

ОРИГИНАЛЬНАЯ СТАТЬЯ

## NUTRITION AND SOMATIC CONDITION OF THE STAFF OF THE HOSPITAL OF ST. ALEXIS DURING GREAT ORTHODOX LENT: A CROSS-SECTIONAL STUDY

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**ABSTRACT.** Many people following different religions undergo fasting as their religious courtesy but the effects of being in a Lenten diet among Russians have not been fully studied yet. The research evaluates the effect of fasting on nutritional status during Great Lent.

**Methodology.** The study was performed among 44 people aged 23 to 65 years, including 9 men and 35 women. A physical examination was carried out and their complaints about well-being were noted carefully. The nutrient composition of the diet was determined by the method of frequency analysis of food consumption during the period of the Great Lent. A general blood test was done to assess anaemia.

**Results.** High rate of vitamins A, D, H, and B<sub>12</sub>, calcium, zinc, chromium, iodine, and molybdenum deficiencies in diet were observed. Many patients complained of dyspepsia, skin dryness, skin peeling, high affinity towards respiratory infections, fatigue, and irritation. The given symptoms were correlated with decreased intake of iodine, zinc, molybdenum, chromium, vitamins H and B<sub>12</sub>.

**Conclusion.** People who follow Great Lent are recommended to consume a high amount of various fruits and vegetables, nuts, sea algae, green leafy vegetables, thermally processed legumes and grains. For the prevention of vitamins D and B<sub>12</sub> deficiencies, it is suggested to consume fortified foods and supplements.

**KEYWORDS:** religious fasting, plant-based diets, micronutrients, vitamins, macro and trace elements.

### INTRODUCTION

In Orthodox Christianity, there are several large Lents (Great, Assumption, and Christmas). In addition, Christians are advised to follow fasting days (Wednesday and Friday) (Simeon Archimandrite; Averintsev et al., 1993–1995). During Lent, they are abstained from having “unscrupulous” foods: meat, offal, eggs, and dairy products. Depending on the specific period of the Lent and the day of the week, the consumption of fish, vegetable oils, and wine may be allowed. Plants are the major source of food in these periods (Tipikon).

Under a number of assumptions, it can be said that the nutrition of religious people during the fasting periods is an alternation of pescetarianism and veganism with the predominance of the latter. Thus, it can be supposed that the nature of nutrient intake and

the associated clinical effects in the fasting state should have similarities with those of vegans.

Studies of completely plant-based diets have shown that their protein content is usually lower than in mixed ones (Larsson et Johansson, 2002; Crowe et al., 2011; Knurick et al., 2015). In addition, even with sufficient protein content, such diets may be deficient in methionine (Venti et Johnston, 2002; McCarty et al., 2009; Galchenko et al., 2017). The content of saturated fatty acids in plant food is usually insignificant (Craig, 2009). They also have less long-chain ω3 polyunsaturated fatty acids (eicosapentaenoic and docosahexaenoic) (Rosell et al., 2005). There is conflicting information regarding carbohydrate content. If dietary fiber is usually higher in plant diets than in mixed ones (Institute of Medicine, 1998), then the consumption

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of starch and, especially, simple carbohydrates is highly dependent on individual preferences.

Plant diets usually contain more potassium and magnesium. At the same time, the exclusion of animal products from the diet leads to an increased risk of calcium deficiency (Galchenko et Nazarova, 2019a, Korobejnikova, 2018a). The latter is primarily associated with a much lower intake of vitamin D with food (Elorinne et al., 2016; Sobiecki et al., 2016). Another vitamin that is almost completely absent in plant diets is vitamin B12 (Elorinne et al., 2016; Sobiecki et al., 2016). On the other hand, vegans are much richer in folic acid (Elorinne et al., 2016; Sobiecki et al., 2016; Schüpbach et al., 2017).

In case of trace elements, plant diets are usually associated with a higher risk of developing zinc (Foster et al., 2013; Melina et al., 2016; Schüpbach et al., 2017; Korobejnikova, 2018b, Galchenko et Nazarova, 2019b), iodine (Kristensen et al., 2015; Richter et al., 2016; Schüpbach et al., 2017; Galchenko et Nazarova, 2020), and selenium deficiencies (Galchenko, 2019; Hoefflich et al., 2010; Schüpbach et al., 2017).

The conducted research in fasting people is supposed to have similar results as in people with completely plant diets, but with some features.

