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**Original research paper**

# CHANGES IN BODY COMPOSITION INDUCED BY ORTHODOX RELIGIOUS FASTING ON HIGH SCHOOL STUDENTS

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**Abstract**. *Scientific research in recent decades has increasingly focused on changes in body composition influenced by Orthodox religious fasting, which the Church has established before major holidays. The purpose of this study is to provide more information on how body composition parameters changed among high school students who followed the recommendations of Orthodox religious fasting for forty days (during Lent). A sample of twenty-eight students from Holy Cyril and Methodius High School in Niš was analyzed. The average age of all male participants was 17.4 ± 1.2 years. Anthropometric measures were taken both before and after the 40-day fast. The Omron BF 511 device, which provided information on body weight, BMI (body mass index), percentage of body fat, percentage of skeletal muscle, and basal metabolic rate, was used to measure body composition values. The acquired data were subjected to statistical analyses, including ANOVA and MANOVA for repeated measures. The results show a statistically significant difference (p = 0.012) between the initial and final measurements based on the MANOVA analysis. This study indicates that students interested in reducing weight while maintaining their muscle mass could benefit from practicing Orthodox religious fasting for 40 days. Further research is needed to confirm these results and explore the long-term effects of religious fasting and the post-fasting period, particularly for this participant sample.*

**Key words**: *Orthodox religious fasting, body composition, students*

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## 1. INTRODUCTION

An intentional refrain from consuming forbidden foods for a certain period is known as fasting, which is linked to numerous spiritual and religious practices. People who observe fasting typically eat very little, or nothing at all, and drink only calorie-containing beverages for durations that usually range from 12 hours to three weeks (Moro et al., 2016). Numerous scientific studies have examined fasting as a dietary strategy and a potential (non-pharmacological) intervention for enhancing health and prolonging human lifespan. The three most frequently researched fasting strategies are dietary restriction (DR), alternate-day fasting (ADF), and calorie restriction (CR) (Trepanowski & Bloomer, 2010). CR involves lowering daily caloric intake (kcal) by a specific percentage, usually 20–40%, compared to unrestricted food intake. It represents an approach that consciously involves consuming fewer calories than usual. Findings from Redman and Ravussin (2011) indicate that CR may significantly reduce body fat and decrease body mass index (BMI). Most et al. (2017) examined the effects of CR on body fat loss and found that it may decrease visceral fat, reduce BMI, and enhance metabolism. Studies have also demonstrated that CR can increase longevity (Spindler, 2010). Pertusa & Mavrommatis (2018) conducted a study using the intermittent fasting (IF) protocols, which have been suggested as alternatives to conventional CR. Given that IF is often more convenient to follow than a constant CR diet, the results indicated that IF can be a useful strategy for weight loss and improving body composition (BC). Consequently, different IF regimens might be presented as option to the conventional CR diet strategy in order to optimize BC and reduce overall body weight. With ADF, days of minimal or no food consumption alternate with 24-hour intervals during which regular food consumption takes place. The two phases of ADF are the "fast period," when food consumption is either strictly forbidden or severely restricted, and the "feast period," when individuals can eat as they like. Water can be consumed freely throughout both periods. According to studies, fasting on alternate days may improve metabolic risk factors, decrease inflammation, enhance body weight management, and prolong life (Spindler, 2010). DR is a type of fasting that involves reducing the overall intake of one or more components of food (usually macronutrients) with minimal or no reduction in overall calorie intake and without starvation. A study conducted by Antoni et al. (2018) explored how long-term DR affected BC. The outcomes demonstrated that DR can significantly decrease a participant's body weight and body fat percentage. Research suggested that DR may be associated with several health benefits, such as a decreased risk of obesity, diabetes, heart disease, and cancer (Calle & Kaaks, 2004; Persynaki et al., 2017).

