Optimal Fasting Time before Measurement of Serum Triglyceride Levels in Healthy Volunteers

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Background: *Coronary heart disease is a major public health problem. Elevated triglyceride levels are a risk factor for atherosclerosis and coronary heart disease. Food intake interferes with the measurement of serum triglyceride levels, and in previous studies, fasting for 12 hours was recommended before blood sampling. In real-world practice, long fasting times cause patient discomfort and poor compliance, and the present study was, therefore, designed to determine the appropriate fasting time prior to measuring serum triglyceride levels.*

Objective: *To determine the appropriate fasting time before measuring serum triglyceride levels.*

Material and Method: *This was a pilot study performed using healthy volunteers aged between 20 and 30 years old from November 2013 to December 2013 at Rajavithi Hospital. The first blood sample was measured in the morning after fasting over 12 hours. The subjects then took their regular breakfast, after which they fasted for 8 hours. Blood samples were taken 6 and 8 hours later and sent to the laboratory for measurement of serum triglyceride levels.*

Results: *40 volunteers, of whom 25 were female, were enrolled. Their mean age was 25.9±2.81 years old, and their mean weight, height, and body mass index were 61.5±12.5 kg, 167.2±8.3 cm and 21.84±3.1 kg/m^2, respectively. Mean fasting serum triglyceride level at 12 hours was 80.23±36.33 mg/dl, at 6 hours it was 110.65±73.45 mg/dl, and at 8 hours it was 75.62±46.81 mg/dl. The group fasting for 12 hours had significantly lower serum triglyceride levels than the group fasting for 6 hours (p-value = 0.003), but no significant difference was found between the group fasting for 12 hours and the one fasting for 8 hours (p-value = 0.493).*

Conclusion: *The present study showed no significant difference in triglyceride levels in patients who had fasted for 8 hours and those who had done so for 12 hours. Fasting for only 8 hours before measurement of serum triglyceride may be sufficient.*

Keywords: *Fasting, Optimal time, Triglyceride, Healthy*

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Coronary heart disease is a major public health problem with high rates of morbidity and mortality in Thailand[1]. Dyslipidemia is a risk factor for cardiovascular disease. High cholesterol levels, high low-density lipoprotein-cholesterol (LDL-C) levels, low high-density lipoprotein-cholesterol (HDL-C) levels and high triglyceride levels can all increase cardiovascular risk. High serum triglyceride levels are associated with higher cardiovascular risk[2,3]; however, food intake can interfere with triglyceride levels. Currently long fasting times are required before measuring serum triglyceride levels[4], and the optimal fasting time before measuring serum triglyceride levels is still controversial.

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Material and Method

This was a pilot study performed with healthy volunteers. The protocol of research was reviewed and approved by the ethics committee of Rajavithi Hospital (No.134/2556), and informed consent was obtained.

Study population

The present study enrolled young healthy volunteers with no known underlying disease. Volunteers of either sex were eligible for inclusion in the present study if they were aged between 20 and 30 years old.

Patients were excluded if they were taking any medication (including vitamins) or had had previous intestinal surgery.

Study protocol

Forty healthy volunteers were enrolled, and baseline characteristics including age, sex, body weight, height, body mass index, and waist circumference were

recorded. The volunteers fasted for at least 12 hours before the first blood samples for analysis of lipid profile were taken. The subjects then took their regular meal at 8.00 AM. After breakfast, they fasted for another 8 hours as per protocol. The second and third blood samples were taken at 2.00 PM and 4.00 PM after the volunteers had fasted for 6 hours and 8 hours respectively.

After the third blood sample was taken, the volunteers returned to their regular diet. During the testing, the volunteers who failed to fast until the end of the study or developed abnormal symptoms were excluded from the research.

Objectives

The primary aim was to determine the most appropriate fasting time (6, 8 or 12 hours) before measurement of serum triglyceride levels. The secondary end point was to determine the effect of diet on serum LDL-C levels.

