ORIGINAL ARTICLE

25-hydroxyvitamin D and physical and cognitive performance in older people with chronic conditions

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KEY WORDS

25-hydroxyvitamin D, cognition, elderly, functional status, physical function

ABSTRACT

INTRODUCTION Recently, the relationship between vitamin D deficiency and various pathologies as well as functional decline has been reported.

OBJECTIVES The aim of the study was to assess the relationship between 25-hydroxyvitamin D, 25(OH)D, levels and functional status in elderly patients.

PATIENTS AND METHODS Mean age of 140 participants (women, 67.1%) was 79.64 ±6.99 years. The study had a cross-sectional design. Physical performance was measured using the handgrip strength, Timed Up and Go, single-leg stance, and tandem stance tests, as well as a balance platform. Cognition was evaluated with the Abbreviated Mental Test Score (AMTS), while functional status with the Basic Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL) scales. Plasma 25(OH)D levels were measured.

RESULTS Less able patients (worse results in all tests) had significantly lower 25(OH)D levels. Subjects with 25(OH)D levels within the 3rd tertile had a higher AMTS score and handgrip strength; they swayed less on the balance platform and performed better in the IADL. In multivariate logistic regression analysis, 25(OH)D levels of 23.26–47.75 nmol/l were associated with increased odds of cognitive impairment (odds ratio [OR], 3.17; 95% confidence interval [CI], 1.04–9.68; $P = 0.04$), but also with less lateral sway (OR, 0.24; 95% CI, 0.09–0.64; $P = 0.005$). Plasma 25(OH)D levels above 47.75 nmol/l were associated with better performance in the tandem stance test (OR, 0.14; 95% CI, 0.04–0.52; $P = 0.003$) and further decreased lateral sway (OR, 0.27; 95% CI, 0.10–0.77; $P = 0.01$).

CONCLUSIONS In elderly people with comorbid conditions, 25(OH)D levels were not associated with handgrip strength, but were associated with balance and cognitive function. These associations as well as high prevalence of vitamin D deficiency necessitate further research evaluating the effect of vitamin D supplementation on the functional status in elderly people.

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INTRODUCTION Aging and comorbid conditions often lead to a decrease in physical, cognitive, and functional capabilities. Recently, the relationship between vitamin D deficiency and various pathologies as well as functional decline has been discussed.[1,2]

The importance of 25-hydroxyvitamin D, 25(OH)D, for muscle function is postulated,[3,4] although the presence of vitamin D receptors in skeletal muscles is questioned.[5] Moreover, studies assessing the relationship of low 25(OH)D levels with muscle weakness provide conflicting results. While some investigators confirmed the presence of such an association,[4,6,7] others did not prove the relation of 25(OH)D with muscle strength in cross-sectional,[8] prospective,[9] and intervention studies with vitamin D supplementation[10,11] Similarly, several studies demonstrated the association of serum 25(OH)D levels with physical performance[12-14] and body sway,[6,11] while others did not.[10] Recent years have also brought interest in the relationship between 25(OH)D and cognition, but the results are inconclusive.[15] The relationship between vitamin D and physical and mental fitness may be particularly important in the face of widespread vitamin D deficiency among elderly people.[1,16] In addition, vitamin D deficiency may be involved in the pathogenesis of numerous chronic diseases associated with aging.[1,2,17,18]

The aim of the study was to assess the relationship between serum 25(OH)D levels and physical and functional ability in elderly patients.

PATIENTS AND METHODS

Study population

This cross-sectional study involved a population of 140 subjects recruited from a geriatric outpatient clinic (n = 62), geriatric ward (n = 31), and from a long-term care institution (n = 47).

The inclusion criteria were as follows: age 60 years and older, ability of independent ambulation with or without walking aids, ability to keep an unaided upright position during balance tests, intellectual status allowing to follow the instruction, lack of acute illnesses or exacerbation of chronic diseases that might affect functional status. For this reason inpatients were examined after rehabilitation, in the stable phase of chronic conditions.

All participants (or his/her caregiver) gave their consent to take part in additional examination. Data concerning coexisting risk factors, comorbidities, falls in a past year, and treatment were obtained as part of routine work-up. In all subjects, weight and height were measured and the body mass index was calculated (BMI = weight [kg]/height [m]^2).

