

# Total Antioxidant Capacity, Haematological and Coagulation Parameters after Orthodox Christian Fast

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## Abstract

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**BACKGROUND:** Orthodox Christian believers fast abstaining from meat, eggs, dairy products or even fish and oil in certain days of the fasting period, three times a year.

**AIM:** The present study aimed to investigate the impact of a 48-day fast before Easter in blood count parameters, coagulation and antioxidant status.

**MATERIAL AND METHODS:** A total of 35 healthy volunteers, 19-66 years old, were included in the study. White blood cells (WBC), lymphocytes (Lymph), granulocytes (Gran), haemoglobin (Hb), hematocrit (Ht), red blood cells (RBC), mean erythrocyte volume (MCV), platelets (Plt), were measured. Blood coagulation parameters, such as PT, aPTT, fibrinogen concentration, factor VII activity were also determined, and INR (PT<sub>sample</sub>/PT<sub>control</sub>) and aPTT ratio (aPTT<sub>sample</sub>/aPTT<sub>control</sub>) were calculated. Total antioxidant capacity (TAC) was assayed.

**RESULTS:** Levels of all parameters remained within normal. By the end of the fasting period, lymphocytes and TAC levels were significantly increased ( $p = 0.011$ ), whereas all the other parameters, except fibrinogen, were significantly decreased.

**CONCLUSION:** Orthodox Christian fast impairs all haematological and coagulation parameters and seems to be beneficial in the body antioxidant protection.

## Introduction

Many religions, including Orthodox Christian religion, require fasting as part of the preparation of believers for certain periods of the year [1]. Greek Orthodox Christian believers fast abstaining from meat, eggs, dairy products, even from fish and oil in certain days of the fasting period; protein and fat intake decrease, saturated and trans-fat is eliminated. The main constituents of this fast include fruits, vegetables, grains, cereals and legumes.

Fasting periods for a Greek Orthodox Christian believer begin 40 days before Christmas, 48 days before Easter and 15 days before Assumption in August.

The present study aimed to investigate the

impact of Orthodox Christian fast during a 48 - day period before Easter in blood count parameters, coagulation and antioxidant status.

## Methods

A total of 35 healthy volunteers, aged 19 - 66 years old, were included in the study. All of the participants were followers of the Orthodox Christian fast, and none of them was taking medication that could affect coagulation parameters or antioxidant status. All subjects signed a consent form for the participation in the study.

Blood samples (whole blood with EDTA,

serum and citrate plasma) were collected, after overnight fast, before and after the pre - Easter fasting period for those participants that followed the fast, whereas only one blood sample was collected from each non - fasting adult. For the purpose of the study, whole blood parameters, such as count of white blood cells (WBC), lymphocytes (Lymph), granulocytes (Gran), haemoglobin (Hb), hematocrit (Ht), red blood cells (RBC), mean erythrocyte volume (MCV), platelets (Plt), were measured by the analyzer Cell - Dyn 1800 (Abbott Laboratories, Chicago, Illinois, USA). Blood coagulation parameters, such as PT, aPTT, fibrinogen concentration, factor VII activity were also determined by the analyzer ACL Elite, (Instrumentation Laboratory, Milano, Italy – Beckman Coulter, Brea, California, USA), and INR (PTsample/PTcontrol) and aPTT ratio (aPTTsample/aPTTcontrol) were calculated. All these parameters were measured immediately after the blood collection, whereas serum was stored in - 80°C until total antioxidant capacity (TAC) was assayed by ELISA (Sigma - Aldrich Inc., PO Box 14508, St Louis, MO, USA).

Data were analysed with IBM SPSS Statistics 20 for Windows. The normality of distribution of values was investigated with Kolmogorov-Smirnov test. Within-group comparisons before and after fasting were performed with paired samples T-test, as long as the distribution of values was normal. Statistical significance was set at  $P < 0.05$ .

## Results

Mean values of blood count parameters, coagulation parameters and TAC in the study group, before and after the fasting period, are shown in Table 1.

**Table 1: Differences of blood count parameters, coagulation parameters and TAC in the study group (n=35), before and after the fasting period**

| Parameter                        | Before fast    | After fast |         | P      |
|----------------------------------|----------------|------------|---------|--------|
|                                  |                | Mean       | (SD)    |        |
| WBC (*10 <sup>3</sup> /μL)       | 5.685 (1.24)   | 4.876      | (0.89)  | <0.001 |
| Lymphocytes                      | 1.846 (0.45)   | 2.073      | (0.57)  | 0.004  |
| Granulocytes                     | 3.485 (0.97)   | 2.439      | (0.58)  | <0.001 |
| RBC (*10 <sup>6</sup> /μL)       | 4.64 (0.41)    | 4.56       | (0.37)  | 0.036  |
| Hemoglobin (g/dL)                | 13.4 (1.10)    | 12.9       | (0.91)  | <0.001 |
| Hematocrit (%)                   | 41.4 (3.20)    | 38.6       | (2.62)  | <0.001 |
| MCV (fL)                         | 89.14 (7.70)   | 85.05      | (6.49)  | <0.001 |
| Platelets (*10 <sup>3</sup> /μL) | 238.50 (41.80) | 225.60     | (34.30) | 0.005  |
| INR                              | 0.94 (0.048)   | 0.95       | (0.049) | 0.028  |
| aPTT ratio                       | 1.07 (0.097)   | 0.91       | (0.096) | <0.001 |
| Fibrinogen (mg/dL)               | 355.23 (75.65) | 341.06     | (61.71) | 0.135* |
| Factor VII (%)                   | 104.8 (18.9)   | 97.7       | (19.4)  | 0.003  |
| TAC (mmol/L)                     | 0.84 (0.28)    | 0.98       | (0.04)  | 0.011  |

\* Non - significant. Abbreviations: WBC, white blood cells; RBC, red blood cells; MCV; mean erythrocyte volume; INR: international normalised ratio; TAC, total antioxidant capacity.