## MATERIALS AND METHODS

The study involved 44 people aged from 23 to 65 years, median – 43, including 9 men and 35 women with a median body mass index (BMI) of 23.4 kg/m<sup>2</sup> with a maximum value of 33.8 kg/m<sup>2</sup> and minimum value of 16.0 kg/m<sup>2</sup>. All the examined people were employees of the ANO “Central Clinical Hospital of St. Alexis MP ROC” in Moscow and followed Great Lent (at the time of the survey, the average duration of the fast was 40 days). Before conducting the research, written consent was obtained from all participants. The research was approved by the Ethical Committee of the Federal Research Centre of Nutrition, Biotechnology, and Food Safety, protocol № 6 (22.12.2017).

A physical examination was carried out with all the participants and their complaints about well-being were collected. All the subjects underwent a general blood test. The nutrient composition of the diet was determined by the method of frequency analysis of food consumption during the period of the Great Lent. Calculation of the average intake of macro and micronutrients with food was implemented using the software Nutrilogic (PLC “Nutrilogic”, Ryazan, Russia).

Analysis of the results of the study was carried out using descriptive statistics. The distribution of the data was unsymmetrical, so medians and percentiles were used. The calculation was performed using the program SPSS 23.

## RESULTS

An important phenomenon to be noticed was that the results of the general blood test did not differ from normal values (Table 1).

*Table 1. Results of a general blood test in subjects undergoing the Great Lent*

Index	Value [25 <sup>th</sup> percentile; 75 <sup>th</sup> percentile]
Hemoglobin	126.6 [120.8; 136.6]
Red blood cells	4.3 [4.1; 4.7]
White blood cells	4.66 [3.98; 5.69]
Platelets	211.3 [195.1; 254]
Lymphocytes	1.5 [1.17; 2]
Neutrophils	2.6 [1.6; 3.4]
Monocytes	0.3 [0.2; 0.5]

Then, the levels of intake of different macro and micronutrients were measured and their distribution was observed, which is illustrated in Table 2.

The general caloric content didn't have any special features. Consumption of the protein was adequate. Redistribution of basic energy substrate was noted towards decreased consumption of fats and increased carbohydrates consumption. Most of the subjects didn't consume excessive amounts of cholesterol. Consumption of potassium, magnesium, phosphorous, iron, cobalt, manganese, and copper was high.

Almost half of the subjects consumed more than 5 grams of potassium per day. At the same time, a majority of the fasting people had a deficiency of calcium, iodine, molybdenum, chromium, and zinc. Subjects consumed enough amount of vitamin B1, folic acid, ascorbic acid and vitamin E. Approximately half of the people had deficiency of riboflavin, pantothenic acid, pyridoxine, and niacin. Retinol equivalent, biotin, and cobalamin were highly low in consumption, and vitamin D was almost totally absent. The distribution of micronutrient deficiency is illustrated in Figure 1.

Table 2. *Distribution of intake of microelements*

Nutrient per day	25 <sup>th</sup> percentile	50 <sup>th</sup> percentile	75 <sup>th</sup> percentile	Recommended daily allowance*
Energy, kcal	2005	2812	3590	
Protein, gm	53	77	104	
Fats, gm	59	74	122	
Carbohydrate, gm	320	415	546	
Cholesterol, mg	31	76	133	< 300
Potassium, mg	3441	4810	6129	2500 (Norms, 2009), 4000 (Strohmet al., 2017)
Calcium, mg	551	674	1060	1000
Sulphur, mg	79	126	214	N/A
Magnesium, mg	445	540	686	400
Phosphorous, mg	1032	1288	1940	800
Iron, mg	20	25	32	10 (males), 18 (females)
Vanadium, µg	2.9	5.5	9.3	10 (Institute of Medicine, 2001)
Iodine, µg	58	94	171	150
Cobalt, µg	14	22	34	10
Manganese, mg	4.2	5.5	7.6	2
Copper, mg	1.6	2.1	2.9	1
Molybdenum, µg	10	17	33	70
Selenium, µg	51	60	101	70 (males), 55 (females)
Chromium, µg	8	14	24	50
Zinc, mg	6.6	8.9	11.2	12
Retinol equivalent, µg	327	565	992	900
Vitamin D, µg	0	0	0.2	10
Tocopherol equivalent, mg	18	25	31	15
Vitamin B <sub>1</sub> , mg	1.8	2.2	3.3	1.5
Vitamin B <sub>2</sub> , mg	1.4	1.8	2.3	1.8
Vitamin PP, mg	17	20	26	20
Vitamin B <sub>4</sub> , mg	75	100	152	500
Vitamin B <sub>5</sub> , mg	3.9	4.9	8.4	5
Vitamin B <sub>6</sub> , mg	1.5	2.1	2.6	2
Vitamin H, µg	6	11	21	50
Vitamin B <sub>9</sub> , µg	347	421	569	400
Vitamin B <sub>12</sub> , µg	0.08	0.3	1.3	3
Vitamin C, mg	118	173	249	90