Cognition was assessed with the Abbreviated Mental Test Score (AMTS).[19] The score less than 7 was considered as cognitive impairment.

Muscle strength was measured as handgrip strength using the Saehan SH5001 Hand Dynamometer (Saehan Corporation, Masan, South Korea). The results in kilograms force (kgf) for the right and left hand were registered and the mean value was expressed in newtons (N) (1 kgf = 9.81 N).

Mobility and physical capacity were checked with the Timed Up and Go (TUG) test.[20] Subjects who performed the test in 14 seconds or more were considered as having problems with mobility.

To assess balance, the single-leg stance and tandem stance tests were used, with possible scores from 0 (inability to perform) to 4 (ability to stand unsupported and without sway for 10 and 30 seconds, respectively). The score of 3 points and more in both tests was regarded as preserved ability to maintain balance.

Postural stability was measured with a dynamometric balance platform (Cosmogamma, Italy). During quiet standing, a movement of the center of foot pressure (CFP) was recorded with the eyes open (EO) and with the eyes closed (EC). To assess postural stability, the following variables were used: mean lateral sway (EO_lat_mean, EC_lat_mean), mean anteroposterior sway (EC_ap_mean), CFP path length (EO_d), lateral CFP velocity (EO_V_lat), surface area covered by the CFP path (EO_area), percentage of time which CFP spent in a circle with a radius of 13 mm (EO_T_13, EC_T_13).

The risk of malnutrition was evaluated with the Mini Nutritional Assessment tool (MNA®).[21] The functional status was evaluated using the Katz Activities of Daily Living (ADL)[22] and the Lawton Instrumental Activities of Daily Living (IADL)[23] scales. A score below 5 points in the ADL or less than median (19.5 points) in the IADL indicated functional deterioration.

25(OH)D was measured by the enzyme-binding protein assay using 25-OH Vitamin D EIA Kit (Immundiagnostic, Bensheim, Germany), which has 100% specificity for 25(OH)D_3, 25(OH)D_2, and 24.25(OH)$_2D_3$ metabolites.

Statistical analysis

Statistical analysis was performed using STATISTICA 8.0 (StatSoft, Poland). The data were expressed as mean values and standard deviations. To compare the groups, the *t*-test or Mann-Whitney test was used. To assess the relationship between 25(OH)D levels and functional performance measures, the study group was divided into tertiles based on calcidiol concentrations. To compare the mean values between the tertiles, the one-way analysis of variance (ANOVA) was used, and in a post-hoc analysis – the Tukey test.

To show which constituents of the functional status were independently associated with 25(OH)D levels, we used a univariate regression analysis. To estimate the odds ratio (OR) for functional decline according to 25(OH)D levels, we used a logistic regression analysis adjusted for possible confounders selected in the univariate analysis. In separate models, the dependent variables were as follows: TUG below 14 s, both balance tests below 3 points, ADL below 5 points, IADL below 19.5 points, and AMTS below 7 points. The independent variables were age, sex, blood pressure, use of walking aids, falls in the past year, use of medications, MNA <24 points, 25(OH)D levels in tertiles, muscle strength below the median value, sway higher than the median value, and selected parameters of the CFP. To calculate odds for the IADL and ADL impairment, the AMTS lower than 7 points was included. *P* value less than 0.05 was considered statistically significant.

RESULTS

Characteristics of the study group

The study included 140 subjects aged 61–95 years (mean age 79.64 ±6.99 years; women constituted 67.1%). There were no significant differences between the mean age of men and women. The characteristics of the study group are presented in TABLE 1.

All patients had multiple chronic diseases, including arterial hypertension (80%), coronary heart disease (47%), osteoarthritis (46%), diabetes (35.7%), and heart failure (28.6%).

