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USE OF VITAMIN D SUPPLEMENTS AND ITS ASSOCIATIONS AMONG OLDER SERVICE HOUSING RESIDENTS

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Abstract: *Background:* Vitamin D supplements are recommended for elderly persons. However the frequency of use has been low and the dose insufficient. *Objectives:* 1) To study the frequency of use of vitamin D supplements in 65+ residents of service houses; 2) to explore the dose of vitamin D among users; and 3) to clarify the factors associated with the use of supplements. *Design, setting and participants:* This cross-sectional study aimed to include all the service housing residents (N=2 214) in 69 service houses in Helsinki and Espoo in 2007. Residents in temporary respite care were excluded (5%). Of permanent residents, 70% (N=1475) were assessed. *Measurements:* Trained nurses in each service house performed a personal interview and assessment including the Mini Nutritional Assessment to assess the residents' nutritional, functional and health status, use of medications and use of vitamin D supplements. Medical records were used to confirm demographic and medical data. *Results:* Of the residents, 60.1% were users of vitamin D supplements. The proportion of users having a therapeutic dose (≥20 μg/day) was 23.9 %. In random effects logit model male gender (OR 0.34, 95% CI 0.24-0.48) and prior hip fracture (OR 2.64, 95% CI 1.71-4.07) were independently associated with the use of vitamin D supplements. *Conclusions:* The use of vitamin D was less than optimal among 65+ service housing residents. However, when comparing with our previous assessment of nursing home population 2003, the proportion of the users has doubled.

Key words: Aged (65+), vitamin D supplements, service housing.

Introduction

Evidence on vitamin D is mainly focused on bone health (1), but adequate vitamin D status may also be protective against other diseases (2). Vitamin D has beneficial effects on preventing falls and fractures (1, 3). It has been suggested that the effect of vitamin D is mediated via musculoskeletal function (4, 5). Vitamin D supplements are recommended for elderly persons by several researchers (6-8).

Vitamin D deficiency is often unidentified (7), although treatment is simple and cheap. Concealing clothes and absence of sun exposure suggest a possible vitamin D deficiency (9). Although prevention of vitamin D deficiency is feasible by UV light exposure, food fortification and supplements (10-12), many older persons do not receive enough vitamin D (13).

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According to the American Dietary Reference Intakes for Calcium and Vitamin D (14), the estimated average vitamin D requirement for 70+ persons is 10 μg (400 IU)/day and the recommended dietary allowance 20 μg (800 IU)/day. The Nordic Nutrition recommendation (15) for vitamin D supplement use in 75+ persons is 10 μg (400 IU)/day. The recommendation of the National Consultative Committee for Nutrition in Finland (8) suggests 60+ persons to use vitamin D supplements 20 μg (800 IU)/day.

Bishoff-Ferrari et al. (3) stated that doses less than 17.5 μg/day may not reduce the risk of falls. Munir et al. (16) found that 22% of long-term care setting residents had their vitamin D level assessed, and 35% had ongoing vitamin D supplementation. In Hamid's et al. study (11) of long-term care 60+ residents, 72% were receiving vitamin D supplements 10 μg/day, 12% 15 μg/day and 7% 20 μg/day.

In a Finnish study (17), one third of the nursing home residents received vitamin D supplements. However, 21% received vitamin D in the dose of 10 μg/day and only 4% in the recommended dose (20 μg/day). Use of vitamin D was associated with female gender, good nutritional status and nutritional care.

Although the benefits of vitamin D have been shown

in many randomized studies, only few studies have explored the implementation of vitamin D supplement use in frail older people. The objective of this study was 1) to assess the frequency of use of vitamin D supplements in older residents of service houses; 2) to explore the dose of vitamin D among users; and 3) to investigate the factors associated with the use of supplements.

Methods

The cross-sectional study assessed nutritional, functional and health status, and use of vitamin D of all residents aged 65+ years living in service housing in the cities of Helsinki and Espoo in Finland. The service houses in these cities provide round-the-clock care, similar to traditional nursing homes. The environment in service housing units is, however, more home-like than in nursing homes. Those persons having severe cognitive decline usually live in group homes and those cognitively capable in detached apartments.

