

RISK FACTORS OF OSTEOPOROSIS - KNOWLEDGE AND PRACTICES AMONG ADOLESCENT FEMALES

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Abstrakt: Osteoporosis is a serious metabolic disease, occurring at later age, most frequently through osteoporotic fractures – which are the main morbidities and invalidities at the old age. Mostly women are suffering from it but it isn't rare among men as well. The most effective prevention of this disease is founded during childhood and adolescence when the organism creates the greatest reserves of calcium. The work uses questionnaire method to find out about the knowledge, attitudes and practices of adolescent females (age of 14–19) regarding the risk factors of osteoporosis, specifically the physical activity, smoking and nutrition. It also records the differences in knowledge in correlation to age and school type. In the nutrition area it determines the average intake of those nutrients that relate to the bone health (calcium, phosphorus, vitamin D, proteins and sodium). The future goal of this work is an intervention programme aimed at support of such behaviour that would be consistent with the healthy lifestyle, supporting the osteogenesis and the maintenance of muscles.

Key words: adolescent females, osteoporosis, risk factors, knowledge, physical activity, calcium intake, smoking

Introduction

Osteoporosis is a serious metabolic bone disease, from which more and more people in the world are suffering. The prevention of this disease is often aimed only at women after menopause, at the age when they already show the proclivity to this disease or the first signs of bone mass decrease. The most important prevention is the primary prevention, i.e. during childhood and adolescence when the prevention is actually the easiest. The body creates the greatest reserves of calcium till the age of 25–30. After that the bone mass is slowly destructed.

Among the main risk factors that can be influenced belong: the low intake of calcium in the diet, low physical activity and smoking. The main factor that influences the bone density is the calcium intake during the childhood, adolescence and early

adulthood. People who created greater reserves of calcium during their youth have more bone mass to be destructed in the osteoporosis-endangered age (Sinkiewicz, 2003). The physical activity contributes greatly to the bone health. It works as the physiological stimulation of the osteoblastic activity and bone neo-production. The most suitable activities regarding osteoporosis prevention are rather weight-bearing activities or activities using some sports tools when there is created a burden upon the bones. They include especially the high impact activities, e.g. gymnastics, figure-skating, basketball, volleyball etc. They have a more favourable effect on bones than sports like swimming or biking which create only a minimal burden upon the bones (Geusens, 1998). More and more sedentary lifestyle of children and adolescents is also alarming. This trend is even more serious among adolescent females who live a sedentary lifestyle more often than boys (Vincent-Rodríguez, 2006).

One of the risk factors of osteoporosis and thus also easier occurrence of fractures is smoking. The explanation of the negative influence of smoking on the bones is not simple because the individual elements of the smoke interfere differently with the bone tissue metabolism (Kocián, 1998). Sinkiewicz (2003) mentions that the female smokers lose 5 to 10 % bone tissue more than female non-smokers by the time they reach menopause. Other lifestyle risk factors of osteoporosis are higher intake of alcohol, caffeine and cola beverages. Drinks like Coca Cola contain a lot of phosphorus which leads to hypocalcemia and osteoporosis (Kocián, 2002). The higher intake of these drinks is therefore undesirable, especially among children and adolescents. The lack of vitamin D also contributes to osteoporosis. That can occur especially in people who spend most of the day indoors. Another factor that affects the bone mineral is the lack of proteins. That can occur in the vegan and macrobiotic diet because it lacks enough building material for the bone tissue. On the other hand the high animal protein diet causes acceleration of bone resorption probably through the increased acidification of organism that is caused by the oxidation of sulfur amino acids (Kocián, 1997). The higher protein intake usually coincides with a higher calcium intake. The calciuric effect of high protein intake can thus be minimized. The adequate protection of bones is probably provided by the proportion calcium:proteins $\geq 20:1$ (mg:g). The high intake of proteins therefore doesn't have to have harmful effects on bones provided that there is an adequate calcium intake (Heaney, 1998).

The goal of the primary prevention of osteoporosis is to ensure the attainable peak bone mass during childhood and adolescence and maintenance of this bone mass in adulthood. That should be achieved through emphasising and ensuring of an appropriate intake of calcium and proteins in the diet, appropriate supply of vitamin C and D, reasonable physical activity and excluding of the toxic influence of the environment.

