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THE EFFECT OF DAIRY PRODUCTS CHOICE ON CALCIUM DIETARY INTAKE IN FEMALE UNIVERSITY STUDENTS OF NUTRITIONAL FACULTY

Dariusz Włodarek, Dominika Głąbska, Ewa Lange*

Chair of Dietetics, Department of Dietetics, Faculty of Human Nutrition and Consumer Sciences, Warsaw University of Life Sciences - SGGW, Poland

ABSTRACT

Background. Dairy products provide the most important source of calcium in a typical human diet, being of particular significance to women.

Objective. To determine dietary calcium intakes in a group of female students studying human nutrition at a Warsaw University of Life Sciences –SGGW through analysing the selections made of dairy products.

Materials and Methods. A food frequency questionnaire was used to assess average consumption of dairy products. Total daily calcium intakes were then estimated by adding the intakes obtained from such dairy products to an average non-dairy calcium value obtained from other foodstuffs and taken to be 250 mg.

Results. Varied choices were made of dairy foodstuffs, with most subjects consuming milk, milk beverages, cottage cheese and rennet cheese. Calcium intakes were thus dependent on the dietary assortment of such selected dairy products made. Whenever cheeses were avoided in the diet, then low calcium intakes became more common.

Conclusions. When compared to dietary recommendations, calcium intakes in this group of young women were inadequately low, especially for those not eating cheese and despite supposedly having sufficient knowledge through studying this subject area.

Key words: *calcium, dairy products, nutritional questionnaire, female students, faculty of nutrition*

STRESZCZENIE

Wprowadzenie. Najważniejszym źródłem wapnia w diecie są produkty mleczne, które dostarczają większość dobowej ilości wapnia w diecie kobiet.

Cel. Celem prezentowanego badania była ocena spożycia wapnia w grupie studentek wydziału nauk o żywieniu człowieka i analiza wpływu wybieranego asortymentu produktów mlecznych na ilość wapnia w ich diecie.

Materiał i metody. Przeprowadzono ankietę częstości spożycia, w której oceniono przeciętne spożycie produktów mlecznych. Na tej podstawie określono przeciętną dobową ilość wapnia z produktów mlecznych, a dodając 250 mg, które jest przeciętnie spożywane z produktów innych niż produkty mleczne, również dobową podaż wapnia.

Wyniki. Stwierdzono, że asortyment produktów mlecznych spożywanych w badanej grupie był różnorodny – większość z badanych spożywała mleko, napoje mleczne, sery twarogowe i sery podpuszczkowe. Podaż wapnia z produktów mlecznych była uzależniona od wybieranego asortymentu produktów mlecznych – kobietom niespożywającym serów trudniej było osiągnąć dużą ilość wapnia w diecie z produktów mlecznych.

Wnioski. W porównaniu z zaleceniami, ilość wapnia w diecie młodych kobiet, szczególnie tych niespożywających serów, była niewystarczająca, mimo posiadanej przez nie wiedzy żywieniowej.

Słowa kluczowe*: wapń, produkty mleczne, ankieta częstości spożycia, studentki wydziału żywieniowego*

INTRODUCTION

It is recognised that individuals suffering from osteoporosis, low bone mass and weak bone tissue have, as a consequence, increased fracture susceptibility and bone fracturability [9]. Osteoporosis occurs more often in women than men, where the frequency increases with age; particularly affecting postmenopausal women [19].

*** Corresponding author:** Dariusz Włodarek, Chair of Dietetics, Department of Dietetics, Faculty of Human Nutrition and Consumer Sciences, Warsaw University of Life Sciences - SGGW, Nowoursynowska Street 159c, 02-776 Warsaw, Poland, phone: +48 22 5937024, fax: +48 22 5937018, e-mail: dariusz_wlodarek@sggw.pl

Preventing osteoporosis should be tackled in childhood, as at an such early ages of life, there is a possibility to increase bone mass by suitable calcium intake with diet [28]. Increasing the bone mass is possible until the age of 30 [10], therefore it is vital to ensure an adequate calcium intake during this time, especially for young women.

The most important sources of calcium in the diet are dairy products, providing most of the daily dietary calcium in women; over 60% of daily calcium intake, [6, 21]. Previous results published in the scientific literature have established that the quantity of calcium from non-dairy products can be regarded as being quite constant, amounting to around 250 mg. Thus, dietary calcium depends on its intake from dairy foodstuffs. In preventing osteoporosis, the consumption of dairy products has also been found to be as efficient, if not more efficient, than calcium supplementation [11]. This high efficiency is due to the presence of lactose in dairy products [15] which improves calcium assimilation [24]. The study aim was to assess dietary calcium intake in a group of female university students of nutritional faculty and to analyse the influence of chosen dairy products on the calcium intake.