Of all the residents (N=2 214), 5% (N=111) were in temporary respite care. Among those living permanently in service houses (N=2103), the informed consent could not be obtained from 628. The non-responders were persons unable to give informed consent because of dementia and not having a close proxy or they refused. Thus, the response rate of those living permanently in service houses (n = 1475) was 70%.

In each ward trained nurse knowing the residents well carried out the interview, assessment and the collection of information from medical records. These nurses took part in educational sessions before the study period.

Structured questionnaire was used in interviewing and assessing the residents. Use of vitamin D was inquired by a single question: “Does the resident use vitamin D supplement” (yes/no). Those responding "yes" were considered as users. In addition, each resident's medical records concerning use of vitamin D supplements were explored. All those residents using vitamin D supplements on regular basis according to the medical records were added to the users if not reported in previous item. There were 485 users recorded in both sources. In addition, there were 212 users in “yes/no” question without recorded in drug lists of medical records. They were using vitamin D products either not reimbursed as drugs by the Social Insurance Institution of Finland or not listed in the Finnish electronic pharmacopoeia from which the drugs are automatically retrieved on residents’ medical records. Furthermore, there were 190 users found in medical records which the nurses did not identify as users. All these users were administered multivitamin and calcium products consisting of some vitamin D. (Figure 1.) The dose of vitamin D supplements was assessed by retrieving it from medication records.

The Mini Nutritional Assessment (MNA) was used in assessing the residents' nutritional status (0 – 30 points). Less than 17 points indicates malnutrition, 17–23.5 a risk for malnutrition, and more than 23.5 points indicates a good nutritional status (18, 19).

The cognitive functioning was assessed by a well-validated question retrieved from the Clinical Dementia Rating Scale (CDR) (20). The subject's stage of cognition was evaluated according to the “Memory” class in the CDR (0: no memory problems, 0.5: mild problems, 1: moderate problems, 2–3: severe problems), and divided into two groups: those with CDR <0.5 and CDR ≥ 0.5 (cognitive impairment). Dependence on the activities of daily living (ADL) was assessed by the CDR “Personal care”: CDR class 1 or higher (“Requiring at least prompting or assistance in dressing, hygiene, managing personal effects, or requiring much help with personal care, often involving incontinence”) was defined as the dependence on the ADL.

Life satisfaction was assessed by a question: “Are you satisfied with your life?” (yes/no). Subjective health was inquired by a question "How do you rate your current health status", (healthy/ quite healthy/ unhealthy/ very unhealthy). Those responding healthy and quite healthy were categorized as having "good subjective health". Residents' mood was assessed by a question “Do you feel depressed”, (never or seldom/ sometimes/ often or always). Those responding "sometimes" or "often" or "always" were categorized as feeling depressed. Resident's ability to move outside was assessed by a question: "Is the resident able to move outside" (yes/ no, needs a stick or a walker/ no, needs help from another person/ no, can't walk). Those responding "yes" were categorized as able to move outside without devices or assistance. The medical records were used in retrieving medical diagnoses. Comorbidity was computed for each resident using Charlson's comorbidity index (21) which is a weighted index that takes into account the number and the seriousness of a resident's diseases.

The local ethics committee of Helsinki University Hospital approved the study. An informed consent was acquired from all participants.

The data were analysed by NCSS statistical programmes. The characteristics of the users of vitamin D were compared with the nonusers by X2-test for categorical variables and by the Mann-Whitney U-test for continuous variables. We used random effects logit model to account for clustering the units of service houses and to determine which variables independently predicted the use of vitamin D supplements. P-values ≤ 0.05 were considered statistically significant.

Results

Residents’ mean age was 83 years and 78% were females. Of the residents, 60.1% (N=887) were users of

Table 1
Characteristics of residents divided according to their use of vitamin D supplements