Note: \* – source is “Norms of physiological requirements for energy and nutrients for various groups of the population of the Russian Federation Methodical recommendations, 2009”, unless otherwise indicated.

At the same time, it was determined that the subjects had problems with the skin: dry skin and skin peeling. As far as the gastrointestinal tract is concerned, dyspepsia was observed in almost half of the patients.

In addition to changes in the skin and gastro-

intestinal tract, many individuals in the fasting period had increased fatigue and weakness. Nearly a third of the people had a high affinity towards respiratory diseases during the fast, while 27% of people complained of increased fatigue (see Figure 2).

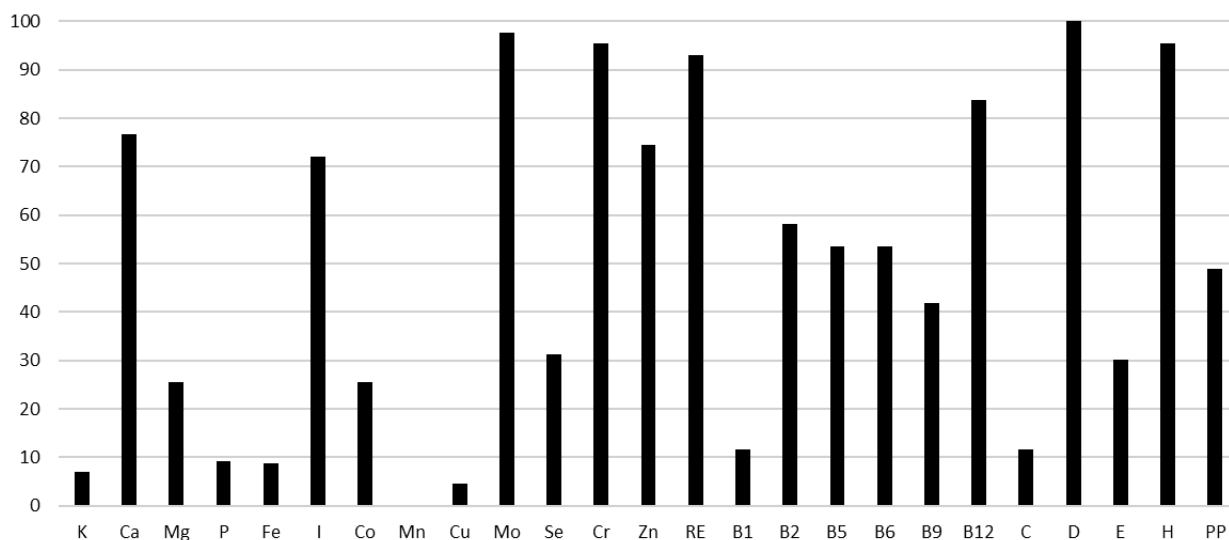


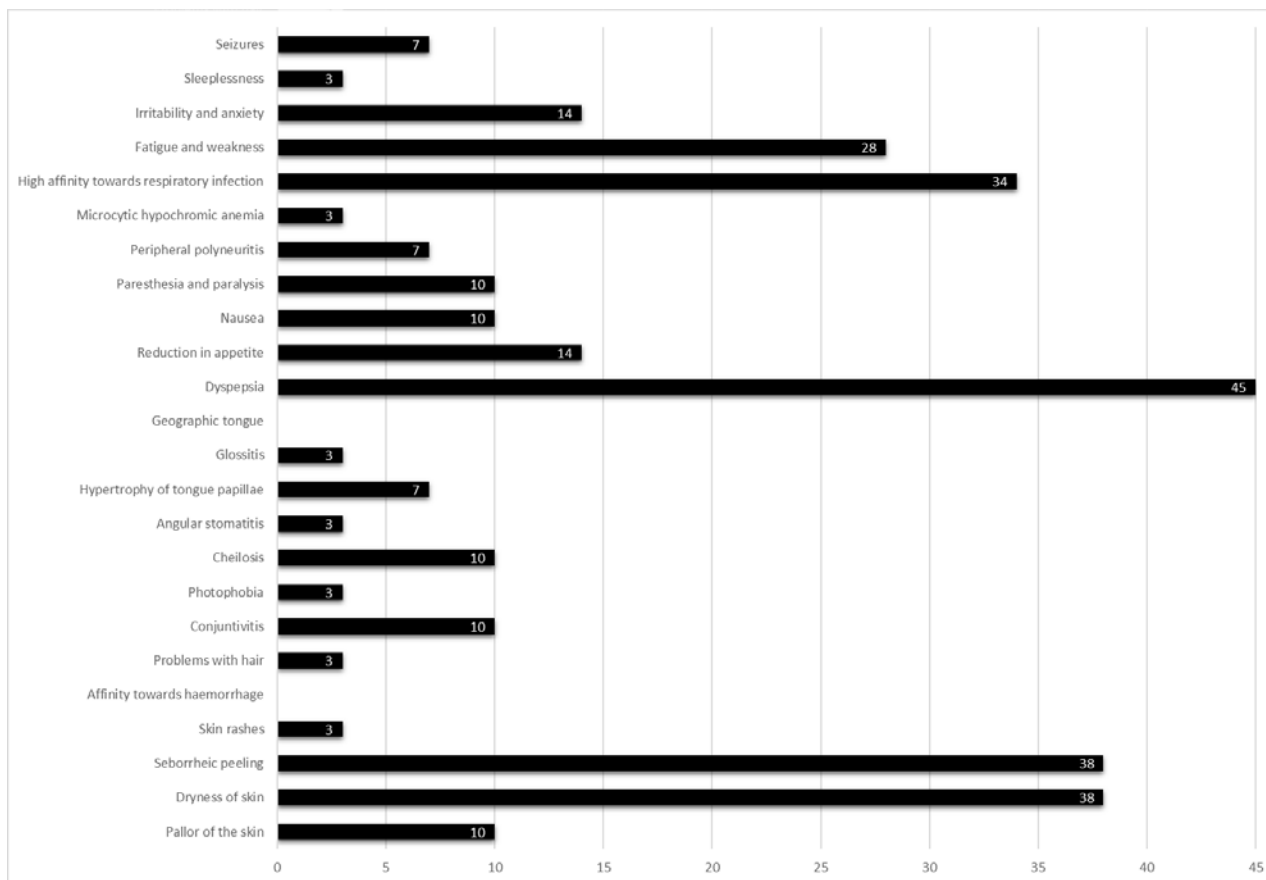
Figure 1. Percentage of people with decreased intake of certain micronutrients

Table 3. Percentage of the frequency of pathological conditions in organs and systems as a result of a deficiency in molybdenum and chromium intake in people who followed Great Lent

Symptom	Frequency of complaints during molybdenum deficiency, %	Frequency of complaints during chromium deficiency, %
Dryness of skin	29	40
Skin peeling	29	44
Dyspepsia	49	50