While religious fasting is typically practiced for spiritual purposes, it can have a substantial negative impact on an individual's physical health. In recent decades, there has been a rise in scientific research examining the potential health risks associated with religious fasting. The Eastern Orthodox Christian Church (EOCC) is the second-largest Christian church, with an estimated membership of 300 million. Russian, Greek, Serbian, Romanian, Bulgarian, Ukrainian, Syrian, and Moldovan ethnic groups account for at least 80% of the EOCC’s membership (Lazarou & Matalas, 2010). The Orthodox religious fasting season, prescribed by the Christian Orthodox Church (COC), lasts 180–200 days annually. Extended fasts are those imposed by the Church ahead of major holidays. The four extended fasting periods represent the seasons of the year: The Great Forty Days of Easter (Great Lent) in spring, St. Peter's Fast in summer, Dormition Fast in autumn, and

Nativity Fast (Little Forty Days) in winter. During the 40-day Nativity Fast, practitioners refrain from eating meat, dairy products, eggs, and fish. Additionally, they avoid using olive oil on Wednesdays and Fridays. The dietary rules for eating during the 48 days, which precedes Easter, include abstaining from meat, eggs, and dairy products, with fish and olive oil being permitted only on Palm Sunday and March 25 (Trepanowski & Bloomer, 2010; Trepanowski et al., 2011). The St. Peter's Fast lasts for 15 days, following similar dietary principles, except for August 6th. A partially vegetarian diet is recommended during these periods, particularly given the Mediterranean climate of Crete, Greece, and Cyprus (Kafatos et al., 1991; Trichopoulou et al., 1995). Western diets have recently gained popularity in Greece and other Orthodox nations, notably impacting the health of their citizens (Kafatos et al., 1997). Foods typically consumed during the Orthodox religious fasting period include bread, fruits, vegetables, fish, legumes, nuts, and snails (Sarri et al., 2003). It is less well-known that the fasting rituals observed by the Greek Orthodox Church (GOC) align closely with traditional diets from the Mediterranean region (Cannon, 2004; Sarri et al., 2004; Sarri et al., 2005). This essentially represents a partially vegetarian diet, consisting primarily of fruits, vegetables, grains, legumes, and potatoes, with olive oil serving as the main source of fat. Alcohol is consumed in moderation, while dairy products, fish, chicken, and red meat are eaten occasionally (Sarri et al., 2004). This dietary regimen can be viewed as a form of DR as well as a type of vegetarianism. Due to dietary constraints during religious fasting, individuals must abstain from rich foods and sweets throughout the fasting period, which often contain a significant amounts of processed carbohydrates (Trepanowski & Bloomer, 2010; Trepanowski et al., 2011; Quinton & Ciccazzo, 2007; Sarri et al., 2004). Daily calorie intake may be reduced or kept constant during the fasting period (Sarri et al., 2003; Papadaki et al., 2008; Sarri et al., 2004; Sarri et al., 2005; Sarri et al., 2009). Research indicates that Orthodox religious fasting increases carbohydrate consumption while decreasing fat intake as a percentage of total energy consumed (Sarri et al., 2003; Papadaki et al., 2008; Sarri et al., 2004; Sarri et al., 2009). Furthermore, the ratio of protein to fat and carbohydrates may decrease or remain the same (Sarri et al., 2009). During fasting, the total amount of fat and protein consumed decreases in absolute quantities, while overall carbohydrate consumption remains constant. Monounsaturated fat intake stays steady, whereas saturated and trans fat consumption declines (Papadaki et al., 2008; Sarri et al., 2004; Sarri et al., 2009). Anthropometric measures taken during the fasting phase indicate that BMI may either decrease or remain the same. Notably, after a week of fasting, there was a minor but non-statistically significant ($p=0.059$) decrease in the average body weight of Greek Orthodox monks (Sarri et al., 2003; Papadaki et al., 2008; Sarri et al., 2009). These findings align with previous studies, suggesting that individuals who follow such dietary practices may experience improvements in their BC as a result of Orthodox religious fasting. Despite its long-standing acceptance as a dietary practice, particularly during religious fasting periods, there appears to be a lack of research examining the effects of Orthodox religious fasting on BC among participants in Serbian regions. This highlights the need to provide appropriate data about this specific dietary pattern and to enhance the existing scientific knowledge, which is remarkably similar to the Mediterranean diet followed by people in Greece, Crete, and Cyprus. Thus, the purpose of this study is to provide insight into how parameters of body composition changed in students who adhered to the rules of the Orthodox religious fasting for forty days during the Easter fasting period.