25(OH)D levels were measured in 138 subjects. Only 26 patients (18.8%) had the optimal 25(OH)D level of >75 nmol/l, 66 subjects (47.8%)

TABLE 1 Characteristics of the study population

Variable	All patients n = 140	Women n = 94	Men n = 46
age, y	79.64 ±6.99	79.99 ±6.70	78.93 ±7.59
fall in the past year, n (%)	74 (52.86)	51 (54.26)	23 (50)
walking aids, n (%)	48 (34.3)	29 (30.85)	19 (41.3)
number of diseases, (range, 1–9)	4.36 ±1.73	4.32 ±1.75	4.43 ±1.71
number of drugs, (range, 1–17)	7.09 ±3.13	6.90 ±3.06	7.46 ±3.25
BMI, kg/m^2	26.4 ±4.95	26.58 ±5.35	26.02 ±4.02
25(OH)D, nmol/l (n=138)	44.72 ±33.81	38.21 ±27.85	58.19 ±40.77[a]
AMTS, points	7.61 ±2.8	7.24 ±3.11	8.36 ±1.81[a]
handgrip, N	118.7 ±86.5	81.7 ±57.9	195.4 ±85.8[b]
TUG, s	23.24 ±17.88	22.48 ±15.18	24.79 ±22.48
single-leg stance, points	1.23 ±1.25	1.096 ±1.17	1.5 ±1.36
tandem stance, points	1.21 ±1.48	1.12 ±1.43	1.39 ±1.57
MNA, points	23.16 ±3.41	23.07 ±3.64	23.34 ±2.89
ADL, points	4.65 ±1.64	4.51 ±1.66	4.93 ±1.58
IADL, points	18.63 ±6.91	18.09 ±6.97	19.74 ±6.70

Data are presented as mean ± standard deviation.

a $P < 0.01$; b $P < 0.00001$

Abbreviations: ADL – Activities of Daily Living, AMTS – Abbreviated Mental Test Score, BMI – body mass index, IADL – Instrumental Activities of Daily Living, MNA – Mini Nutritional Assessment, TUG – Timed Up and Go

TABLE 2 Mean 25(OH)D levels in the subgroups of patients with preserved performance status and inefficiency in psychophysical tests

25(OH)D, nmol/l		P
ADL <5, n = 69 30.2 ±19.9	ADL ≥5, n = 69 59.3 ±38.5	<0.000001
IADL <19.5, n = 69 32.4 ±21.6	IADL ≥19.5, n = 69 57.2 ±39.1	<0.000001
single-leg stance ≤2, n = 117 40.2 ±30.5	single-leg stance >2, n = 23 67.4 ±40.8	0.0003
tandem stance ≤2, n = 104 38.2 ±29.9	tandem stance >2, n = 36 63.9 ±37.5	0.00006
TUG ≥14 s, n = 88 35.3 ±25.9	TUG <14 s, n = 48 61.1 ±40.1	0.0001
handgrip <97.1 N, n = 63 37.5 ±31.1	handgrip ≥97.1 N, n = 64 49.7 ±35.5	0.04
fallers, n = 74 35.76 ±23.7	non-fallers, n = 64 55.08 ±40.4	0.001

Data are presented as mean ± standard deviation.

Abbreviations: see TABLE 1

had reduced concentrations indicating insufficiency (25–75 nmol/l), and 46 individuals (33.3%) had 25(OH)D levels below 25 nmol/l (vitamin D deficiency). We did not observe any associations between the season and 25(OH)D levels (November to April, 48.3 ±37.8 vs. May to October, 40.2 ±27.6 nmol/l; $P = 0.15$).

25(OH)D levels and performance measures The analysis showed that people who performed worse in all functional tests had lower 25(OH)D levels (TABLE 2).

Functional and cognitive performance vs. 25(OH)D tertiles There were 46 patients with 25(OH)D levels below 23.26 nmol/l (1st tertile), 46 subjects with the levels of 23.26–47.75 nmol/l (2nd tertile), and 46 patients with the levels above 47.75 nmol/l (3rd tertile). The results of the one-way ANOVA and the post-hoc analysis are presented in TABLE 3.

The Fisher exact test was used to analyze the differences between the single-leg stance and tandem stance test results. The analysis showed that the percentage of patients with preserved balance in both positions (both tests) was significantly higher in those with the 3rd tertile compared with those with the 1st tertile of 25(OH)D levels ($P < 0.001$ and $P < 0.01$, respectively).