This work deals with the preventable risk factors, specifically the lifestyle factors, and investigates the level of adolescent females' knowledge in this area. The work focuses on adolescent females' attitudes and their real practices – i.e. the calcium intake in their diet, the level of physical activity and the occurrence of smoking.

Goals and hypotheses

The goal of this work was to evaluate the knowledge, attitudes and practices of adolescent females in relation to the risk factors of osteoporosis, specifically their physical activity, smoking and diet and to find out the differences in the knowledge in relation to age, sex and school type. In the nutrition area the goal was to set the average intake of nutrients that are in relation to the bone health – calcium, phosphorus, vitamin D, proteins and sodium.

Hypothesis 1: There is a dependence between the adolescent females' physical activity knowledge and their real physical activity.

Hypothesis 2: There is a dependence between the adolescent females' nutrition knowledge and their real nutrition behaviour.

Hypothesis 3: There is a dependence between the adolescent females' smoking knowledge and their smoking.

Sampling and methods

The sampling was represented by 323 adolescent females and 225 adolescent males (14–19 years old) from four southern Moravian schools. There was more attention focused on adolescent females sampling. 38 young females and 36 young males were from the primary school „Základní škola Pražská“ in Znojmo, 158 young females and 145 young males were from the secondary school „Gymnázium Vídeňská“ in Brno, 64 young females and 34 young males were from the secondary school „Gymnázium Křenová“ in Brno and 64 young females and 10 young males were from the vocational school „SOU and SOŠ Jánská“ in Chrlice.

A questionnaire was used as a tool to find about the knowledge, attitudes and practices of the respondents. A questionnaire used in a similar project in Canada in 2003 (Anderson, 2005) was used as a model. The model questionnaire was adjusted and updated. It includes 34 questions on basic data about the respondents, their knowledge, attitudes and practices regarding physical activity, smoking and calcium intake. In order to find out the nutrition habits we used a frequency questionnaire and a 24-hour recall, when the respondents recorded immediately what they ate and drank the day before.

Results

Knowledge

The table 1 shows percentages of correct responses to the questions concerning the knowledge of the adolescent females.

Tab. 1: Frequency of correct responses to knowledge questionnaire items

question	correct response	%
Knowledge (physical activity):		
Bones are living tissues that need physical activity to be healthy and strong.	Yes	45%
Regular physical activity helps your body use calcium more efficiently.	Yes	61%
Physical activity can help keep you from losing muscle when you're dieting to lose weight.	Yes	82%
Excessive physical activity combined with severe dieting can speed up bone growth.	No	81%
Irregular or complete loss of your periods due to excessive exercise can increase the risk of osteoporosis.	Yes	32%
Knowledge (nutrition):		
It is difficult to get the calcium you need from vegetables alone.	Yes	81%
Adolescents need more calcium than children age 6.	Yes	25%
Drinking too much cola beverages or coffee can be harmful to your bones.	Yes	39%
Knowledge (smoking):		
Cigarette smoking will not harm your health.	No	92%
Cigarette smoking increases bone growth.	No	93%
Cigarette smoking can lead to osteoporosis.	Yes	42%

The percentage of adolescent females that answered all the questions in the particular area correctly was determined in order to compare the knowledge of two groups of different age. The older adolescent females had better knowledge only in the area of physical activity. In the area of nutrition and smoking the level of knowledge was slightly higher among the younger adolescent females.

In order to compare the knowledge between adolescent females and males a group of adolescents from the primary school and a grammar school was used (215 males and 259 females). The percentage of respondents who answered correctly in the given area was found out. The adolescent females' level of knowledge was slightly higher only in the area of smoking. The adolescent males showed a slightly higher level of knowledge in the area of physical activity and nutrition.

The percentage of adolescent females that answered all the questions in the particular area correctly was also determined among the groups of 221 adolescent females from the grammar school and 64 adolescent females from the vocational school. The level of knowledge in all areas – physical activity, nutrition and smoking – is better among the adolescent females from the grammar school.

Attitudes

More than 50 % adolescent females showed the advisable attitude in the area of the physical activity and nutrition. In the area of smoking there are 32.7 % adolescent females who think that smoking of cigarettes can lead to osteoporosis, 24.3 % adolescent females don't think so and 43 % adolescent females are not sure.