Characteristic	Using vitamin D supplements (N=887)	Not using vitamin D supplements (N=588)	Differences between the means or proportions (95% CI[1])	P value[2]
Age, years, mean (SD)	83.2 (7.6)	81.8 (8.0)	0.6 to 2.2	<0.001
Sex (%)				
Female	85.3	67.0	13.9 to 22.9	<0.001
Nutritional status (%)				0.001
Good nutritional status (MNA >23.5)	18.9	26.7	-12.2 to -3.4	
Risk for malnutrition (MNA 17-23.5)	66.5	61.7	-0.2 to 9.8	
Malnutrition (MNA <17)	14.5	11.6	-0.5 to 6.5	
Satisfied with life (%)	83.9	79.5	-0.3 to 9.1	0.06
Good subjective health (%)	74.3	76.4	-7.0 to 2.8	0.40
Charlson comorbidity index [3], mean (SD)	2.9 (1.1)	2.8 (1.0)	-0.01 to 0.2	0.02
Prior hip fracture (%)	16.5	9.3	3.8 to 10.6	<0.001
Prior stroke (%)	24.2	28.0	-8.5 to 0.8	0.11
Feeling depressed (%)	45.2	41.6	-1.9 to 9.1	0.29
Dementia (%)	62.6	54.4	3.1 to 13.4	0.002
No cognitive impairment (CDR[4] "memory"<0.5) (%)	24.8	30.5	-10.6 to -0.9	0.018
Independent in activities of daily living (CDR[4] "personal care"<1) (%)	14.0	17.9	-7.9 to -0.03	0.044
Able to move outside without devices or assistance (%)	13.7	21.4	-11.9 to -3.6	<0.001

1. CI = Confidence interval; 2. Differences between the users and nonusers of vitamin D supplements were tested with X2-test for categorical variables and Mann-Whitney U-test for non-normally distributed continuous variables; 3. Charlson comorbidity index (Charlson et al. 1987); 4 CDR = Clinical Dementia Rating (Hughes et al. 1982).

vitamin D supplements. Higher age, female gender, poorer nutritional status, higher comorbidity index, prior hip fracture, dementia, higher dependence in activities of daily living and inability to move outside without devices or assistance were associated with the use of vitamin D supplements. Good subjective health, life satisfaction, prior stroke or feeling depressed were not associated with the use of vitamin D (Table 1).

Of the users of vitamin D supplements, 23.9% (N= 353) were administered vitamin D supplements at least the recommended dose (20 μg/day). 45 residents (3%) had the dose more than 20 μg/day (maximum 40 μg/day) and 45 as well had the dose less than 10 μg/day. (Table 2)

In random effects logit model only gender (male gender OR 0.34, 95% CI 0.24-0.48; p<0.001) and prior hip fracture (OR 2.64, 95% CI 1.71-4.07; p<0.001) were independently associated with the use of vitamin D supplements (Table 3).

Table 2
Proportion of residents using vitamin D supplements and the dose used. All residents were taking vitamin D products as tablets and on a daily basis

Dose of vitamin D used	Residents receiving vitamin D supplements
<10 μg[1]/day, % (N)	3.0 (45)
10-19 μg[2]/day, % (N)	18.8 (277)
≥20 μg[3]/day, % (N)	23.9 (353)
Dose unreported , % (N)	14.4 (212)

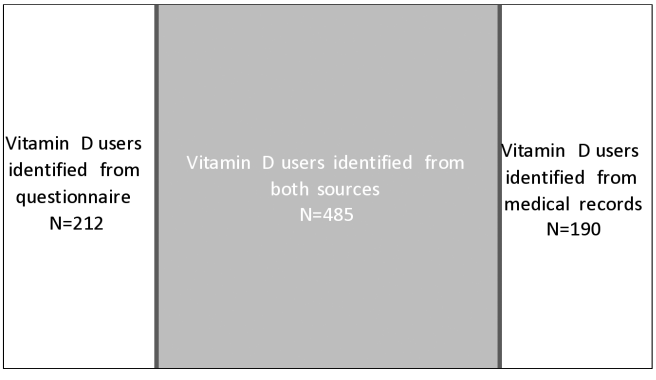
1. <400 IU; 2. 400-760 IU; 3. ≥800 IU

Table 3
Variables associated with the use of vitamin D (random effects logit model to account for clustering units of service houses)

Variable	Odds ratio	Confidence intervals (95 % CI)	P value
Age	0.99	0.98 to 1.01	0.57
Male gender	0.34	0.24 to 0.48	<0.001
Satisfied with life	1.30	0 90 to 1.89	0.16
Nutritional status according to MNA	1.07	0.82 to 1.40	0.60
Prior stroke	0.81	0.59 to 1.12	0.20
Dementia	1.02	0.75 to 1.38	0.92
Prior hip fracture	2.64	1.71 to 4.07	<0.001
Dependence in activities of daily living (CDR[1] "personal care"≥1)	1.13	0.97 to 1.33	0.12

