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Osteoporosis Risk Score Evaluation in Population over Fifty

Summary

Osteoporosis is a systemic disease characterized by structure bone disorders and low bone mass. Disorder leads to fragility and increased risk of osteoporotic fracture (Killinger, Payer, 1998). Important in the osteoporosis management is a healthy lifestyle and lifelong physical activity, which increases the bone density level up to 50% (Bartošová, 2000). Labudová (2000) recommends exercises focused on aerobic endurance, muscle strength development and flexibility.

The aim of the study (VEGA 1/0915/13 – Athletics as a part of disabled people life quality) was to evaluate the osteoporosis risk score in the over 50 population. We expected higher risk of osteoporosis in women section and higher manifestation of vices in men section. Using the questionnaire method we summarized answers of 77 respondents.

Based on osteoporosis risk score analysis, we identified that 71.7% of women have slightly increased risk of osteoporosis development. We noticed higher percentage of more than 5 cm body height decrease in women section (13.2%) compared to men section at level of 2.6% (Chi = 3.006, $p < 0.10$). Most women (57.9%) certified calcium rich eating habits & adequate milk intake from their childhood.

Key words: osteoporosis, healthy lifestyle, risk factors, physical activity.

Introduction

Osteoporosis as a disease is well known for many years. The surge to occur mainly is caused by prolonging human life, improper diets, unhealthy lifestyle as well as other regional and civilizational factors. Estimated prevalence in the

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population of Caucas is 6–7% and it is significantly increasing. According to epidemiologists the mankind stands on the threshold of a new pandemic osteoporosis (Fig.1). The incidence of fractures resulting from an inadequately small traumas is alarming. Every second woman and every eighth man in the age group above 50 years suffer during their lifetime at least one osteoporotic fracture (Killinger et al., 2013).

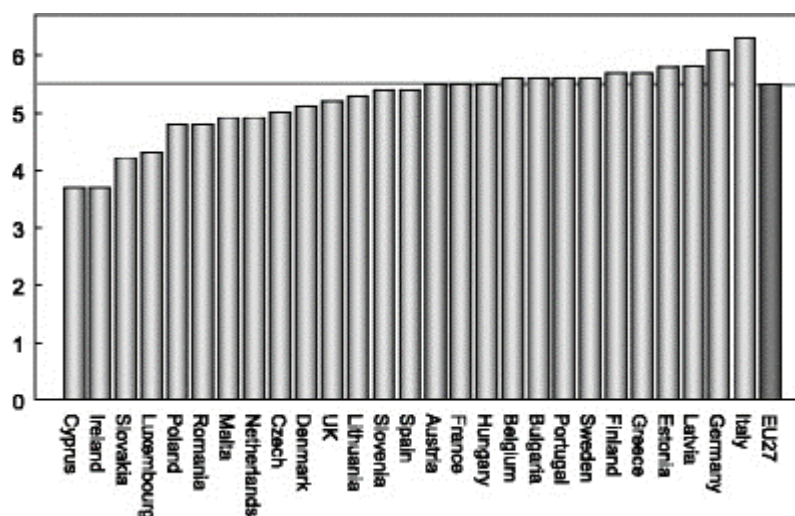


Fig. 1. Prevalence of osteoporosis and osteoporotic fractures (Kanis, 2013)

Osteoporosis is a systemic metabolic disease characterized by reduced bone mass and disruption of the bone microarchitecture. Bones are metabolically active organs in which are being remodeled during the human life. Bone formation and the amount of bones is increasing in the childhood and adolescence. The “Peak Bone Mass” is achieved in the period from 20 to 30 years of age. Subsequent equilibration between osteoformation and osteoresobtion is maintained in women up to the menopause, when the deficiency of estrogen leads to bone loss of 1–3% per year. Failure leads to fragility and increased risk of osteoporotic fracture. Osteoporotic fracture occurs at most in both bones of the forearm above the wrist called “Colles fracture”, thoracic and lumbar vertebrae or in the femoral neck. Fractures occurring in elderly polymorbid patients have a serious impact on morbidity, mortality, and quality of life. Fracture is mainly in the elderly, the cause of secondary complications. Each prevalent fracture is a precondition of further. More than a third of the patients after fracture of femoral neck has permanent restriction of movement and 20% of them die a year after the accident of various complications. The risk of osteoporotic fracture is comparable to the risk of cardiovascular disease (Killinger, Payer, 1998; Killinger et al., 2013). The first step to identifying risk factors is explicit anamnesis. Most frequent risk factors of osteoporosis are the following (Fig. 2) (Řehořková, Špičková a Špičková, 2008):

