

Characteristics of calcium intake in nursing home residents in Zagreb

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Abstract

Elderly people, especially those who live in nursing homes, are at high risk for getting osteoporosis and bone fractures. Knowing that an adequate calcium intake is important for prevention and therapy of osteoporosis, we aimed to estimate calcium intake in old people living in nursing homes in Zagreb. In a cross-sectional study, calcium intake was estimated using previously validated food frequency questionnaire especially designed for calcium intake, among 292 nursing home residents (232 women and 60 men), mean age 82.4±6.5 years. Mean dietary calcium intake in men was 653±297 mg/day and in women 528±279 mg/day (p=0.004). Only 10 % of women and no men were taking calcium supplements. Calcium intake below the 750 mg/day was present in 67.3 % of men and 77.5 % of women. Very low calcium intake, below the half of the recommended value, was present in 18.3 % of men and 31.0 % of women. Milk and dairy products were the main source of calcium intake in our study and contributed more than 80% of total daily calcium intake. No significant correlation was found between the body mass index and calcium intake in both genders. We conclude that the mean calcium intake in nursing home residents was below the recommended values.

Key words: calcium intake, elderly people, nursing homes

Introduction

The number of elderly people in most populations worldwide is increasing, and part of that population needs to be taken care of in institutions such as nursing homes. Nursing homes are faced with a very heterogeneous population of residents, which is reflected in various and specific nutritional needs. Many residents living in nursery homes are chronically ill and are often prescribed different medication. All this may affect their nutritional status, together with other problems, which are often presented in the elderly, such as anorexia, lack of

teeth, dementia and depression (Zelenik, 2016). These factors can have a significant impact on the nutritional status of the elderly, who are at higher risk of malnutrition and sarcopenia.

Aged residents of nursing homes are at particularly high risk of osteoporosis. The consequences of osteoporosis for individual nursing home residents are an increased risk of fractures, pain and disability (Zarowitz, 2014). More than 80 % of institutionalized old people have osteoporosis and approximately 40 % of them had hip fractures (Duque, 2016). Many of them need continuing care, and it has been show that the mortality after hip fracture

is nearly 20 % (Johnell, 2006). One of the most important factors in preventing bone loss is an adequate calcium intake. Calcium is best absorbed through the foods and it has been shown that calcium from well-balanced diet is better utilized than that from supplements alone (Papaloanou, 2015). But most results show that calcium and vitamin D intake in nursing homes in Croatia are far below the recommended intake (Rumbak, 2010; Mandić, 2014). However, the literature review addressed the complexity of determining what an adequate intake is for elderly. The recommendations are ranging from 500 mg to 1500 mg of dietary calcium for elderly (Nordic Council of Ministers, 2004; Yates, 1998; Department of Health and Ageing, 2006; Tang, 2007). Moreover, there is not always a clear legislation regulating food quality control in nursing homes. Many countries rely on guidance for the diet for older people which can be used to prepare menus for nursing homes (Vranešić Bender, 2011). Therefore, it has not yet been formalized whether the existing recommendations can be applied strictly to older people.

The aim of the study was to investigate dietary calcium intake in elderly population who live in nursing homes in Zagreb and to describe the characteristics and factors associated with their calcium intake.

Materials and methods

The study protocol was previously described in detail in the publication about the physical activity and bone density in the same study group (Cvijetić, 2019). Briefly, the study population comprised residents of six public nursing homes for older people in Zagreb, who had been institutionalized for more than one year. Informed consent was obtained from all subjects included in the study. Participants were recruited on a voluntary basis and the study was approved by the Ethics Committee of the Institute of Medical Research and Occupational Health.

Questionnaire

A validated, quantitative food frequency questionnaire (FFQ) was used to determine the average daily calcium intake (Šatalić, 2007). The amount

of calcium intake was calculated using national food composition tables (Kaić Rak, 1990). The short calcium FFQ was developed from the draft version based on the FFQs used in the previous studies involving schoolchildren and university students (Colić Barić, 2002, 2004; Šatalić, 2004). The draft version was applied on 100 subjects, allowing the creation of the final short calcium FFQ with 27 items which provided most of the total calcium intake. Those 27 items contributed to 95 % of total calcium intake on the previous FFQ. The questionnaire comprised 4 food groups rich with calcium, with different number of foods in each group: 1.) Dairy products: milk, yogurt, fruit yogurt, cheese (semi-hard, fresh and processed), pudding, ice-cream; 2.) Fruits: apples and oranges; 3) Vegetables: spinach, beans; 4) Canned fish: sardines. The intake of bread and water was also included into the questionnaire. The menus in different nursing homes were relatively similar and some foods from the questionnaire, like canned fish, ice cream and pudding, were rarely present in the diet. Therefore, in the data analysis, those foods were categorized as "other".

