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Letter to the Editor

Urgent need of vitamin D supplementation among Iranian elderly: a cross-sectional study

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Dear Editor:

Fortification programs are not established for nutrients like vitamin D among other nutrients in Iran. It is reported that approximately 80% of Iranians do not meet the estimated average requirement for calcium and vitamin D[1]. The Iranian Multicenter Osteoporosis Study (IMOS) has shown that more than 80% of Iranians have vitamin D deficiency[2]. However, currently, there is no data on vitamin D supplementation in elderly adults in Iran. We carried out a secondary analysis of a bigger population-based cross-sectional study, which was conducted among elderly men and women in the 6th district of Tehran to determine the frequency of sarcopenia[3].

Using cluster random sampling, we chose 30 clusters in the 6th district of the Tehran Municipality in collaboration with the Iran Post Office. The head of the clusters was selected based on a ten-digit postal code and subjects were asked for home interviews. Sampling was performed in each cluster in clockwise order until the desired sample size was reached. In each cluster, two individuals (one male and one female) were invited from each of the following age groups: 55–59, 60–64, 65–69, 70–74, and over 75 years with 10 persons in each cluster. During the home interviews, they were briefed about the project and its objectives. For those who agreed to participate, clinic appointments were set. Participants were asked to comply with the following requirements prior to their appointments: a) no pregnancy, b) fasting for 10 hours prior to testing, c) not using any calcium supplements two days prior to testing, and d) not using any metal objects. Inclusion criteria were: a) age at least 55 years, b) the ability to move without crutches, walker or other assistive devices, c) no artificial limbs or limb prosthesis, d) no active cancer by self report, e) no congestive heart failure, chronic obstructive pulmonary disorder, chronic renal failure, liver cirrhosis and liver failure.

Information on demographic, medical history, anthropometric, vitamin D supplementation and bone mineral density (BMD) was recorded. Participants were categorized as users or non-users of vitamin D supplements based on information from both the medication and supplement sections of the questionnaire. Dosages and duration of calcium-vitamin D supplement were not recorded. Three questionnaires including a general questionnaire, a physical activity questionnaire[4], and a food frequency questionnaire (FFQ)[5] were completed for each participant by a trained dietician. The physical activity level was evaluated by a short form physical activity questionnaire (IPAQ)[6] in Persian. Participants were asked to report time spent on walking, moderate-intensity activity, and vigorous-intensity activity during the week prior to testing. The physical activity data was converted to minutes per week and expressed as a metabolic equivalent (MET-min/week) according to IPAQ guidelines for data processing[7]. The participants with total physical activity lower than 600 MET-minutes/week, the amount between 600 to 3,000 MET-minutes/week and the amount above 3000 MET-minutes/week were considered as low, moderate, and high physical activity, respectively.

The dietary intake was assessed by using 117 items in a validated semi-quantitative FFQ[8]. Participants were asked to report their consumption, frequency of each food item during the year prior to testing according to daily, weekly and monthly intervals. Foods were analyzed for their nutrient content using Iranian and the United States Department of Agriculture food composition table[9].

Height was measured in meters using a wall tape in standing position without shoes. Weight of participants′ (in kg) was assessed using a digital scale, while they were minimally clothed. Waist circumference was measured in the middle of lower rib margin and iliac

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Table 1 **Sample characteristics and mean BMD levels stratified by vitamin D supplement use in Iranian elderly population, Tehran**

Variable	Nonusers	Users	95%CI	*P* value
Number (%)	231(77)	69(23)	-	<0.001
Sex (M/F) (%)	32.9/67.1	33.3/66.7	-	0.92
Active person, n (%)	74(32)	69(27.5)	-	0.56
Age (year)	67.3±8.0	66.3±7.4	-2.4 to 1.1	0.87
Weight (kg)	75.7±10.5	69.1±13.0	-2.5 to 3.2	0.83
BMI (kg/m^2)	26.3±3.1	28.4±4.8	-0.56 to 1.4	0.42
Dietary vitamin D intake (IU/day)	77.1±76.6	84.6±78.5	-109.4 to 160.3	0.71
Dietary calcium intake (mg/day)	1,332.8±543.0	1,345.4±612.5	-3.1 to 39.1	0.21
BMD levels (g/cm^2)				
Left arm	0.71±0.08	0.72±0.10	-0.005 to 0.036	0.13
Right arm	0.71±0.08	0.73±0.14	-0.015 to 0.034	0.44
Lumbar spine	0.93±0.19	0.95±0.15	-0.015 to 0.063	0.23
Pelvis	1.0±0.11	1.0±0.14	-0.003 to 0.058	0.57

BMI: body mass index; BMD: bone mass density; CI: confidence interval; IU: international unite

crest, standing and breathing normally. The DXA scanner (Discovery W S/ 247N 84430) was used to determine body composition. BMD at the left arm, right arm, thoracic spine, pelvis levels were determined. Participants were asked to lie supine without movement during imaging. The time which was required for evaluation of each participant was 15 minutes.

Mean daily calcium and vitamin D intake were computed. A one-sample t-test was performed to estimate whether the mean daily vitamin D intake was significantly different from the recommended values[8]. Intake of vitamin D was then compared to the Dietary Reference Intake (DRI) values for adequacy established by the institute of Medicine. The DRI for vitamin D is 800 IU/day for persons >50 year of age. Characteristics of supplement users and nonusers were compared using 2-sample t test and chi-square test for discrete data. Dietary intakes and BMD levels were analyzed by sex groups. Nutrients were analyzed by nutritionist III software, version 7.0 (N-Squared computing, Salem, OR, USA). All analyses were done using SPSS for Windows (version 16.0, SPSS Inc., Chicago, IL).

