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IMPLICATIONS OF LIPID PROFILE DOSAGES IN FASTING AND POSTPRANDIAL STATUS

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Abstract:

Introduction: *This study was undertaken to improve patient adherence to lipid tests. More numbers of laboratories are now performing these tests without the need for a 12 h fast at random times during the day.* ***Methods:*** *The study consisted of 51 volunteers and venous blood was collected in a 12 h fast and after a meal the next day. The volunteer then comes back to the laboratory for blood collection 2, 3 and 4 h after having usual breakfast. The following tests: cholesterol, triglycerides, C-LDL, C-HDL and VLDL with the Enzyme/Colorimetric method on Beckman-Coulter®AU5800 equipment and Beckman-Coulter reagent will be performed. In addition to the dosage, C-LDL was calculated by Fried Ewald Equation.* ***Results:*** *It was observed that there was no significant difference for the parameters of TC and C-HDL as compared in the fasting lipid profile versus 2, 3 and 4 h after the meal, and for the calculated C-LDL, with average TC (p=0.237), C-HDL (p=0.130) and for C-LDL (p=0.089). However, for the dosed C-LDL, TG and VLDL showed significant differences with the respective mean concentrations and standard deviation for each hour after 2 h C-LDL (112.1 ± 33.6 mg/dL, p=0.008), 3 h (111.7 ± 35.0 mg/dL, p=0.019) and 4 h (115.0 ± 34.9 mg/dL, p=0.017) for TG 2 h (156.0 ± 86.4 mg/dL, p=0.000), 3 h (148.5 ± 92.0 mg/dL, p=0.000) and 4 h (143.4 ± 93.0 mg/dL, p=0.000) and for VLDL calculated: 2, 3 and 4 h (35.9 ± 53.5 mg/dL, p=0.000, 35.2 ± 53.6 mg/dL, p=0.001, and 34.0 ± 53.6 mg/dL, p=0.000).Conclusion: Our data confirmed that the meal did not influence the TC, C-HDL and C-LDL calculate data, but for TG, VLDL and C-LDL doses a significant difference was observed at post-meal concentrations. Analyzing our data, we observed that the best blood collection time could be between 2 and 3 h after the meal, where the degree of lipemia would have less influence in most individuals.*

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INTRODUCTION:

The technological evolution of clinical laboratories currently involves the automation of almost all of a clinical analysis service, which, together with a quality control of excellence, directly infers the reliability of the results obtained. It should be noted that medicine is constantly evolving and cannot rule out new changes, since based on scientific studies in Laboratory Medicine that have officially stood against the obligation of fasting for 12 hours for cholesterol and triglyceride tests [1].

A 12 h fast is a big problem for people who need to get tested, especially children and the elderly. European Heart Journal published in a recent study that assessment of lipid profile parameters at 12 h or after meal does not clinically affect patient outcomes.

Many labs around the world now perform these tests without the need for a 12 h fasting to improve patient adherence with blood collection at random times during the day [2]. In many of the laboratory methods blood collection just after a meal still generate interference by lipemic turbidity. Fasting in specific situations will still be recommended, for example, when the patient has a high blood triglyceride concentration (above 440 mg/dL, the reference value being up to 150 mg/dL fasting, unlike the not fasting). In general, however, laboratories should perform blood collection independent of fasting time [3].

Measurement of lipids in the non-fasting condition is a simple approach to evaluate lipids, however, it does not allow a complete functional evaluation of postprandial lipid clearance and possible abnormalities. A glycemic-like method to evaluate lipid parameters at fixed time points after eating a high-fat meal, i.e. an oral fat tolerance test (OFTT), to examine the efficiency of lipid metabolism. However, postprandial lipid responses to fat-containing meals have been examined in research contexts in humans in the last decades [4-6].

Evaluating the metabolism of postprandial lipids provides indications of an individual's ability to process dietary lipids from digestion and absorption of lipids through lipoprotein secretion and clearance [7, 8].

As can be observed, the determination of the lipid profile in fasting or without fasting can bring us more information, which goes beyond the identification of dyslipidemias, as well as in the classification and elucidation of lipid clearance mechanisms in humans [9,10].

It was considered that a study should be undertaken to determine the feasible time interval that we could recommend in our laboratory after a meal, keeping in mind the variability of lipid absorption of each individual [11].

The authors of this study aimed to validate within our conditions, equipment and methodologies, so that we can introduce these changes in the pre-analytical phase of our laboratory routine. It was also part of our objectives to determine the mean concentration range of each parameter of the lipid profile studied at 2, 3 and 4 h after the meal.