Anthropometry

Height and weight were measured on a portable stadiometer and scale (Model TTM; Zagreb, Croatia) and were rounded to the nearest 0.5 cm and 0.5 kg, respectively. The body mass index (BMI) was calculated as weight (kg) divided by the square of height (m²).

It has been suggested that the difference in calcium intake between the genders may be partly attributed to differences in their body size. So, when calcium intake is controlled by body weight, the mean recommended values for calcium are 18.1 to 18.5 mg/kg body weight per day (Uenishi, 2002). Therefore, we considered differences in body weight between men and women when comparing calcium intake between them.

Statistics

The results are shown as mean ± standard deviation. The distribution of variables was tested using

the Kolmogorov-Smirnov test. Since most variables were distributed normally, parametric functions were used in data analyses. Differences between men and women were tested using the t-test. Association between continuous variables were analysed with correlation matrices. All calculations were done with the Statistica (Dell Inc, Tulsa, OK) ver.13.0 software. The level of significance was set at $p < 0.05$.

Results and discussion

The mean age of participants was 82 years (Table 1). The mean duration of their stay in the nursing homes was approximately 10 years. Women had significantly higher BMI than men ($p = 0.001$). According to BMI, 18.5 % of women and 38.3 % of men had normal weight, 62.1 % of women and 50.0 % of men were overweight, while 19.4 % of women and 8.3 % of men were obese. No participant had a BMI below 18.0.

TABLE 1. Age, anthropometry and calcium intake in nursing homes residents

	Men (N 60)	Women (N 232)	p
Age (yrs.)	82.7±6.3	82.4±6.6	n.s.
Height (cm)	175.5±8.2	160.3±5.8	<0.001
Weight (kg)	79.3±8.9	70.3±8.6	<0.001
BMI (kg/m ²)	25.8±3.1	27.3±3.3	0.001
Dietary calcium intake (mg/day)	653±296	528±279	0.004
Supplemental calcium intake (mg/day)	/	355±118 (N 10)	/

The mean dietary calcium intake in men was 653±296 mg per day and in women 528±279 mg/day ($p = 0.004$) (Table 1). Among women, 10 % were taking calcium supplements and 15 % vitamin D₃, while no man was taking calcium or vitamin D supplements. Calcium intake below EFSA recommended values (750 mg/day) was found in 67.3 %

of men and 77.5 % of women (Table 2). Very low calcium intake (<375 mg/day, which is half of the recommended value) was found in 31.0 % of women and 18.3 % of men. Calcium intake higher than 1000 mg/day was determined in 5.6 % of women and 13.3 % of men ($p = 0.039$).

TABLE 2. Dietary calcium intake below EFSA recommended values

Dietary calcium intake	Men N (%)	Women N (%)	p
≥ 750 mg/day	20 (32.7)	52 (22.5)	n.s.
< 750 mg/day	40 (67.3)	180 (77.5)	n.s.
< 375 mg/day	11 (18.3)	72 (31.0)	n.s.
Total	60 (100.0)	232 (100.0)	

In our elderly institutionalized participants, dietary calcium intake was somewhat lower than the recommended values, both in men and women. There are many recommendations for an adequate daily calcium intake for people over 50 years: from 700 mg/day in the United Kingdom, 800 mg/day in Scandinavian countries to 1200-1300 mg/day in the United States and Australia (Warensjö, 2011). The European Food Safety Authority (EFSA) has issued its recommendations at which the adults over the age of 24 should have 750 mg of calcium per day (EFSA, 2017). In Croatia, calcium intake recommendations are set to 800 mg/day regardless of the gender or age (Croatian Official Gazette, 2011).

Our results on calcium intake in elderly people are similar to previous research on the diet quality in nursing home residents in Zagreb, which showed that approximately 53 % of residents had a calcium intake below 50 % of recommended value and that only 3.2 % of participants had an adequate calcium intake (Rumbak, 2010). In the study on adequacy of nutrition in elderly residents and non-residents of nursing homes in Croatia, Colić Barić (2006) found that all meals provided adequate amount of micronutrients, with exception of calcium, which was 63 % of DRI. In the study group of 120 adults from eastern Croatia, aged 33.8 years, the average daily dietary intake of calcium was 661 mg/day (Mandić-Puljek 2005). It has also been shown that menus in nursing homes in Croatia are in accordance with the recommendations regarding the

energy value of the meal and the energy share of the macronutrients, but the calcium content is less of DRI values (Keser, 2005; Ćurin, 2006).

