VITAMIN D STATUS IN SURGICAL PATIENTS – OWN EXPERIENCE

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ABSTRACT

Vitamin D plays an important role in calcium homeostasis. It has a pleiotropic health effect. Vitamin D deficiency is a risk factor for cardiovascular and immune diseases, infections, cancers and mental disorders. Epidemiological data on vitamin D status in the Polish population are limited. The aim of the study was to evaluate the vitamin D status in patients hospitalized in the surgical ward. Serum levels of 25-hydroxyvitamin D (25(OH)D) were measured from June to November 2017, in 66 patients (44 (66.67%) women, 22 (33.33%) men) aged 22-87 years (the mean age 57.67±15.62 years old) admitted to the Department of General and Oncological Surgery, Medical University of Lodz, Poland. Levels of 25(OH)D were determined using chemiluminescent microparticle immunoassay (CMIA). The mean 25(OH)D level in the studied population was 19.58±6.98 ng/ml (range, 4.80 to 43.20 ng/ml); 56.06% of the patients had 25(OH)D levels of less than 20 ng/ml; 36.36% had suboptimal levels of 20 to 30 ng/ml; and only 7.58% demonstrated the optimal levels of 30 to 50 ng/ml. In the group with thyroid disease: 54.76%, 38.10%, and 7.14% of patients, respectively. There were no statistical differences in the 25(OH)D level depending on gender, age, Body Mass Index (BMI), season of the year and in groups of patients with thyroid disease and other diagnosis. No statistically significant correlation was observed between the vitamin D level and age, weight and BMI. Due to the common vitamin D deficiency in surgical patients, widespread vitamin D supplementation is necessary even in the summer months.

BACKGROUND

Vitamin D plays a crucial role in mineral metabolism, calcium homeostasis and musculosceletal health [1, 2, 3, 4, 5]. It has a pleiotropic effect across extraskeletal systems [1, 2]. According to previous studies vitamin D deficiency is also associated with an increased risk of developing cardiovascular and immune diseases, cancers, neurological and mental disorders [2, 6, 7, 8, 9, 10, 11, 12, 13]. Reduced vitamin D concentration is considered as a potential risk factor for mortality [14, 15, 16].

Vitamin D is mainly derived from synthesis in the skin exposed to sunlight, specifically solar ultraviolet-B irradiance. It can be also ingested with food containing large amounts of vitamin D [17, 18]. Cholecalciferol-D3 (from UVB-induced conversion of 7-dehydrocholesterol in the skin and from animal dietary sources) and ergocalciferol-D2 (from plant dietary sources) undergo 25-hydroxylation in the liver and form calcidiol (25(OH)D3 and 25(OH)D2) [19,20]. In the kidneys it is converted into the highly metabolically active form of vitamin D called calcitriol (1,25(OH)2D) [2, 21].

The vitamin D status in the body is determined by total serum 25-hydroxy-vitamin D (25(OH)D) level. This term refers to both circulating forms of the vitamin D from both cutaneous and oral sources. 25(OH)D is the most abundant circulating and storage form of vitamin D [22, 23]. Its production in the liver is not tightly regulated by calcium requirements and mainly depends on the substrate availability. It has longer half-life (21–30 days vs 4–15 h) and higher concentration (nanomole vs picomole) than 1,25(OH)2D [23, 24, 25].

The debate on diagnostic thresholds defining vitamin D status is ongoing [26, 27, 28]. According to the current Practical guidelines for the supplementation of vitamin D and the treatment of deficits in Central Europe formulated by the Polish Interdisciplinary Team (2013), reference values for Polish population are as follows: < 20 ng/ml (50 nmol/l) – reflect vitamin D deficiency; 20–30 ng/ml (50–75 nmol/l) – indicate suboptimal vitamin D level; 30–50 ng/ml (75–125 nmol/l) – reflect adequate vitamin D status; >50 ng/ml (>125 nmol/l) – indicate high vitamin D supply; >100 ng/ml (>250 nmol/l) – is risky for overall health outcomes; >200 ng/ml (>500 nmol/l) – is considered toxic [17].