Age
Race (Caucasian)
Gender (women)
Low body mass index (BMI < 19 kg/m ²)
Fracture of the femur (parents)
Genetic bone diseases and diseases that cause secondary osteoporosis
Rheumatological diseases
Kidney diseases, adrenal glands diseases, lungs diseases, intestines diseases, liver diseases, thyroid and parathyroid diseases
Untreated lack of sex hormones
Lack of vitamin D and K
Low calcium intake and insufficient protein intake
Smoking, alcoholism
Excessive intake of roughage

Fig. 2. Risk factors of the osteoporosis

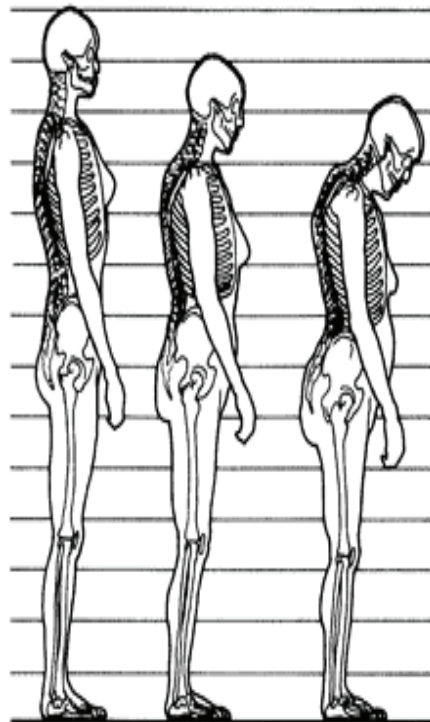


Fig. 3. Objectivisation of the osteoporosis

Etiopathogenetically we describe primary (postmenopausal, senile), secondary, idiopathic and idiopathic juvenile osteoporosis. In general, osteoporosis occurs asymptomatic but already the first signs may be obvious complication of the disease. Back pain can cause spontaneous vertebral compression fracture with subsequent decrease in body size and enlargement of thoracic kyphosis, leading to compensatory lordosis in the distal part of the spine with characteristic bulging abdomen (Fig. 3). Physical activity and healthy lifestyle play an important role in the prevention and treatment of. Smoking, alcohol and hypokinesia are risk factors for the disease. Modification of lifestyle in the form of risk elimination, increasing physical activity and a responsible patient are important elements in the treatment of osteoporosis. Physical activity is very important in the process of bone remodeling and by positively influence deposition of calcium into the bones. An important prerequisite for harmonic variation of the tissue is the balance between dynamic and static load. Lack of dynamic load leads to attenuation of the modulation process and the lack of static load limits or possibly suppresses the activation of mesenchymal cells. Mixed static – dynamic load can increase bone density by up to 50%. Conversely disproportionately exposure can cause bone density decrease (Bartošová, 2000 Killinger et al., 2013).