1. CDR = Clinical Dementia Rating (Hughes et al. 1982).

Figure 1
Sources of information concerning vitamin D users (N=887)



Discussion

In this service housing population the proportion of residents having vitamin D supplements was 60.1%. Only 23.9% reported using the dose ≥20 μg/day, which has evidence in preventing falls and fractures. The use of vitamin D supplements was associated with older age, female gender, malnutrition, comorbidities such as prior hip fracture and dementia and poor functioning and mobility. In random effects logit model only gender and hip fracture were independently associated with the use of vitamin D supplements.

The strength of the study is its large sample size, fairly good response rate and representativeness of the sample. The study population consisted of all residents residing in service housing in the cities of Helsinki and Espoo, and 70% of all permanent residents participated in the study. However, among the non-responders there were more individuals with dementia, thus not being able to give informed consent. Thus, the differences could have been even more significant related to items related cognitive impairment and functioning. Unfortunately, we were unable to collect data on the non-responders. Therefore, it is impossible to explore a more detailed picture of them. Additional limitation of the study is its cross-sectional nature. The causality of the use of vitamin D supplements and related factors cannot be concluded.

According to the recommendations, the sufficient vitamin D dose for elderly persons varies 10-20 μg/day (14, 15). In this Finnish service housing population the proportion of residents receiving vitamin D supplements at the current recommended dose (≥ 20 μg/day) was quite low, 23.9%. However, 60.1% of the service housing residents received vitamin D supplements regularly when any dose was included in the analysis. The study was carried out in 2007 when the national recommendation for the dose of vitamin D supplement was lower, 10 μg/day, and this may be a reason why administered dosage in this study was fairly low. In Hamid's et al. (11) study in long-term care in USA, larger proportion of residents (72%) were receiving vitamin D supplements than in our study. The proportion of residents receiving vitamin D 20 μg/day (7%) was, however, lower than in our study. In Canadian study of long-term care residents, 43% had vitamin D supplementation above and 30 % below their recommended adequate intake (15 μg/day) (22). A recent European study on 57 nursing homes in 8 countries showed that only 18,7% residents were administered antiosteoporosis drugs, including vitamin D (23).

When the first comprehensive assessment of nutrition (including vitamin D) in 2003 was performed in nursing homes in Helsinki (17), the proportion of the vitamin D users (32.9%) was significantly lower than in this present study. Although the populations are not directly comparable, these service houses include residents with similar functional status as those in nursing homes. Thus, the proportion of vitamin D users has increased significantly between the years 2003-2007, and also the use with a therapeutic dose of 20 μg/day had increased from 3.5% to 23.9%. Probably this is a consequence of the developmental work performed in all long term care units in Helsinki after the first measure in 2003 (24). The studies of Suominen et al. and Vikstedt et al. (25,26) have revealed that better quality in nutritional care also assures the supplementation of vitamin D among elderly residents.

This study confirms some of the findings of previous studies concerning the associated factors with the use of vitamin D among nursing home residents. Female gender, malnutrition and comorbidies have been associated with use of vitamin D in previous studies (17, 27, 28). Kaiser et al. (29) and Soini et al. (30) have suggested that nutritional status deteriorates as dependence, dementia and care needs increase. In this study prescribing of vitamin D also seems to be more common among those found to be in poor condition. The persons being female and suffering from malnutrition, prior hip fracture or dementia received vitamin D supplements more often than the others. Dependence on daily activities and inability to move outside as well as high comorbidity index were also associated with the use of vitamin D supplements. These conditions are intertwined and, therefore, only female gender and prior hip fracture appeared as independent associated factors of usage.

Conclusions

The use of vitamin D with a therapeutic dose was still inadequate among older service housing residents in Helsinki and Espoo in the year 2007. The proportion of the residents using vitamin D had, however, doubled when compared to the findings in nursing homes in 2003. Education of regular assessments of nutritional status and care, including the use of vitamin D, should continue in service housing units.

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