Affinity towards infection	31	29
Fatigue and weakness	31	32

Table 4. Percentage of the frequency of pathological conditions in organs and systems as a result of a deficiency in zinc intake in people who followed Great Lent

Symptom	Frequency of occurrences, %
Dryness of skin	36
Skin peeling	36
Dyspepsia	46
Reduction in appetite	21
Affinity towards infection	32
Fatigue and weakness	36
Irritability	21



**Figure 2.** Percentage of the frequency of pathological conditions in organs and systems during Great Lent

**Table 5.** Percentage of the frequency of pathological conditions in organs and systems as a result of a deficiency in vitamin B<sub>4</sub>, vitamin B<sub>12</sub>, and vitamin H intake in people who followed Great Lent

Symptom	Frequency of complaints during vitamin B <sub>4</sub> deficiency, %	Frequency of complaints during vitamin B <sub>12</sub> deficiency, %	Frequency of complaints during vitamin H deficiency, %
Dryness of skin	63	445	48
Skin peeling	56	48	48
Dyspepsia	75	52	59
Reduction in appetite	38	21	19
Affinity towards infection	31	35	41
Fatigue and weakness	38	35	41
Irritability	25	17	22

Only subjects with iodine deficiency complained of having dyspeptic disorders, skin peeling, and dryness of the skin.

