



BONE HEALTH FACTORS IN ADOLESCENTS FROM VARNA

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SUMMARY:

Purpose: The purpose of our study is to research nutritional behavior and PA in a representative sample of 12th grade students (18-20 years of age) from Varna.

Methods: We used two questionnaires: on the frequency of food consumption and on the assessment of physical activity. We applied the International Physical Activity Questionnaire, recommended from WHO.

Results: The survey includes 401 young people. These are 11.2% of all 12th grade students in Varna. Two portions or more per day of dairy products are consumed by 94.5% young men and 48.7% of young women. More than half of the girls have inadequate intake of bioavailable calcium. The lowest consumption is in the underweight female group. There is a significant positive correlation between low milk consumption and Body Mass Index (BMI) in girls ($r = 0.409$ **, $p < 0.001$).

Around 1/3 of the youngsters have an adequate intake of fish. The remaining 63.1% of young boys and 68% of girls are at risk of vitamin D deficiency during the winter season.

Low levels of PA were measured in 43.7% of the boys and 20.1% of girls.

Conclusions: The eating behavior of adolescents from Varna shows a shortage of important nutrients for bone development. The consumption of fish is low for both sexes, and 1/2 of the girls do not consume enough dairy products. Recommendations for optimal PA (high to moderate) were met in 79.90% of young men and 56.30% of girls. Nearly 1/2 of young women have low PA and are at risk for their bone health.

Keywords: bone mass, adolescent, physical activity, eating behavior

Nutritional behavior and physical activity (PA) in adolescence strongly affect bone health throughout life. Adolescence is a critical moment for the accumulation of bone mass. Behavior in this period, including dietary pref-

erences, PA, and screen-based behavior can invest in good bone health for life or on the contrary - increase the risk of osteoporosis and fractures.

The bone mass and skeletal size are largely genetically predetermined, but they also depend on dietary intake and PA [1]. Over 50% of bone density accumulates during adolescence. There is evidence that low dietary intake of bio-availalbe calcium from milk (food) and vitamin D may be an obstacle to reaching the peak bone mass in adolescence. In youth intervention studies, it has been found that regular intake of dairy foods and certain types of physical exercise (including jumping and running) can have a positive and time-beneficial effect on bone mass [2, 3, 4]. Dairy products are particularly important in adolescence because of their osteoplastic effect. Milk is an irreplaceable diet for the health of growing bones for several reasons: it delivers to the bone matrix all the necessary amino acids; contains calcium and phosphorus in an optimal ratio (1: 1). Dairy foods provide between 32% and 60% of alimentary calcium during childhood and adolescence [5].

Full-fat milk is a source of vitamin D₃, which is essential for the absorption of calcium. National Nutrition Monitoring in Bulgaria shows that the average daily intake of milk in adolescent girls does not reach even half of the recommended amount [1]. This reflects on the intake of calcium, which is below the daily intake recommendations. Deficiency of vitamin D is common in adolescents worldwide [7, 8, 9, 10, 11]. The reasons for this are complex: shorter stays in the open, more indoor activities (home, classroom, office, restaurants, shopping malls, etc.), low consumption of foods that are a natural source of vitamin D. Even a subclinical deficiency in young age may affect bone health and be critical for the accumulation of peak bone mass [12]. Fish plays an important role in providing the vitamin D needs. The quantity of vitamin D synthesized in the skin as a result of natural sun exposure depends heavily on the latitude and seasons [13], and in some months of the year it may be

totally inadequate to cover the needs of the body [14].

