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Research paper

Calcium intake of service house residents – when are supplements needed?

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ABSTRACT

Purpose: Calcium has beneficial effects in preventing osteoporosis and fractures among older adults but supplements may have adverse effects if calcium accumulates in the arteries. Aim was to examine total calcium intake from food and supplements of older residents in service houses and assess whether the use of supplements was directed appropriately.
Subjects and methods: Residents in service houses in the metropolitan region of Helsinki, Finland. Residents' calcium intake was calculated from one-day food diaries. Use of calcium supplements was retrieved from medical records.
Results: In total, 350 service house residents participated. Their mean age was 83 years; 82% were females. According to the MNA, 21% suffered from malnutrition. The mean dietary calcium intake of females was 1113 mg per day. Including food and supplements, their mean intake was 1441 mg. The corresponding figures for males were 1224 mg and 1528 mg. Of all residents, 13% had a total daily calcium intake from food and supplements that was < 800 mg, 29% 800–1200 mg, and 59% > 1200 mg. More than one-third (37%) of the residents used calcium supplements daily. Of those having calcium intake from food < 800 mg, only 32% were administered calcium supplements. The respective proportions among groups in which calcium intake from food was 800–1200 mg, 1200–1500 mg, or > 1500 mg were 37%, 43%, and 36%.
Conclusions: Dietary intake of calcium should be evaluated and administration of calcium supplements should be directed to those whose intake of calcium from food is low.

1. Introduction

Evidence supports that calcium supplementation, at least in combination with vitamin D, has beneficial effects in preventing osteoporosis and fractures [1,2]. Calcium supplements have been shown to decrease bone loss in both sexes [3,4], but their effect on fracture risk is more inconsistent [4]. However, high calcium intakes may also have adverse effects. A large register-based study suggested that high calcium intake may be associated with a higher risk of hip fractures. In this study, the optimal dietary calcium intake for preventing fractures was 882–996 mg [5]. Calcium supplements may have adverse effects if calcium accumulates in the arteries, causing vascular calcification [6–8].

In some studies, neither dietary nor supplemental intakes of calcium have been associated with the risk of ischemic heart disease [9], whereas Bolland et al. [10] reported that the risk of heart attack, strokes, and other vascular events was higher among postmenopausal women using calcium supplements. In a Finnish study, calcium supplementation with or without vitamin D appeared to increase risk of coronary heart disease among middle-aged women [11]. It has been suggested that calcium usage should be moderated and that food sources of calcium may be preferable to pharmacological supplements because they cause much smaller effects on serum calcium [7].

Calcium intake from food [12], and the use of calcium supplements in long-term care [13] have been researched in earlier studies. However, to our knowledge, no studies have examined total calcium intake from food and supplements among old and frail residents in institutional care, identified the

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proportion receiving sufficient calcium from their diets, or investigated whether supplement administration is directed to those with low calcium intake. The aim of this study was to examine total calcium intake from food and supplements among older service house residents and to assess whether supplement use is directed according to residents' needs.

2. Materials and methods

We assessed the nutritional status and food intake of service house residents aged 60 years and over. In service houses, the residents live in their own flats or have their own room in group homes. Nursing care is provided around the clock. Medical services are provided by primary care doctors. Residents can have their meals in the common dining room of the service house or group home, have their food delivered to their room, or take care of their meals themselves. This study forms part of a larger study assessing the nutritional status, psychological well-being, nutrient intake, and nutritional care of older people living in residential care in the cities of Espoo and Helsinki in 2007 [14,15].

Residents' nutritional status was evaluated with the Mini Nutritional Assessment (MNA) [16]. The MNA is a well-validated scale used to estimate the nutritional status of aged individuals (> 65 years) living in various settings [17]. Fewer than 17 points indicates malnutrition, 17–23.5 points represents a risk for malnutrition, and 24–30 points or more indicates good nutritional status.

Residents' weight and height were measured and body mass index (BMI) was calculated by dividing weight by the square of their height in meters. Residents' food intake for one day was calculated from detailed food diaries. A trained nurse familiar with the participants carried out the MNA and completed the food diaries together with participants. The nutritionist guided the nurses in completing the food diaries when needed. The food records were analyzed by the Aivo program [18], and nutrient intake was calculated. In addition, the use of calcium supplements was retrieved from medical records.

