



A COMPARATIVE STUDY OF EATING HABITS, CALCIUM AND VITAMIN D INTAKES IN THE POPULATION OF CENTRAL-EASTERN EUROPEAN COUNTRIES

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Summary

Introduction. Vitamin D and calcium intake have got crucial role in the well-balanced, health promoting diet. Many studies indicated that population of different countries can be characterised by inadequate intake of both nutrients. Up to date data are not available from the population of Central-Eastern European countries.

Aim. Compare the eating habits of Central-Eastern European countries, in particular to calcium and vitamin D intake.

Material and methods. Participating people from the investigated countries were randomly selected. 60 Austrian, 187 Polish, 106 Hungarian and 81 Slovenian volunteers were involved. Data were obtained by a self-developed questionnaire, as well as semi-quantitative food frequency questionnaire (sq-FFQ). Data processing was executed by NutriComp FFQ, and GraphPad Prism 5.0 softwares.

Results. All of the four investigated countries, excessive energy intake was observed, and the associate overweight and obesity as well. Highest calcium intake was recorded in the Hungarian population, while the lowest in Slovenia. Vitamin D intake was critically low in both of the countries.

Conclusions. Awareness campaign is necessary to inform the population about the dangers of the low intake of calcium and vitamin D (e.g. increased risk of osteoporosis, and higher incidence of upper respiratory tract infections). Prevention strategies should be also prepared with the inform of the participating volunteers.

Keywords: eating habits, calcium, vitamin D, deficiency, prevention

INTRODUCTION

Results of several studies brought the recognition of many risk factors associated with inappropriate nutrition, and we get better picture about the relationship between inaccurate eating habits and the prevalence of chronic, non-communicable diseases. Now we know that the quality of menu, and nutrition itself can clearly affect the years spent in good health, and one's habits can increase or decrease the length of lifespan.

It is also an evidence that it's more economical to prevent diseases than to treat them, thus obtaining information about the nutritional health status by surveys has got a crucial role. Those longitudinal studies which give information about the nutrient intake frequencies of the population have especially significant relevance in this field (1-3).

Researches executed in recent years highlight the important role of vitamin D in human physiology. It effects the immune function, and inadequate intake can lead to an increased risk of Type 1 Diabetes Mellitus, hyper-

tension, and colorectal carcinoma as well (4). From the viewpoint of bone health, it is necessary to investigate vitamin D and calcium intake simultaneously as mainly these two factors contribute to bone development, and thus determine bone density itself. Although they are key nutritional elements of healthy nutrition, from literature we know that a population can be characterised by inadequate intake of both of these two components. Because of these, we aimed to investigate the calcium and vitamin D intake of Hungarian and other Central-Eastern European countries' populations.

AIM

Our aim was to compare the eating habits of Central-Eastern European countries, in particular to calcium and vitamin D intake.

MATERIALS AND METHODS

In this study 434 volunteers were involved from four Central-Eastern European countries (60 Austrian,

187 Polish, 106 Hungarian and 81 Slovenian). Gender distributed to 311 women and 123 man, medians of age given in table 1. Higher number of women can be explained by their higher willingness of answer, as the fill of questionnaire was voluntary (tab. 1). The study was adhered to the tenets of the most recent revision of the Declaration of Helsinki.

Table 1. Age data of participants (data in median [minimum-maximum] format).

Slovenia	Austria	Poland	Hungary
38.8 [15.0-75.0]	39.9 [17.0-78.0]	35.2 [17.0-91.0]	35.8 [17.0-72.0]

To assess the nutrition status and nutrients intake, a questionnaire based on closed questions was applied, which was supplemented by a semi-quantitative food frequency questionnaire (sq-FFQ) (5-7) that contained 77 foodstuffs. Analysis of data was performed by NutriComp FFQ. To analyse the differences of Ca²⁺ and vitamin D intake between countries, Two Way ANOVA was applied with Bonferroni post hoc test. Assessment of volunteers distribution by BMI categories, Chi-square test was applied. Energy intake alteration between nationalities was analysed by Kruskal-Wallis test with Dunn's multiple comparison post hoc test. All analysis were performed at 5% significance level (p = 0.05) by using GraphPad Prism version 5.00 for Windows, GraphPad Software, San Diego California USA, www.graphpad.com.

RESULTS

Among the investigated countries excessive energy intake (fig. 1) was observed, and the related overweight and obesity were also indicated by the study (tab. 2).