In the warm season of our latitude, biosynthesis of vitamin D covers over 80% of the body's needs, and 20% is supplied with food. In winter when exposure to sunlight is severely limited, vitamin D is imported with food. The most appropriate source of vitamin D is fatty fish [15]. Regular moderate / intense PA plays an important role in reaching the peak bone mass. High PA in adolescents is associated with two to three times higher bone mass in postmenopausal women compared to women of the same age with low PA in youth [16]. In adolescents and youths, A is positively related to muscle strength and bone density. One of the highest risk groups for (hypodinamia) immobilization is high school students in large cities where lifestyle predisposes to reduced PA. According to international recommendations, young people and girls should have a moderate to high PA every day for at least 1 hour [17, 18, 19, 20, 21]. Over 60-75% of adolescents and youths have low PA [22, 23].

Small deviations from optimal, genetically set peak mass of the skeleton due to incomplete nutrition or lack of physical activity in adolescents may lead to a significant

increase in the risk of fractures in later stages of life [24].

PURPOSE:

The purpose of our study is to study nutritional behavior and PA as PA factors affecting bone health in a representative sample of 12th grade students (18-20 years of age) from Varna.

MATERIAL/ METHODS:

We used two questionnaires: on the frequency of food consumption (FFQ) and on the assessment of physical activity. We applied the short version of the International Physical Activity Questionnaire (IPAQ), recommended for WHO's 18-65 age-based assessment by the WHO and measuring exercise activity for the past 7 days [25].

RESULTS:

The survey includes 401 young people from schools in Varna. These are 11.2% of all 12th grade students in Varna. The analysis of the FFQ results is presented in table 1.

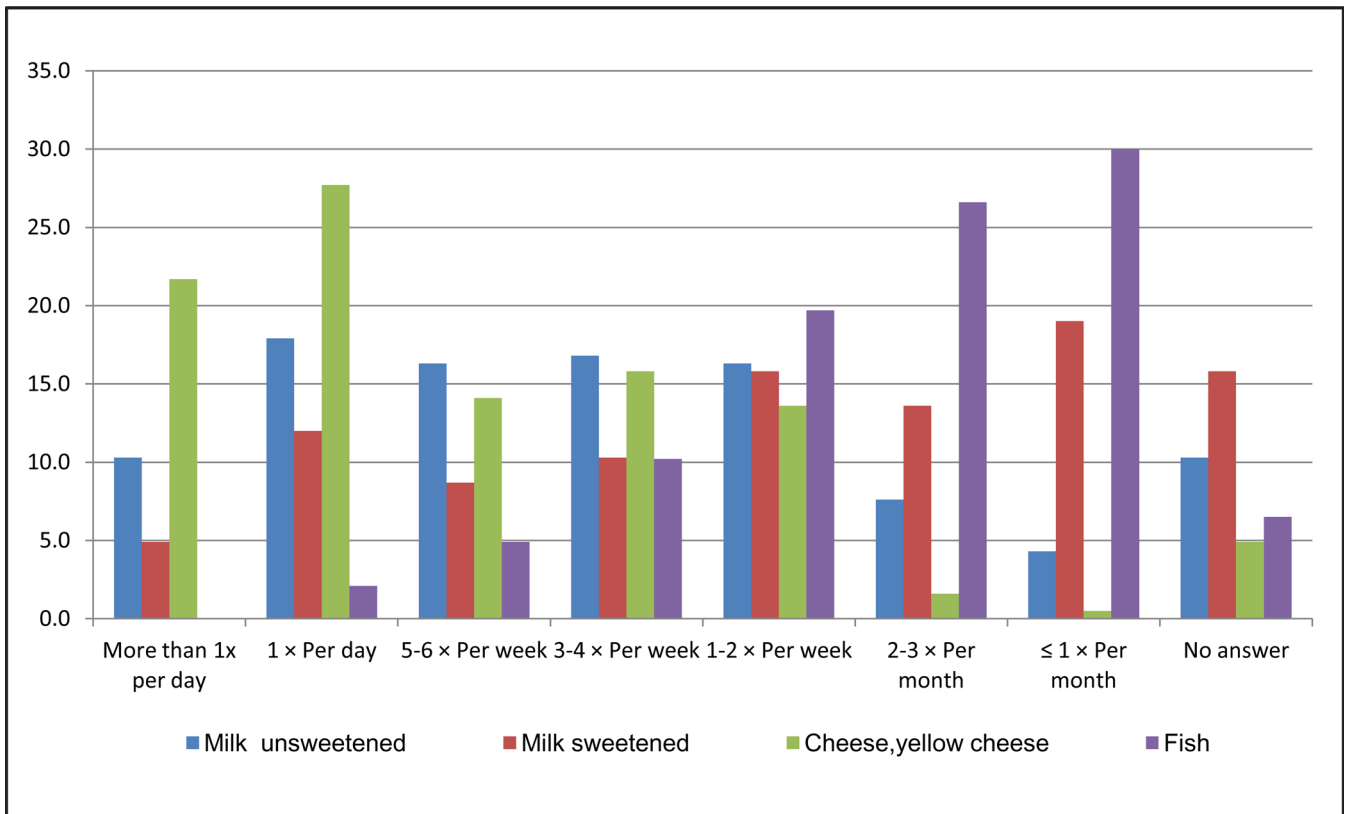
Table 1. Frequency of consumption of milk, dairy products and fish.