## 2. MATERIALS AND METHODS

### 2.1. Study design and sample participants

The study took place in the sports hall at the Faculty of Sports and Physical Education in Niš. The research was conducted in accordance with the Declaration of Helsinki, and the protocol received approval from the Ethics Committee of the Faculty (Approval Document No. 04-504/2). Each adult participant provided written consent to participate in the study after reading and understanding the informed consent form. A question concerning the participants' level of physical activity was also included in the written consent form. They were also able to leave the study at any moment without facing any negative consequences. The parents or guardians of participants who were underage signed the consent form. Participants, their parents, the school administration, and the teachers were all informed about the purpose of the study and the confidentiality of the findings. When planning the scheduled measurements, the school administration and the teachers were always consulted. To be eligible to participate in the study, participants had to meet certain criteria, such as being in good general health, having no long-term comorbidities (such as diabetes mellitus), and being able to complete all anthropometric measurements at the designated times. Twenty-eight students from the Holy Cyril and Methodius High Theological School in Niš made up the sample of participants. The participants followed the same diet, which strictly complied with the recommendations of Orthodox religious fasting, and lived in a boarding facility with tightly regulated living conditions. The average age of the male participants was 17.4 ± 1.2 years. Anthropometric measurements were taken both before and after a 40-day fast.

### 2.2. Anthropometric measurements and body composition measures

The researchers were instructed on how to properly conduct tests, code data, and maintain the confidentiality of the test findings. Before the measurements began, they set up all the necessary equipment. The study was conducted between 2:00 and 4:00 p.m. in the hall of the Faculty of Sport and Physical Education. Height was measured with an accuracy of 0.5 cm using a Martin anthropometer. The participants were told to stand in shorts and a T-shirt, remove their shoes, relax their shoulders, straighten their legs, hang their arms by their sides, and place their backs against the apparatus (Frankfurt Plane position). Each participant was also instructed to abstain from food and liquids for three hours before the scheduled session. The BC device (Omron BF-511; Omron Healthcare Co., Ltd., Kiyoto, Japan) was used to measure body weight, BMI (body mass index), body fat percentage, muscle mass percentage, and basal metabolic rate (expressed in kilocalories, i.e., Kcal). The unique technology with 8 sensors ensures the most accurate methods of measuring BC. Before using the scale, the participant's age, height (cm), and gender were entered into the device. BMI results were generated following the device's direct weight assessment. The Omron BF 511 analyzer is a tool used in research because of its high precision and repeatability of results (Vasold et al., 2019).

### 2.3. Statistical data analysis

For the statistical analysis in this research, SPSS software version 21 (Statistical Package for the Social Sciences; SPSS, Chicago, IL, USA) was utilized. Two important statistical methods were employed: one-way analysis of variance (ANOVA) and repeated-measures multivariate analysis of variance (MANOVA), both with a significance level set

at p = 0.05, to examine differences between two measurements and relationships between variables. To determine if the data had a normal distribution, the Kolmogorov-Smirnov test was used. The standard deviations (SD) and mean values of the results are presented. To specifically assess differences between the variables evaluated at the start and end of the study, ANOVA was applied. By comparing the means of the measurements, it was possible to ascertain whether there were statistically significant differences between them. The purpose of this test was to assess changes in different dependent variables between the group's initial and final assessments. Repeated-measures multivariate analysis of variance (MANOVA) was used to assess changes at the multivariate level between initial and final measurements for several dependent variables. Initial data were collected for all dependent variables at the start of the study and final data were collected again after 40 days of Orthodox religious fasting. The dependent variables measured included body weight, BMI, body fat percentage, muscle mass percentage, and basal metabolism.

## 3. RESULTS

The findings of descriptive statistics at both measurements are shown in Table 1. With the exception of the variable muscle mass (36.977), all other variables results revealed lower values than their initial measurements. The Kolmogorov-Smirnov test indicated that all variables had a normal distribution of results at a significance level of p > 0.05.