With insufficient consumption of molybdenum and chromium, dryness of skin and skin peeling were

observed (28% of the observed subjects with molybdenum deficiency had skin dryness and skin peeling, whereas 40% and 44% of the observed subjects had the same symptoms with a deficiency of chromium, respectively).

Dyspeptic disorders were observed in half of the individuals who had a deficiency of molybdenum or chromium.

As in the case of iodine deficiency, fasting people with deficiencies in molybdenum and chromium also had a high susceptibility to respiratory infections, and fatigue (see Table 3).

In addition to a pronounced deficit in the consumption of the above elements, most of the subjects had a deficiency in zinc consumption (74%). A decrease in zinc intake was associated with a number of complaints (see Table 4).

The subjects with the deficiency of vitamin B<sub>4</sub> and B<sub>12</sub> were found to complain about dyspepsia, dryness of skin, and skin peeling, while the majority of people with vitamin H deficiency had not only dyspepsia, dryness of skin and skin peeling but also affinity towards infection and fatigue (see Table 5).

## DISCUSSION

Higher distribution of deficiency of calcium, molybdenum, chromium, zinc, vitamins A, H, B<sub>12</sub>, and D was observed. The most common complaints among the examined people were: dryness and peeling of the skin (38%), dyspeptic symptoms and decreased appetite (45% and 14% respectively), increased fatigue and irritability (28% and 14% respectively), as well as a decrease in the body's immune resistance (34%). These complaints may be manifested due to insufficient intake of zinc, vitamins B<sub>6</sub> and H. The mentioned complaints were highly correlated with decreased consumption of biotin, cobalamin, zinc, chromium, molybdenum, and iodine.

Other studies have also noted changes in the chemical composition of the diet during fast. When evaluating the nutrient intake of students of the Orthodox gymnasium of Vladivostok, a significant decrease in the consumption of iodine and vitamins A, B<sub>1</sub>, and B<sub>2</sub>, as well as the total calorie intake during the Lent was revealed (Titova and Nagirnaya, 2012).

In a study conducted by Greek authors, a decrease in almost all indicators was found in a general blood test, such as haemoglobin, haematocrit, mean corpuscular volume, white blood cells, etc. in individuals who followed the Orthodox Great Lent, just before Easter (Makedou et al., 2018). The total antioxidant availability of blood, in turn, was found to be increased significantly. An increase in lymphocyte concentration was also noted. At the same time, in a study of Sarri et al. a

40-day fast of Christmas Lent did not have such effects on blood haemoglobin (Sarri et al., 2005). The question of anaemia status in plant diet followers is discussible. Although the consumption of iron is higher, its bioavailability is usually much lower in plant products (Aggett, 2012; Galchenko et Sherstneva, 2020; Haider et al., 2018).

Other studies of the same authors (Sarri et al., 2003; 2004; 2007) revealed the beneficial effect of all three large Orthodox Lents (Christmas, Great, and Assumption) on blood lipid profile. It was noted that after Lent people who had undergone fast had a decrease in serum concentrations of total cholesterol, low density lipoproteins (LDL), high density lipoproteins (HDL), and BMI in comparison to the corresponding indicators before the beginning of the fast. In the control group that did not comply with Lent, significant changes in blood lipid profile and BMI were not observed. When analysing the diet during the Lent, a decrease in the energy value of the diet by 10%, a decrease in the fat content in the diet by 17%, and an increase in carbohydrates by 23% were observed as compared to the diet in non-fasting periods. The dietary fiber content was increased by 43%. During Lent, the protein content and total intake of calcium and sodium were also decreased. The intake of vitamins did not differ between groups except for folic acid, which was consumed significantly higher during fasting. The intake of magnesium and iron was also higher during fasting, but the bioavailability of this iron was likely to be reduced (Institute of Medicine, 2001). The annual dynamics of the nutrient composition of the diet of the control group did not change by more than 7%. It is worth noting that this study was conducted in Crete, the mixed diets of the population of Russia change more significantly during the year.