METHODS:

Subjects

The subjects in this study were randomly selected to perform laboratory tests of basic lipid profile, with and without fasting. Individuals signed the EHIC and received guidance on the study. Venous blood was collected with a 12-h fast and the next day the volunteers returned to the laboratory after having their usual breakfast, to be collected venous blood samples at 2, 3 and 4 h postprandial to be performed and lipid profile of each time.

Laboratory procedures

The following tests were performed: cholesterol, triglycerides, C- LDL, C-HDL and VLDL with the Enzymatic/Colorimetric method on Beckman-Coulter® AU5800 equipment and the Beckman-Coulter reagent. In addition to the dosage, LDL-C was calculated by the Friedewald equation (LDL-C=Total Col-(HDL-C+VLDL).

Statistical analysis

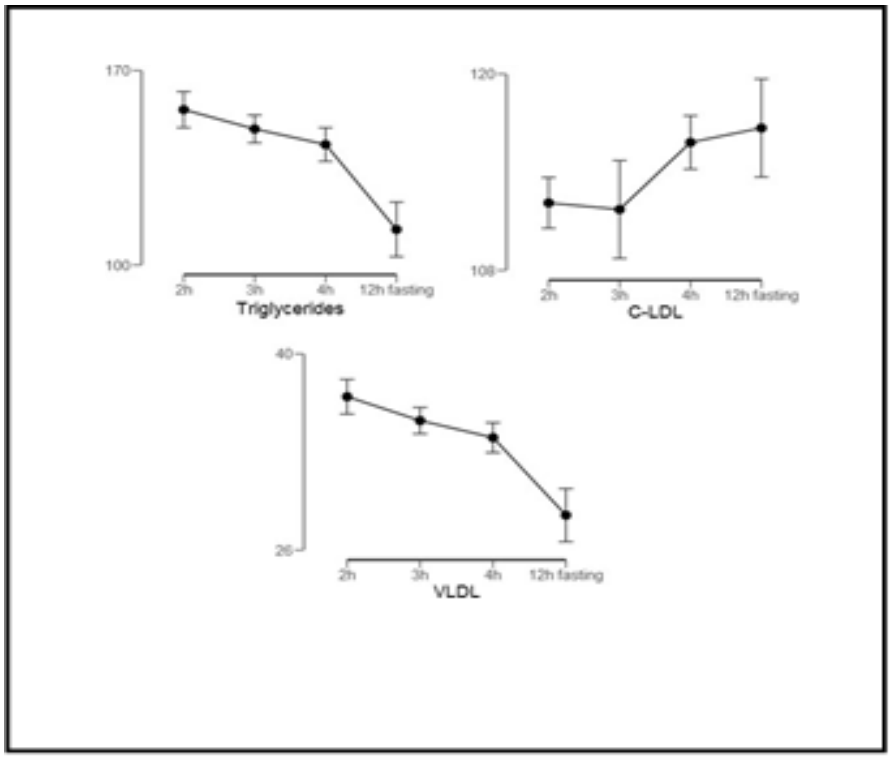
For the analyses a Repeated Measures GLM was used with time point (2 h, 3 h, 4 h and 12 h fasting) as a fixed effect. The Sphericity assumption was tested using Mauchly test and in case of non-conformity with this assumption, a Greenhouse correction was calculated. The Tukey post hoc test was used for univariate results and the graphs with confidence intervals (95%) was presented to describe the significant differences among time points with Cohen d reported as a measurement of effect size. The significance level for all analysis was 5% ($p<.05$).

RESULTS:

Table 1 shows the general characteristics of the sample studied with their respective mean and standard deviation values of each parameter of the basic lipid profile.

	N	50	50	50	50
Triglycerides*	**Mean**	155.9	148.9	143.4	112.8
	SD	86.41	92.06	93.05	69.00
	N	51	51	51	51
C-LDL*	**Mean**	112.1	111.7	115.8	116.7
	SD	33.62	35.08	34.07	33.27
	N	50	50	50	50
C-HDL	**Mean**	55.94	56.47	57.35	56.76
	SD	14.93	15.01	14.90	14.99
	N	51	51	51	51
VLDL*	**Mean**	36.94	35.24	34.02	28.49
	SD	53.53	53.61	53.65	53.75
	N	51	51	51	51
*Variables that presented significant effect of time collection using Repeated Measures GLM					

Table 1: Descriptive data from lipid information as a function of time points (2, 3, 4 and 12 h fasting).