Statistical analysis

Baseline characteristics were described as number (percentage), and mean ± standard deviation (SD). Chi-square test/Fisher's exact test was employed to test the difference in qualitative variables, student t-test was used for quantitative variables, and Mann Whitney U test was used for non-normal distributions with significance set at *p*-value <0.05 using SPSS program, version 17.0.

Results

From November 2013 to December 2013, 40 healthy volunteers with no known underlying disease, not taking any medication were enrolled in the present study.

The baseline characteristics are shown in Table 1. The subjects were mainly female and their mean age was 25.9±2.81 years old. The average body weight, average height, average body mass index (BMI) and average waist circumference were 61.52±12.5 kilograms (kg), 167.17±8.3 centimeters (cm), 21.84±3.1 kg/m^2, and 74.90±14.00 cm, respectively.

Serum triglyceride levels after fasting for 12 hours, 8 hours and 6 hours were 80.28±36.33 mg/dl, 75.62±46.81 mg/dl, and 110.65±73.45, respectively. Serum triglyceride levels measured after fasting for 8 and 12 hours showed no significant difference, while levels after fasting for only 6 hours were significantly higher than those after 12 hours' fasting (*p*-value = 0.003) as shown in Fig. 1.

LDL-C levels were measured at the same time. The LDL-C levels after fasting for 12 hours, 8 hours and 6 hours were 135.70±34.42 mg/dl, 138.25±34.04 mg/dl, and 134.00±32.61 mg/dl, respectively. There was no significant difference in LDL-C levels in all three fasting periods as shown in Fig. 2.

Discussion

Food intake interferes with the measurement of serum triglyceride levels. In a previous study[5], no

Table 1. Baseline characteristics

Characteristics	n = 40
Sex	
Female, n (%)	25 (62.5)
Age (years), mean ± SD	25.90±2.81
Weight (kg), mean ± SD	61.52±12.48
Height (cm), mean ± SD	167.17±8.29
BMI (kg/m^2), mean ± SD	21.84±3.13
Waist circumference (cm), mean ± SD	74.90±14.00

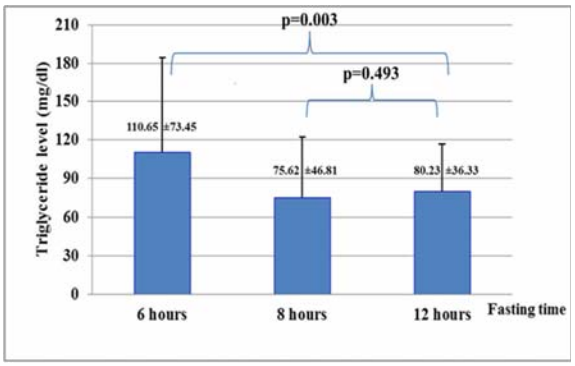

Fig. 1 Fasting triglyceride levels.

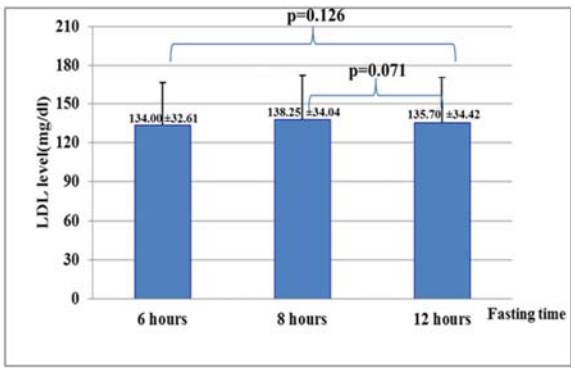

Fig. 2 Fasting low-density lipoprotein-cholesterol (LDL-C) levels.

difference in serum triglyceride levels was found in subjects who had fasted for 18 hours and those who had done so for 12 hours. In another study[6] there was a significant difference in serum triglyceride levels in subjects fasting for 1.5 hours, 3 hours, 4.5 hours and 6 hours, and this was similar to the findings of other studies which showed increased triglyceride levels up to 6 hours after the last meal[7,8]. When comparing serum triglyceride levels between non-fasting subjects and those fasting for over 6 hours[9], fasting serum triglyceride levels were lower than non-fasting ones. In another study[10] serum, triglyceride concentration fell with increasing duration of fasting.