**Table 1** Descriptive Statistics

| Variables | N | Minimum | Maximum | Mean | Std. Deviation | Kolmogorov Smirnov test |
|---|---|---|---|---|---|---|
| Weight (kg) Ini | 26 | 62.6 | 132.3 | 88.796 | 18.6257 | .561 |
| Weight (kg) Fin | 26 | 61.1 | 128.9 | 87.592 | 18.4803 | .674 |
| BMI (kg/m²) Ini | 26 | 18.2 | 41.3 | 27.215 | 5.9454 | .955 |
| BMI (kg/m²) Fin | 26 | 18.2 | 40.2 | 27.169 | 5.8396 | 1.000 |
| Fat (%) Ini | 26 | 5.8 | 39.3 | 25.288 | 9.5709 | .720 |
| Fat (%) Fin | 26 | 6.9 | 38.2 | 24.712 | 9.0429 | .912 |
| Muscles (%) Ini | 26 | 29.7 | 46.3 | 36.792 | 4.8698 | .689 |
| Muscles (%) Fin | 26 | 29.8 | 46.7 | 36.977 | 4.5747 | .690 |
| Basal Metabolism (kcal) Ini | 26 | 1614 | 2471 | 1921.46 | 235.562 | .528 |
| Basal Metabolism (kcal) Fin | 26 | 1448 | 2431 | 1912.69 | 241.081 | .901 |

N-number of participants; Minimum-minimum measured value; Maximum-maximum measured value; Mean-mean value; Std. Deviation-standard deviation; Ini-initial measurement; Fin-final measurement.

Table 2 displays the obtained results at the multivariate level, based on the Wilks' Lambda values (0.012), indicating a statistically significant difference between the initial and final measurements. The Wilks' Lambda value of 0.012 indicates that the fasting regimen has a significant overall impact on variables related to BC. The confidence interval provides the range within which the true effect is expected to remain, supporting the statistical significance of the observed differences.

**Table 2** Multivariate Analysis of Variance for repeated measurements

| Wilks' Lambda | F | Hypothesis df | Error df | Sig. |
|---|---|---|---|---|
| .521 | 3.867c | 5.000 | 21.000 | .012 |

The obtained results at the univariate level indicate that the variables: Weight (0.723), BMI (0.693), Fat (0.157), and Muscles (0.605) do not show a statistically significant difference between the initial and final measurements (Table 3).

**Table 3** Univariate Analysis of Variance for repeated measurements

| Variables | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Weight (kg) | .236 | 1.000 | .236 | .128 | .723 |
| BMI (kg/m²) | .028 | 1.000 | .028 | .159 | .693 |
| Fat (%) | 4.327 | 1.000 | 4.327 | 2.130 | .157 |
| Muscles (%) | .443 | 1.000 | .443 | .275 | .605 |

## 4. DISCUSSION

To the best of our knowledge, this is the first study conducted in Serbia on the effects of Orthodox religious fasting on the BC of students who follow this diet. Fasting according to Orthodox practices promotes healthy eating and a balanced lifestyle. The general quality of life for those who observe fasting is positively impacted by these practices (Chliaoutakis et al., 2002). Anthropometric characteristics did not show significant differences in the variables between the initial and final measurements in this research. Although there was no significant difference in the BMI, attention should be drawn to the high average values of BMI both before and after the fasting period. The high average values of this parameter - 27.215 before and 27.169 after the fasting period- could be explained by the fact that the majority of participants reported low levels of physical activity, with some never having engaged in any organized physical activity. Students in theological schools require physical activity, even when physical education programs cannot be effectively organized due to specific demands of boarding life. "Gymnastics," or physical education, is not a novel concept in Serbian theological schools; it has long been a part of the tradition. Reforming theological education has been a major topic in Serbian theological discourse in the last two decades of the 20th century and the first two decades of the 21st (Мићић, 2009). A similar study that included 48 participants who did not fast for 40 days and 37 participants who did fast also found high BMI values (Sarri et al., 2004). According to Haddad et al. (1999), the average BMI values for both the fasting group and the control group were in the overweight range. Among those who completed their fasting period, there was a small but statistically significant effect of fasting on BMI, however, this effect did not persist during the subsequent period of a regular, non-fasting diet. The same authors followed a group of vegans and non-vegetarians and found significantly lower BMI values in the vegan group. Research conducted by Mekonen and Haile (2019) found that the vegan diet followed by Orthodox Christians in Ethiopia reduces total cholesterol and improves BC