The analysis of the relationship between 25(OH)D levels and performance in different areas indicated the levels of vitamin D that were essential for functional fitness. Regarding independence in ADL, performance score rose almost linearly with increasing plasma 25(OH)D levels, for higher muscle strength, self-reliance in IADL, and for better cognitive function 25(OH)D levels above 47.75 nmol/l were required (TABLE 3).

Vitamin D and psychophysical performance in regression analysis In a univariate logistic regression analysis, the tertiles of 25(OH)D levels were used as an independent variable. The dependent variables were as follows: handgrip strength below the median value, TUG above 14 s, single-leg stance and tandem stance tests below 3 points, mean lateral sway and CFP path length with the eyes open above the median value, IADL below the median value, and ADL below 5 points. ORs with 95% confidence interval (95% CI) were calculated. Higher 25(OH)D levels in a univariate analysis were associated with higher muscle strength, better performance in TUG and balance tests, and better functional performance measures (TABLE 4).

A multivariate logistic regression analysis (forward procedure) adjusted for other possible confounders (age, sex, blood pressure, fall in the past year, MNA <24 points, use of psychotropic drugs, hemoglobin level) showed a significant correlation between 25(OH)D levels and cognitive impairment, tandem stance test score, and lateral sway, and nonsignificant correlation between 25(OH)D levels and low handgrip strength, poorer performance in TUG, single-leg stance test, IADL, and ADL.

To establish which 25(OH)D levels are necessary for better performance, we conducted an analysis and observed that the 2nd tertile of 25(OH)D levels was associated with a higher risk of worse cognitive function (lower AMTS score, OR, 3.17; 95% CI, 1.04–9.68; $P = 0.04$).

TABLE 3 Results of performance tests and 25(OH)D levels

	25(OH)D			*P*			
	<23.26 nmol/l n = 46	23.26–47.75 nmol/l n = 46	>47.75 nmol/l n = 46	1 vs. 2	2 vs. 3	1 vs. 3	for trend
AMTS	7.4 ±3.0	6.9 ±3.0	8.4 ±2.1	0.78	0.03	0.15	0.03
handgrip, N	97.1 ±81.4	106.9 ±75.5	152.1 ±94.2	0.84	0.04	0.007	0.008
TUG, s	27.7 ±20.2	22.4 ±16.3	19.5 ±16.3	0.32	0.72	0.066	0.08
ADL, pts	4.1 ±1.7	4.6 ±1.6	5.2 ±1.5	0.2	0.2	0.002	0.004
IADL, pts	16.2 ±6.3	17.5 ±6.5	22.1 ±6.6	0.58	0.002	0.00005	0.00004
EO_lat_mean	5.3 ±3.1	3.6 ±1.8	4.1 ±2.6	0.004	0.6	0.06	0.006
EO_area	9.6 ±11.8	5.2 ±5.3	6.2 ±7.5	0.04	0.84	0.14	0.04
EO_V_lat	9.7 ±5.8	7.3 ±3.7	7.6 ±4.2	0.03	0.95	0.06	0.02
EO_T_13	89.2 ±16.8	96.7 ±6.9	93.3 ±11.2	0.009	0.38	0.23	0.02
EC_lat_mean	6.9 ±3.8	5.0 ±2.6	6.9 ±5.1	0.05	0.06	0.98	0.03
EC_ap_mean	5.8 ±2.5	4.5 ±1.6	5.7 ±2.6	0.02	0.03	0.95	0.01
EC_T_13	79.4 ±20.2	90.6 ±13.5	80.9 ±20.3	0.01	0.03	0.9	0.008

Data are presented as mean ± standard deviation.