All mean values were within normal range before the initiation of fast. Significant alterations,

within normal values, were observed after 48 days of fast in most of the parameters, except fibrinogen. In particular, the parameters that decreased significantly were WBC, granulocytes, haemoglobin, RBC, MCV, platelets, INR, aPTT and FVII activity, whereas lymphocytes presented significant elevation.

About TAC levels, there was statistically significant increase by the end of the fasting period ( $P = 0.011$ ) (Table 1, Figure 1).

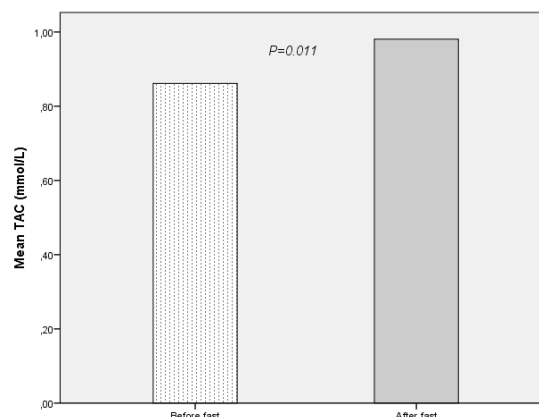


Figure 1: Changes in mean TAC values before and after fast

## Discussion

Although many studies have investigated the impact of nutrition on the levels of the above-mentioned parameters, on coagulation [2][3][4] and, some, to the plasma TAC levels [5][6][7], very little evidence exists on the impact of Orthodox Christian fasting on the above mentioned parameters. The present study states that there is a significant modification of blood parameters after a 48 - day fasting period.

Orthodox Christian fast is very similar to the Mediterranean diet, with olive oil as the only oil used and with deprivation even of oil in certain days of the week. Milk and dairy products are excluded from this dietary pattern, as well as meat and eggs. A significant increase of INR and decrease of aPTT ratio shows an impact of the fast on both the exogenous and the endogenous coagulation pathway. This study shares some common findings with that of Liali et al. [8], but the mechanism of the activation of both pathways remains to be clarified. Moreover, there was a significant reduction in the platelets count after the fast in the study group. Fibrinogen levels were not altered significantly, in contrast to the study of Mezzano et al., who studied the impact of Mediterranean diet. The significant reduction of FVII activity after the fast can be attributed to the use of

olive oil, rich in monounsaturated fatty acids, then other oils and the abstention from saturated fat, as shown by the study of Allman - Farinelli MA et al. [9]. Moreover, Orthodox Christian fast is enriched in nuts, vegetables and seeds, which have shown to exert beneficial effects on coagulation parameters [10], something that is stated by the results of the present study, as well.

About white blood cells, to our knowledge so far there is no other study investigating the impact of Orthodox Christian fast on white blood cell count. Nevertheless, the study of Latilynia et al., [11] showed that Ramadan has a beneficial effect on neutrophil phagocytic function. In contrast to these results, the present study showed a significant decrease in the count of granulocytes and total white blood cells, with a significant increase in lymphocytes' count, after the 48 - day pre - Easter fasting period. Nevertheless, the mechanism for these alterations is not yet known.

Furthermore, it seems that Ht, Hb and MCV are significantly decreased after a 48-day fast, within the normal range, in contrast to the study of Sarri et al., who showed non - significant reduction of Hb after a 40 - day pre - Christmas Orthodox Christian fast [12]. Another parameter investigated in the present study was antioxidant status, in the study group before and after fast. The findings, presented in Table 1 show that members of the study group had significantly higher TAC serum levels after the fast. This can be attributed to the constituents of the Orthodox Christian fast, such as olive oil, nuts, red wine, vegetables and seeds, all previously shown to be rich in flavonoids, carotenoids and other antioxidants [13].

In conclusion, the findings of the present study suggest that the Orthodox Christian fast, a vegetarian type of diet followed for three periods of time each year, has a significant impact on most parameters studied. In particular, blood count and coagulation parameters were significantly impaired by the fast, but within normal range. Hematocrit, haemoglobin, MCV and RBC were significantly decreased, as well. Endogenous and exogenous coagulation pathways were both significantly impaired, whereas there may not be an impact on blood coagulation due to contradictory effects on the two pathways. On the whole, the Orthodox Christian fast might not have a serious impact on the fasters' health, due to its short duration, that keeps the alterations within normal range. On the other hand, it seems that this fast enhances the antioxidant system and might have long-term health benefits. The results of the present study, in addition to the results of previous studies [12][14][15] show that Orthodox Christian fast might help in the prevention of cardiovascular diseases. Nevertheless, further studies are needed to establish the findings of the present study.

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