In contrast to the recommended 4-5 times of eating, tendencies of participants of this study show, that people mostly eat only two-three times a day. Analysis of macronutrients intake brought the result that it is typical that carbohydrate contribution to the total energy intake is low in all of the countries (A: 43.4 E%, PI: 41.9E%,

H: 39.2E%, Slo: 42.3E%). In contrast, ratio of fats (A: 42.7E%, PI: 43.2E%, H: 46.0E%, Slo: 42.8E%) in the menus was above the 30% of energy recommendations. Protein intake ratio (A: 13.5E%, PI: 14.5E%, H: 14.8E%, Slo: 14.5E%) was nearby the edge of acceptable upper limit in all of the countries. From the above detailed data, the results of Hungarian population proved to be the worst among the four countries.

Calcium intake that comes from nutrition in the youngest 14-18 years (A: 668.29 mg, PI: 746.91 mg, H: 938.14 mg, Slo: 970.67 mg) and the oldest, > 70 years age group, the Austrian (700.82 mg), the Polish (955.30 mg) and the Slovenian (363.90 mg) population were inadequate, although deviation of data are high. It was surprising that the highest calcium intake (1284.4 mg/day) was recorded in participants from Hungary, even in the age group > 70 years (1517.33 mg), which observation is not in line with the last national survey OTÁP 2009 results (9). Smallest intake was measured in Slovenia (894.4 mg) (tab. 3, fig. 2).

There are only few national surveys accessible about the Slovenian nutrients intake, and the available results are not representative to the whole population, thus results of this country are usually compared to the results of Central European D-A-CH (10).

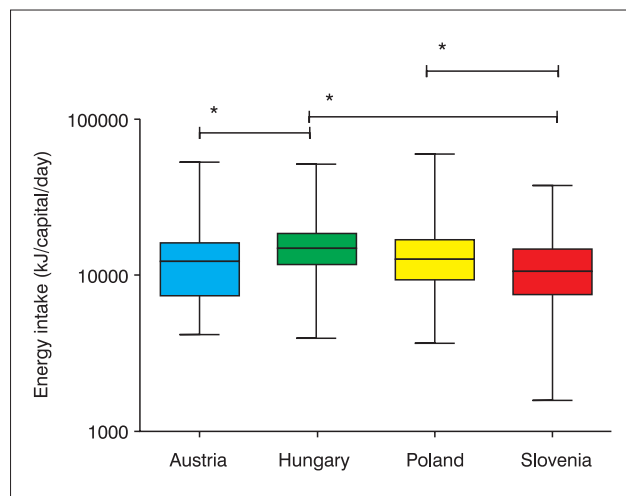


Fig. 1. Daily energy intake in the investigated countries (median, IQR, p = 0.05).

Table 2. Distribution of participants by BMI categories (capita) (8).

BMI categories	Austria	Hungary	Poland	Slovenia	
Underweight	1	9	19	4	X ² = 16.35 p = 0.0597
Normal range	29	66	104	39	
Overweight	24	20	45	28	
Obese	7	11	19	10	

Table 3. Calcium intake results of the participants (data in mg/capita/day; mean \pm SD format).

Age	Austria	Hungary	Poland	Slovenia
14-18 years	668.29 \pm 300.49	938.14 \pm 645.41	746.91 \pm 237.93	970.67 \pm 937.74
19-29 years	1016.49 \pm 367.39	1337.96 \pm 510.39 ^a	1407.62 \pm 787.85 ^a	1247.81 \pm 633.88
30-69 years	1233.65 \pm 627.10	1342.92 \pm 413.59	1071.66 \pm 567.72	995.15 \pm 462.61 ^b
> 70 years	700.82 \pm 178.09	1517.33 \pm 58.83 ^a	955.30 \pm 542.92 ^b	363.90 \pm 678.07 ^{a,b,c}