Since the variant of apolipoprotein E has a significant effect on the lipid profile, and in particular, on the sensitivity of the blood lipid spectrum to diet therapy (Lopez-Miranda et al., 1994; Dreon et Krauss, 1997; Ordovas, 1999), the authors conducted a genetic study of the distribution of apoE gene polymorphisms. The result showed that it did not differ between groups.

In the work of Papadaki et al., when evaluating the nutritional composition of the diet of Greek monks during and after Lent, similar results were obtained. On fasting days, monks consumed less total fat, saturated fatty acids, trans fats, and calcium. At the same time, during Lent, the intake of

dietary fiber, iron, and folate increased significantly. Consumption of B vitamins, vitamins C and E, as well as sodium, potassium, zinc, and phosphates did not differ during and after fast (Papadaki et al., 2008).

Other Greek authors attempted to understand the influence of the Orthodox Lent on blood coagulation, but no significant differences were found (Liali et al., 2015).

Serum concentrations of vitamins A and E during Lent can decrease, however, as shown by Sarri et al., these changes are proportional to the decrease in the concentration of total cholesterol and LDL. Therefore, the alpha-tocopherol to cholesterol ratio as a whole did not change in their study (Sarri et al., 2009). As shown by Karras et al., the monks of Athos monastery during fasting days consume fewer carbohydrates and saturated fats but more protein. The energy value of their diets on fasting days was also lower. These results are not entirely consistent with most of the published articles. In addition, a study of a group of 50 monks from the Athos monastery revealed a decrease in serum concentrations of calcidiol coupled with hyperparathyroidism, which was surprising for such a southern region. This can be explained by the fact that the monks wear cloths covering full body all year round, which causes less total exposure to sunlight, despite the relatively high exposure to ultraviolet rays in this region. At the same time, calcium concentrations remained at normal values, as did the indicators of fat and carbohydrate metabolism (Karras et al., 2017). Although plant products often contain calcium with very low bioavailability due to the action of oxalic and phytic acids, some foods are rich in highly available calcium. Kale or tofu can be good sources of calcium during fasting period (Galchenko et Ranjit, 2019; Tucker, 2014).

The features of the Danilov fast were evaluated by Bloomer et al. As expected, the total caloric intake of the diet, as well as the intake of protein, total fat, saturated fatty acids, trans fats, and cholesterol were lower in the observed subjects. At the same time, the intake of carbohydrates, dietary fiber, and ascorbate increased. After Lent (21 days), there was a decrease in the concentrations of total cholesterol and LDL in the blood test (Bloomer et al., 2010).

A review of 2002 did not provide a clear answer to the question of how protein intake

changes during Lent. However, most of the studies showed a decrease in saturated fat intake and an increase in carbohydrates and dietary fiber. Many authors have also noted a decrease in serum concentrations of total and LDL cholesterol (Basilakis et al., 2002).

The results of the review of 2017 are almost completely consistent with these data. The question of the status of vitamins B12, vitamin D, and calcium remains open to this day. There is no clarity regarding the effects of fast on protein intake (Koufakis et al., 2017; Persynaki et al., 2017). In addition, since the source of the protein is changing, its amino acid composition is also changing. Data from previous studies indicate that plant-based diets do not always adequately supply the body with some essential amino acids, particularly with methionine, despite the normal amount of protein intake (Galchenko et al., 2017).

It is interesting to note that not a single study has found a significant decrease in vitamin B12 intake during Lent, which would otherwise be expected. Such a significant difference from the vegan diet is due to the fact that the Lent contains some days when consumption of fish is allowed. The main reason, apparently, is the ambiguous attitude towards the consumption of marine invertebrates during Lent (Press Service of the Patriarch of Moscow and All Russia, 2015).

In their review, Bloomer and Trepanowski emphasized that the Orthodox Lent can have a significant healing effect on the body, but it is necessary to rationally approach this process (Trepanowski et Bloomer, 2010). A rational approach is especially appropriate for groups that are most sensitive to changes in nutrition. Thus, in a study of lactating women in Ethiopia, it was found that in those periods, when mothers followed Lent, the physical development of their children slowed down (Desalegn et al., 2019).

In their review, Lazarou and Matalas noted that, in general, the practice of fasting is likely to have a beneficial effect on the body, since restricting the intake of animal food helps normalize carbohydrate and fat metabolism, while the intake of micronutrients does not suffer so much, and in some cases (with regard to the intake of folate, magnesium or dietary fiber) Lenten diet has an advantage (Lazarou et Matalas, 2010).