Calcium intake in our participants was somewhat better when compared to similar studies outside the country. In 93 elderly Thai women who were living in nursing homes, dietary calcium intake was 322.3 mg/day (Kruavit, 2012), while in participants from nursing home in China, the intake was 355.4 mg/day (Meng, 2016). In institutionalized elderly people from Southeast Spain, the intake of many nutrients, including calcium and vitamin D, was low in >80 % of participants (Rodríguez-Rejón, 2019).

The recommended values for calcium intake are set up according to the most important physiological effect for maintaining normal plasma calcium levels, which is movement of calcium into or out of the bones. It has been shown that calcium intake less than 700 mg/day in women was associated with increased risk of losing bone calcium and getting an osteoporosis (Warensjö, 2011). However, an additional higher calcium intake does not actually appear to lower a person's risk for osteoporosis, therefore it is not recommended to increase

calcium intake significantly above these levels for the bone loss prevention (Warensjö, 2011). Evidence suggests that calcium intake of as little as 300 mg per day, in the absence of vitamin D deficiency, is unlikely to result in clinically significant bone loss (Beckerleg, 2017). Therefore, we think that dietary calcium intake between 528 and 653 mg per day in our participant did not pose the risk for bone density loss, depending, of course, of other risk factors like physical activity, other diseases and medications.

It is noticeable that a small percentage of our female participants and also no male participant, was taking calcium or vitamin D supplementation, which is similar to Thai study (Kruavit, 2012). However, there is growing concern that calcium supplements can lead to unwanted effects such as kidney stones or cardiovascular disorders, especially in elderly people (Bolland, 2015) and that the benefit of calcium supplements in preventing fractures is small (Zhao, 2017). That is why elderly people are recommended to increase the intake of dietary calcium by increasing the consumption of foods such as milk and dairy products (Bauer, 2013).