Practices

96.3 % adolescent females declared that they walk at least 30 minutes a day most of the days in the week or at least 3 hours a week. 52 % adolescent females do sports regularly in their free time. The most often declared frequency of physical activity was twice a week – with 30.3 % adolescent females. 3.1 % adolescent females do sports less often than once a month. 40.3 % adolescent females declared that their usual physical activity usually lasts 30–60 minutes and 26.6 % declared the length of 60 - 90 minutes. The most frequently stated – 56 % – was the middle intensity of physical activity. 22 % adolescent females declared high intensity and 15 % moderate intensity.

27.9 % adolescent females smoke. The highest percentage of female smokers is at the vocational school – 53 %. There are 23.5 % smokers among female students of the grammar school and 10.5 % among female pupils of the primary school (Tab 2).

Tab 2: Response to the question „Do you smoke cigarettes?“

response		primary school	grammar school	vocational school	total
Yes	absolute frequency	4	52	34	90
	relative frequency	10.5%	23.5%	53.1%	27.9%
No	absolute frequency	34	169	30	233
	relative frequency	89.5%	76.5%	46.9%	72.1%

The average age of the first cigarette among the female smokers is 12.93 ± 2.45 (SD). The most frequent data value in the sample is the age of 14. The average number of cigarettes smoked by adolescent females per day is 7.44 ± 5.98 (SD). The highest average number of cigarettes smoked per day is at the vocational schools: 10.48 ± 7.1 (SD). 17 % adolescent females who smoke now started smoking before the age of 12.58 % adolescent females started smoking at the age of 12–14. 25 % adolescent females started smoking after the age of 14. 71.1 % female smokers answered that they have tried to stop. 52.8 % adolescent females want to stop smoking now.

Food frequency questionnaire:

In the table 3 there are the consummation frequencies of particular foodstuff.

Tab 3: Food frequency questionnaire

Foodstuff	almost never	1-3 times per month	1 times per week	2-3 times per week	1 times per day	2-3 times per day	4 and more times per day
Milk	9.00%	11.80%	17.10%	25.80%	25.20%	10.60%	0.60%
hard cheese	3.10%	11.50%	19.30%	43.80%	18.30%	3.70%	0.30%
Yoghurt	7.10%	8.10%	16.10%	35.10%	27.00%	5.60%	0.90%
Curd	28.30%	46.00%	16.80%	7.80%	0.90%	0.30%	0.00%
milk drinks	13.80%	25.40%	21.30%	19.40%	14.70%	4.70%	0.60%
sardines (with bones)	63.40%	30.60%	5.00%	0.90%	0%	0%	0%
Broccoli	44.70%	40.10%	10.90%	4.00%	0%	0.30%	0%
processed cheese	12.10%	12.70%	21.10%	35.10%	14.00%	3.40%	1.60%
cola beverage	27.30%	29.50%	18.60%	17.10%	4.00%	2.20%	1.20%
coffee (with caffeine)	38.50%	11.80%	11.50%	11.80%	14.00%	10.90%	1.60%

24-hour recall

Only 11.7 % adolescent females had a calcium intake higher than 1200 mg, which is the value recommended in the proposal VDD for the Czech republic (Blatná, 2005). 36.8 % adolescent females had their calcium intake lower than 600 mg. The average proportion calcium : phosphorus is 1 : 1.65. The intake of vitamin D was lower than the recommended dose in 97 % adolescent females. 74 % adolescent females exceed the recommended daily dose of sodium.

Hypotheses verification

Hypothesis 1 was not proven true, no dependency was found between the adolescent females' physical activity knowledge and their real physical activity.

Hypothesis 2 was not proven true, no dependency was found between the adolescent females' nutrition knowledge and their real nutrition behaviour, specifically their calcium intake.

Hypothesis 3 was proven true. A clear dependence was found between the adolescent females' smoking knowledge and their smoking. On the 5 per cent significance level we can say that in the group of adolescent females who knew that the smoking of cigarettes can lead to osteoporosis, there are less female smokers than among the adolescent females who did not know that.

