipid profile parameters in fasting and non-fasting male and female subjects have been shown in Figure 2 and 3 respectively. Figure 4 represents percentage increase in TC, TG, HDL-C, LDL-C and VLDL-C level of male and female subjects under non-fasting state compared to that of fasting state.



The values are presented as mean value of the parameters. Error bars represent ± SD. All the above mentioned non-fasting lipid profile parameters are significantly different from that of fasting state at P value <0.001.

Figure 3: Comparison of lipid profile parameters under fasting and non-fasting state in female subjects.



Note that the percentage increase of the respective parameters was almost similar in male and female subjects.

Figure 4: Percentage increase in lipid profile parameters of male and female subjects under non-fasting state compared to fasting state.

The differences in mean concentration of all the above lipid profile parameters that were observed under fasting and non-fasting condition when analyzed using student's t-test and were found to be statistically significant at P value <0.001. This holds true in both male as well as female subjects. Further, it was noticed that the increase in all the measured parameters in non-fasting condition over the fasting condition followed almost similar trend both in male and female subjects.

DISCUSSION

Due to sedentary lifestyle and change in dietary habits, the lipid profile is usually altered compared to the normal level. Elevated levels of total cholesterol, LDL-C and TG and low levels of HDL-C cause deposition of lipids in

arteries thus causing atherosclerosis. So, lipid profiles are routinely measured for risk assessment in preventing coronary artery disease.[7] It is usually done in the fasting blood sample. Efforts are in process to replace the fasting blood sampling with that of non-fasting samples. Though fasting blood sample is preferred for lipid profile test for total cholesterol and LDL-C or non-HDL cholesterol based cardiovascular disease risk assessment, HDL-C, triglycerides, total/HDL cholesterol ratio and apoprotein-1 could predict coronary artery disease when measured under non-fasting condition.[8] It is interesting to note that the level of non-fasting triglycerides may be better predictor of cardiovascular risk as compared to fasting triglycerides.[9,10] However, controversy exists regarding the clinical usefulness of fasting triglycerides as an independent predictor of CVD risk.[11]

In the present study, total cholesterol in fasting and non-fasting state, both in male and female subjects has been estimated. The cholesterol level in non-fasting state has been found to be significantly increased as compared to the fasting condition in both male and female subjects (Table 2 and Figure 2 to 4). All the other cholesterols such as HDL-C, LDL-C, VLDL-C levels also significantly increased in non-fasting state. The level of triglyceride also increased greatly in non-fasting state as compared to the fasting state. It has been reported that serum HDL, triglycerides and total cholesterol/HDL ratio predict CVD risk when measured under non-fasting state while total serum cholesterol, serum LDL-C, and non-HDL cholesterol measurement provided less useful CVD risk information when measured in a non-fasting state.[9] In contrast to these studies, the results of the present study showed that the lipid profile test should be preferably done under fasting state. All the measured parameters increased significantly in non-fasting state compared to fasting state. The same trend of increase in tested lipid levels was observed in male and female subjects. Under non-fasting state, an increase of 25% cholesterol level (both in male and female), 28% and 32% in triglyceride level (male and female), 32% and 30% HDL-C level (male and female), 20% LDL-C level (both in male and female) and 28% and 26% VLDL-C level was observed compared to the fasting state.

CONCLUSION

The present study revealed that there was a large increase in the total cholesterol, triglyceride, HDL-C, LDL-C, VLDL-C level of non-fasting state compared to the fasting state. Therefore, measuring the lipid profile parameters under non-fasting state may not be recommended for the determination of CVD risk and other clinical purposes.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Mandle KS, Prashant V, Sahu GK. Comparison of fasting and non-fasting serum lipid profile in healthy population. Int J Res Med Sci 2019;7:790-4.