a: $p < 0.05$ vs. Austria, b: $p < 0.05$ vs. Hungary, c: $p < 0.05$ vs. Poland

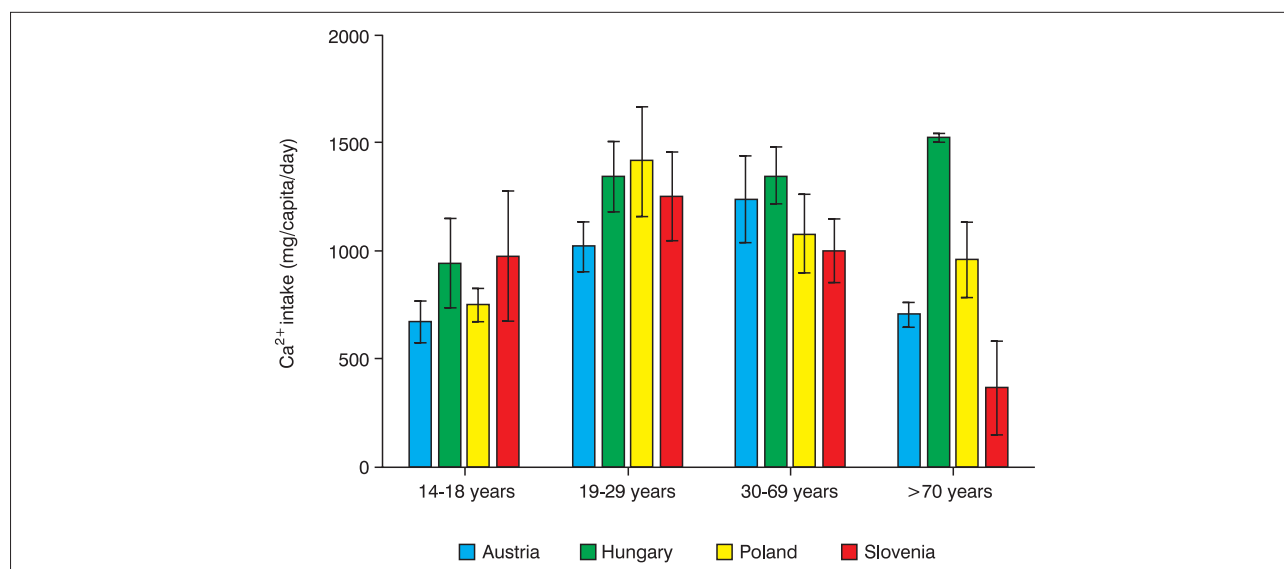


Fig. 2. Calcium intake distribution of the participants (mean, SD).

Vitamin D intake proved to be critically low in every nation (tab. 4, fig. 3). In this case values of the youngest (14-18 years; A: 1.74 μg , PI: 2.92 μg , H: 3.13 μg , Slo: 3.72 μg) and the oldest (> 70 years; A: 0.67 μg , PI: 3.94 μg , H: 5.16 μg , Slo: 1.00 μg) age group proved to be the most worrisome, although the Hungarian group > 70 years values exceeded the current recommendations (5 μg). From the viewpoint of average intake, the Hungarian (4.12 $\mu\text{g}/\text{day}$ versus 5 $\mu\text{g}/\text{day}$ recommendation (11)) was the best, while the value of Austrian population (2.19 $\mu\text{g}/\text{day}$ versus 20 $\mu\text{g}/\text{day}$ recommendation (10)) was the farthest from the optimal. Mean intake of Polish participants was 3.83 $\mu\text{g}/\text{day}$ (in contrast to the recommended 15 $\mu\text{g}/\text{day}$ (12)) which is similar to the Hungarian value. The 2.57 $\mu\text{g}/\text{day}$ Slovenian value is near to the Austrian (in contrast to the $\mu\text{g}/\text{day}$ (4) RDA value).

Situation is further complicated by the fact that the recommendations in each of the countries are different, hence comparative analysis of results quite difficult. The lowest recommended daily intake value currently in effect is the 5 $\mu\text{g}/\text{day}$ Hungarian one, which will probably increase as it is suggested by the consensus of the associations and societies (4).

The reference values of macro and micronutrients are currently under revision by the European Food Safety Authority (EFSA), and practical, food stuff based recommendation will be set up by these synchronised values (13). Because of the above mentioned reasons, our results obtained by the semi quantitative Food Frequency Questionnaire (sq-FFQ) presented here are only indicative. As the new, unified recommendations will be available, reanalysis of the results and new studies will be necessary to get an even clearer picture.

Results of sq-FFQ indicate that the consumption of calcium rich milk products were the highest in Hungary (3.03 serve/day), while minimum amount was recorded in Slovenia (1.95 serve/day).

Vitamin D rich fishes were consumed excessively low in all the investigated countries. The highest value was only 0.38 serve/day in the Polish population, and the lowest one was observed in Austria (0.25 serve/day).

Offal consumption value of 0.14 serve/day was the highest, which is observed in Hungary, although it is also quite low. In contrast, consumption of meat, and

Table 4. Vitamin D intake distribution of the participating countries (data in $\mu\text{g}/\text{capita}/\text{day}$; mean \pm SD format).

