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ORIGINAL ARTICLE

CALCIUM AND VITAMIN D CONTENT IN THE MENUS OFFERED TO ELDERLY PEOPLE DURING SPA TREATMENT IN KRYNICA-ZDRÓJ RESORT

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ABSTRACT

Background. Calcium and Vitamin D are key nutrients in the diet of elderly people due to osteoporosis. One of the places where seniors, through observation, can gain knowledge on how to compose a meal to make it wholesome is a sanatorium that combines spa treatment and rehabilitation with diet therapy.

Objective. The aim of the study was to assess the menus in terms of the content of calcium and vitamin D in the meals consumed by the elderly people during spa treatment in the health resort and to compare the results with the Polish Dietary Reference Values.

Material and methods. The study was carried out at Krynica Zdrój resort among patients who underwent spa therapy as part of 14-day stay periods. Menus prepared for 3 different diets were assessed, namely regular diet, easy-to-digest diet and diet for diabetics with limitation of easily digestible carbohydrates. The meals were served for 309 people (194 women and 115 men) most of them aged over 50.

Results. All meals served in the spa were deficient in calcium and vitamin D. The mean daily intake of calcium throughout the six months was 711.68 mg, whereas the Estimated Average Requirement (EAR) for both women and men is 1000 mg. The mean contents of vitamin D in all 3 served diets were at a similar level. The diets daily supplied approximately 4-5 µg vitamin D/person, which constituted about 30% of the daily requirement for this vitamin.

Conclusions. In order to reduce the risk of diseases resulting from calcium and vitamin D deficiency, the amount of foods containing these nutrients should be increased in daily diet or, if this is impossible, they should be supplemented.

Key words: *calcium, vitamin D, nutrition, spa resort, sanatorium, menus*

STRESZCZENIE

Wprowadzenie. Wapń i witamina D są kluczowymi składnikami diety osób starszych w aspekcie osteoporozy. Jednym z miejsc, gdzie seniorzy poprzez obserwację mogą zdobyć wiedzę na temat komponowania zdrowego posiłku jest sanatorium, które łączy leczenie uzdrowiskowe i rehabilitację z dietoterapią.

Cel. Celem badań była ocena jadłospisów pod kątem zawartości wapnia i witaminy D w posiłkach spożywanych przez osoby starsze w trakcie leczenia uzdrowiskowego oraz porównanie wyników z obowiązującymi w Polsce normami żywienia.

Materiał i metody. Badanie przeprowadzono w uzdrowisku Krynica Zdrój w grupie kuracjuszy korzystających z 14-dniowego pobytu uzdrowiskowego. Ocenie poddano 14-dniowe jadłospisy przygotowane dla 3 różnych diet, a mianowicie podstawowej, łatwostrawnej oraz diety z ograniczeniem łatwo przyswajalnych węglowodanów. Posiłki spożywało 309 osób (194 kobiet i 115 mężczyzn), w większości powyżej 50. roku życia.

Wyniki. Wszystkie posiłki serwowane w sanatorium były ubogie w wapń i witaminę D. Średnia zawartość w nich wapnia w ciągu sześciu miesięcy wyniosła 711,68 mg, podczas gdy średnie zapotrzebowanie (EAR) zarówno dla kobiet jak i mężczyzn wynosi 1000 mg. Średnia zawartość witaminy D we wszystkich 3 dietach była na zbliżonym poziomie. Diety dostarczały dziennie około 4–5 µg witaminy D, co stanowiło około 30% dziennego zapotrzebowania na ten składnik.

Wnioski. W celu zmniejszenia ryzyka chorób wynikających z niedoboru wapnia i witaminy D należy w codziennej diecie zwiększyć ilość pokarmów zawierających te składniki lub, jeśli to niemożliwe, suplementować.

Słowa kluczowe: *wapń, witamina D, żywienie, sanatorium, jadłospisy*

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INTRODUCTION

Modern society has an age structure characterized by an increase in the number of elderly people with a reduced number of new-borns. Therefore, it is important to take measures in every possible field to ensure that the elderly remain in proper health and physical condition for as long as possible. Many social campaigns promote a proper lifestyle and physical activity. Healthy eating is also promoted. One of the places where seniors, through observation, can gain knowledge on how to compose a meal to make it wholesome is a sanatorium that combines spa treatment and rehabilitation with diet therapy [1, 2]. The obligation of the diet therapy during spa treatment results from the Polish regulations [3].