Discussion

In order to prevent osteoporosis effectively it is necessary to have the knowledge about the lifestyle risk factors, the positive attitudes towards them and to practice in a corresponding, suitable way. However, the practices does not have to correspond to the knowledge and attitudes.

The knowledge about the physical activity is quite good among the adolescent females. They knew well that the physical activity can help keep them from losing muscle when they are dieting or losing weight. The knowledge in the area of nutrition is not very good. There is quite good knowledge in the area of smoking. Almost all the adolescent females knew that smoking of cigarettes harms the health and does not increase bone growth. But more than a half of all adolescent females did not know that smoking can lead to osteoporosis.

The knowledge results found out in this project were compared to the Canadian project (Anderson, 2005). It is a similar project and some of the results are therefore comparable. Anderson was investigating the knowledge, attitudes and practices of 227 Canadian adolescent females in the age of 12–16. In this project the sample of 323 adolescent females in the age of 14–19 was investigated. The success in different questions was sometimes significantly different but in both groups the knowledge in the area of physical activity was quite good. Regarding the nutrition, there were significantly more adolescent females in Canada who knew that drinking a lot of cola beverages can be harmful to bones. The knowledge in the area of smoking was in both groups balanced.

After comparing the knowledge of younger and older adolescent females it was found out that the older adolescent females had a much better knowledge regarding physical activity. The knowledge in the other two areas was slightly better among the younger adolescent females. It is possible that the pupils are better educated in the field of lifestyle at the primary school and therefore they master the relevant knowledge. The influence of the secondary school might not be that strong anymore.

The adolescent females from the vocational schools have significantly lower knowledge in all the areas in comparison to the adolescent females from the grammar school. The difference was statistically significant in the area of physical activity. It could be caused by the lower level of education, as well as by the family background, which could be neglecting and not that stimulating in this group. The adolescent females from the grammar school on the other hand could have a stimulating and supportive family background. However, this does not have to be always valid. The knowledge is of course learned not only at school but also in the out-of-school environment. The adolescent females at the grammar schools have extensive general knowledge, whereas the adolescent females at vocational school have knowledge limited by their vocation.

The physical activity is not on a very good level with respect to the age of the respondents. It is necessary to bear in mind that the low level of physical activity contributes also to other chronic diseases. But we have to take account of the fact that the level of physical activity was investigated only through the questionnaire method and it is therefore necessary to rely on the declared answers. The level of physical activity can be thus even lower in reality.

About one quarter of all questioned adolescent females are smokers. The highest occurrence of smoking at the vocational schools is probably caused by sometimes lower socioeconomic background of the families of the adolescent females from the vocational schools but another factor is probably also the social pressure of their peers. Vocational schools sample also has the lowest average age of the first cigarette and the highest number of cigarettes smoked per day.

The results of the frequency questionnaire are not the best. Although most of the adolescent females chose the milk consumption frequency 2–3 times a week (25.8 %), almost 38 % adolescent females declared the frequency equal or lower than once a week. On the opposite a very frequently eaten milk product is processed cheese. 35.1 % adolescent females consume them 2–3 times a week. This frequency has to be considered very high because of the high percentage of phosphorus in the processed cheese, which contributes to the inadvisable proportion of calcium:phosphorus. It would be advisable to reduce the intake of processed cheese and replace it with the hard cheese. The whole quarter of adolescent females consume cola beverages more than once a week, which is not insignificant. Quite a high percentage of adolescent females – 10.9 % – declared that they drink coffee mit caffeine 2–3 times a day. That is with respect to the age structure quite a lot. It can be caused by frequent placing of beverage vending machines in the school buildings.

The results of the 24-hour recall are not satisfactory. The average intake of calcium 757 ± 367 mg/day (SD) is low below the recommended dose. Almost 40 % adolescent females' intake was lower than 600 mg/day. The proportion calcium: phosphorus should be 1.3:1 for the optimal bone health and up to 2:1 in case of a bad calcium absorption (Dostálová, 2005). The real proportion found out is rather opposite, namely 1:1.65, which makes the situation even worse. The average intake of sodium was 3,556 mg a day which is about 3.5 g. The average intake of sodium should not exceed 2.4 g a day. The higher intake of sodium increases calciuria dramatically and thus restrains the calcium availability.