In the majority of elderly patients osteoporosis is an uninsulated disease. Comorbidities systems are often in connection with arthritic changes in joints and degenerative changes in the spine. Therefore, it is important to consult any physical activity with a doctor and physiotherapist (Řehořková, Špičková a Špičková, 2008). Bartošová (2000) states that the decline in upper limb extensor strength and lower limbs force begin in age of 30. Physical activity in old age improves muscle strength, stability, posture, mobility can slow down bone loss and in early menopause may reduce the increased bone loss caused by estrogen deficiency. Targeted exercise is used not only to modify the internal structures of bones with reinforcement and reconstruction trabeculae in the direction of greatest pressure and tension, but it also protects the overall skeletal integrity. Physical activity, which should prevent the emergence and eventual progression of osteoporosis, should be adapted to physical condition and comorbidities of the patient. Targeted movement increases bone mass in adult women in the lumbar part of backbone by 5.9%, on the forearm by 4.8% and total bone mass by 12.8%. A three-year experiment in the group of 200 women aged 51 years who exercised 45 minutes concluded that the decline of minerals in the experimental group was 4% lower than in the control group (Bartošová, 2000 Řehořková, Špičková a Špičková, 2008).

By Zvarka (1998), is adequate physical activity along with diet, medicamentosa prevention and therapy, is a crucial factor in comprehensive prevention and treatment of osteoporosis. The role of physical therapy is to

- loose muscle hypertonus and get rid of pain sufferers,
- strain the bone so that there was an increase in the formation of bone matrix,

- strengthen the muscles in order to be burdened with more force and that in the area of the spine more massive muscles are created, which help cushion the vertebrae abutting each other with intervertebral discs, which will reduce the pain,
- increase the ability to reconcile the activities of daily nature.

The general principle appears to favor tension exercise before swish exercise, endurance over speed, prefer bipedal locomotion with submaximal intensity adhere to the adequacy of the content, form, intensity and time (30–60 min, maximum 180 min) (Bartošová, 2000).

Literature recommends exercising at least 3-times a week (Řehořková, Špičková a Špičková, 2008). Each exercise should be repeated 10 to 15 times in one serie, and gradually increasing the load during 3–4 weeks. Fundamentally we avoid spinal flexion exercises, because they increase the compressive pressure on the front of the body and the risk of vertebral wedge fractures and further deterioration of kyphosis. Inappropriate physical activity are those with risk of falls, steep swings, shocks and rebounds on a hard surface, intense dynamic exercise extreme rotation (watch out also for spinal exercises), big load, load lifting and contact sports (Sojáková, Gályová, 2000).

For lying patients with acute complications during their stay in the hospital and later at home we use breathing exercises with later training of abdominal and thoracic breathing, isometric exercises to strengthen abdominal, gluteal and quadriceps muscles, practicing passive joints of the lower and upper limbs, and strengthening using rubber devices. Whereas, bed rest can increase bone loss, it is necessary to mobilize the patient as soon as possible (Zvarka, 1998).

After the subsidence of the acute stage, patients generally manifested chronic pain caused by scoliotic or kyphotic spine changes and undue stress ligaments and muscle tone. Therefore, it is necessary to start with training proper posture and eliminate muscle imbalances (Vojtašák, 1998). Dominant role plays (Zvarka, 1998):

- Strengthening the back extensors to achieve muscle corset. Exercises are done in the lying on bruch position in case of a major pain sitting on a chair,
- Strengthening the gluteal muscle in combination with pulling and paravertebral muscle relaxation training,
- Hauling of musculi iliopsoas and pectoral muscles.

Complex changes occurring in osteoporosis require a special, comprehensive program-osteogymnastics – a targeted movement program that requires trainer (physiotherapist) to create a complete picture of the patient, about his medical condition and the consequences that occurs it in connection with osteoporosis. The patient should assume a good supply of exercises that he is later able to train himself in domestic program, without professional guidance (Sojáková, Gályová, 2000). To achieve the objective, it is necessary to gain confidence of patient and be able to understand his pain and respond to questions in order to justify the need and importance of exercise to improve health.

The program of osteogymnastics includes (Sojáková, Gályová, 2000):

- relaxation,
- stretching exercises,
- breathing exercises,
- mobilization exercises,
- shortened muscles hauling,
- strengthening of weakened muscles,
- dynamic stabilization,
- training of posture and basic locomotion.

Labudová (2000) recommends program focus on aerobic endurance in order to improve the functional capacity of the respiratory and cardiovascular function, to develop the muscles of the shoulder girdle, pelvis and back, and flexibility.