Gender Nutritional product	More than 1x per day		1 × Per day		5-6 × Per week		3-4 × Per week		1-2 × Per week		2-3 × Per month		d' 1 × Per month		No answer	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Milk unsweetened	10,3	5,1	17,9	8,2	16,3	14,2	16,8	13,1	16,3	21,3	7,6	15,1	4,3	9,8	10,3	8,2
Milk sweetened	4,9	2,3	12,0	4,6	8,7	9,3	10,3	11,5	15,8	16,9	13,6	16,9	19,0	27,0	15,8	12,0
Cheese, yellow cheese	21,7	13,2	27,7	15,3	14,1	20,2	15,8	19,7	13,6	10,7	1,6	5,3	0,5	8,2	4,9	7,1
Fish	0,0	1,1	2,1	3,3	4,9	6,6	10,2	8,2	19,7	21,9	26,6	24,0	30,0	26,2	6,5	8,7

The use of milk and dairy foods contributes to reaching the genetically set peak bone mass and reduces the risk of osteoporosis. Daily consumption of 2-3 portions of milk and dairy products is recommended (1 serving is 200 ml of fresh or yoghurt or 50 g of cheese or yellow cheese [2]). Adolescent boys drink unsweetened milk almost twice as often as girls. One glass of milk each day receives regular 29.9% of the samples, and two or more glasses - 15.2%. Cheese is consumed daily by 49.4% of adolescent boys. The recommendation for a minimum of two portions of dairy products a day is met in 94.5% of young men. High consumption of milk and dairy products (more than one serving per day) correlates positively with BMI in youths (r=0.401**, p<0.001).