We enrolled 99 men and 201 women (mean age, 66.5 years). Their mean vitamin D intake was 80.9±77.5 (median, 57.6; range 1.5–606.0) IU/day. They consumed significantly less vitamin D than the recommended level of 800 IU/day ($P<0.0001$). Inadequate vitamin D intake (<600 IU/day) was found in almost all the subjects (99.3%). Calcium and vitamin D intake correlated with each other ($R^2 = 0.47$, $P<0.001$). There was no correlation between vitamin D intake and age, height, weight, BMI, or BMD at any site (data not shown). Twenty-three percent (n = 69) regularly took daily vitamin D supplements (***Table 1***). Moreover, no significant difference was observed between users and non-users by age (67.3 vs. 66.3 years), sex (female: 67.1% vs. 66.7%), weight (75.7 vs. 69.1 kg), BMI (26.3 vs. 28.4 kg/m^2), physical activity (32 vs. 27.5%, active persons) and dietary calcium (1332.8 vs.1345.4 mg/day) and vitamin D intake (77.1 vs. 84.6 IU/day) (***Table 1***). The mean intake of dietary vitamin D was not different between user and non users of supplemental vitamin D ($P=0.71$). The median and range of dietary vitamin D and calcium was 65.6 (1.5 to 604.5) and 1319.0 (506.7 to 3215.3), respectively, in the user group, and 55.6 (1.8 to 558.2) and 1187.5 (454.6 to 3136.4), respectively, in the non-user group. No differences were observed for total BMD and BMD levels at the pelvis, left arm, right arm and lumbar spine ($P>0.05$ for all) between users and non-users. Moreover, we reanalyzed data by sex groups. Again differences between user and non-users were not significant (***Table 2***).

To the best of our knowledge, this is the first study reporting the use of supplemental vitamin D in elderly subjects in Iran. Regardless of dosage and duration of supplement use, supplemental vitamin D may not be sufficient. No participants met the vitamin D recommended adequate intake[8]. Moreover, mean dietary vitamin D intake did not differ between those who were taking supplemental vitamin D and those who were not, which suggest dietary habits of our participants were not affected by vitamin D supplementation. Consistent with our study, more than 95% of the par-

Table 2 **Mean BMD levels stratified by sex and vitamin D supplement use in Iranian elderly population, Tehran**

	Men				Women			
	Nonusers	**Users**	**95%CI**	**P value**	**Nonusers**	**Users**	**95%CI**	***P* value**
Dietary calcium intake (mg/day)	1,298.5±507.6	1,386.1±594.2	-90.1 to 265.3	0.33	1,316.5±526.5	1,320.7±497.1	-168.8 to 177.2	0.96
Dietary vitamin D intake (IU/day)	76.6±65.8	97.1±64.1	-5.2 to 46.0	0.11	68.7±56.5	90.5±91.5	-3.8 to 77.4	0.09
BMD levels (g/cm^2)								
Left arm	0.72±0.11	0.71±0.18	-0.019 to 0.039	0.49	0.71±0.11	0.73±0.11	-0.008 to 0.049	0.16
Right arm	0.71±0.11	0.70±0.09	-0.039 to 0.036	0.88	0.71±0.11	0.72±0.13	-0.019 to 0.050	0.32
Lumbar spine	0.93±0.16	0.92±0.18	-0.041 to 0.077	0.54	0.94±0.14	0.92±0.17	-0.023 to 0.081	0.28
Pelvis	1.00±0.12	0.99±0.11	-0.006 to 0.068	0.10	1.03±0.14	1.00±0.11	-0.010 to 0.070	0.14

ticipants in another study from Iran had inadequate vitamin D intake (<400 IU)[10]. Inadequate intakes of calcium and vitamin D supplement was also reported in other studies to be at 70 and 80%, respectively. Our findings are also in agreement with the results of a study conducted in Iranians with osteoporosis, which demonstrated a high prevalence of vitamin D inadequacy based on serum 25(OH)D levels. Our results are consistence with other studies from other countries which have similarly reported low levels of vitamin D supplement use among women treated with prescription medicines for osteoporosis. In Iran, there are no fortified foods with vitamin D; therefore, sufficient intake from food, even with a healthy diet, is difficult. To achieve an optimal serum level, two approaches may help, increased sun exposure and or vitamin D supplementation.

Vitamin D supplementation is a safe, inexpensive strategy to reduce fractures and vitamin D deficiency is associated with substantial direct and indirect costs. Despite beneficial effects of vitamin D use to prevent risk of fracture, usage of vitamin D supplement is very low in Iranian elderly persons ,which is a high risk population due to lack of well-defined protocol for calcium-vitamin D supplementation in Iran. Based on high prevalence of vitamin D deficiency in Iranian elderly persons and insufficient sun exposure, and the low percentage of calcium-vitamin D supplement use, along with low dietary intake and no food fortification strategy for micronutrients in Iran, it is important to pay attention to the clinical utility of supplementation with vitamin D. The potential of this approach needs further initiatives to change attitudes to bone health, improvement of patient education and pharmacotherapy.

Inadequate vitamin D intake was common in this cohort of elderly Tehranians. There is an urgent need to recommend adequate intake of vitamin D supplement, and to heighten awareness among this population group and healthcare providers.

Yours Sincerely,
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