Aerobic activities

From aerobic activities patients start with short walks, which cause muscle fatigue, but not muscle pain, or chest pain. A good incentive to maintain adequate functional capacity of the cardiovascular system, respiratory system and an excellent way to develop endurance skills is walking. The impact of walking on the muscle strength is influenced by proper engagement of the leg muscles. The weight of the body while walking puts pressure on the long bones and leads to irritation of receptors at the site of muscle attachments, which comprehensively impact on improving bone strength. Walking with proper technique improves posture, balance and coordination. The untrained patients must start with walks in the length of 1 km, distance gradually extended to 3–4 km, then 5–7 km with simultaneous increase of walking speed. In older individuals with lower physical fitness program start with a frequency of 70 steps/min for 10 min, then a rate of 100 steps / min for a period of 55–60 minutes (Sojáková, Gályová, 2000).

Cycling is also suitable for osteoporotic patients, who have good posture while driving and avoiding the so-called roach backs (Zvarka, 1998, Řehořková, Špičková a Špičková, 2008). In cyclical movement harmoniously working muscle groups are performing movement in hip, knee and ankle joint. Static work of the muscles of the upper extremities and trunk posture strengthens and helps to maintain balance. Optimal speed for recreational cycling is 16 km/hour. In case of heart rate higher than 120/min five minutes after the end of active work in sitting, it is necessary to reduce the driving speed. For walking as well as for cycling we choose flat terrain, so that we prevent the risk of falling or the possible need of dropping down from the bicycle. During breaks we choose balancing exercises to compensate bending during cycling. Movement in the countryside on a sunny day is also an excellent means to obtain necessary vitamin D (Zvarka, 1998 Sojáková, Gályová 2000).

Positive impact of antigravity movement in the aquatic environment on the health status of patients with osteoporosis is confirmed by many scientific studies. Training in water allows the perception of sensitivity of the body, strength and endurance exercises against the resistance of water, exercises and practicing of joint coordination in a relaxed state. Swimming strengthens the musculature of the spine. Spine must take the proper position while swimming, the movements are fluid, subtle yet carried out against the slight resistance of the water, so the muscles are getting stronger. Regular practice in aqueous environment requires the physical properties of the water environment a positive impact on the body of the patient with osteoporosis (Sojáčková, Gályová, 2000). The effect is substantially conditioned by the temperature of water. Very low water temperature (below 20°C) solidifies the muscles and causes lack of their involvement in the training (Kilinger, Payer, 1998 Řehořková, Špičková a Špičková, 2008). Zvarka states(1998) that swimming is in terms of improving bone density usually inefficient, it is important to maintain fitness and muscle coordination. Its effect is shown on muscle and connective tissue component and on the functionality of the blood stream (Bartošová, 2000).

For patient it is important to understand the meaning and attenuated effect of exercise and not just accept exercise as a mechanical work. Practicing in osteoporosis means to exercise regularly and long term, because the positive effect of physical activity on bone mineral density is lost after ending (Sojáčková, Gályová, 2000).

Materials and methods

The aim of the study, which was part of the project VEGA 1/0915/13 – Sporting activities as a part of quality of life of people with disabilities, was the incidence of osteoporosis prognosis in a selected sample of women and men over 50 years. We assumed higher risk of developing the disease in the sample of women. In the second hypothesis, we assumed a higher percentage of abuse – smoking and drinking alcohol as part of the risk factors in sample of men. Research tasks were:

- Assess the risk of osteoporosis score in the group of women,
- Analyze risk factors showing the highest incidence rate in both groups,
- Compare the results in a group of men and women group.

Using the questionnaire method was summarized responses from 77 respondents – 50.6% men and 49.4% women. 71.4% of the respondents belong to the group of active workers, retirees group consisted of 21 respondents (28.6%). Characteristics of the reference group-average age, height, weight and Body Mass Index (BMI) are presented in the table (Tab. 1).

