Original Article

The Effects of Orthodox Christian Fasting on Blood Coagulation

Maria Liali, Leonidas Mpirintzis, Eleni Vagdatli, Evagelia Pantziarela, Vasiliki Konstantinidou*, Eygenia Limperaki, Georgios Andreadis

Department of Medical Laboratory Studies, Technological Educational Institution of Thessaloniki, Greece

Introduction: Several studies in recent literature refer to the effects of nutrition and religious fasting on blood coagulation. Nevertheless, the influence of Orthodox Christian fasting on blood coagulation has not yet been studied. The aim of this study is to investigate whether the 48 days that Orthodox Christians fast prior to Easter affects blood coagulation. Materials and Methods: The studied sample consisted of 41 volunteers, aged 20-55 years, who fasted and abstained from animal products for 48 days. For each participant, blood samples were collected in sodium citrate tubes before and after the fasting period. Prothrombin time (PT), activated partial thromboplastin time (APTT), fibrinogen concentration, and the activity of coagulation factor VII (FVII) were measured with an automated coagulation analyzer. Data was analyzed using SPSS v.21 software for Windows. Normality of continuous data was determined. In order to compare the results before and after the fast t-test was applied. A p value < 0.05 was considered statistically significant. Results: At the end of the 48 day fasting period, a statistically significant decrease in APTT ($p < 0.001$) and FVII activity ($p = 0.001$) were noted. In contrast, PT increase and fibrinogen concentration decrease were observed, but neither change was statistically significant ($p = 0.577$ and $p = 0.096$, respectively). Conclusions: It is possible that blood coagulation is not affected by Orthodox Christian fasting, as the balance between the exogenous and the endogenous coagulation pathways does not change. This fact can be attributed to two possible mechanisms: a) low consumption of animal fatty acids has beneficial effects on the exogenous coagulation pathway, b) the endogenous coagulation pathway appears to show greater activation post-fasting, even the lower fibrinogen levels. The mechanism of this activation is still unknown and needs to be elucidated.

Key words: Orthodox Christian fasting, religious fasting, coagulation, hemostasis

Introduction

Several religions require specific nutritional habits, part of which is fasting (1). Integrated into a wider set of regulatory behaviors with practical character and heavily symbolic meaning, religious fasting through dietary restrictions and prohibitions appears to have spiritual and physical benefits (2).

Orthodox Christian fasting is defined as the abstention from meat, dairy products, eggs, and occasionally fish, during certain days or periods of the year. The three main fasting periods of the Greek Orthodox Church are the Nativity fast (i.e., 40 days prior to Christmas), Lent (i.e., the 48 days that precede Easter), and the Assumption (i.e., for 15 days in August).

The diet of Greek Orthodox fasters consists mainly of fruits, vegetables, cereals, seafood, nuts, and legumes. Total food consumption and hence daily calorie intake is limited, but carbohydrate and fiber intake increases. Furthermore, protein and fat intake decreases**.** Besides, the quality of the fat intake changes: fasters consume more monounsaturated and polyunsaturated fat, and decrease their consumption of saturated and trans fats. In addition, the consumption of most micronutrients (such

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Correspondence: Dr Konstantinidou Vasiliki, MD, PhD
Postal address : Kyprou 26, 55133 Thessaloniki, Greece
Tel: +30 2310 013839, Fax : +30 2310 939038, e-mail address : themikonstantinidou@yahoo.gr

as vitamins and minerals) does not change**.** Therefore, Orthodox Christian fasting is an integral part of the Mediterranean diet, which is arguably the most beneficial diet model worldwide.

In the last two decades, studies concerning the correlation between religious practices and health outcomes have been conducted (1, 2). Some of these studies have demonstrated the beneficial impact of Orthodox Christian fasting on health status and blood parameters (3, 4). For example, three studies have noted lower levels of total cholesterol and low density lipoprotein during fasting periods (4-6). In addition, Sarri et al. compared hematological parameters between fasters and non-fasters during the Christmas fast. The study demonstrated a relative increase in ferritin levels, while there was no relative change in hemoglobin, serum iron, and transferrin levels (3).

Nevertheless, no study to date has investigated the effect of Orthodox Christian fasting on blood coagulation. The aim of this study was to assess whether the 48 days of Orthodox Christian fasting that occur prior to Easter affect blood coagulation parameters.