Abbreviations: EO – eyes open, EO_lat_mean – mean lateral sway in eyes open test, EO_area – surface area covered by the center of foot pressure (CFP) path, EO_V_lat – lateral CFP velocity, EO_T_13 – percentage of time which CFP spent in a circle of radius 13 mm, EC – eyes closed, EC_lat_mean – mean lateral sway in eyes closed test, EC_ap_mean – mean anteroposterior sway, EC_T_13 – percentage of time which CFP spent in a circle with a radius of 13 mm, others – see **TABLE 1**

TABLE 4 Relationship between 25(OH)D levels and physical and functional decline in a univariate logistic regression analysis

	25(OH)D <23.26 nmol/l OR (95% CI)	25(OH)D 23.26–47.75 nmol/l OR (95% CI)	*P*	25(OH)D >47.75 nmol/l OR (95% CI)	*P*
handgrip <97.1 N	1	0.67 (0.28–1.57)	0.35	0.33 (0.13–0.79)	0.01
TUG >14 s	1	0.5 (0.19–1.31)	0.16	0.19 (0.08–0.50)	0.001
single-leg stance <3 points	1	0.22 (0.04–1.11)	0.06	0.11 (0.02–0.53)	0.006
tandem stance <3 points	1	0.35 (0.1–1.22)	0.09	0.11 (0.03–0.35)	<0.001
EO_lat_mean >3.46 mm	1	0.31(0.13–0.72)	0.007	0.30 (0.13–0.72)	0.007
CFP EO_d >386 mm	1	0.38 (0.16–0.87)	0.02	0.58 (0.25–1.34)	0.2
IADL <19.5 points	1	0.79 (0.34–18.82)	0.58	0.24 (0.10–0.57)	0.001
ADL <5 points	1	0.46 (0.19–1.08)	0.07	0.30 (0.12–0.76)	0.01

Abbreviations: CI – confidence interval, OR – odds ratio, others – see **TABLES 1** and **3**

Compared with the 1st tertile (OR, 0.24; 95% CI, 0.09–0.64; *P* = 0.005), these levels were sufficient to reduce lateral sway. Only the highest tertile of 25(OH)D levels was associated with better performance in the tandem stance test (OR, 0.14, 95% CI 0.04–0.52; *P* = 0.003).

DISCUSSION To our knowledge, this is the first study to comprehensively demonstrate the relationship between vitamin D levels and functional capacity, including muscle strength, balance, mobility, functional fitness, and cognitive function. The results show associations between lower 25(OH)D levels and various indices of physical and functional impairment in elderly patients.

Vitamin D and muscle strength A univariate analysis showed that patients in the highest tertile of 25(OH)D levels had 64% lower risk of low handgrip strength compared with subjects in the lowest tertile. This association was not significant in a multiple analysis. This finding is in line with previous studies.[4,12,24-26] Similarly to our results, EPIDOS (The Epidemiology of Osteoporosis Study) demonstrated a correlation between quadriceps strength and 25(OH)D levels, but after adjustment for other confounders the relationship was no longer significant.[27] The authors suggested that other factors, including age, BMI, comorbidity, or physical activity, might have had a greater effect on muscle strength than vitamin D.[27] In our analysis, low handgrip strength was associated with age, sex, and nutrition status (data not shown). This finding was in line with the study of Bischoff et al.,[28] who observed a relationship between vitamin D and leg extensor strength in a univariate analysis but not in the ANOVA.[28] In our study, physical activity was not assessed and all our subjects had multiple coexisting chronic diseases that might have affected their physical condition and muscle strength. It is also suggested that vitamin D affects muscle power and endurance rather than strength.[11]

Vitamin D and balance performance Our results and those of other investigators[6,12,29,30] confirm the beneficial effect of normal serum 25(OH)D levels or ergocalciferol supplementation[11] on body sway and balance control. In the present study, 25(OH)D levels above 47 nmol/l were associated with 89% lower risk of balance loss in single-leg and tandem stance tests compared with 25(OH)D levels below 23 nmol/l. In a multiple regression model, after adjustment for other confounders, higher 25(OH)D levels were associated with 55% lower risk of balance loss in the tandem stance test, and the levels above 47 nmol/l reduced the risk by 86%. These findings are in line with other studies. Increased serum 25(OH)D levels were associated with improved balance in the single-leg stance as observed by Gerdhem et al.[24] and Okuno et al.,[30] and in the tandem stance test as observed by Wicherts et al.[14]