Tab. 1. Sample characteristic

	age	height	mass	BMI
MEN	58,3	177,9	89,4	28,2
WOMEN	56,5	167,7	72,7	25,9

To obtain the data, we used a combination of two questionnaires. Dichotomous questions of forecasting increased risk of osteoporosis (Čápová, 2000) was in the group of women added by questionnaire “Osteoporosis risk score” (Gályová, 2000). The obtained data were evaluated percentages, individually for each sex. In the group of women we have to determine the significance of differences between the most frequent answers using the t-test. For comparison of results, we used Chi-square statistical method. The results were evaluated at the level of significance of $p < 0.05$ and $p < 0.01$.

Results and Discussion

Analysis of the results reached the following knowledge. The important factors in the prevention and treatment of osteoporosis include determining the risk profile of the patient. By analysing the osteoporosis risk score, we came to the finding that 13.2% of respondents belong to a group with low risk of osteoporosis, 15.8% in the group with an increased risk of developing the disease, with the recommendation of significant lifestyle changes. Not more than 71.7% of them belong to the group with a slightly increased risk and therefore the necessity of subsequent dispensing (Fig. 4).

The menopause started at the age of 48–52 years in 47.4% of women respondents, at the age of 45 to 47 years in 26.3% ($t = 2.138$, $p < 0.05$). Before the 45th year of age the menopause started in 15.8% of respondents ($t = 5.965$, $p < 0.01$). For reasons other than pregnancy missed menstrual cycle for more than a year 10.5% of the respondents ($t = 6.882$, $p < 0.01$). In the group of men had potency problems, loss of libido or other symptoms of low levels of male sex hormones 25.6%, other respondents negate health problems associated with low levels of sex hormones ($\text{Chi} = 2.956$, $p < 0.10$). Based on the results of clinical trials, hormone replacement therapy is nowadays indicated for the prevention and treatment of osteoporosis, but only for the purpose of influencing the climacteric syndrome. Positive effect on bone is therefore an additional positive aspect of this therapy (Killinger et al., 2013).

In contrast to the group of men who experienced height loss of more than 5 cm (Fig. 5, question 4) in 2.6%, in the group of women a drop to 13.2% occurred ($\text{Chi} = 3.006$, $p < 0.10$). The most important anthropometric determinant of bone mineral density is body weight (Ho-Pham, 2014). We appreciate that 63.2% of women have normal weight, 34.2% suffer from overweight ($t = 2.557$, $p < 0.05$).

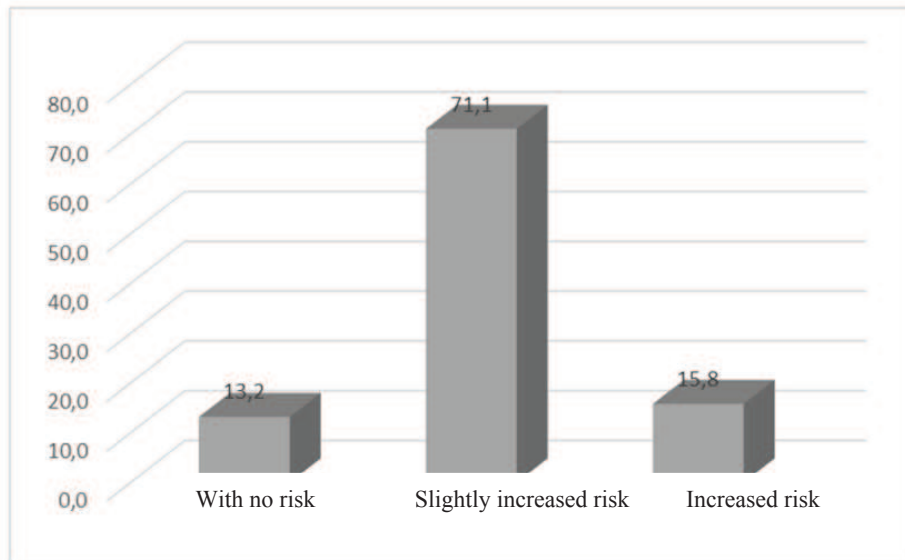
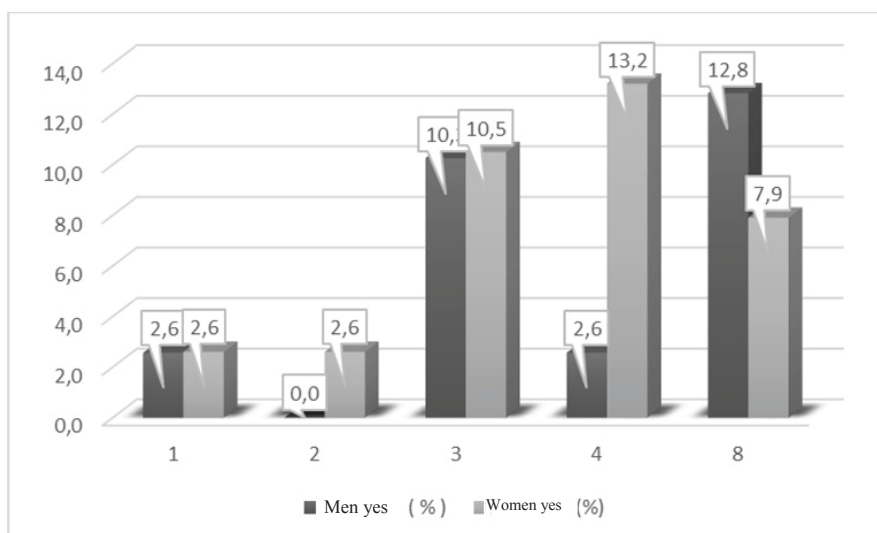