In the present research, there was a significant difference in serum fasting triglyceride levels after 12 hours and 6 hours but not after 12 and 8 hours, and this finding is compatible with those of previous studies. As shown in a study of the metabolism of triglyceride[11], the primary peak of serum triglyceride levels is first seen 1-3 hours after a meal and the secondary peak is present at 4 to 7 hours postprandial, and this is line with the results of our study. Our findings suggest that serum triglyceride levels can be accurately assessed after only 8 hours of fasting.

The study did not limit physical activity during fasting period of 6-8 hours before the second and third blood sampling, and this may have had an effect on serum triglyceride levels. One study showed that during exercise, fatty acid oxidation was increased[12]; however, another study demonstrated that serum triglyceride levels were unchanged for 4 hours after exercise[13]. In our study, the participants did not exercise during the study period and the triglyceride levels should not be affected.

LDL-C levels can be calculated from the Friedewald equation or direct measurement. The Friedewald equation, however, uses triglyceride levels in calculations, and inaccurate measurement has an effect on the estimated LDL-C[14] when compared with direct LDL-C measurement[15]. Fasting Friedewald LDL-C levels were higher than direct LDL-C levels[16]. Direct LDL-C is now used worldwide as it is more accurate.

In previous studies[7,17], there was some difference between fasting and non-fasting state in the calculation of LDL-C levels. In our study, there was no significant difference in direct LDL-C measurement after fasting for 12, 6 or 8 hours. Direct measurement of LDL-C should be the preferred method.

Conclusion

The present study showed no significant difference in triglyceride levels measured after fasting for 8 hours as opposed to 12 hours, so fasting for only 8 hours before measurement of serum triglyceride might be sufficient. Food intake does not interfere with the measurement of LDL cholesterol.

Limitations

First, the present study was a pilot study with a small sample size. Second, this study enrolled only healthy volunteers aged between 20 and 30 years old, and this may not be representative of older patients with known underlying disease. Third, the study did not measure the caloric intake and proportions of fats and carbohydrates in the diets of the volunteers.

Clinical implications

Fasting for only 8 hours before measurement of serum triglyceride may be sufficient in healthy patients. However, this finding should be confirmed by a larger study including the elderly and sick.

What is already known on this topic ?

Dyslipidemia, including triglyceride, is a risk factor for cardiovascular disease.

Serum triglyceride levels are affected by food intake.

Previous studies have shown differences in serum triglyceride levels in subjects fasting for 6 hours and those doing so for 12 hours but no difference between levels in subjects fasting for 12 hours and 18 hours.

Long fasting of over 12 hours is usually required before measurement of serum triglyceride levels.

A few studies have been conducted to determine the appropriate fasting time before lipid profile measurement.

What this study adds ?

The present study showed no significant difference between fasting for 8 hours and 12 hours before measurement of serum triglyceride levels, but fasting for only 6 hours resulted in a significant increase in serum triglyceride levels.

LDL-C levels were not different in the fasting and non-fasting state.

It may be feasible to change to fasting for only 8 hours before measurement of serum triglyceride.

Acknowledgement

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Potential conflicts of interest

None.