Materials and Methods

Participants

A total of 41 healthy women aged 20-55 years old were involved in this study. All of the participants were nuns living in a Greek Orthodox monastery who strictly abstained from meat, poultry, dairy products, and eggs for 48 days during the Orthodox Christian fasting leading up to Easter. Participants responded to the open announcement by our laboratory for subject recruitment and were asked to provide signed consent for participation in the study. A full medical history was recorded from each participant in order to exclude any subjects with a history of thrombophilic factors. None of the participants used prescribed or non-prescribed medication that could affect hemostasis.

Blood sampling and processing

The effect of Christian Orthodox fasting on blood coagulation parameters was studied by measuring PT, APTT, fibrinogen concentration, and FVII activity before and after the 48 day fasting period.

Blood samples were collected before and after the fasting period. Blood samples were collected at a fasting state in a 2.7 ml BD (Becton Dickinson, Crowley, UK) vacutainer Sodium Citrate tube. The phlebotomy of all participants was performed at the laboratory. The samples were centrifuged immediately after phlebotomy at 2.000 g for 15min, and were analyzed in their fresh state by the ACL Advance Coagulation Analyzer (Instrumentation Laboratory, Milano, Italy). The following blood tests were performed before and after the fasting period: a) PT, b) APTT, c) fibrinogen concentration (reference range 220-496 mg/dl), and d) FVII activity (clotting time assay). Decreased FVII activity was defined as an activity level lower than 65%.

Statistical Analysis

Data were analyzed using SPSS version 21.0 for Windows. Normality of continuous data was determined. For comparison among groups, a paired-sample t-test or Wilcox Signed Ranks Test was used for parametric and nonparametric tests, respectively. In order to study the possibility of gradual alteration of the parameters, a one-way analysis of variance test was used. A two tailed p-value < 0.05 was considered statistically significant for all comparisons.

Results

The mean values of PT, APTT, fibrinogen concentration, and FVII activity are shown in Table 1 and Figure 1.

Prior to the beginning of the fast, PT, APTT, fibrinogen concentration, and FVII activity were all within the normal ranges for all study subjects (Table 1).

At the end of the 48 day fasting period, PT had increased but remained within the normal range (mean = 1.02). Nevertheless, the rise was not statistically significant ($p = 0.577$).

Regarding APTT, a statistically significant decrease ($p < 0.001$) was noted at the end of the 48 day fast. However, the values remained within the normal range (mean = 0. 95).

Fibrinogen concentration decreased at the end of the 48 day period as well, and the difference between the two mean values was not statistically significant ($p = 0.096$). FVII activity was significantly lower ($p =0.001$) at the end of the fasting period compared to the initial values.

Statistical comparisons of pre-post fast PT and APTT levels, as well as fibrinogen and FVII activity, are shown in Table 2.

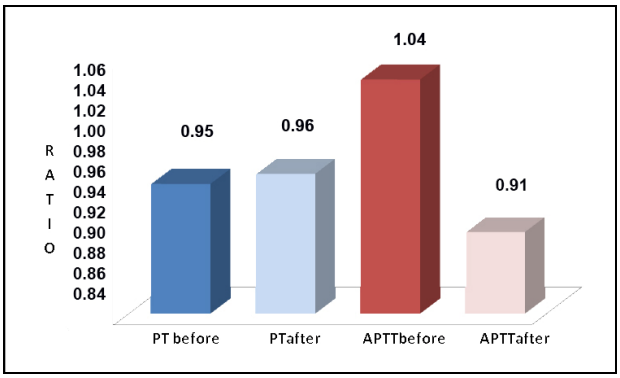

Fig.1 Mean values of PT and APTT ratio before and after the fasting period

Table 1 Mean values and Standard. Deviation of PT ratio, APTT ratio, fibrinogen and FVII activity before and after the fast

	RatioPT		RatioAPTT		Fibrinogen (mg/dl)		FVII (%)	
	before	**after**	**before**	**after**	**before**	**after**	**before**	**after**
Mean	0.95	0.96	1.04	0.91	353.27	338.73	107.82	91.97
Std. Deviation	0.06	0.05	0.12	0.09	69.45	60.097	19.15	18.43

Table 2 Paired Samples Test among groups

		Mean	Std. Deviation	p
Pair 1	RatioPTbefore - RatioPTafter	-0.004	0.044	0.577
Pair 2	RatioAPTTb - RatioAPTTa	0.137	0.094	0.000
Pair 3	Fibbefore - Fibafter	14.536	54.585	0.096
Pair 4	VIIbefore - VIIafter	7.831	10.139	0.001

Discussion

In the past two decades, increasing interest has aroused concerning the impact of diet and nutrition on health status. Several studies have referred to the effects of nutrition on blood coagulation (7-9). Recent studies provide evidence for the benefits of fasting, in particular religious Greek Orthodox fasting, on health, including positive implications for participants' lipid profile, hematological parameters, blood pressure levels, biomarkers of oxidative stress, and body mass. Nevertheless, the influence of Christian Orthodox fasting on blood coagulation has not been studied to date. The aim of this study was to investigate the potential association of Christian Orthodox fasting with hemostasis.