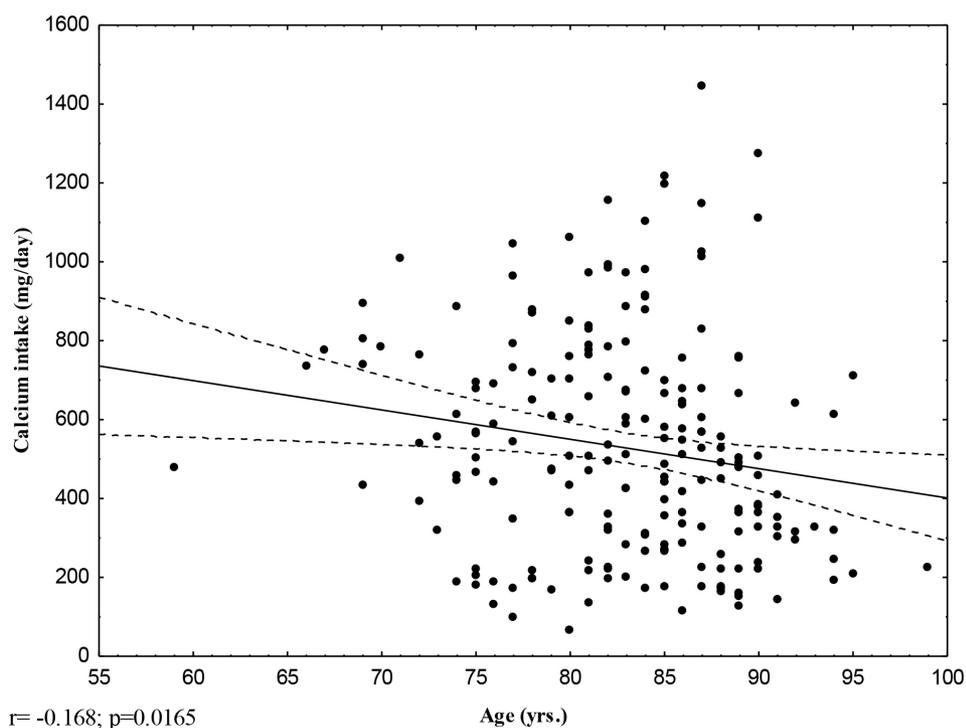


FIGURE 1. Correlation between calcium intake and age in women

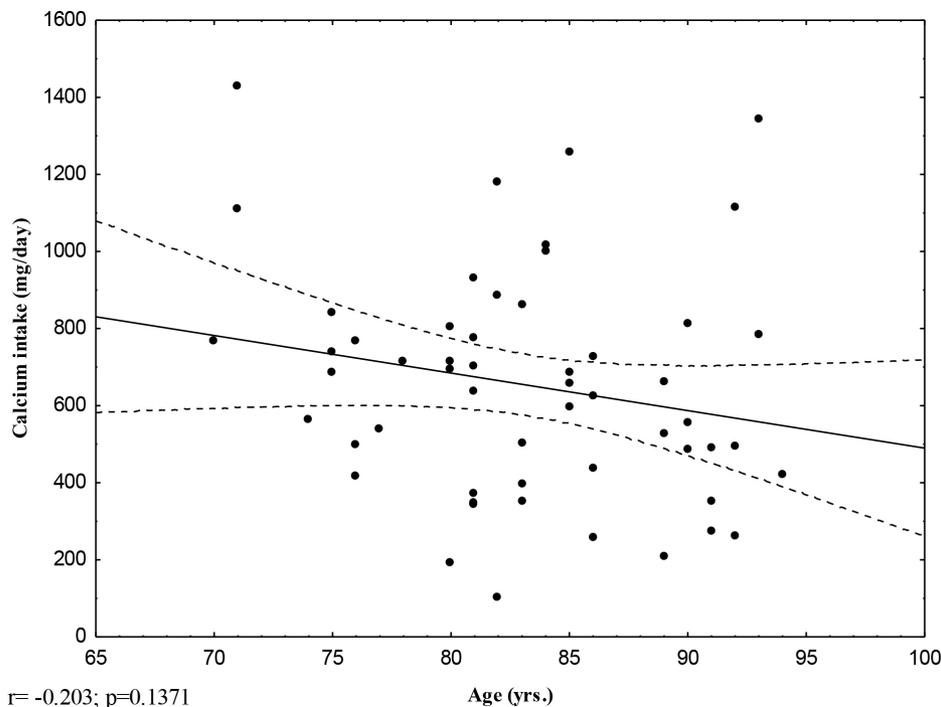


FIGURE 2. Correlation between calcium intake and age in men

Dietary calcium intake correlated negatively with the age, but that correlation was significant only in women (Figures 1 and 2). Although a significant correlation between the age and BMI was found in women ($p = 0.003$), there was no significant correlation between BMI and the calcium intake in both genders. When presents dietary calcium intake according to the body weight (kg), 90 % of men had a calcium intake below 18.1 mg/kg, while 85.8 % of women were below 18.5 mg/kg. Calcium intake in our participants decreased with age, which is similar to findings of some past studies

(Mandić-Puljek, 2005; Genari, 2001). Decrease in dietary calcium intake could be the result of the overall decrease in calorie intake, since elderly people may have poor appetite or some illnesses that decrease the sense of hunger. Additionally, calcium intake according to body weight was satisfactory in only 10 % of men and in 14 % of women who took part in this study. Bearing in mind that nearly 85 % of women and 67 % of men were overweight or obese, we think that estimation is more a consequence of high prevalence of increased body weight than of low calcium intake.