References

1. Genest J, Libby P. Lipoprotein disorders and cardiovascular disease. In Mann DL, Zipes DP, Libby P, Bonow RO, editors. Braunwald's heart disease, a textbook of cardiovascular medicine. 10th ed. Philadelphia, PA: Elsevier Saunders; 2015: 980-1000.
2. Miller M, Cannon CP, Murphy SA, Qin J, Ray KK, Braunwald E. Impact of triglyceride levels beyond low-density lipoprotein cholesterol after acute coronary syndrome in the PROVE IT-TIMI 22 trial. J Am Coll Cardiol 2008; 51: 724-30.
3. Nordestgaard BG, Benn M, Schnohr P, Tybjaerg-Hansen A. Nonfasting triglycerides and risk of myocardial infarction, ischemic heart disease, and death in men and women. JAMA 2007; 298: 299-308.
4. Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report. Circulation 2002; 106: 3143-421.
5. Fukuyama N, Homma K, Wakana N, Kudo K, Suyama A, Ohazama H, et al. Validation of the Friedewald Equation for Evaluation of Plasma LDL-Cholesterol. J Clin Biochem Nutr 2008; 43: 1-5.
6. Lund SS, Petersen M, Frandsen M, Smidt UM, Parving HH, Vaag AA, et al. Agreement between fasting and postprandial LDL cholesterol measured with 3 methods in patients with type 2 diabetes mellitus. Clin Chem 2011; 57: 298-308.
7. Langsted A, Freiberg JJ, Nordestgaard BG. Fasting and nonfasting lipid levels: influence of normal food intake on lipids, lipoproteins, apolipoproteins, and cardiovascular risk prediction. Circulation 2008; 118: 2047-56.
8. Rifai N, Merrill JR, Holly RG. Postprandial effect of a high fat meal on plasma lipid, lipoprotein cholesterol and apolipoprotein measurements. Ann Clin Biochem 1990; 27 (Pt 5): 489-93.
9. Emberson JR, Whincup PH, Walker M, Thomas M, Alberti KG. Biochemical measures in a population-based study: effect of fasting duration and time of day. Ann Clin Biochem 2002; 39: 493-501.
10. Sidhu D, Naugler C. Fasting time and lipid levels in a community-based population: a cross-sectional study. Arch Intern Med 2012; 172: 1707-10.
11. Olefsky JM, Crapo P, Reaven GM. Postprandial plasma triglyceride and cholesterol responses to a low-fat meal. Am J Clin Nutr 1976; 29: 535-9.
12. Wolfe RR, Klein S, Carraro F, Weber JM. Role of triglyceride-fatty acid cycle in controlling fat metabolism in humans during and after exercise. Am J Physiol 1990; 258: E382-89.
13. Cullinane E, Siconolfi S, Saritelli A, Thompson PD. Acute decrease in serum triglycerides with exercise: is there a threshold for an exercise effect? Metabolism 1982; 31: 844-7.
14. Cohn JS, McNamara JR, Schaefer EJ. Lipoprotein cholesterol concentrations in the plasma of human subjects as measured in the fed and fasted states. Clin Chem 1988; 34: 2456-9.
15. Sahu S, Chawla R, Uppal B. Comparison of two methods of estimation of low density lipoprotein cholesterol, the direct versus friedewald estimation. Indian J Clin Biochem 2005; 20: 54-61.
16. Mora S, Rifai N, Buring JE, Ridker PM. Comparison of LDL cholesterol concentrations by Friedewald calculation and direct measurement in relation to cardiovascular events in 27,331 women. Clin Chem 2009; 55: 888-94.
17. Mora S, Rifai N, Buring JE, Ridker PM. Fasting compared with nonfasting lipids and apolipoproteins for predicting incident cardiovascular events. Circulation 2008; 118: 993-1001.