Recent literature has elucidated the beneficial impact of the Mediterranean diet on hemostasis, which occurs through favorable effects on platelet aggregation, coagulation, and fibrinolysis (10-12). Such effects are primarily attributed to olive oil, which is rich in monounsaturated fatty acids (13-15). Furthermore, polyunsaturated fatty acids derived from other components of the Mediterranean diet such as fish, nuts, seeds, and vegetables exert beneficial effects on the coagulation pathway (16, 17). Several studies demonstrated that the Mediterranean diet and olive oil consumption are associated with decreased FVII concentration and activation (18, 19). No study has investigated the effects of these dietary habits on first line coagulation tests PT and APTT. Greek Orthodox fasting is a form of vegetarianism that shares all the characteristics of the Mediterranean diet. Nevertheless, our results did not demonstrate an overall favorable impact of fasting on blood coagulation pathways. At the end of the 48 day fasting period, prolongation of PT was observed, however this change was not statistically significant. On the contrary, APTT decreased significantly. According to these findings, it can be assumed that the higher consumption of unsaturated fatty acids during the Christian Orthodox fast has a beneficial impact on the exogenous coagulation pathway. On the contrary, the endogenous coagulation pathway

seems to be more activated after fasting. The mechanism of this activation is still unknown and needs to be elucidated.

Consequently, the balance between the exogenous and the endogenous coagulation pathways does not seem to be altered by the Greek Orthodox fast. Further research should be conducted in order to confirm these findings.

According to our results, fibrinogen concentration decrease was not statistically significant. The results of previous studies concerning the impact of monounsaturated and polyunsaturated fatty acids on fibrinogen concentration are conflicting. Some studies found an increase in plasma fibrinogen levels, while others found no difference (10, 20). However, Mezzano et al. found a reduction in fibrinogen concentration in healthy males who followed the Mediterranean diet for 90 days (12).

At the end of the fasting period, plasma FVII concentration was significantly lower. This finding can also be attributed to the beneficial properties of olive oil. It is well established that diets rich in monounsaturated fatty acids decrease FVII concentration (13). This favorable effect has also been confirmed by the findings that Mediterranean diet and virgin olive oil-rich diets not only suppress FVII concentration, but also decrease its postprandial activation (11,18,19). It is highly unlikely that the decrease in FVII can be attributed to the higher intake of polyunsaturated fatty acids, since the majority of studies found no association (7).

In conclusion, it is possible that Orthodox Christian fasting decreases FVII activity but has no impact on blood coagulation because of its contradictory effects on the exogenous and the endogenous coagulation pathways. Further research is needed in order to establish conclusive evidence.