Fig. 4. Clasification of osteoporosis risk score

Adequate intake of calcium and vitamin D is an absolute prerequisite for the prevention and treatment of osteoporosis. The most substantial step is to start with prevention during childhood. The preferred source of calcium in the first year of life is breast milk of effective and proper nursed mother, in the case of failure initial and ongoing lactation milk fortified with adequate amount of calcium (Kapellerová, 2002). Kovács (2010) for children as well as for adults as the best source of calcium recommends milk, yogurts and cheese. Vitamin D is given regardless of the manner of nutrition from 3 weeks of age until at least the second year of life, with recommendation of re-administration during adolescence daily in drip form in case of premature infants at a dose of 800 IU/day (2 drops/day in a spoon of lukewarm milk). For adults, the daily intake of vitamin D 100 IU/day and of calcium 1000–1200 mg/day is recommended, ideally in the form of normal nutrition. Most respondents (57.9%) revenue diet rich in calcium, with sufficient intake of milk and milk products since childhood. 26.3% reported that their adult intake of calcium and milk products has decreased in general significantly $t = 2.559$, $p < 0.05$. Respondents also commented on the issue of problems of stool and diarrhoea incidence (Fig. 5, question 8), whose regular occurrence was identified by 12.8% of men and 7.9% of women. We believe that a possible reason of mentioned difficulties with the stool could be bloating, flatulence and borborigmi as a result of the intake of milk products, which may be associated with a decrease in lactase and justify restrictions on intake of milk products. If the patient is unable to receive the recommended

amount of calcium in the diet caused for example by lactose intolerance supplementation using calcium preparations is indicated (Killinger et al., 2013).

Elimination of avoidable risk factors – excessive alcohol intake, smoking, low intake of vitamin D and calcium in the diet and hypokinetic way of life is an important element for prevention of the disease (Killinger et al., 2013). We appreciate that in the sample of women, the number of active smokers decreased. In the past, 39.5% smoked actively, currently smoke 15.8% of respondents. 78.9% of women drink alcohol occasionally, 18.4% are abstinents $t = 5.347$, $p < 0.05$. In the group of men currently smoke 25.6% of men, 30.8% of respondents drink alcohol regular (Chi = 6.420 ($p < 0.05$)). Among other risk factors respondents reported diabetes mellitus, liver diseases and osteoporosis in the mother anamnesis.