The data concerning vitamin D deficiency in surgical patients in Poland are incomplete. The vitamin D status has been recently investigated in Polish population and in Polish patients suffering from metabolic syndrome, primary hypertension, type 1 diabetes, multiple sclerosis, or systemic lupus erythematosus [29, 30, 31, 32, 33].

The aim of the study was to evaluate the vitamin D status in surgical patients in a single department.

MATERIAL AND METHODS

The independent bioethics committee of the Medical University of Lodz approved the study. All the respondents gave their written informed consent for participation in the study, which comprised questionnaire and laboratory examinations. The secondary analyses presented in this manuscript were conducted anonymously.

Over the period from June 2017 to November 2017, 66 patients (44 (66.67%) women, 22 (33.33%) men) aged 22-87 years (the mean age 57.67±15.62 years old) admitted to the Department of General and Oncological Surgery, Medical University of Lodz, Poland were enrolled into the study. Patients who had had previous thyroid surgery or irradiation, concomitant parathyroid disease, or took either calcium or vitamin D supplements were excluded.

Blood for laboratory tests was taken from the basilica vein. The blood samples were used to assess the concentration of 25(OH)D with the application of the ARCHITECT test using chemiluminescent microparticle immunoassay (CMIA) technology. In addition to blood sampling, body height and weight were measured with standard calibrated equipment with accuracy of up to 1 cm and 0.5 kg, respectively. Body mass index (BMI; kg/m^2) was calculated using a standard formula.

In the present study the following serum 25(OH)D concentration criteria were assumed according to the current diagnostic criteria formulated by the Polish Interdisciplinary Team (2013): <20 ng/ml was defined as deficiency, 20–30 ng/ml as suboptimal level, 30–50 ng/ml as normal level [17]. Deficiency and suboptimal level were classified as inadequate vitamin D status.

Statistical analysis was performed using Statistica 12 software. Continuous variables were expressed as mean ± SD, median and minimum–maximum values. The normal distribution was computed with the Shapiro-Wilk test. Data were compared for statistical analysis using the Student's t-test to evaluate differences between quantitative variables since 25(OH)D, age, weight and BMI values followed a Gaussian distribution. The Pearson's rank correlation coefficient was calculated to evaluate correlations between 25(OH)D levels and anthropometric variables. P value of less than 0.05 were considered statistically significant.

RESULTS

The group consisted of 66 adult patients at a mean age of 57.67±15.62 years (range, 22–87 years), including 44 women (mean age, 56.02±14.98 years; range, 22–86 years) and 22 men (mean age, 60.95± 16.70 years; range, 24–87 years). General characteristics of the study group are shown in Table 1.

The mean 25(OH)D level in the group as a whole (n=66) was 19.58±6.98 ng/ml (range, 4.80 to 43.20 ng/ml). The largest group (37 patients, 56.06%) showed significant vitamin D deficiency (<20 ng/ml). Twenty four volunteers (36.36%) showed the suboptimal level of 25(OH)D (20–30 ng/ml). The normal level 25(OH)D (30 -50 ng/ml) was observed in 5 cases (7.58%). In general, 92.42% of 66 volunteers demonstrated 25(OH)D levels that were lower than 30 ng/ml. 6.06% of adults revealed severe hypovitaminosis D (25(OH)D levels lower than 10 ng/ml).

The average 25(OH)D level in the group with thyroid disease was 19.95±5.73 ng/mL. In 23 participants (54.76%), serum 25(OH)D levels were lower than 20 ng/ml. In 16 cases (38.10%), the levels of 20 to 30 ng/ml were noted, and 3 volunteers (7.14%) had the levels of 30 to 50 ng/ml. There were no statistical differences in the 25(OH)D levels in the groups of patients with thyroid disease and other diagnosis (p=0.57).

There were no differences in 25(OH)D level depending on gender (p=0.57). However, a higher mean 25(OH)D level was found in men compared to women: 20.27±7.52 ng/ml vs. 19.23±6.76 ng/ml. 45.45% of men and 61.36% of women were vitamin D deficient (25(OH) D<20 ng/ml).