	Austria	Hungary	Poland	Slovenia
14-18 years	1.74 \pm 0.98	3.13 \pm 1.40 ^a	2.92 \pm 1.31	3.72 \pm 3.26 ^a
19-29 years	2.77 \pm 1.24	3.96 \pm 2.53	4.26 \pm 3.89 ^a	3.01 \pm 2.08 ^c
30-69 years	3.59 \pm 3.25	4.23 \pm 1.43	4.19 \pm 2.68	2.53 \pm 1.69 ^{b,c}
> 70 years	0.67 \pm 0.15	5.16 \pm 0.68 ^a	3.94 \pm 1.51 ^{a,b}	1.00 \pm 2.34 ^{b,c}

a: $p < 0.05$ vs. Austria, b: $p < 0.05$ vs. Hungary, c: $p < 0.05$ vs. Poland

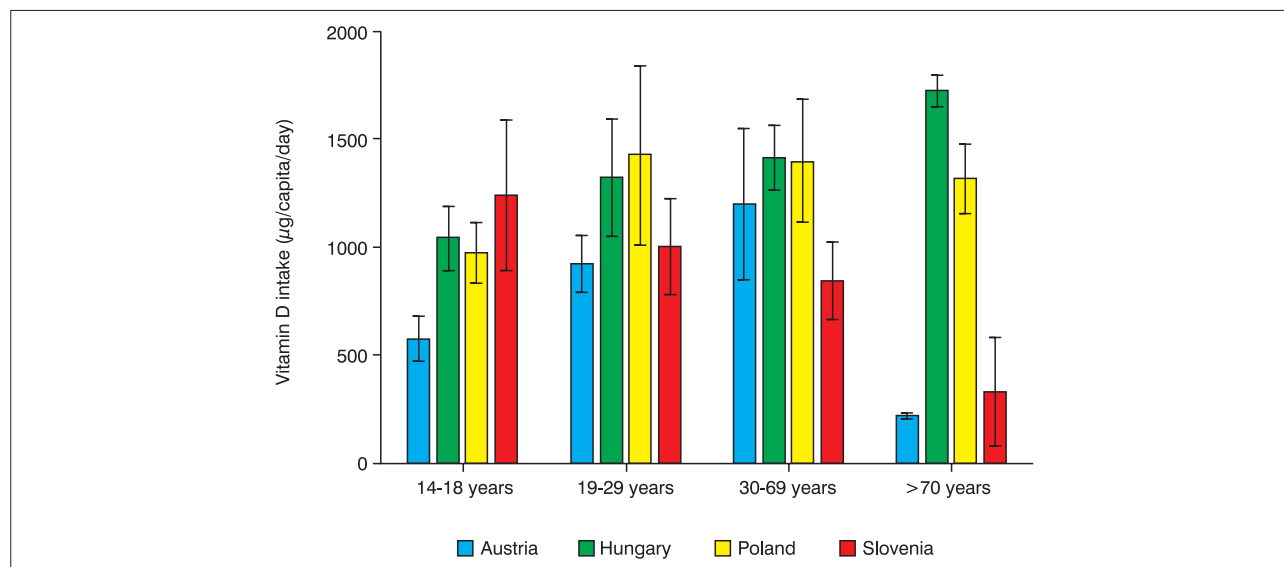


Fig. 3. Vitamin D intake of participating countries by age groups (mean, SD).

meat products was presented in a high ratio. Meat was most commonly occurred in the diet of the Slovenian population (1.1 serve/day), while meat products were mostly preferred by the Hungarian participants (1.63 serve/day).

DISCUSSION

Our results show, that unfavourable trends dominate the eating habits of the investigated countries. In all cases excessive energy intake was observed, and because of this, overweight and obesity were frequent.

Calcium intake provided by foodstuffs was appropriate, although it is notable that people from the age group of 14-18 years consume calcium under the recommendations. It is quite unfavourable, as this is the critical age for the bone development. The other critical age group is the > 70 years, where the intake was also insufficient, which is serve deficiency, as it brings an increased rate of bone destruction.

Current research together with the previous national studies indicate that adequate vitamin D intake is hard to provide even by a well-balanced nutrition. According to these information, enriched foods, or supplementation

by medical recommendation should also be considered. Furthermore interventions and complex health-prevention programs should be implemented and popularised for the correction of the insufficiencies.

This study also justifies the relevance of further investigations, and the actualization of the current recommendations. □

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