

# SELF-REPORTED PHYSICAL ACTIVITY, QUALITY OF LIFE, AND PSYCHOLOGICAL STATUS IN RELATION TO PLASMA 25-HYDROXYVITAMIN D CONCENTRATION IN PREVALENT HEMODIALYSIS PATIENTS

Alicja E. Grzegorzewska<sup>1</sup>, Agnieszka Izdebska<sup>2</sup>, Leszek Niepolski<sup>3</sup>, Wojciech Warchoł<sup>4</sup>, Paweł P. Jagodziński<sup>5</sup>

<sup>1</sup>Poznań University of Medical Sciences, Department of Nephrology, Transplantology and Internal Diseases, Poznań

<sup>2</sup>Adam Mickiewicz University, Institute of Psychology, Poznań

<sup>3</sup>B.Braun Avitum Poland, Dialysis Center, Nowy Tomyśl

<sup>4</sup>Poznan University of Medical Sciences, Department of Biophysics, Poznań

<sup>5</sup>Poznan University of Medical Sciences, Department of Biochemistry and Molecular Biology, Poznań, POLAND

**INTRODUCTION AND AIMS:** Vitamin D is announced among factors that may influence physical performance and mental health. The objective of this study was to evaluate self-reported physical activity, quality of life, psychiatric functioning, and affects with respect to plasma vitamin D concentrations in prevalent hemodialysis (HD) patients.

**PATIENTS AND METHODS:** The study was carried out in autumn in 112 HD patients not receiving vitamin D supplements. The group (age 68.0, 29.0 - 91.5 years, renal replacement therapy vintage 4.82, 1.96 - 21.0 years, 65 patients on high-flux HD) included 53 women, 34 patients with type 2 diabetic nephropathy, and 33 subjects with coronary artery disease. Plasma concentration of 25-hydroxyvitamin D [25(OH)D] was measured by a chemiluminescent microparticle immunoassay. Physical activity was measured with the long version of the International Physical Activity Questionnaire (IPAQ-L). The Ferrans & Powers' Quality of Life Index - Dialysis Version III (QLI-D), General Health Questionnaire (GHQ-28), and The Positive and Negative Affect Schedule (PANAS) were employed to measure quality of life and associated mental health. Linear regression was used to determine associations among 25(OH)D concentration, psychological characteristics, and patient data. Multivariate analyses were used to exclude confounding variables among 29 parameters including demographic, genetic, clinical, and laboratory data.

**RESULTS:** Plasma 25(OH)D was suboptimal in all HD patients ( $14.6 \pm 4.1$  ng/mL). Adjusted determinants of 25(OH)D concentration included the GG genotype of GC rs7041 ( $\beta \pm SE: 1.77 \pm 0.70$ ,  $P = 0.014$ ), female sex ( $\beta \pm SE: -2.19 \pm 0.75$ ,  $P = 0.004$ ), and treatment with high flux HD ( $\beta \pm SE: 2.59 \pm 0.69$ ,  $P = 0.0003$ ). By IPAQ, none of the HD patients was working or performing vigorous-intensity activities. Transport-related activity was revealed in 44 (39.3%) patients, leisure-time activity was reported by 35 (31.3%), and housework and gardening activity was shown in 25 (22.3%) patients. In respect to forms of physical activity, walking was reported by 45 (40.2%) subjects, and moderate-intensity activities were performed by 39 (34.8%) subjects. As many as 45 (40.2%) patients did not report any physical activity in terms of asked questions. In adjusted analyses, circulating 25(OH)D was revealed as a significant positive determinant of "total domestic and gardening physical activity" domain ( $\beta \pm SE: 53.2 \pm 23.8$ ,  $P = 0.028$ ). In terms of intensity, a significant impact of vitamin D was shown on total moderate-intensity activities ( $\beta \pm SE: 54.9 \pm 27.4$ ,  $P = 0.048$ ). Quality of life, psychiatric functioning, and affects were not significantly associated with circulating 25(OH)D concentrations. All these latter domains were negatively influenced by type 2 diabetic nephropathy as a cause of end-stage renal disease.