In the tests on the balance platform, the 2nd and 3rd tertile of 25(OH)D levels, after adjustment for possible confounders, significantly reduced the risk of lateral body sway (by 76% and 73%, respectively) and improved lateral stability. These results are consistent with other studies. Pfeifer et al.[29] and Dhesi et al.[11] observed a significant reduction in the body sway after vitamin D supplementation by 13% and 9%, respectively. The effect of vitamin D on the synthesis of the nerve growth factor[31] and the presence of vitamin D receptors (VDRs) in neurons[32] may explain why vitamin D affects neuromuscular function and coordination to the greater extent than muscle strength.[3] Increasing serum 25(OH)D levels were associated with a reduction in the reaction time.[11,12]

Vitamin D and locomotion Our results showed only a slight reduction in the TUG test with increasing plasma 25(OH)D levels. Also, the study showed 81% lower risk of achieving worse TUG results (above 14 s) in subjects with the highest 25(OH)D levels in a univariate analysis, but this association was nonsignificant in a multiple model. However, a relationship between plasma 25(OH)D levels and TUG[12,26,30] and walking speed tests[13,14,30] was observed in other studies. In our study population, characterized by comorbidity and polypharmacy, other factors than 25(OH)D levels might have played a role in maintaining mobility.

Vitamin D and functional capacity A univariate analysis revealed a positive association between higher calcidiol levels and functional performance. Patients in the highest tertile of 25(OH)D levels had lower risk of becoming dependent (70% in ADL and 76% in IADL). However, after adjustment for possible confounders only the relationship between independency in IADL and the highest 25(OH)D levels was borderline significant, and such levels decreased the risk of functional decline by 80%. Other studies demonstrated the relationship between vitamin D deficiency/insufficiency and limitation in ADL and IADL.[33] Moreover, functional improvement was observed after vitamin D and calcium supplementation.[34] The lack of an independent effect of 25(OH)D levels on functional capacity in our study may be explained by complex interdependence of various factors determining the functional level, including muscle strength, balance, cognition, mood, ability to walk, and physical fitness. All these factors may be affected by low physical activity and chronic conditions, which perhaps had a greater effect on the functional status of our subjects than vitamin D deficiency.

Of note, an inverse relationship should also be considered. It is possible that older people with reduced mobility have lower levels of vitamin D because of limited outdoor activity and less sun exposure.

The key issue is to establish plasma 25(OH)D levels that are needed to improve performance in different areas. In our study, the one-way ANOVA and logistic regression models showed that only the levels above 47 nmol/l were associated with significantly better results in functional tests. Okuno et al.[30] obtained similar results in the improvement of gait and balance performance at 25(OH)D levels of at least 47.5 nmol/l in the group of elderly women; however, the best performance was observed at the levels of 25(OH)D exceeding 67.5 nmol/l.[30] Bischoff-Ferrari et al.[13] and Wicherts et al.[14] also established similar tresholds (60 nmol/l and 20 ng/ml = 0 nmol/l, respectively), below which a significant deterioration in performance was observed.

Vitamin D and cognition In multiple logistic regression analysis, the second tertile of 25(OH)D levels was associated with a 3-fold higher risk of cognitive impairment. The risk decreased with the increasing levels, but the relationship was not significant at higher 25(OH)D levels. Other studies provided conflicting results, although the comparison is difficult because of different methodology.[15] Buell at al.[35] observed only a trend towards a relationship between vitamin D and the Mini Mental State Examination (MMSE) score, but Wilkins et al.[36] reported no such correlation. Based on the available data, it may be possible to establish the association between serum 25(OH)D levels and cognitive function using a comprehensive neuropsychological test battery[36-38] or at more advanced stages of dementia, as reported by Oudshoorn et al.,[39] who observed a significant correlation between the MMSE score and 25(OH)D levels in patients with Alzheimer disease.[39] In the National Health and Nutrition Examination Survey III, involving patients aged 65 years and older, the increased risk of cognitive impairment was observed in subjects with 25(OH)D insufficiency and deficiency. However, the survey used a wider range of neuropsychological tests to assess cognition.[40]