In Poland and other countries of Central and Eastern Europe, spa treatment is perceived as an integral part of healthcare systems. It is estimated that annually 400 000 patients in Poland use spa services and most of them receive this treatment financed by the National Health Fund [1]. Although spa treatment is very popular in Poland, nutritional value of menus planned for elderly in sanatoriums has not been sufficiently investigated.

The essence of spa treatment is a 2- or 3-week therapeutic, rehabilitative and preventive procedure delivered in a sanatorium or other spa hospital located in health resorts. Most of such places use natural mineral waters, gases and peloids in the form of bathing, drinking, or inhalation. Balneotherapy is thought to be a method of treating various diseases, rehabilitation and prevention that's why in sanatorium, there are many therapeutic devices for patients, such as mineral water pump rooms, graduation towers, parks, spa pools, which perform rehabilitation and treatment functions. According to the Ministry of Health, there are currently 45 towns in Poland considered to be health resorts. Among them is Krynica-Zdrój, whose history dates back to 1793.

For the comfort of life of the elderly, it is important to have the correct content of vitamins and minerals in meals the deficiencies of which may result in various adverse changes in the body, such as osteoporosis. Adequate nutrition, especially adequate intake of vitamin D and calcium and limitation of sugar and saturated fatty acids in a diet [4], the avoidance of risk factors such as smoking and abuse of alcohol [5] and regular exercises are the most effective nonpharmacologic measures preventing osteoporosis. The conscious composition of meals and an appropriate diet can directly translate into health, better physical and mental condition, and greater independence of the elderly, which in turn gives a measurable social and economic effect.

Calcium is a mineral that is essential in the daily diet of people of all ages. According to the Polish Dietary Reference Values (DRVs) the level of Estimated Average Requirement (EAR) for calcium is 1000 mg for men over 65 years and women over 50 [6].

Vitamin D is essential for the proper functioning of the body. Its active form, i.e. 1,25-dihydroxyvitamin D, has a number of positive effects, especially on the skeletal system. It also affects the immune system, namely: it regulates the body's immune response to factors that threaten it. It was shown that its deficiency may cause the development of autoimmune diseases or their aggravation [7]. Regular vitamin D supplementation also reduces the risk of developing cardiovascular and nervous system diseases, including multiple sclerosis, Alzheimer's disease.

The recommended intake for vitamin D established in 2020 by the National Institute of Public Health NIH – National Research Institute at the level of Adequate Intake (AI) is 15 μg/person/day [6].

Although spa treatment is very popular in Poland, content of calcium and vitamin D in meals served for elderly in sanatoriums has not been sufficiently investigated. To our knowledge, only one study concerning nutritional values was realised in spa [8].

The aim of the study was to assess the menus in terms of calcium and vitamin D content in the meals consumed by elderly people during spa treatment at the Krynica-Zdrój resort and to compare the results with the Polish Dietary Reference Values [6]. The study also assessed the energy value of meals, and protein, carbohydrate and fat content in them.

MATERIAL AND METHODS

The research was based on the analysis of the menus served to patients receiving 14-days long spa treatment in Krynica-Zdrój in the first half of 2020. Six patients' stays, one in a month, were randomly selected. Three types of diets, namely regular diet, easy-to-digest diet and diet for diabetics with limited digestible carbohydrates were assessed for each stay, resulting in a data obtained from 252 daily menus.

14-days menus were analysed with regard to the number of patients, their gender and the diet used. The obtained data of patients was completely anonymous and contained only information about gender, age, height, body weight and the diet used during the spa treatment. All anthropometric measurements were made and recorded by nurses employed in the spa. Body weight and height were measured on the first day of patients' stay using a certified scale (BA200L, Axis, Poland). Based on the information obtained about the body weight and height of the patients, the BMI was calculated. The BMI values were compared with the classification established by the World Health

Organization, namely: normal weight was in the range of 18.5-24.9 kg/m^2, overweight: 25-29.9 kg/m^2, obesity class I: 30-34.9 kg/m^2, obesity class II: 35-39.9 kg/m^2, obesity class III: BMI ≥ 40 kg/m^2.

The spa center had its own kitchen where meals were prepared. The spa manager and all patients were informed of the study procedures and provided written informed consent.

Dieta 6 software was used to assess energy intake and content of calcium, vitamin D, proteins, fats and carbohydrates in the patients' meals [9]. Dieta 6 software contains a database of Polish food composition tables [10] and recipes based on the Polish cuisine. The nutrient content was calculated for each menu. All calculations considered food losses resulting from technological processes. Then all values were summed up to achieve energy, calcium, vitamin D, proteins, fats and carbohydrates intake during 14 days long stay. In this way, the average intake of calcium, vitamin D and energy and macronutrients were estimated. Descriptive statistics (mean and standard deviation) were used to report the nutritional value of the menus [11]. Next, the results obtained were compared to the Dietary Reference Values for elder people in Poland [6]. The Estimated Average Requirement (EAR) for calcium and the adequate intake (AI) for vitamin D were used for comparisons. The average energy value of the menus established by the spa dietitian was 2500 kcal, and the percentage distribution of the energy supply was planned as follows: 35% of the daily energy supply during breakfast, 40% of the energy was lunch and 25% dinner. Taking into account the relatively low physical activity of the patients and their age, the physical activity level (PAL) was 1.6 and the planned energy value for all age groups was 1925 kcal for women and 2240 kcal for men [6]. It was assumed that the patients consumed all food served.

Characteristics of the group

The study was carried out at the Krynica Zdrój resort among patients who underwent spa therapy as part of 14-day stay periods. The study population consisted of 309 patients, including 115 males and 194 females, of whom almost 95% were over the age of 50. The age of the patients ranged from 39 to 87 years, with the mean age of 62.58 years. Most patients were on regular diet or easy-to-digest diet with predominance of water-boiled, low-fat meals (Table 1).

Women constituted 63% of the group. Table 2 presents the division of the study group by gender, BMI and type of diet used by patients. The most popular diet in the group of women was regular diet; it was used by 43.3% of patients. Among men, the regular diet was also the most popular (61.7%). Easily digestible diet was much more popular among women than men. Only one woman in the study population followed an easily digestible diet with reduced fat and was excluded from the analysis. Detailed data is presented in Table 2.

Table 1. Age of the study groups

	Total (N=309)	Women (N=194)	Men (N=115)	p*
Mean value [years]	62.58	62.19	63.23	0.231
SD	7.40	7.48	7.25	
Min	39	39	39	
Max	87	84	87	
>50 years [%]	94.8	94.3	95.6	

*- *Student's* t-test

Table 2. Study group according to gender, BMI and type of diet used (N = 309)

		Women (N=194) %	Men (N=115) %	p
Diet	Regular	43.3	61.7	0.0043
	Easy-to-digest	42.8	23.5	
	With limitation of easily digestible carbohydrates	13.4	14.8	
	With limitation of fat	0.5	0.0	
BMI	Normal weight	33	21.7	0.038
	Overweight	42.3	40.9	
	Obesity class I	17.0	31.3	
	Obesity class II	5.7	4.4	
	Obesity class III	2.0	1.7	

The body mass index in the studied group most often indicated overweight - 82 women and 47 men struggled with it, which constituted 41.7% of the group. In general, overweight and obese patients represented up to 71.3% of the group. Obesity was more common among men than among women. Detailed data is presented in Table 2.

RESULTS

The minimum calcium content in the assessed menus was in the diet with limitation of easily digestible carbohydrates and was 198.95 mg. The maximum content of calcium amounted 1962.93 mg and it was found in the regular diet. The mean calcium intake throughout the six months was 711.68 mg. The calcium content provided in the meals did not meet the recommended values (EAR: 1000 mg), neither in the group of women nor in the group of men (Table 3).

The average vitamin D content in the three diets significantly differed from the Polish DRVs. The recommended Adequate Intake (AI) for vitamin D,

Table 3. Calcium and vitamin D content in menus in six month period compared to the Polish Dietary Reference Values

Diet	Calcium [mg]							Vitamin D [µg]					
	N	Mean value	SD	Min	Max	EAR [mg/ person/ day]	% of the daily requirement for women	% of the daily requirement for men	Mean value	SD	Min	Max	AI [µg/ person / day	% of the daily requirement for women	% of the daily requirement for men
Regular	155	812.41	202.47	505.36	1962.93	1000	81.2	81.2	4.71	4.54	0.75	28.87	15	31.4	31.4
Easy-to-digest	110	776.07	209.80	485.80	1491.16	1000	77.6	77.6	4.55	4.15	0.66	28.87	15	30.3	30.3
With limitation of easily digestible carbohydrates	43	546.57	206.44	198.95	1262.46	1000	54.6	54.6	4.03	4.04	0.75	29.15	15	26.9	26.9
Total	308	711.68	206.24	396.70	1572.18	1000	71.13	71.13	4.43	4.24	0.72	28.96	15	29.53	29.53

SD - Standard Deviation; EAR - Estimated Average Requirement; AI - Adequate Intake

established in 2020 by the National Institute of Public Health NIH – National Research Institute, is 15 µg/ person/day. The mean content of vitamin D in the individual diets were at a similar level. The diets daily supplied approximately 4-5 µg of vitamin D, which constituted about 30% of the daily requirement for this vitamin.

For meals served for patients, the energy value, average protein, fat and carbohydrate content were determined. The average energy value was the highest in the menus of the regular diet during the whole six months and amounted to 2616.9 kcal. In turn, in a diet with limited easily digestible carbohydrates, the average energy value was the lowest - 2265 kcal. The above mentioned menus for 3 diets met the Polish DRVs in 117.7-136% for women and 101-116.8% for men.

The mean content of protein in the regular and easily digestible diets were at the level of 105 g and 108 g, which corresponded to the DRVs for women in 181% and 186%, and 159% and 163.6% for men. In turn, in the diet with limited easily digestible carbohydrates, the recorded amounts were the lowest - 98.52 g., but still higher than the EAR level.

The mean fat values were 91.52 g, 107.2 g and 101.9 g, respectively, for the diet with the restriction of easily digestible carbohydrates, the regular diet and the easily digestible diet. The regular diet contained 328.4 g of carbohydrates, which met 117.2% of the recommended value for women and 96.8% for men. An easy digestible diet - 319.9 g, which is 114.2% of the recommended daily amount for women and 94.3% for men. Content of carbohydrates was the smallest in the diet for diabetics. Carbohydrates met the recommended value in 101.2% for women and 83.6% for men (Table 4).

DISCUSSION

Proper nutrition is a very important element of any treatment process. Both nutritional excess and deficiency are associated with disease. Moreover, according to Polish law, diet is one of the main therapeutic methods used in practice during spa treatment in all sanatoriums [3]. Unfortunately, according to this study, it can be said that during spa treatments patients do not receive proper diet.

In this study, the average content of calcium and vitamin D in all three diets do not meet the Dietary Reference Values of the National Institute of Public Health NIH – National Research Institute for the elderly for these nutrients. The regular and easily digestible diets contained nearly 800 mg of calcium. In turn, the average amount of calcium present in the diet with the limitation of easily digestible carbohydrates met only 54.6% of the daily requirement. Moreover,

Table 4. Detailed data on energy value, protein, fat and carbohydrate content in menus of 3 diets

	Regular diet		Easy-to-digest diet		With limitation of easily digestible carbohydrates diet		Reference values for women	Reference values for men
	Mean ±SD	Range	Mean ±SD	Mange	Mean ±SD	Range		
Energy [kcal]	2616.9±271.2	1594-3663	2561.8±246.8	2015-3229	2265.5±263.4	1773-3164	1925	2240
Protein [g]	104.8±14.3	72.9-136.4	108.2±21.0	72.86-179.8	98.5±15.9	63.0-137.4	33-58	37-66
Fat [g]	107.2±18.4	65.6-193.4	101.9±18.3	72.4-155.3	91.5±16.8	64.1-141.9	64* (43-75)	75* (50-87)
Carbohydrates [g]	328.4±33.2	261.4-448.9	319.9±35.3	227.7 -448.9	283.70±43.6	199.9-458.6	217-313	252-364

* The amount of fat covering 30% of the energy in the diet of women (1925 kcal) and men (2240 kcal)

the fiber level in the study was high (33g±3.7), which may further hinder calcium absorption.

The average vitamin D content in all three diets differed significantly from the AI and accounted for about 30% of the daily requirement for this vitamin.

To our knowledge, only one other work concerning menu assessment was realised in spa [8]. The authors took into account seasonality of meals in spa centers in Kłodzko Valley but the number of menus and number of centers are not known. However, calcium and vitamin D intake was similar as in our study.

No other reports were found showing the supply of calcium and vitamin D in sanatoriums. Many studies on the nutrition of elderly people in nursing homes also confirmed insufficient calcium intake [12, 13, 14]. In the study by *Goluch-Koniuszy* and *Fugiel* [15], conducted on a group of 37 seniors aged 60-84 who lived in a nursing home, the daily intake of calcium by residents was 420 mg. In nursing homes, the mean intake of vitamin D ranged from 1.98 µg to 2.7 µg/person/day [12, 13, 14, 15]. Comparing the assessment of menus carried out in Poland, it can be noticed that in none of the mass catering establishments the reference value for vitamin D was not even met in half.

Rodrigues-Rejon et al. [16] evaluated nutritional value of 3 types of menus served in long-term care homes in Granada. The calcium was mostly at the recommended level. Only in pureed menues calcium content was not enough. The vitamin D level was even lower than in our study. However, the possibility to obtain vitamin D from other sources is greater in Granada than in Krynica Zdrój because of greater sunlight exposure.

The analysis by *Vaes* et al. [17], carried out on the population of elderly people in the Netherlands, shows that seniors with a daily diet provided an average of 3.9 µg of cholecalciferol per day. Small amounts of this vitamin in the meals of seniors from Poland and other European countries may be due to a diet poor in food products containing it. In mass catering establishments, menus are often organized in terms of the daily financial rate, which may contribute to the fact that diets are deficient in certain nutrients or have an excess of others. In turn, the prices of food products depend on the season, harvest and their availability.

It should be noted that in this study, the average value of energy value of the different diets used in the sanatorium met the reference values in 118-136% for women and 101-117% for men. Proteins recorded in the menus in Krynica significantly exceeded recommended values - 58 g for women and 66 g for men. In an easily digestible diet, the recommended value for this macronutrient was exceeded twice for women and reached almost 170% of the recommended level for men. It can be seen that in the spa-provided diets, women consumed about 30% more protein than

men. The amounts of protein in all the diets were very similar, regardless of the sex and diseases of the patients for whom they were intended.

The amount of fat found in all 3 diets was high. In diet with limited simple carbohydrates, although the amount of fat was the lowest, it met the reference value for this macronutrient in 144% for women and 119% for men. Considering that the fat content in this diet should be regulated and limited, exceeding the recommended value to such an extent is not a desirable phenomenon. The recommended level was also exceeded in the case of the regular diet. For women, the reference value was exceeded by 69%, and for men by 19%. Despite the fact that the regular diet is used by people who do not require special modifications for nutritional treatment, the macronutrients, minerals and vitamins which contains should be composed in such a way as to maintain the appropriate proportions that ensure the proper functioning of the body and prevent the development of diseases. In the case of an easily digestible diet the recommended amounts of this nutrient were exceeded by 71% in women and 41% in men. It can be seen that in the regular and easily digestible diets, the observed amounts of fat are very similar to each other. It is strange, because fat in an easily digestible diet should be limited. In addition, despite the division into different types of diets, they are characterized by a similar fat content. The long-term use of such a diet by elderly people whose metabolism is slowed down may lead to undesirable weight gain.

The level of carbohydrates was very similar in all 3 diets and was higher than in a similar study by *Rodrigues Rejon* [16]. The regular diet contained 328.4 g and met 117.2% of the assumed recommended value for women and 96.8% for men. None of assessed diets met 100% of the daily requirements for men. A diet limiting easily digestible carbohydrates differs to the greatest extent from the recommended value for men (83.6%). Considering that as many as 61.7% of men were on this diet, its failure to meet the recommended value for carbohydrates may cause anxiety. In diabetes, which is the main disease in which this type of nutrition is used, the proportions of all nutrients, with an emphasis on carbohydrates, should be precisely regulated according to recommendations. Otherwise, the metabolic processes may be disturbed and there may be a risk of health deterioration.

Sanatoriums are thought to be places where patients receive spa treatment, rehabilitation and diet therapy. However, according to literature review nutrition in spa places is not examined. Our study was realised during 6 different 14-days long stays and included 3 different diets but only in one spa. More studies are needed to assess nutrition in spa centres dedicated to the treatment of elderly people. Due to the treatment of osteoporosis in sanatorium conditions, the content of calcium and vitamin D in the meals served in these places is very important.

CONCLUSIONS

1. Calcium and vitamin D content in menus offered for elderly people during spa treatment in sanatorium did not reach the Dietary Reference Values established by the National Institute of Public Health NIH – National Research Institute.
2. To reduce the risk of diseases resulting from calcium and vitamin D deficiency, the amount of foods containing these nutrients should be increased in the daily diet or, if this is impossible, they should be supplemented.

Conflict of interest statement
The authors declare no conflict of interest.

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