The only differences found in the comparison was for the dosed C-LDL, TG and VLDL showed significant differences with the respective mean concentrations and standard deviation for each hour after 2 h C-LDL (112.1 ± 33.6 mg/dL, p=0.008), 3 h (111.7 ± 35, 0 mg/dL, p=0.019) and 4 h (115.0 ± 34.9 mg/dL, p=0.017) for TG 2 h (156.0 ± 86, 4 mg/dL, p=0.000), 3 h (148.5 ± 92.0

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All variables presented significance according with a GLM Repeated Measures. The 95% Confidence Intervals among time points that not intersect, report a significant difference (p<.05). Triglycerides presents significance (p=0.002, partial n2=0.03) with 12 h fasting time different form all other time points (pooled Cohen d=-0.78). C-LDL presents significance (p=0.042, partial n2=0.02) with 2 h-3 h different form 4 h (Cohen d=0.5) and 12 h (Cohen d=0.38). VLDL presents significance (p=.001, partial n2=0.08) with 12 h fasting difference with all other time points (Pooled Cohen d=1.01).

DISCUSSION:

Several factors are responsible for affecting the TG response to a meal that contains fat, it includes the amount of fat consumed, the amount of alcohol consumed, fibre content, contents of other macronutrients and physical activity [12,13]. An important fact to keep in consideration is the limitations of method for the dosages of this profile with reference to serum prandial lipemias [14].

Factors such as gender, body mass index (BMI), age, are also of great importance for these dosages. However, it was not considered in this small study because the initial objective was to analyse the laboratory methodological behaviour of these determinations in the laboratorial reality in the two conditions (fasting and postprandial) [15].

This study demonstrates that although some significant differences were found, they did not present a clinical impact on the classification of dyslipidaemias, when the test was performed with the usual meal of the individuals [16,17].

Evaluation of the functional postprandial lipid profile with a standardized meal is the preferred methodology to ensure optimal comparability between test subjects. However, the methodology of the oral fat tolerance test (OFTT) continues to be widely used but not standardized. Researches that use these methodologies standardize their own meal [1,4].

In this scenario, further studies are needed to develop standard procedures that can distinguish between healthy and at-risk populations, including population-specific meal sizes, nutrient composition, blood sampling time points and markers to measure [18-20].

Another analysis that was performed, the comparison of the LDL-C calculated with the LDL-C dosed for each time in both conditions and statistically significant differences were found with low clinical impact [21, 22].

In addition, robust reference values, which are critical for interpreting postprandial parameters, continue to be precisely established. However, these should be specific to each methodological condition used. Lipid profile can be made in some differentiated conditions: fasting lipid profile of 12 h, lipid profile after individual home meal and lipid peril after OFTT. For each type of profile has to have a reference value that best suits the applicability of the tests [6, 11, 16].

The authors also analysed that the best time for blood collection would be between 2 and 3 h after the meal, when the maximum peak of triglycerides reached these times. Recent studies have clearly demonstrated the importance of intestinal lipid dysfunction in the pathogenesis of insulin-resistant and diabetic conditions. The translation of new important findings from basic research studies to the clinic is essential to improve the clinical evaluation of postprandial dyslipidaemia, increasingly recognized as a major contributor to the development of atherosclerosis and cardiovascular diseases [23].

There are studies, which show that metabolic syndrome, inflammation and obesity have a significant influence on the lipid parameters in different conditions (fasting and postprandial) [24, 25].

Another question in this study was that 80% of the participants were women and therefore the authors did not analyse the differences by gender in this casuistic. However, there are studies that show that women have differences in lipid parameters when compared to men related to adiposity levels.

Further studies are also warranted to elucidate mechanisms of postprandial dyslipidaemia associated with insulin resistant conditions. A more complete understanding of the underlying pathobiology will allow the subsequent development of standardized methodologies and biomarkers profiles to be used in clinical practice for early and accurate identification of people at risk for cardiovascular disease.

CONCLUSION:

Our findings reinforce studies in the literature that point out that the lipid profile test can be performed with blood sampling at random times without previous fasting. The assistance methodologies used presented a good

performance with the prandial condition maintaining the not significant variation between the fasted state and the after meal.

The assessment of post-meal lipids was reasonable in many clinical settings, since the prediction of cardiovascular disease risk is similar to fasting condition even using different cut-off points for the different conditions: fasting and non-fasting. There were no differences found in calculation or dosage of C-LDL parameter with clinical impact and could be used in the different conditions.

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