Although not all investigators reported a relationship between 25(OH)D levels and cognitive function,[41] increasing evidence suggests that vitamin D is beneficial for brain function. It may protect the central nervous system and slow down the aging process.[32,42] The mechanism of the beneficial effect of vitamin D in the central nervous system is not fully understood, but the presence of VDRs and metabolic pathways of vitamin D in the cortex, the limbic system, and cerebellum have been demonstrated.[32,35,42] Vitamin D, through an increase in gamma-glutamyltransferase activity and glutathione content in glial cells, protects oligodendrocytes and contributes to proper nerve conduction in the regions responsible for memory and behavior processes.[35,37] Administration of $1,25(OH)_2D_3$ resulted in increased activity of choline acetyltransferase,[37] and its chronic use inhibited the aging of hippocampal neurons associated with impaired calcium homeostasis.[42]

Limitations A cross-sectional design of the study allows us to show only the association between 25(OH)D levels and physical and cognitive performance, but does not identify which factor is the cause and which is the effect. In conclusion, reduced 25(OH)D levels in elderly patients are associated with impairment in general functioning, but are not directly associated with lower muscle strength. Considering the prevalence of vitamin D deficiency in older populations, further research is needed to evaluate the effect of vitamin D supplementation on the functional status.

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ARTYKUŁ ORYGINALNY

Stężenie 25-hydroksywitaminy D a sprawność fizyczna i funkcje poznawcze u osób starszych z chorobami przewlekłymi

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SŁOWA KLUCZOWE

25-dihydroksy-witamina D, funkcje poznawcze, osoby starsze, sprawność fizyczna, sprawność funkcjonalna

STRESZCZENIE

WPROWADZENIE Badania ostatnich lat przyniosły dane dotyczące związku niedoboru witaminy D zarówno z różnymi stanami patologicznymi, jak i z pogorszeniem sprawności funkcjonalnej.

CELE Celem pracy była ocena zależności między stężeniem 25-hydroksywitaminy D, 25(OH)D, a sprawnością funkcjonalną u osób w podeszłym wieku.

PACJENCI I METODY Średni wiek 140 uczestników (w tym 67,1% kobiet) wynosił 79,64 ±6,99 roku. Badanie miało charakter przekrojowy. Sprawność fizyczną oceniano na podstawie: siły uścisku dłoni, testu „Wstań i idź” (Timed Up and Go), a także testów stania na jednej nodze i w pozycji tandem oraz na platformie balansowej. Funkcje poznawcze oceniano za pomocą Skróconego Testu Sprawności Umysłowej (Abbreviated Mental Test Score – AMTS), a sprawność funkcjonalną – za pomocą skali Podstawowych (Activities of Daily Living – ADL) i Złożonych Czynności Codziennych (Instrumental Activities of Daily Living – IADL). Oznaczano stężenie 25(OH)D w osoczu.

WYNIKI U osób mniej sprawnych (słabsze wyniki we wszystkich testach) stężenia 25(OH)D w osoczu były istotnie mniejsze. Badani ze stężeniem 25(OH)D w zakresie 3. tercyla uzyskiwali wyższą punktację w AMTS, charakteryzowali się większą siłą uścisku dłoni i mniejszą chwiejnością na platformie balansowej, a także większą sprawnością w zakresie IADL. W analizie wieloczynnikowej regresji logistycznej stężenie 25(OH)D w zakresie 23,26–47,75 nmol/l było związane z prawdopodobieństwem pogorszenia funkcji poznawczych (OR 3,17; 95% CI: 1,04–9,68; p = 0,04), ale także z mniejszym kołysaniem bocznym (OR 0,24; 95% CI 0,09–0,64; p = 0,005). Stężenie 25(OH)D >47,75 nmol/l wiązało się z utrzymywaniem równowagi w pozycji tandem (OR 0,14; 95% CI: 0,04–0,52; p = 0,003) i dalszym zmniejszeniem kołysania bocznego (OR 0,27; 95% CI: 0,10–0,77; p = 0,01).

WNIOSKI U osób starszych ze współistniejącymi chorobami przewlekłymi siła mięśniowa dłoni nie była związana ze stężeniem 25(OH)D, stężenie to było natomiast związane z równowagą i sprawnością funkcji poznawczych. Z tego powodu, a także ze względu na dużą częstość występowania niedoboru witaminy D, potrzebne są dalsze badania oceniające wpływ suplementacji tej witaminy na sprawność funkcjonalną u osób starszych.

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