Chliaoutakis et al. has pointed out that fasting people generally have a healthier lifestyle. In addition, the authors noted that religious people have a

positive psycho-emotional state, which enhances health in general through psychosomatic mechanisms (Chliaoutakis et al, 2001).

### CONCLUSION

In order to reduce the change of micronutrient deficiency during Great Lent, it is recommended to consume much colorful vegetables, rich in carotenoids and chromium. Biotin is found in nuts and different fruits. Source of highly bioavailable calcium and zinc can be green leafy vegetables with less oxalate content like kale. Besides it, even slight thermal treatment can decrease phytates' activity with respect to these metals. Furthermore, mineral water and fortified products can be a good source of calcium. Sea algae can provide some iodine and molybdenum. Adequate supply with vitamins D and B12 in fasting people seems to be the most difficult task. The source of these vitamins may be fortified foods or supplements. Moreover, both of these substances may be accumulated in the human body for a quite long period of time. In this way, even a complete absence of intake of these nutrients during the Lent may not lead to any clinical significance, provided that the consumption of these substances was enough before the Lent.

From the research, it can be concluded that although there are some minor symptoms associated with the Lenten diet like dryness and peeling of the skin, dyspeptic symptoms with decreased appetite, increased fatigue, and irritability, there was no catastrophic failure with body's organs and systems. In contrary, the observed people had religious satisfaction which concludes that there should not be any restriction for fasting, provided that the person is physically and mentally well.

### LIMITATIONS

The examined people had significant heterogeneity in sex and age, while they were relatively few in number. In addition, there was no way to assess the dynamics of patients, as well as to determine the degree of contribution of the restrictions imposed by the Lenten diet on the nutritional composition of the diet, since the study was conducted once.

### ACKNOWLEDGMENTS

The authors express their deep gratitude to the head doctor of the Autonomous Non-commercial organization Central Clinical Hospital of Saint Alex PM ROC (Patriarch of Moscow, Russian Orthodox

Church) – Alexey Yuryevich Zarov and to the head of the clinical laboratory of the Hospital – Sukhno Ekaterina Olegovna, who helped in organizing the research.

### FOUNDATION

The research was carried out by the Federal State Budgetary Institution of Nutrition, Biotechnology and Food Safety with the support of subsidy for accomplishing the governmental assignment.

### CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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## ПИЩЕВОЙ И СОМАТИЧЕСКИЙ СТАТУС СОТРУДНИКОВ ГОСПИТАЛЯ СВЯТИТЕЛЯ АЛЕКСИЯ В ВЕЛИКИЙ ПОСТ: ОБСЕРВАЦИОННОЕ ИССЛЕДОВАНИЕ

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**РЕЗЮМЕ.** Последователи различных культов придерживаются периодических ограничений в диете по религиозным предписаниям. Влияние соблюдения Великого поста на православное население России на настоящий момент изучено недостаточно полно. Цель работы – оценить пищевой статус верующих во время Великого поста.

**Методология.** Исследование проведено среди 44 человек, 9 мужчин и 35 женщин, в возрасте от 23 до 65 лет. У обследованных были собраны жалобы на симптомы микронутриентных дефицитов, проведен физикальный осмотр. Оценка фактического питания проводилась за время соблюдения Великого поста, методом частотного анализа. Выполнен общий анализ крови.

**Результаты.** Обнаружена высокая частота дефицита потребления витаминов А, D, Н и В<sub>12</sub>, а также кальция, цинка, хрома, йода и молибдена. Многие пациенты жаловались на диспепсию, высокую подверженность простудным заболеваниям, слабость и раздражительность. Часто обнаруживались сухость и шелушение кожи. Указанные симптомы коррелировали с недостаточным потреблением йода, цинка, молибдена, хрома, витаминов Н и В<sub>12</sub>.

**Заключение.** Лицам, придерживающимся Великого поста, рекомендуется потреблять больше разных фруктов и овощей, орехов, зелени, морских водорослей, термически обработанных бобовых и зерновых. Для предотвращения развития дефицита витаминов D и В<sub>12</sub> можно добавить в рацион обогащенные продукты или пищевые добавки.

**КЛЮЧЕВЫЕ СЛОВА:** религиозный пост, растительные рационы, микронутриенты, витамины, макро- и микроэлементы.

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