References

1. J. F Trepanowski, R. J Bloomer The impact of religious fasting on human health Nutr. J. 2010 Nov 22;9:57
2. Trepanowski JF, Canale RE, Marshall KE, Kabir MM, Bloomer RJ. Impact of caloric and dietary restriction regimens on markers of health and longevity in humans and animals: a summary of available findings. Nutr J. 2011 Oct 7;10:107
3. K. O. Sarri, A. G. Kafatos , Siobhan Higgins Is religious fasting related to iron status in Greek Orthodox Christians? Br J Nutr. 2005 Aug;94(2):198-203
4. K. O. Sarri , M K. Linardakis, F N. Bervanaki, N E. Tzanakis, A. G. Kafatos Greek Orthodox fasting rituals: a hidden characteristic of the Mediterranean diet of Crete Br J Nutr. 2004 Aug;92(2):277-84.
5. Papadaki A, Vardavas C, Hatzis C, Kafatos A: Calcium, nutrient and food intake of Greek Orthodox Christian monks during a fasting and nonfastingweek. Public Health Nutr 2008, 11:1022-1029
6. Sarri KO, Tzanakis NE, Linardakis MK, Mamalakis GD, Kafatos AG: Effects of Greek Orthodox Christian Church fasting on serum lipids and obesity.BMC Public Health 2003, 3:16.
7. Pieters M, de Maat MP Diet and haemostasis — A comprehensive overview Blood Rev. 2015 Jul;29(4):231-41
8. F. Perez-Jimenez, J. Delgado Lista, P. Perez-Martınez, F. Lopez-Segura, F. Fuentes, Begon˜a Corte´s, A. Lozano,J. Lopez-Miranda. Olive oil and haemostasis: a review on its healthy effects Public Health Nutr. 2006 Dec;9(8A):1083-8
9. Vorster HH, Cummings JH, Jerling JC Diet and haemostatic processes Nutr Res Rev. 1997 Jan;10(1):115-35
10. Smith RD, Kelly CN, Fielding BA, Hauton D, Silva KD, Nydahl MC, Miller GJ, Williams CM Long-term monounsaturated fatty acid diets reduce platelet aggregation in healthy young subjects. Br J Nutr. 2003 Sep;90(3):597-606.
11. Lopez-Miranda J, Delgado-Lista J, Perez-Martinez P, Jimenez-Gómez Y, Fuentes F, Ruano J, Marin C Olive oil and the haemostatic system. Mol Nutr Food Res. 2007 Oct;51(10):1249-59.
12. Mezzano D, Leighton F, Martínez C, Marshall G, Cuevas A, Castillo O, Panes O, Muñoz B, Pérez DD, Mizón C, Rozowski J, San Martín A, Pereira J. Complementary effects of Mediterranean diet and moderate red wine intake on haemostatic cardiovascular risk factors. Eur J Clin Nutr. 2001 Jun;55(6):444-51.
13. Allman-Farinelli MA, Gomes K, Favaloro EJ, Petocz P. A diet rich in high-oleic-acid sunflower oil favorably alters low-density lipoprotein cholesterol, triglycerides, and factor VII coagulant activity. J Am Diet Assoc. 2005 Jul;105(7):1071-9.
14. Delgado-Lista J, Garcia-Rios A, Perez-Martinez P, Lopez-Miranda J, Perez-Jimenez F. Olive oil and haemostasis: platelet function, thrombogenesis and fibrinolysis. Curr Pharm Des. 2011;17(8):778-85.
15. Perez-Jimenez F, Alvarez de Cienfuegos G, Badimon L, Barja G, Battino M, Blanco A, Bonanome A, Colomer R, Corella-Piquer D, Covas I, Chamorro-Quiros J, Escrich E, Gaforio JJ, Garcia Luna PP, Hidalgo L, Kafatos A, Kris-Etherton PM, Lairon D, Lamuela-Raventos R, Lopez-Miranda J, Lopez-Segura F, Martinez-Gonzalez MA, Mata P, Mataix J, Ordovas J, Osada J, Pacheco-Reyes R, Perucho M, Pineda-Priego M, Quiles JL, Ramirez-Tortosa MC, Ruiz-Gutierrez V, Sanchez-Rovira P, Solfrizzi V, Soriguer-Escofet F, de la Torre-Fornell R, Trichopoulos A, Villalba-Montoro JM, Villar-Ortiz JR, Visioli F International conference on the healthy effect of virgin olive oil. Eur J Clin Invest. 2005 Jul;35(7):421-4.
16. Rauramaa R, Väisänen SB Interaction of physical activ-

ity and diet: implications for haemostatic factors. Public Health Nutr. 1999 Sep;2(3A):383-90.
17. McEwen BJ The influence of diet and nutrients on platelet function. Semin Thromb Hemost. 2014 Mar; 40(2):214-26.
18. Kelly CM, Smith RD, Williams CM Dietary monounsaturated fatty acids and haemostasis. Proc Nutr Soc. 2001 May;60(2):161-70.
19. Larsen LF, Jespersen J, Marckmann P. Are olive oil diets antithrombotic? Diets enriched with olive, rapeseed, or sunflower oil affect postprandial factor VII differently. Am J Clin Nutr. 1999 Dec;70(6):976-82.
20. Sanders TA, Oakley FR, Miller GJ, Mitropoulos KA, Crook D, Oliver MF. Influence of n-6 versus n-3 polyunsaturated fatty acids in diets low in saturated fatty acids on plasma lipoproteins and hemostatic factors. Arterioscler Thromb Vasc Biol. 1997 Dec;17(12): 3449-60.