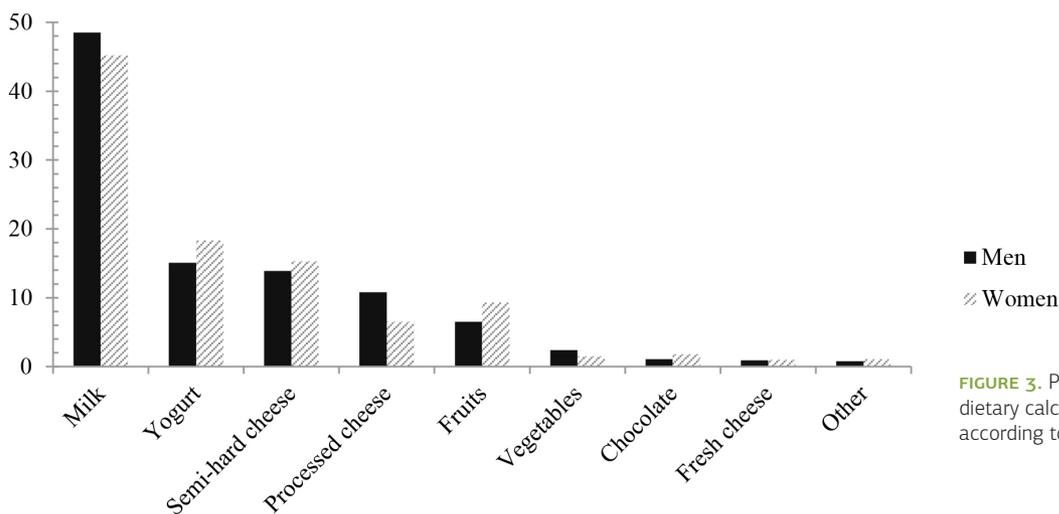


FIGURE 3. Percentage of dietary calcium intake according to food group

In both genders, the highest proportion of dietary calcium consumption has originated from milk (48.5 % in men and 45.2 % in women), followed by yogurt (15.1 % in men and 18.3 % in women) and semi-hard cheese (13.9 % in men and 15.3 % in women) (Figure 3). As a source of calcium intake, processed cheese was on the fourth place in men, while fruits were on the fourth place in women. Men took significantly more calcium from vegetables than women ($p < 0.001$). The lowest calcium intake in both genders was from fresh cheese and "other" foods. A similar distribution of calcium-rich food was found in the group of participants with low calcium intake (< 750 mg/day) and in those with higher calcium intake (> 750 mg/day). Milk, yogurt and semi-hard cheese were the most common sources of calcium intake in both groups.

As expected, milk and dairy products made the greatest contribution to the calcium intake in our study. More precisely, nearly 50 % of the total calcium came from milk, which is twice as much as from other dairy products. Milk and milk products contributed more than 80 % of the total daily calcium intake, which is much higher than in previous study on younger population from eastern Croatia (Mandić-Puljek, 2005). This indicates an adequate presence of dairy products in menus in nursing homes in Zagreb.

One of the limitation of this study was the lack of data about vitamin D intake, since the absorption and bioavailability of calcium is dependent on vitamin D status. However, food is a minor source of vitamin D and even though someone has an adequate vitamin D intake, it does not necessarily result

in vitamin D sufficiency. Another limitation was a relatively low recruitment rate (around 33 %) in our study, but our participants were uniform according to the age and consequently comparable to other studies dealing with nutrition in elderly people.

Conclusions

In elderly participants who live in nursing homes in Zagreb, daily calcium intake was significantly higher in men than in women although neither of them had an adequate mean calcium intake according to the recommended values. A very small percentage of women and no men took calcium or vitamin D supplements. Although the presence of dairy products, as the most important source of calcium intake, was satisfactory in nursing homes included in this study, in our opinion a clear legislation and systematic quality control of nutrition in nursing homes is still needed in order to accomplish better overall calcium intake for their residents.

Acknowledgements

The authors thank the residents and personnel of the nursing homes: Centar, Ksaver, Maksimir, Park, Sveti Josip and Trešnjevka for their participation, help and support.

The study was supported by the Institute for Medical Research and Occupational Health (Project "Bone mineral density and fracture risk in older institutionalized people").

Karakterizacija unosa kalcija među korisnicima domova za starije osobe u Zagrebu

Sažetak

Stariji ljudi, pogotovo oni koji žive u domovima za starije osobe, imaju visok rizik obolijevanja od osteoporoze te posljedično lomova kostiju. Obzirom da je primjeren unos kalcija važan čimbenik u prevenciji i liječenju osteoporoze, u ovom presječnom istraživanju smo analizirali unos kalcija u osoba koje žive u domovima za starije osobe u Zagrebu. Korišten je prethodno validirani upitnik, dizajniran za procjenu unosa kalcija. Sudjelovale su 292 osobe, 232 žene i 60 muškarca, prosječne dobi $82,4 \pm 6,5$ godina, a podaci o unosu kalcija su dobiveni upitnikom. Prosječan unos kalcija je iznosio 653 ± 296 mg/dan u

muškaraca i 528 ± 279 mg/dan u žena ($p=0,004$). Unos kalcija ispod preporučenih vrijednosti od 750 mg/dan je utvrđen u 67,3 % muškaraca i 77,5 % žena. Vrlo niski unos kalcija, manji od polovine preporučene vrijednosti, je utvrđen u 18,3 % muškaraca i 31,0 % žena. Mlijeko i mliječni proizvodi bili su glavni izvor (više od 80 %) ukupnog dnevnog unosa kalcija u ispitanika. Nije utvrđena značajna povezanost između indeksa tjelesne mase i unosa kalcija u oba spola. Zaključujemo da je prosječni unos kalcija u naših ispitanika koji žive u domovima za starije osobe ispod preporučenih vrijednosti.

Ključne riječi: unos kalcija, stariji ljudi, domovi za starije osobe

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