ระยะเวลาที่เหมาะสมในการงดอาหารเพื่อตรวจระดับค่าไตรกลีเซอไรด์ในเลือดในกลุ่มอาสาสมัครที่สุขภาพปกติ

สุรพันธ์ พงศ์สุธนะ, นริศ ติวะตันสกุล

ภูมิหลัง: โรคหลอดเลือดหัวใจโคโรนารีเป็นปัญหาทางด้านสาธารณสุข และภาวะไขมันในเลือดผิดปกติ เป็นปัจจัยเสี่ยงต่อการเกิดภาวะหลอดเลือดแข็งและโรคหลอดเลือดหัวใจโคโรนารี โดยระดับไตรกลีเซอไรด์ในเลือดจะถูกรบกวนได้จากการรับประทานอาหารในอดีตได้แนะนำให้อดอาหาร 12 ชั่วโมงก่อนตรวจเลือด แต่ในทางปฏิบัติผู้ป่วยบางคนจะได้รับความทรมานจากการอดอาหารเป็นเวลานาน ในการศึกษานี้จึงหาระยะเวลาที่เหมาะสมในการงดอาหารเพื่อตรวจระดับไตรกลีเซอไรด์ในเลือด

วัตถุประสงค์: เพื่อศึกษาหาเวลาอดอาหารที่เหมาะสมก่อนตรวจเลือดหาระดับไตรกลีเซอไรด์

วัสดุและวิธีการ: เป็นการศึกษานำร่อง โดยศึกษาในอาสาสมัครที่มีสุขภาพแข็งแรง อายุระหว่าง 20-30 ปี ในโรงพยาบาลราชวิถี ระหว่างเดือนพฤศจิกายน ถึง ธันวาคม พ.ศ. 2556 ผู้เข้าร่วมการวิจัยจะได้รับการเจาะเลือดในตอนเช้าหลังจากงดอาหารเป็นเวลามากกว่า 12 ชั่วโมง หลังจากนั้นให้รับประทานอาหารตามปกติ และอดอาหารต่อหลังรับประทานอาหารเช้า โดยจะมีการตรวจเลือดซ้ำครั้งที่สอง และครั้งที่สาม เมื่ออาหารหลังมื้อเช้าไป 6 และ 8 ชั่วโมงตามลำดับ ผลเลือดจะได้รับการตรวจจากห้องปฏิบัติการตามปกติ

ผลการศึกษา: มีอาสาสมัครเข้าร่วมการศึกษาจำนวน 40 คน (อายุเฉลี่ย 25.9±2.81 ปี) เป็นเพศหญิง 25 ราย (ร้อยละ 67.5) น้ำหนักเฉลี่ย 61.5±12.5 กิโลกรัม ส่วนสูงเฉลี่ย 167.2±8.3 เซนติเมตร ดัชนีมวลกาย 21.84±3.1 กิโลกรัม/เมตร^2 โดยมีระดับไตรกลีเซอไรด์ในเลือดหลังอดอาหาร 12 ชั่วโมงเฉลี่ยอยู่ที่ 80.23±36.33 มิลลิกรัม/เดซิลิตร ที่ 6 ชั่วโมง และ 8 ชั่วโมงอยู่ที่ 110.65±73.45 มิลลิกรัม/เดซิลิตร และ 75.62±46.81 มิลลิกรัม/เดซิลิตร ตามลำดับ หลังจากเปรียบเทียบแล้วพบว่าระดับไตรกลีเซอไรด์ในเลือดหลังอดอาหาร 12 ชั่วโมงต่ำกว่าที่ 6 ชั่วโมงอย่างมีนัยสำคัญทางสถิติ (p-value = 0.003) แต่ไม่แตกต่างกันทางสถิติเมื่อเทียบกับการอดอาหารที่ 8 ชั่วโมง (p-value = 0.493)

สรุป: ไม่พบความแตกต่างกันของระดับไตรกลีเซอไรด์ระหว่างการอดอาหารที่ 8 กับ 12 ชั่วโมงก่อนตรวจเลือด แต่การอดอาหารเพียงแค่ 6 ชั่วโมงก่อนตรวจเลือดจะเพิ่มระดับของไตรกรีเซอไรด์อย่างมีนัยสำคัญ ซึ่งอาจเปลี่ยนแปลงเวลาการอดอาหารก่อนตรวจระดับไตรกลีเซอไรด์เหลือเพียง 8 ชั่วโมงก็เพียงพอ