Adolescent females do not consider osteoporosis as a disease that threatens them currently, therefore their knowledge and attitudes do not correspond to their right behaviour. In this project as well as in the Canadian project there was found a dependency between the knowledge about smoking and smoking itself (Anderson, 2005). As a matter of fact, the adolescent females who know that smoking can damage their health and bones don't smoke more likely than adolescent females who do not know that. The improvement of their knowledge could therefore contribute to a reduction of the number of young smokers or to the stopping of the upward trend.

Conclusions

The knowledge about physical activity and smoking in relation to the bone health is quite good. The level of knowledge about nutrition is not very good.

The level of the knowledge about physical activity among older adolescent females (age 17–19) is statistically significantly higher than among the younger adolescent females (age 14–16). In the areas of nutrition and smoking the level of knowledge is slightly higher among younger adolescent females.

The level of knowledge about smoking is slightly higher among adolescent females than males. However, the level of knowledge about physical activity and nutrition is slightly higher among adolescent males.

Adolescent females from the grammar school have a higher level of knowledge than adolescent females from the vocational school, especially in the area of physical activity, but also in the area of nutrition and smoking.

Adolescent females' attitudes to risk factors of osteoporosis are favourable in the area of physical activity and nutrition. Attitudes in the area of smoking are rather adverse.

About a quarter of adolescent females smoke. More adolescent females smoke at the vocational school than at the grammar school and primary school.

The physical activity is not on a very good level with respect to the age of the respondents. However, it can be considered positive that over a half of the adolescent females do sports regularly, most of them twice a week.

The nutrition behaviour of adolescent females is unsatisfactory. Their vitamin D intake is low, they have a high intake of sodium and the proportions of calcium:phosphorus and calcium:proteins are unfavourable.

No dependency was found between the adolescent females' physical activity knowledge and their real physical activity.

No dependency was found between the adolescent females' nutrition knowledge and their real nutrition behaviour, specifically their calcium intake.

A clear dependence was found between the adolescent females' smoking knowledge and their smoking.

With regard to the conclusions mentioned above it is desirable to improve adolescent females' knowledge through a suitable intervention programme. The knowledge improvement is needed especially in the area of nutrition risk factors of osteoporosis, but also in the other areas. Adolescent females need to comprehend that osteoporosis is not just a problem of their mothers and grandmothers but that they should and can prevent it right at their age. It would be appropriate to instruct adolescent females about the importance of nutrition in the osteoporosis prevention, and inform them about other calcium sources than just milk products to contribute to food variety in their diet. However, it is desirable to increase the milk and milk products consumption as well. It is also necessary to focus on the instruction of adolescent females about the harmful effect of smoking to bone tissue. Adolescent females should be encouraged to do sports regularly and be instructed about the best kind of physical activity regarding osteoporosis prevention. These conclusions will be exploited in the intervention programme which will follow this project and whose goal it will be to promote the right practices for osteoporosis prevention.

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RIZIKOVÉ FAKTORY OSTEOPORÓZY – ZNALOSTI A CHOVÁNÍ DOSPÍVAJÍCÍCH DÍVEK

Souhrn: Osteoporóza je závažné metabolické onemocnění projevující se ve vyšším věku nejčastěji tzv. osteoporotickými zlomeninami, což jsou hlavní morbidity a invalidity starších lidí. Postihuje především ženy, ale není vzácné ani u mužů. Nejefektivnější je prevence tohoto onemocnění v dětském věku a v době dospívání, kdy si organismus vytváří největší zásoby vápníku. Práce zjišťuje dotazníkovou metodou znalosti, postoje a chování dospívajících dívek ve věku 14–19 let týkající se rizikových faktorů osteoporózy, konkrétně fyzické aktivity, kouření a výživy a zaznamenává rozdíly znalostí v závislosti na věku a typu školy. V oblasti výživy stanovuje průměrný příjem nutrientů, které mají vztah ke kostnímu zdraví (vápník, fosfor, vitamin D, bílkoviny a sodík). Budoucím cílem této práce je intervenční program na podporu takového chování, které bude v souladu se zdravým životním stylem podporujícím vývoj kostí a udržení svalové hmoty.

Klíčová slova: dospívající dívky, osteoporóza, rizikové faktory, znalosti, pohybová aktivita, příjem vápníku, kouření