

Applied nutritional investigation

Seemingly paradoxical seasonal influences on vitamin D status in nursing-home elderly people from a Mediterranean area

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Manuscript received August 1, 2007; accepted January 4, 2008.

Abstract

Objective: We investigated vitamin D status in institutionalized elderly subjects by measuring serum 25-hydroxyvitamin D (25[OH]D) and its association with season and other factors: age, gender, nutritional status, cognitive function, functional ability, dietary intake, vitamin D supplement consumption, and disease.

Methods: The cross-sectional study included 86 subjects, 65–94 y of age (29 men and 57 women), who lived in three nursing homes in Murcia, a Spanish Mediterranean area. The Mini Nutritional Assessment, Short Portable Mental Status Questionnaire, and BI were used to evaluate nutritional status, functional ability, and cognitive function, respectively. Serum 25(OH)D concentrations were used to assess vitamin D status. The thresholds of inadequacy were considered to be <25 nmol/L (vitamin D deficiency) and <50 nmol/L (vitamin D insufficiency).

Results: Body mass index was 28.8 ± 5.8 kg/m² (mean \pm SD). Vitamin D dietary intake was very much below the recommended dietary intake. The Mini Nutritional Assessment was 23.6 ± 4.0 , cognitive function was 7.8 ± 1.9 , and functional ability 82.9 ± 23.1 . The percentages of subjects with inadequate serum 25(OH)D concentrations were 58.2% and 32.6%, taking into consideration cutoffs of 50 and 25 nmol/L, respectively. Vitamin D deficiency was more common in women (40.3%) than in men (20.7%). Serum 25(OH)D concentrations varied significantly with the season in which the samples were taken, but not with the other factors analyzed.

Conclusion: In this Mediterranean area, a substantial percentage of institutionalized subjects showed an inadequate vitamin D status, which could be remedied by the consumption of vitamin D–fortified foods and/or vitamin D supplements, especially during the summer months. © 2008 Elsevier Inc. All rights reserved.

Keywords:

Vitamin D; 25-Hydroxyvitamin D deficiency; Dietary intake; Nutrition; Mini Nutritional Assessment; Elderly; Nursing home; Institutionalization

Introduction

Vitamin D deficiency has been found to be prevalent among elderly populations in many regions of the world [1–6]. In community-dwelling elderly people, the preva-

lence of vitamin D deficiency is 5–25% and this is much greater (48–80%) in the institutionalized elderly population [7–10].

Vitamin D is produced endogenously when the skin is exposed to sunlight (ultraviolet B 290–315 nm) and can be obtained exogenously from a few natural food sources and by food fortification and supplements. Several factors potentially affect vitamin D status. These include genetic factors, adiposity, and factors affecting the cutaneous synthesis of vitamin D such as skin pigmentation, age, season, lati-

This study was supported by the Social Action Institute of Murcia, Murcia Region Government, Spain.

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tude, melanin concentration, clothing, and use of sunscreens [11]. Elderly people are prone to vitamin D deficiency because of various risk factors including decreased dietary intake, diminished sunlight exposure, reduced skin thickness, impaired intestinal absorption, and impaired hydroxylation in the liver and kidneys [12,13]. In addition, several studies carried out in elderly people have revealed a poorer vitamin D status during the autumn and winter because of the lower sunlight exposure during these months [2,14–17].

An inadequate vitamin D status is associated with increased bone turnover and bone loss, which increases fall and fracture risks. This condition is also related to muscle weakness and more recently to the risk of colorectal, breast, ovarian, and prostate cancers and type 1 diabetes and heart disease [18–23]. Vitamin D and calcium supplementation has been shown to contribute to the prevention of hip and non-vertebral fractures in elderly women and men [14, 24–28].

It is well recognized that elevated serum parathyroid hormone concentrations and low 25-hydroxyvitamin D (25[OH]D) levels are common indicators of vitamin D deficiency. Serum or plasma 25(OH)D concentration is considered an appropriate measurement of vitamin D status [11,29]. The limit for optimal 25(OH)D concentrations is still unclear, with levels ranging from 20 to 122 nmol/L to prevent secondary hyperparathyroidism [30–33]. We chose to operate with limits of 25 nmol/L for vitamin D deficiency and 50 nmol/L for insufficiency, in agreement with previous studies [2].

The aim of the present study was to determine vitamin D status (assessed by measuring serum concentrations of 25[OH]D) in elderly nursing-home subjects from the province of Murcia, a Mediterranean area in southeast Spain, and the relation to season and other factors, namely age, gender, dietary intake, vitamin D supplements, nutritional status, functional ability, cognitive function, and disease.

Materials and methods

Subjects

The cross-sectional study was carried out in the province of Murcia (southeast Spain) between May 2005 and October 2006. The age of the subjects ranged from 65 to 94 y and all lived in three public nursing homes from urban areas. Only subjects who had a normal diet were included (subjects who had enteral or parenteral nutrition or pureed foods were excluded). From a total of 464 subjects living in the three nursing homes studied, 143 (30.8%) consumed a normal diet and/or were not severely cognitively or physically impaired. However, 54 subjects (38%) were unwilling to participate, and three (2%) were admitted to hospital care during this study. Thus, 86 subjects participated in this study (60%, 57 women and 29 men). The mean age \pm SD was 77.4 ± 8.1 y (range 65–94 y).

Study design

All participants were examined to assess their nutritional status, cognitive function, functional ability, dietary intake, consumption of vitamin D supplements, and seasonal variations in vitamin D concentrations, in addition to anthropometric and biochemical measurements. Any illnesses were ascertained from medical records.

Nutritional status

Nutritional status was assessed by the Mini Nutritional Assessment (MNA) test [34], which includes 18 items in four sections: anthropometric measurements, global assessment, dietary questions, and a subjective assessment; the score obtained (maximum 30 points) permitted the elderly people to be classified into three categories: malnourished (<17), at risk of malnutrition (17–23.5), and well nourished (>24).

Cognitive function

Cognitive function was assessed by the Short Portable Mental State Questionnaire (SPMSQ) [35], which consists of 10 questions with a maximum score of 10. A score of 0–2 indicates severe intellectual impairment, and scores of 3–5 and 6–7 indicate moderate or mild intellectual impairment, respectively; a score of 8–10 indicates intact functioning.

Functional ability

Activities of daily living were evaluated by Barthel's Index (BI) [36,37]. BI measures performance in basic self-care in seven areas: feeding, bathing, personal toilet, dressing, bowel/bladder control, getting on/off the toilet, and locomotion. A score of 100 (maximum 100) indicates that the subject is independent in physical function and the lowest score, 0, indicates a totally dependent bedridden state.

Dietary intake

Food intake was assessed by a 4-d weighed-food record of all food and fluids consumed during each meal. All subjects were also asked about any food consumed other than in the dining room of the nursing home. Average daily intakes of energy, macronutrients, calcium, and vitamin D were estimated by the software Grunumur [38], using the Spanish food composition tables [39,40]. Dietary intake data were compared with recommended dietary intakes for the Spanish elderly population (vitamin D 15 μ g/d) [40].

Anthropometric measurements

Weight was measured in subjects wearing light clothes and bare-footed to the nearest 0.1 kg using portable equip-

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