When divided into two age groups: of less than 60 years, and subjects aged 60 and older, there were 33 (50.00%) individuals below 60 and 33 (50.00%) above 60 years of age. There were no statistical differences in the 25(OH)D level in both the groups of patients (mean 20.06±7.20 ng/ml vs 19.1±6.84 ng/ml; p=0.58).

In the whole study group, 22 participants (33.33%) met a diagnostic criterion of obesity (Body Mass Index– BMI ≥30 kg/m^2). No statistically significant differences were found in BMI, between men and women (mean 27.87±4.22 ng/ml vs. 27.83±4.92 ng/ml; p=0.98). In the obese subgroup, mean 25(OH)D levels of 19.32±6.26ng/ml was insignificantly lower than the value observed in individuals with BMI of less than 30 kg/m^2 (19.70±7.36 ng/ml; p=0.84).

In summer (June, July, August), mean 25(OH)D values of 20.07±6.12 ng/ml (n =27), were insignificantly higher than the values of 19.24±7.58 ng/ml (n=39), assayed from blood samples taken in the autumn season (September, October) (p=0.64). 59.26% of patients in summer and 53.84% of volunteers in autumn were vitamin D deficient (25(OH) D<20 ng/ml).

The correlation analysis showed a weak, statistically insignificant, negative correlation between 25(OH)D levels and age (Pearson rank correlation coefficient r= –0.06, p=0.68); 25(OH)D levels and body weight (r= –0.04, p=0.73) and 25(OH)D levels and BMI (r= –0.08, p=0.51).

DISCUSSION

Our results demonstrate widespread vitamin D deficiency in surgical patients (56.06%). 9 per every 10 patients had 25(OH)D levels below the recommended normal level (30 to 50 ng/ml). In contrast, only a limited part of the studied group (7.58%) revealed adequate 25(OH)D levels. In our material the rate of inadequate vitamin D status in investigated population was higher than in a study by Godala included 326 residents of Lodz (92.42% vs 69.33%). The mean serum level of 25(OH)D was lower in studied population than in this study (19.58±6.98ng/ml vs 24,96±9,84 ng/ml) [34,35]. Similar data to ours has been reported in Pludowski et al. study [18]. This large research included a total of 5775 adult volunteers (mean age, 54.0 ±15.9 years; range, 15.6–89.8 years) who were examined through late winter and spring (low season), when the lowest 25(OH)D values are expected due to limited vitamin D synthesis in the skin. Vitamin D insufficiency and deficiency was recorded in 89.9% and 65.8% of participants, respectively. Among studied participants, 16.0% of adults had 25(OH)D levels lower than 10 ng/ml. In our series only 6.06% of participants demonstrated severe hypovitaminosis D (<10 ng/ml).

Over half of the studied adults with thyroid disorders had 25(OH)D levels lower than 20 ng/ml. Previous studies found that preoperative vitamin D levels were biochemical predictor of post-thyroidectomy hypocalcaemia [36, 37, 38]. Postsurgical hypoparathyroidism is also associated with an increased risk of depression and other types of neuropsychiatric diseases as well as infections and renal complications [39, 40].

In Europe 25(OH)D serum levels vary seasonally. Its peak annual 25(OH)D levels are recorded in August and September [41, 42]. In northern hemisphere at latitudes above 51 degrees, vitamin D synthesis occur between late April and early September due to proper solar angle and weather conditions. Skin synthesis does not occur from October to March [43]. According to a study by Webb et al. a peak 25(OH)D serum level of at least 32 ng/mL in summer is required to maintain non-deficient (> 20 ng/mL) vitamin D status during winter [44]. In our series the mean 25(OH)D serum level in August and September was 19.85±7.13 ng/ml. It was lower than 25(OH)D level (22.2 ± 7.5 ng/ml) measured in the same period in the group of not-supplementing subjects in Kmiec et al. study [22]. In our material 51.22% of volunteers showed vitamin D deficiency in August and September. No statistically significant difference has been found in the mean vitamin D level, regardless of the season (summer and autumn). The prevalence of vitamin D deficiency was in summer and, in autumn 59.26 % and 53.85%, respectively.

In our study insignificantly higher mean 25(OH)D level was found in men compared to women. