

NUTRITION OF PATIENTS WITH OSTEOPOROSIS

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Abstract

Osteoporosis is a multifactorial system illness of the bones that occurs very frequently (like tumours and cardiovascular illnesses). It is also an illness that is partly preventable. The goal of this article was to find out whether the total energy intake and the intake of macronutrients and micronutrients are sufficient for the respondents. There were 60 patients with decreased bone density who suffered from osteopenia or osteoporosis. The respondents' average age was 71.9 years and the average Body Mass Index (BMI) was 26.4 kg/m². We used questionnaires and forms to record the patients' daily intake. We found that energetic nutrition and the intake of basic nutrients were mostly sufficient. Although a significant number of patients intentionally tried to include calcium in their daily nutrition, the total calcium intake only from food was not sufficient. For this reason, it is necessary to put a greater emphasis on education.

Keywords: *Condition of nutrition; Eating habits; Nutrition; Osteoporosis; Risk factors*

INTRODUCTION

Osteoporosis is a multifactorial system illness of the bones which is included in the diseases of civilization. It is characterized by decreased bone density and poor microarchitecture of bones, i.e. bone trabeculae thinning and decreased bone tissue stability. It is especially prevalent in people of a higher age, but prevention should start in childhood. In the Czech Republic, approximately 7% of the population suffers from osteoporosis (Sotorník, 2016). After 50, every other woman and every fifth man suffers from a fracture (Vlček et al., 2014). At the age of over 70, osteoporosis occurs in 39% of men and 47% of women (Society for Metabolic Illnesses of the Skeleton, 2007). There are approximately 50 000 annually registered osteoporotic fractures. It is positive that public awareness about this illness is increasing (Horák and Píka, 2006). The

emphasis is put on prevention, early diagnostics and treatment. According to the WHO, osteoporosis remains in the first ten most frequent illnesses in the world (Horák and Píka, 2006; Zittermann and Oeynhausen, 2007).

We can distinguish between primary and secondary osteoporosis. Primary osteoporosis in the first 10 to 15 years after menopause is called postmenopausal (I type) and it is becoming the most frequent type. It is followed by involutional osteoporosis (II type). It occurs in women over 65 years and men over 70 years (Horák and Píka, 2006; Kasper, 2015).

The goal of the prevention is to ensure maximum bone mass. From birth to puberty, the organism must accumulate 1 to 1.2 kg of calcium, i.e. retain 100 to 180 mg of calcium a day, and in some life periods even more. The recommended daily calcium intake for adults is 750 to 1,300 mg a day (Štěpán, 2009). The intake of os-

teoporotic patients should be at least 1,000 to 1,200 mg a day (Luchavcová and Raška, 2011). It is also important to have the correct intake of proteins, vitamin D, vitamin C and physical activity. We should avoid risk factors, such as nicotinism, an overabundance of phosphates in food, heavy metal exposure or alcohol overconsumption (Hutchinson and Munro, 1986; Štěpán, 2009). Other nutrients are significant in the prevention and therapy of osteoporosis as well, such as vitamin K, n-3 polyunsaturated fatty acids, magnesium, zinc, silicon, manganese, copper or phosphorus (Fojtík et al., 2009).

Treatment is focused on maintaining bone mass and possibly improving it, decreasing the risks of fractures and falls, and maintaining physical fitness and the quality of life. Every treatment of osteoporosis should include calcium and vitamin D. Sufficient calcium and vitamin D intake has an important effect on maintaining bone mass (Hlúbik and Fajfrová, 2008).

MATERIALS AND METHODS

The goal of this research was to find out whether the total energy intake and the intake of basic nutrients are sufficient for the respondents. We also studied calcium intake.

The study included 60 patients. The patients were from two specialized institutions. Their average age was 71.9 years and the average Body Mass Index (BMI) was 26.4 kg/m² (23 patients had a normal BMI and 37 patients had a BMI over 25 kg/m²). All patients had decreased bone density and suffered from osteopenia or osteoporosis. We used forms to record the patients' daily intake, a short questionnaire which was focused on physical activities and calcium intake, a frequency questionnaire for eating habits, and selected patients' anamnestic data.

One form recorded daily nutrition on three days – two weekdays and one day during the weekend. The patients used a model to record all consumed nutrients and drinks during the day including nutrient weight or sweetening drinks etc. They could also record daily physical activities and whether they used dietary supplements, their names, quantity and time. The forms were assessed in the Nutriservis professional programme.

The role of the frequency questionnaire was to find out how often the patients consumed the selected groups of nutrients (19 items). They could select options, such as more times a day, 1–3 times a week, less or never. The nutrients were common (fruit, vegetable, meat, eggs or sweets or salty snacks), natural sources of calcium (milk, kefir, yoghurt or curd cheese, semi-hard and hard cheese, nuts and seeds), as well as those less convenient for bone metabolism (cola drinks, alcohol, cream cheese).

Another questionnaire focused on the classification of foods that were natural sources of calcium in the daily diet (including selected nutrients), consumption or non-consumption of milk and dairy products. It was also used to find out whether the patients exposed their skin to the sun to supply their organism with vitamin D and whether they did physical activities (type and regularity).

Additional anamnestic data that were necessary for this research were obtained from the patients' doctor after their consent. This was the information about using medications that could be associated with decreased bone density, data on previous fractures, and the results of the densitometric examination.

For the statistical assessment of the established hypotheses, we selected the paired samples t-test, which was preceded by the *F*-test for the verification of the dispersion consistency. The level of significance was set to $p = 0.05$.

RESULTS

The results of the daily nutrition records

According to the nutrition records, the energy intake of the patients (average of the three-day records) was between 4,009 and 11,878 kJ and the average value was 7,987 kJ (1,908 kcal). The energy intake, the intake of individual macronutrients and other nutrients is shown in Table 1.

It was found that the total energy intake of the patients was 37% fats, 48% carbohydrates and 15% proteins. We also found a statistically significant difference between the carbohydrate intake of the respondents with physiological weight (averagely 251 g/day) and overweight/obese patients, who on

Table 1 – The amount of selected nutrients

Nutrient	Intake ¹ (<i>n</i> = 60 patients)	Recommendations ²	Intake
Fats in food	37% of energy intake	between 25 and 30% of energy intake	+
	min. 26%, max. 58%; absolute values between 30 and 148 g/day		
Carbohydrates in food	48% of energy intake (average of 251 g/day – patients with physiological weight – or 218 g/day – overweight or obese patients)	between 55 and 60% of energy intake	–
	min. 28%, max. 61%; absolute values between 118 and 388 g/day		
Proteins in food	15% of energy intake	between 10 and 15% of energy intake	0
	min. 11%, max. 22%; absolute values between 36 and 129 g/day		
Fibre	18.5 g/day	at least 30 g/day	–
Calcium	754 mg/day	between 1,000 and 1,200 mg/day	–
Sodium	2,083 mg	between 2,000 and 2,400 mg	0

Source: ¹ research; ² Referential values for nutrient intake for the Czech Republic (2011); Luchavcová and Raška (2011).

average had a lower intake of carbohydrates (218 g/day). We also found that the average fibre intake was only 18.5 g/day. A significant nutrient was calcium. The patients' calcium intake from natural sources was 754 mg/day. The difference was between the patients from Prague and České Budějovice (814 mg/day and 685 mg/day), but it was not statistically significant. These values do not include supplements. Calcium in food was included in several daily portions and the highest intake was in the evening.

The results of the frequency questionnaire

Using the frequency questionnaire, we found that the patients liked consuming fruit, but vegetables were not as popular. 75% of patients consumed fruit every day and only 35% consumed vegetables. Semi-hard and hard cheese were more popular than cream cheese. Almost 50% of patients consumed the following every day: milk, kefir or acidophilic milk. The least consumed nutrients were fizzy drinks and vegetable drinks; 35% of patients stated that they consumed sweets on a daily basis. The frequency questionnaire was later compared to daily diets.

The results of the questionnaire focused on nutrition intake, such as sources of calcium, sunbathing and physical activities

70% of patients stated that their diet included nutrients that were a natural source of calcium. They were also asked to specify them. The nutrients were milk and dairy products, broccoli, cabbage, poppy seeds, fish, nuts or pulses. Only 20% of patients did not consume milk; this was due to lactose intolerance or not liking the taste. 62% regularly exposed their skin to the sun (depending on the weather) to supply their organism with vitamin D. 88% were regularly physically active (walking, riding a bicycle/stationary bicycle, yoga and relaxation exercises) 2–3 times a week between 120 and 240 minutes or 20 and 60 minutes a day.

The results of the anamnestic data

Half of the respondents had already suffered a fracture. They were mostly Colles fractures, vertebral compressions and ankle fractures. The other half had not suffered a fracture yet. 83% of the patients were smokers and 68% occasionally consumed alcohol. There were no connections between nicotineism or alcohol

consumption and the occurrence of fractures. Other illnesses that the patients suffered from were hypertension, thyroid disease, tumours or cardiovascular diseases, diabetes mellitus or rheumatoid arthritis. The average menopause age was 48 years. All patients had decreased bone density. Food supplements (calcium or vitamin D) were consumed by 73% of patients.

DISCUSSION

The recommended daily energy intake changes according to age, weight, height, gender and, especially in our group, physical activity. Women need between 7,560 and 9,240 kJ/day (Healthy Diet Forum, 2014). The average energy intake of our respondents was 7,987 kJ/day and consistent with recommended values.

The patients' diet included too much fat. The average daily intake was 37% of daily energy intake. The recommendations for the Czech Republic are a decrease in fat intake to a maximum of 30% of the total energy intake. The possible decrease is under 25%, but fat intake should not be under 20% due to the absorption of vitamins soluble in fats (Brát, 2016). We also found an insufficient intake of fibres (the average was only 18.5 g/day) and the recommended daily dose is 30 g/day or even 40 g/day (Hrstková et al., 2008; Referential Values for Nutrient Intake for the Czech Republic, 2011).

Regarding bones, the intake of a very important nutrient – calcium – from natural sources was also insufficient. The average daily intake was 754 mg of calcium. The intake should be at least between 1,000 and 1,200 mg/day. The highest level of absorption is in childhood and adolescence and this then decreases with age (Luchavcová and Raška, 2011). The daily intake of calcium in dosages during the day with the largest dosage in the evening was good. Štěpán (2009) points out the advantage of the evening dosage, which can help to decrease the night peak of osteoresorption.

Using a daily diet form, we found that the patients had the intake of calcium only from natural resources and we did not assess the intake from supplements. The total calcium intake was not consistent with the needs of most patients. For this reason, it is convenient

to recommend patients in therapy to consume calcium supplements and vitamin D, which helps calcium absorption, but its intake in today's population is insufficient. We found a difference in calcium intake between the patients from České Budějovice and Prague. The doctor from the Prague facility put more emphasis on the education of patients regarding the right nutrition in relation to the illness. 73% of patients used a food supplement, mainly calcium and vitamin D supplements that were prescribed by a doctor.

Vitamin D intake should be 400 IU until the age of 50 and 800 IU after 50, especially due to the positive influence of calcium absorption (Bischofová and Ruprich, 2017; Březková et al., 2014). The study of Tang et al. (2007) shows that there is not a difference in the decrease of fracture risk in patients who consume only calcium supplements and those who consume calcium and vitamin D supplements. If they only consume a calcium supplement, they should consume at least 1,200 mg a day. If they add a vitamin D supplement, the recommended dosage is at least 800 IU of vitamin D (Tang et al., 2007). Broulík and Broulíková (2013a) and Zamrazil (2012) recommend between 800 and 1,200 IU of vitamin D a day. Broulík and Broulíková (2013b) also point out that they did not find any positive influences of the daily intake of vitamin D supplement of 400 IU. Stránský (2015) states that calcium supplementation without vitamin D supplementation is not efficient. Stránský (2015) also points out that the ability of the kidneys to hydroxylate vitamin D decreases with age. At the same time, the production of this vitamin in the skin decreases by up to 80%. The National Institute of Public Health informed about the insufficient vitamin D supply of the population (Bischofová and Ruprich, 2017). In Europe and the USA, between 30 and 50% of the population is threatened by hypovitaminosis D (Broulík and Broulíková, 2013a) and over 60% of children (Zittermann, 2010).

We should not neglect adequate protein intake. The protein intake in our sample group comprised 15% of the total energy intake. There is also the effort of decreasing the intake of salt (Šíma and Turek, 2010). Other important nutrients include vitamin K, magnesium, zinc, silicon, manganese, copper, omega 3 fatty acids or phosphorus. Alcohol

overconsumption is a risk factor. It damages the liver, which decreases the activation of vitamin D and calcium absorption (Březková et al., 2014; Kasper, 2015; League against Osteoporosis, 2011).

It is necessary to point out that our patients filled in questionnaires and diet forms alone so there may be mistakes. The fact is that in some patients the nutrients and the portions were estimated. Another problem was the exact composition of all the consumed food and meals. They did not mention flavour enhancers added during consumption, such as adding salt. Doctors or nurses explained to the respondents how to fill in the questionnaire and diet forms. All patients were also provided with the contact details of nutritional therapists, who processed the questionnaires. I was contacted by 15 respondents (25%) to verify the correct recording, e.g. homemade muesli etc. The respondents in this group were mostly retired and we did not study overweight or obesity. There was no reason to intentionally leave out any food, e.g. sweet or salty snacks. However, after the comparison of the respondents' statements in the frequency questionnaire and diet forms, some cases showed differences. The respondents underestimated the consumption of sweet and salty snacks and overestimated the consumption of pulses and vegetable. This finding could show that the patients filled in correct information in the frequency questionnaire, i.e. not real but how it should be.

It is important to mention the positive influence of physical activities as a protective factor. Physical activities help to maintain muscle mass and so they prevent falls (Březková et al., 2014). 88% of the patients were regularly physically active. They did pilates, exercises with a ball, walking or light weight training. On the other hand, swinging movements, shaking movements, and sharp movements are inappropriate (Drahoš, 2017). According to age and health condition, it is recommended that one should be physically active for 30 to 40 minutes 3 to 4 times a

week (Institutional Pharmacy IKEM, 2016). A sedentary way of life is risky; it signals to bones that their mass is unnecessary (League against Osteoporosis, 2011).

CONCLUSIONS

Although the relationship may seem insignificant, nutrition is an inseparable part of osteoporosis prevention and therapy. Prevention should be aimed especially at children and their parents so that the production of sufficient bone mass begins in childhood and is maintained at a higher age. Despite pharmacological treatments, we should not forget the effect of a balanced diet with the necessary nutrients, and the importance of avoiding risk factors. In case of insufficient calcium intake, it is good to consume supplements (calcium, vitamin D). It was found that the patients had sufficient energy intake – the average daily intake was approximately 8,000 kJ. However, it would be advisable to decrease the percentage of fats, which comprised 37% of the total energy intake, or focus on the quality of the fats. For the increase of fibre intake, it would be good to increase the intake of vegetables or whole-wheat cereals, which stood at only 18.5 g/day. Despite the patients' effort to include the sources of calcium in their diet (milk and dairy products, seeds and nuts, poppy seeds etc.), the average intake of this micro-nutrient was low (only 754 mg/day). Their diet should also include one more portion of calcium (in the evening). They can also consume calcium and vitamin D supplements (in the evening).

If the patients are interested, it would be good to attend physical exercise courses. Such a possibility is offered to patients at the EUC clinic in České Budějovice.

Conflict of interests

The author has no conflicts of interests to declare.

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