and basal metabolism. These findings, which demonstrate average basal metabolism values of 1921.46 before and 1912.69 after the fasting period, are consistent with our research. Further studies have shown that vegetarians typically have lower BMI values compared to individuals who consume meat (Burr & Butland, 1988; Key et al., 1999; Key & Davey, 1996). Adhering to the Mediterranean diet has also proven to be beneficial for weight loss (De Lorenzo et al., 1999). Our research demonstrates that average body weight decreased from 87.59 before fasting to 88.79 after fasting. Measurements taken after fasting show lower average of body fat percentage (24.712) and higher average of muscle mass percentage (36.977), supporting the claim that the diet during fasting positively affects BC values. The study by Karras et al. (2018) revealed that monks from Mount Athos have a lower BMI and less body fat than men from the general population who regularly fast. Another study involving 40 days of fasting among nuns and monks found decreases in body weight, upper arm circumference, and triceps skinfold thickness after fasting. A one-week fasting period was also associated with weight loss among monks, although this loss was not statistically significant (Basilakis et al., 2002). According to a year-long longitudinal study, individuals who fasted had 1.5% lower BMI at the end of the fasting phase compared to those who did not fast, with a 1.4% decrease in BMI noted in the same individuals (Sarri et al., 2003). While BMI values slightly decreased after fasting, this change is not likely to have negative consequences for individuals with normal BMI values. The authors concluded that the Orthodox religious fast can be beneficial for weight control. The results of our research also reflect the daily lives of high school theology students during non-fasting period, which can be useful information for their superiors. It is important to consider several factors that could explain the non-significant results in certain variables to better address the observed discrepancies in changes in BC. Hormonal profiles, metabolic rates, and genetic variations can all influence how an individual's BC changes in response to a given regimen. The discrepancies in BC changes and non-significant findings in some variables are likely due to a combination of individual variability, measurement limitations, adherence issues, compensatory behaviors, and other physiological and psychological factors. Addressing these factors in future studies, through longer intervention durations, improved adherence strategies, and consideration of individual differences, could help to clarify the effects of fasting on BC. The results of the research were likely impacted by the participants' reported low levels of physical activity, which limited the intervention's efficacy in terms of fat reduction or muscle maintenance. Regular physical activity (PA) in children and adolescents is associated with a decreased risk of chronic diseases, including obesity, according to meta-analyses and systematic review studies (Ochoa-Martínez et al., 2020). Incorporating initiatives to raise physical activity levels - such as personalized training plans, increased support, and education about the value of regular exercise - will be crucial for improving future outcomes. This could lead to more noticeable and beneficial changes in BC and overall health.

This study has certain limitations. It was conducted on a small sample of male students, which prevents generalizing the findings to the broader population, especially since all participants are male. The sample size is relatively limited due to the small number of enrolled students at the school. Specifically, Serbia has four High Theological Schools: Saint Sava in Belgrade, Saint John Chrysostom in Kragujevac, Saint Arsenius in Sremski Karlovci, and Holy Cyril and Methodius in Niš. Additionally, this study did not include data from dietary diaries, 24-hour meal recall reports, or questionnaires about the frequency of food consumption and physical activities, both on regular days and during

fasting. Most studies in this area have required participants to record food intake in dietary diaries, complete 24-hour meal recall reports, and fill out questionnaires regarding the frequency of food consumption during regular days and during fasting. Although these studies also have certain limitations, they typically involve larger sample sizes, which enhances the ability to generalize the findings to the general population.