MATERIALS AND METHODS

Study subjects consisted of 101 female students aged 20-23 years attending the Faculty of Human Nutrition and Consumer Sciences at the Warsaw University of Life Sciences - SGGW in Poland. Each were asked to fill in a questionnaire on the types and frequencies of foods consumed, focused on assessing their calcium intake from dairy products. In total, 49 such dairy products that are most commonly available in Poland were considered. These included milk, yogurt, other milk beverages, rennet cheese, cottage cheese etc. Questions were asked also about meals containing dairy products and typical portion sizes of products and meals.

For each given product, the calcium intake was estimated by the following formula: calcium intake [mg] = typical portion size [g] x calcium content [mg/g]. The results obtained from the questionnaire were then analysed by the Polish 'Dietetic 2' software package and a national Polish database on nutritional values of foodstuffs [15]. Standard error of estimate for used questionnaire (calculated on the basis of 50 measurements – 2 for each patient with repetition in the period of 6 weeks) was 180 mg of calcium while median of difference for two estimations of daily calcium intake was 12%, that was assessed for other group of Polish young women. Moreover, applied food frequency questionnaire was previously used in other groups of Polish women [27].

The total dietary calcium intake per day was estimated by summing the amount of calcium determined from all the dairy products consumed with the 250 mg of calcium obtained from non-dairy products [6, 21]. These were compared with a value of 800 mg i.e. the Estimated Average Requirements (EAR) level in Poland, as recommended for this age group [12]. Results are presented as mean values ± standard deviations (SD) with median, minimum and maximum values also given. The distribution of analysed factors was verified using the W *Shapiro-Wilk* test. The non-parametric *Mann-Whitney* U test was used to determine the significance of differences between groups. To define the significance of correlations, the level of significance $p \leq 0.05$ was accepted. All statistical analysis were performed using the Statistica software version 8.0 by StatSoft Inc.

RESULTS AND DISCUSSION

The food frequency questionnaire is a widely used method for assessing calcium intake [6, 7, 14, 20, 23]. This arises because of calcium being a nutrient that is supplied by specified group of foodstuffs; dairy products. So instead of analysing the entire diet for calculating calcium intake using the method of dietary recall, it can be more simply and quickly assessed through using a food frequency questionnaire.

All women subjects consumed dairy products and the food frequency questionnaire indicated what choices of dairy products had been made. It was observed that 89% of women consumed milk, 93% other milk beverages, 90% cottage cheese and 90% rennet cheese. In total, 73% of women declared consuming dairy products from all of four analysed groups. Only 5% of women did not consume any dairy products from at least two of the four groups. It was mainly found that a wide variety of dairy products were consumed as almost all subjects consumed foodstuffs from all the dairy products groups.

Another Polish study, conducted on youth/adolescents, demonstrated cottage cheese consumption by 32% subjects, whilst for rennet cheese it was by 70% [2]; this was lower than in the presented research. A Croatian study using a food frequency questionnaire on an analogous group of female students showed that consuming dairy products was also less common than in the current study, where 12% of women subjects declared consuming these products less than once a month [22]. The higher amounts of dairy products consumption herein, may be due to the particular educational background of the subject group, who were students of nutritional faculty at university and who could thus be expected to be aware of the important role that dairy products play in a proper diet. Moreover, the Croatian research showed that the 7% of women who did not con-

Table 1. Dairy calcium intake [mg] in the diet of analysed group of women – comparison of calcium intake between those consuming and not consuming of dairy products

Group of dairy products	Subgroups consuming specified dairy products				Subgroups not consuming specified dairy products				p[b]
	Mean ± SD	Median	Minimum	Maximum	Mean ± SD	Median	Minimum	Maximum	
Milk	659 ± 309	598[a]	69	1791	504 ± 262	477	156	990	0.0860
Other milk beverages	657 ± 308	588[a]	122	1791	435 ± 205	498	69	650	0.0584
Rennet cheese	673 ± 304	602[a]	136	1791	360 ± 162	372	69	601	0.0005
Cottage cheese	655 ± 294	588[a]	122	1791	390 ± 468	167[a]	69	1202	0.0410
All groups of dairy products	subgroup consuming all the groups of dairy products				subgroup consuming no more than 3 of groups of dairy products				
	704 ± 296	657	238	1791	463 ± 263	420	69	1202	0.0001

[a] distribution different than normal (verified on the basis of W *Shapiro-Wilk* test – p≤0,05)
[b] subgroups compared using U *Mann-Whitney* test

sume any dairy products also performed low levels of physical activity, of which 1% had a too low body mass [22]. It should however be emphasised, that in order to reduce risk of osteoporosis, not only diet is important (with adequate calcium content), but also other factors such as physical activity, an appropriate body mass or even being slight overweight [18].