Several expert recommendations and reference values have been developed to assist with elderly people's nutrient intake. Dietary Guidelines for Americans 2010 recommends calcium 1200 mg/day for people aged over 51 years [19]. Nordic countries have compiled the Nordic Nutrition Recommendations (NNR) [20] on which the Finnish National Nutrition Council recommendations are based [21]. According to the Finnish National Nutrition Council, the recommended intake of calcium is 800 mg/day for people aged over 60 years. The Finnish Medical Society has stated that extra calcium, mainly from food, of 500–1000 mg may be beneficial in preventing and treating of osteoporosis [22].

In this study, participants were divided into three or four groups according to their total calcium intake or calcium intake from food alone. The groups of total calcium were < 800 mg/day, 800–1200 mg/day, and > 1200 mg/day. The groups of calcium intake from food alone were < 800 mg/day, 800–1200 mg/day, 1200–1500 mg/day and > 1500 mg/day. The grouping was based on calcium intake recommendations [19,21].

Cognitive functioning was assessed by a well-validated question retrieved from the Clinical Dementia Rating Scale (CDR) [23]. The subject's stage of cognition was evaluated according to the "Memory" class in the CDR (0–0.5: no or possible memory problems, 1: mild problems, 2–3: moderate or severe problems) and divided into two groups (those with CDR < 0.5 and CDR 0.5 or more (dementia).

Medical records were used to retrieve medical diagnoses and information on prior hip fractures and constipation. Comorbidity was computed for each resident using Charlson's comorbidity index [24]. Charlson's comorbidity index is a weighted index that takes into account the number and seriousness of a resident's comorbid diseases. Mortality during a one-year follow-up was retrieved from central population register.

The local Ethics Committee of Helsinki University Hospital approved the study protocol, as did the City of Helsinki and the City of Espoo. Each resident or proxy provided his or her informed consent.

Data were analyzed with the SPSS and NCSS statistical programs. Categorical variables were compared between the calcium intake groups using X^2 test. Continuous variables were compared using the Kruskal–Wallis test. $P \leq 0.05$ was considered significant.

3. Results

Altogether 350 residents (mean age 83 years, 82% females) participated in this study by providing their food diaries for one day. According to the MNA, 21% of the participants suffered from malnutrition and 65% were at risk for malnutrition. The proportion suffering from dementia was 70%.

In females, the mean calcium intake from food was 1113 mg (SD 390) per day. Including food and supplements their mean total intake of calcium was 1441 mg (SD 601). In males the corresponding figures were 1224 mg (SD 478) and 1528 mg (SD 612). Of all residents, 13% ($n = 44$) received daily calcium from food and supplements that was < 800 mg, 29% ($n = 100$) 800–1200 mg, and 59% ($n = 206$) > 1200 mg. More than one-third (37%) of the residents used calcium supplements daily according to their medical records, 25% of them receiving a dose of 500 mg and 75% 1000 mg.

Those whose calcium intake from food and supplements was < 800 mg had lower mean energy (1263 kcal) and protein (42.1 g) intake than those whose intake was 800–1200 mg (energy 1618 kcal and protein 57.7 g) or > 1200 mg (energy 1826 kcal and protein 67.4 g) (Table 1).

Those whose total intake of calcium was < 800 mg had low total daily intake of vitamin D (4.7 μg/day) compared with those whose intake was 800–1200 mg intake (total mean vitamin D intake 9.6 μg/day) or those with the highest calcium intake (total vitamin D 18.7 μg/day) (Table 1).

The proportion suffering from malnutrition according to the MNA (38.6%) was highest in the group receiving total calcium intake < 800 mg/day, whereas the respective figures in the calcium intake groups of 800–1200 mg and > 1200 mg were 25.0% and 16.0% ($P = 0.013$). Among those whose calcium intake was lowest, 50% had constipation, whereas among the highest calcium intake group the respective figure was only 35%. There were no differences in deaths after one year in different calcium intake groups (Table 1). Those who were malnourished according to the MNA had highest mortality at one-year follow-up (36.0%) compared to those with risk of malnutrition (13.4%) and those with good nutritional status (13.7%) ($P \leq 0.001$).

Of those with calcium intake from food < 800 mg, 32% were administered calcium supplements and 41% vitamin D supplements; of those receiving 800–1200 mg of calcium from food, 37% were on calcium supplements and 48% vitamin D supplements. Even among those whose intake of calcium from food was 1200–1500 mg, 43% had supplements (53% vitamin D supplements), and in the group receiving > 1500 mg of calcium from food 36% had supplements (55% vitamin D supplements). No differences in using calcium supplements in the various food intake groups of calcium emerged. Neither there were differences in these groups in how they were administered vitamin D supplements (Fig. 1).

4. Discussion

The mean total intake of calcium from food and supplements of older service house residents was sufficient or high. Many of those