Characteristics	Unadjusted percent change in 25(OH)D concentration		Spearman correlation		Adjusted percent change in 25(OH)D concentration	
	$\beta^b \pm SE$	P value	R value	P value	$\beta^b \pm SE$	P value
Age (per 10 years)	0.14 ± 0.27	0.622	0.043	0.656	0.02 ± 0.26	0.933
Female sex	-3.25 ± 0.69	<b>0.000008</b>	-0.350	0.0002	-2.19 ± 0.75	<b>0.004</b>
College education or more	-0.15 ± 0.87	0.862	-0.002	0.982	-0.54 ± 0.79	0.491
RRT vintage (per 1 year)	0.042 ± 0.105	0.694	0.005	0.960	0.88 ± 0.93	0.350
GG genotype of GC rs7041	1.66 ± 0.78	<b>0.035</b>	0.213	0.025	1.77 ± 0.70	<b>0.014</b>
CC genotype of GC rs1155563	-1.66 ± 1.11	0.137	-0.178	0.061	-1.55 ± 0.99	0.123
HF-HD vs. LF-HD	2.68 ± 0.73	<b>0.0004</b>	0.262	0.005	2.59 ± 0.69	<b>0.0003</b>
Dry body mass, kg	0.59 ± 0.23	<b>0.011</b>	0.260	0.006	0.03 ± 0.02	0.195
BMI, kg/m <sup>2</sup>	0.48 ± 0.35	0.178	0.173	0.069	-0.04 ± 0.16	0.791
Anti-HBc positivity	1.3 ± 1.0	0.198	-0.026	0.783	-1.38 ± 0.94	0.146
Anti-HCV positivity	-2.07 ± 1.39	0.138	-0.170	0.073	-1.71 ± 1.21	0.159
HCV RNA positivity	-0.38 ± 1.57	0.811	-0.079	0.406	-0.81 ± 1.32	0.542
Generation of anti-HBs in response to HBV vaccination	1.3 ± 1.0	0.198	0.117	0.261	1.48 ± 0.91	0.108
Generation of anti-HBs in response to HBV vaccination or infection	1.2 ± 1.0	0.271	0.100	0.294	1.21 ± 0.94	0.200
Anti-HBs (per 200 U/L)	18.7 ± 0.15	0.871	0.032	0.736	0.11 ± 0.14	0.425
ALT activity, U/L	-0.007 ± 0.032	0.837	-0.024	0.800	-2.72 ± 5.81	0.640
AST activity, U/L	0.011 ± 0.043	0.794	0.012	0.897	0.02 ± 0.04	0.543
GGT activity, U/L	-0.009 ± 0.010	0.385	-0.016	0.888	-0.01 ± 0.01	0.334
Type 2 diabetic nephropathy as a cause of ESRD disease	-0.047 ± 0.828	0.955	0.034	0.720	-0.58 ± 0.75	0.442
Chronic glomerulonephritis as a cause of ESRD disease	-1.26 ± 1.01	0.521	-0.149	0.118	-0.14 ± 0.93	0.880
Chronic tubulointerstitial nephritis as a cause of ESRD disease	1.37 ± 1.57	0.383	0.142	0.137	1.64 ± 1.42	0.251
Hypertensive nephropathy as a cause of ESRD disease	0.414 ± 0.914	0.651	0.032	0.739	-0.36 ± 0.88	0.682
Coronary artery disease	0.995 ± 0.829	0.233	0.180	0.058	0.37 ± 0.77	0.636
Myocardial infarction	1.13 ± 1.15	0.323	0.157	0.099	0.81 ± 1.06	0.448
Total calcium, mg/dL	0.55 ± 0.48	0.262	-0.202	0.172	-0.38 ± 0.80	0.641
Phosphorus, mg/dL	0.055 ± 0.2821	0.845	0.042	0.781	0.23 ± 0.41	0.579
Total alkaline phosphatase, U/L	25.8 ± 31.8	0.418	-0.135	0.365	0.00 ± 0.928	0.003
Parathyroid hormone (per 200 pg/mL)	18.7 ± 0.17	0.864	-0.034	0.819	-0.04 ± 0.26	0.870
Albumin (per 1 g/dL)	0.70 ± 0.99	0.483	0.057	0.551	-0.80 ± 0.99	0.417

Parameter	Unadjusted		Adjusted	
	$\beta^a \pm SE$	P value	$\beta^a \pm SE$	P value
Self-reported physical activity by IPAQ-L	NA	NA	NA	NA
Total work-related physical activity, MET-minutes/week	4.7 ± 9.8	0.633	0.9 ± 11	0.935
Total transport-related physical activity, MET-minutes/week				
Total domestic and gardening physical activity, MET-minutes/week	39.5 ± 20.1	0.052	53.2 ± 23.8	<b>0.028</b>
Total leisure-time physical activity, MET-minutes/week	9.3 ± 11.4	0.419	10.3 ± 13.9	0.459
Total walking, MET-minutes/week	11.5 ± 12.7	0.368	9.5 ± 14.2	0.504
Total moderate-intensity activities, MET-minutes/week	42.0 ± 23.0	0.070	54.9 ± 27.4	<b>0.048</b>
Total vigorous-intensity activities, MET-minutes/week	NA	NA	NA	NA
Total physical activity, MET-minutes/week	53.5 ± 29.6	0.073	64.4 ± 34.9	0.068
Total physical activity, MET-kcal/week	76.5 ± 37.9	<b>0.046</b>	83.0 ± 44.9	0.067
The average time spent sitting (without time spent on HD session and on transportation), minutes/day	-2.7 ± 4.3	0.521	-6.2 ± 5.0	0.212
Total physical activity level scores	0.006 ± 0.016	0.699	0.01 ± 0.02	0.542
Quality of life by QLI-D				
Health and functioning subscale	0.06 ± 0.08	0.494	0.07 ± 0.10	0.497
Social and economic subscale	0.01 ± 0.10	0.953	-0.04 ± 0.11	0.754
Psychological/spiritual subscale	0.07 ± 0.12	0.585	0.09 ± 0.14	0.542
Family subscale	-0.06 ± 0.11	0.585	-0.06 ± 0.13	0.682
Overall quality of life score	0.07 ± 0.08	0.367	0.05 ± 0.09	0.580
Psychiatric functioning by GHQ-28				
Somatic symptoms	0.06 ± 0.09	0.492	0.16 ± 0.20	0.447
Anxiety/insomnia	-0.07 ± 0.08	0.397	0.01 ± 0.17	0.947
Social dysfunction	0.10 ± 0.06	0.135	0.08 ± 0.14	0.561
Severe depression	-0.08 ± 0.08	0.339	-0.02 ± 0.15	0.909
Total score	0.01 ± 0.24	0.976	0.23 ± 0.49	0.639
Affects by PANAS				
Positive affect	0.15 ± 0.27	0.585	-0.01 ± 0.32	0.983
Negative affect	-0.43 ± 0.23	0.061	-0.11 ± 0.27	0.683

**CONCLUSIONS:** Vitamin D [25(OH)D] is a meaningful positive contributor to physical activity in HD patients. Quality of life and mental health do not seem to be differentially influenced by suboptimal levels of circulating 25(OH)D.