1 – femoral neck fracture in family history, 2 – hip fractures in the personal history, 3 – corticosteroid therapy, 4 – a decrease in the amount of body height, 8 – problems with stool

Fig. 5. Osteoporosis risk factors in the group of men and women

Only 1 respondent in both samples had hip fracture following a small fall or the injury in family history (Fig. 5, question 1). Only one women respondent had hip fracture in personal history (Fig. 5, question 2). Reduction of the incidence of osteoporotic fracture formation contributes, according to Killinger et al. (2013), reducing the risk of falls in the form of removal of architectural barriers, choice of suitable shoes, correction of vision, dizziness, and removing inappropriate antihypertensive therapy. 10.5% women and 10.3% men reported corticosteroid as part of the drug therapy (Fig. 5, question 3)

Sport for all is a type of health-enhancing physical activity. Labudová (2011) states that men aged 51–64 years health improvement as the most important motive for their participation in sports. Women aged 51–60 years considered in the first place relaxation. Orientation to health improvement was only a secondary motive. Bendíková (2010) reported, that the primary motive of participation in sporting activity, was for 89% from sample of 211 elderly women improvement of health and socialization.

Daily participation in regular physical activity of appropriate antigravity character (dance, skiing, gymnastics, brisk walking) has a positive impact not only on bone density but also on improving muscle coordination and movement as a crucial element in prevention of falls. Alarming is that in the group of women most respondents are attending sport activities occasionally (34.2%) and sporadically (28.9%), moreover with sedentary job.

Conclusion

For the prevention and treatment of osteoporosis, dominant regime recommendations, nonpharmacological and pharmacological intervention are used. Preventive recommendations are essential, particularly for individuals with increased risk of osteoporosis score (Killinger et al., 2013). We appreciate the reduction of active smokers in the group of women, what decreased the amount of oxygen radicals and the negative oxidation phospholipid cell membranes were suppressed. Disappointing is the fact that only 3 of 38 (7.8%) attend regular sports activity. Physical activity is one of the best natural implements to maintain bone strength. Most of our women respondents (71.7%) belongs to a group with a slightly increased risk of osteoporosis and therefore the subsequent dispensing is needed. We suggest to reduce the impact of risk factors, increase the participation in sport and physical activity and adequate intake of calcium and vitamin D through natural diet or through supplementation with dietary supplements in both groups of respondents.

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Abstrakt

Hodnotenie rizikového skóre vzniku osteoporózy v populácii nad 50 rokov

Osteoporóza je systémové ochorenie charakterizované poruchou štruktúry kostí s nízkou kostnou hmotou. Porucha vedie ku fragilite a zvýšenému riziku osteoporotickej fraktúry (Killinger, Payer, 1998). Významné miesto v manažmente osteoporózy zastáva zdravý životný štýl

a celoživotná pohybová aktivita (Bartošová, 2000). Labudová (2000) odporúča pohybový program zameraný na aeróbnu vytrvalosť, rozvoj svalovej sily a flexibility.

Cieľom výskumu, ktorý bol súčasťou projektu VEGA 1/0915/13 – Športová činnosť, súčasť kvality života ľudí so zdravotným postihnutím, bolo hodnotenie rizikového skóre osteoporózy v populácii nad 50 rokov. Predpokladali sme, že ženy prejavia vyššie riziko vzniku ochorenia a muži prejavia percentuálne vyššiu prítomnosť abúзов. Dotazníkovou metódou sme sumarizovali odpovede 77 respondentov.

Analýzou rizikového skóre osteoporózy sme dospeli k poznatku, že najviac až 71,7% opýtaných žien patrí do skupiny s mierne zvýšeným rizikom a teda s nutnosťou následnej dispenzarizácie. Na rozdiel od skupiny mužov, u ktorých došlo k poklesu telesnej výšky o viac ako 5 cm len u 2,6%, v skupine žien bol pokles výšky výraznejší až u 13,2% ($\chi^2 = 3,006$; $p < 0,10$). Väčšina respondentiek (57,9%) prijíma stravu bohatú na vápnik, s dostatočným príjmom mlieka od detstva.

Kľúčové slová: osteoporóza, zdravý životný štýl, rizikové faktory, pohybová aktivita.