The median calcium intake of the women subjects was found to be 580 mg daily, however the range was wide; from 69 mg to 1791 mg. Table 1 demonstrates the analysis of calcium intake in the subgroups of dairy products. A significantly higher calcium intake was observed in women consuming cottage cheese and that consuming rennet cheese compared with subgroups who did not consume these foodstuffs. Other research has also showed that higher dairy products' consumption is associated with higher calcium intake in the diets of young women [4]. The present findings demonstrates that the most important dairy products responsible for high calcium intakes were cottage cheese and rennet cheese, that stressed the general and important role of cheese as a source of calcium. Furthermore, significant differences in dairy calcium intake were observed between women consuming all the different kinds of dairy products, with women not consuming at least one kind of dairy product. It may be concluded, that a wider variety of dairy products provide a higher likelihood that calcium intake recommendations are met.

The dairy calcium intake was added to 250 mg; being the quantity of dietary calcium obtained from non-dairy products [6, 21]. This value has been previously established as being typical from such non-dairy products [6, 21]. A study by of *Wądołowska* et al. showed that the mean calcium intake from non-dairy products observed in Polish women subjects was not higher than the assumed 250 mg value [26]; on this basis, the median of daily calcium intake of women in present study could be specified as 830 mg. Other research on young women gave lower daily calcium intakes of 455 mg [3] or ranges of 400 – 800 mg [16] in variously defined groups of individuals. Other factors influencing calcium intake have been also taken into account in other studies of individuals already possessing adequate nutritional knowledge [3]. Indeed this may possibly help explain the differences of calcium intake observed between the *Chang* [3] and *Maggiolini* et al. [16] studies compared with the results herein presented. It may be so expected, that students of nutritional faculty at university have a higher level of nutritional knowledge than the general population. According to literature, other factors may also contribute to higher calcium intake; not having children, low body mass in proportion to height and a high level of education [3] which could additionally explain the high levels found in the presented study. Here, subjects at least possessed secondary education and were continuing to study still further; most did not have children and most had an appropriate body mass.

In nearly 50% of subjects, the calcium intake was lower than EAR level (Figure 1). The study by *Wądołowska* et al. on a group of young women showed that 80% subjects had a calcium intake lower than the AI level [26]. It must however be pointed out that the AI level (1000 mg) that was applied to the assessment was according to the Polish dietary recommendations from 2008 [13] and was higher than EAR level (800 mg) used in the presented analysis [12]. Moreover, if the presented results are compared with the 1000 mg

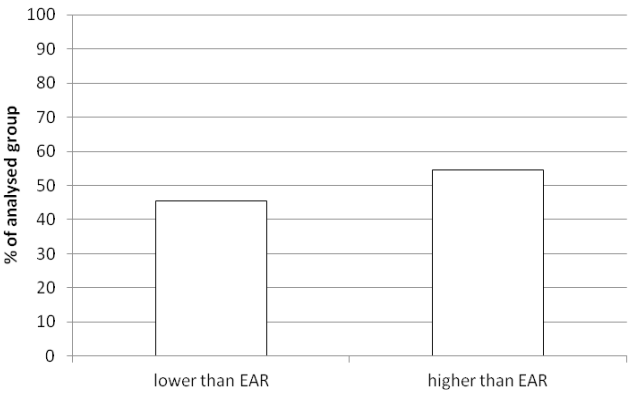

Figure 1. The share of analysed group of women characterised by calcium intake lower or higher than the recommended EAR level

AI level, then conclusions become similar to those of the *Wądołowska* et al. study [26] i.e. that almost 70% subjects have insufficient calcium intake. An insufficient calcium intake is typical for young women in Poland, being observed both from dietary recall studies [1, 5, 8, 17] and measurements made by atomic absorption spectrometry on daily food rations [17]. Other studies that confirmed this where *Cais-Sokolinska* and *Borski* [2], that compared dairy product and calcium intake in the diets of girls and boys from 6 European countries; the country with the highest dairy products consumed and calcium intakes (for girls) was Croatia, (out of Croatia, France, Germany, Hungary, Ireland, Poland); whereas Polish youth had the lowest dairy products intake (400 g daily, vs 1400 g in Croatia). Likewise dietary calcium intake in Polish girls was one of the lowest (250 mg vs 900 mg in Croatia).

In summary it may be concluded, that in own research, in spite of the fact that most of individuals consumed dairy products, it is possible, that servings were not sufficient to provide adequate amount of calcium, that was associated with nutritional habits generally observed in Poland.

CONCLUSIONS

1. Female students of nutritional faculty at university consumed a wide variety of dairy products; almost all consumed milk, other milk drinks, cottage cheese and rennet cheese.
2. Calcium intakes were in most subjects lower than those recommended.
3. Calcium intake depended on the dairy products chosen. In subjects consuming cottage cheese and rennet cheese the possibility of meeting calcium intake recommendations was higher.

Conflict of interest

The authors declare no conflict of interest.

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