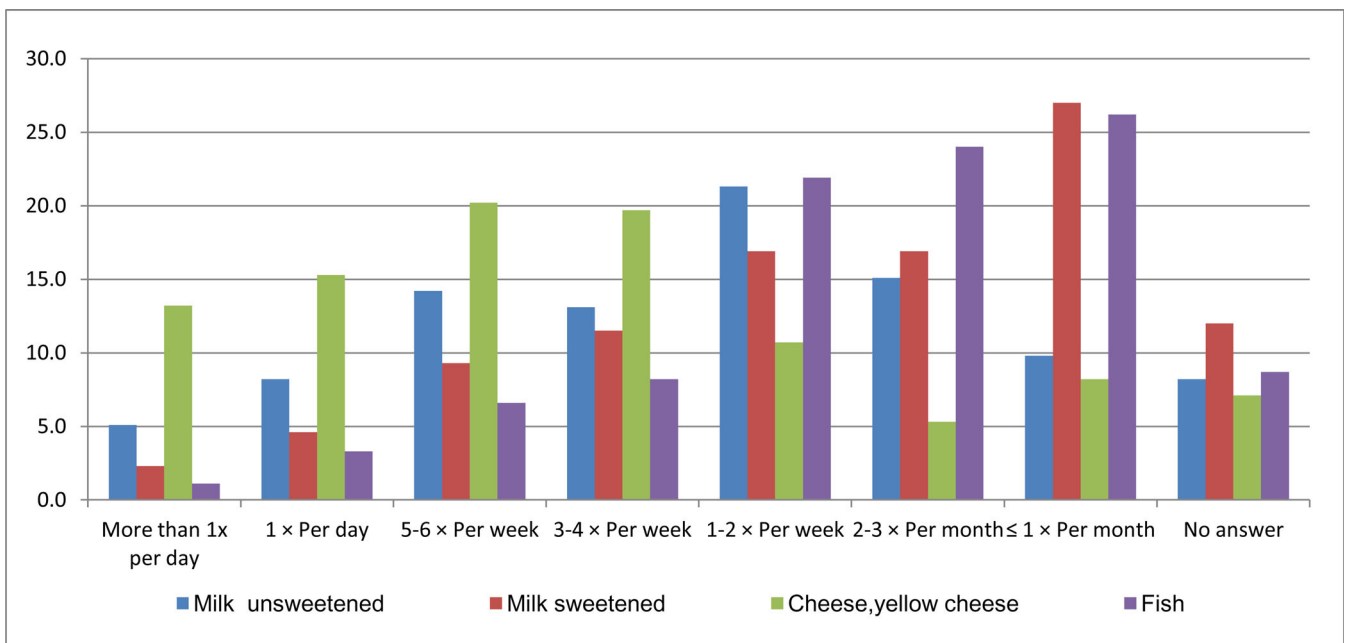
Dairy foods are being consumed by 28.5% of young women every day (figure 1). One cup of milk per day consumes 12.8% of teenage girls and 2 or more glasses - 7.4%. The recommendation for a minimum of two portions of milk and (or) cheese per day was performed in 48.7% of young women. More than half of the girls have inadequate intake of bioavailable calcium, with the lowest consumption in the underweigh group. There is a significant positive link between low milk consumption and BMI in girls(r=0.409**, p<0.001).

Fig. 1. Food frequency consumption - young men



Around 1/3 of the youngsters and girls surveyed have an adequate intake of fish (figure 2). They consume fish at least 1-2 times a week. The remaining 63.1% of boys and 68% of girls are at risk of vitamin D deficiency during the winter season.

Fig. 2. Food frequency consumption - young women



Data analysis allows us to conclude that nutrition among 12th graders in Varna does not meet the current healthy eating recommendations. Disadvantages in eating patterns include inadequate consumption of fish (both sexes), milk and dairy products (girls). According to the PA level, the students were divided into three groups: high PA,

moderate PA and low PA. High levels of PA were measured in a two-fold higher proportion of young people (47.3% in boys and 22.4% in girls, $p < 0.001$) and low in girls (43.7% and 20.1% , $p < 0.001$). About a third of young boys and girls have a moderate PA. There is a trend towards high PA among boys and low PA in girls (figure 3).

Fig. 3. Comparison of PA in young men and young women



The most preferred sports by 12th grade students are fitness, running and soccer – sports with heavy physical exercise and cardio-training that stimulate bone's health [26, 27].

CONCLUSIONS:

The eating behavior of adolescents from Varna shows a shortage of important nutrients needed for bone building. The intake of fish and seafood, vitamin D supplements is low for both sexes, and ½ of the girls do not consume enough dairy foods and do not supply the calcium necessary for bones. Recommendations for optimal PA (high to

moderate) were met in 79.90% of young boys and 56.30% of girls. Nearly ½ of young women with low PA and do not have a suitable lifestyle for keeping bone health intact.

Abbreviations:

BMI - Body Mass Index
FFQ – Frequency of food consumption
IPAQ - The International Physical Activity Questionnaire
PA – Physical Activity
WHO – World Health Organization

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