## 5. CONCLUSION

The rules of the Orthodox religious fast are less strict compared to other religious fasts, but they are stricter regarding prohibited foods. Those who observe the fast must be careful about their dietary choices due to these restrictions. Although most participants in clinical studies on humans typically follow the same traditional Mediterranean diet and share the same religion, the results cannot be generalized to individuals from other ethnic groups or the Greek population. A potential advantage of existing research is that it has, for the first time, evaluated a specific dietary pattern, such as Orthodox religious fasting, which is accessible to anyone. Generally, this well-considered dietary regimen, along with the habits and lifestyle associated with Orthodox religious fasting, can support health promotion and reduce the risk of illness. It is recommended that further research should be conducted with larger samples from diverse countries and ethnic groups, considering potential influences on the findings. We believe the information provided by this study will be useful for organizing and conducting future research on the positive effects of Orthodox religious fasting on BC, particularly in health contexts. The study's findings suggest that a 40-day Orthodox religious fasting regimen may effectively support weight loss while preserving muscle mass. Further investigation is necessary to confirm our findings and examine the long-term effects of religious fasting, as well as the period following its conclusion. Due to its strict limitations, this version of the Mediterranean diet leads to significantly lower calorie intake on fasting days, which in turn reduces BC parameters. The authors noted that, because the available data is inconclusive and requires more investigation, the use of this dietary pattern as a health-promoting method should be approached with caution and personalized accordingly. In summary, this study is significant as it presents Orthodox religious fasting as a practical dietary approach for controlling BC. It paves the way for further studies to explore its benefits and limitations, ultimately guiding the development of customized dietary strategies and enhancing our understanding of fasting’s role in promoting health. The study positions Orthodox religious fasting as an effective strategy for managing BC, emphasizing its potential to aid in weight loss while maintaining muscle mass. While the findings are specific to a particular sample, the principles of Orthodox religious fasting may be applicable to other populations. This strategy could offer advantages for individuals seeking alternative fasting methods or culturally inclusive dietary strategies. With necessary adaptations to meet individual needs, this approach has the potential to benefit a wide range of populations, including those who diverse dietary preferences or cultural backgrounds.

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# PROMENE U TELESNOM SASTAVU UČENIKA SREDNJE ŠKOLE PROUZROKOVANE PRAVOSLAVNIM RELIGIOZNIM POSTOM

*Naučna istraživanja tokom poslednjih decenija su sve više usmerena na promene telesnog sastava pod uticajem Hrišćanskog pravoslavnog religijskog posta, koje je Crkva ustanovila pred velike praznike. Cilj ovog istraživanja je da pruži uvid u promene parametara telesnog sastava učenika srednje škole koji su se 40 dana (tokom Usršnjeg posta) hranili u skladu sa principima ishrane pravoslavnog posta. Uzorak ispitanika je bio sastavljen od 28 učenika koji su pohađali srednju bogoslovsku školu Svetih Ćirila i Metodija u Nišu. Svi ispitanici su bili muškog pola, prosečne starosti 17,4±1,2 godina. Antropometrijska merenja su sprovedena pre i posle 40 dana posta. Vrednosti telesnog sastava su merene uz pomoć aparata Omron BF 511 koji je prikazao podatke o težini tela, BMI - indeksu telesne mase, procentu masnog tkiva u telu, procentu skeletnih mišića i vrednosti bazalnog metabolizma. Za analizu dobijenih podataka, osim deskriptivne statistike, korišćene su statističke analize ANOVA i MANOVA za ponovljena merenja. Rezultati MANOVA analize pokazuju statistički značajnu razliku između inicijalnog i finalnog merenja (p = 0.012). Rezultati ovog istraživanja sugerišu da ishrana tokom pravoslavnog posta u trajanju od 40 dana može biti korisna kod učenika koji žele da smanje količinu telesnih masti u organizmu i da održe mišićnu masu. Potrebna su dodatna istraživanja kako bi se potvrdili dobijeni rezultati i istražili dugoročni efekti religijskog posta i perioda nakon prestanka njegove primene, naročito za ovaj uzorak ispitanika.*

Ključne reči: *Hrišćanski pravoslavni post, telesni sastav, učenici*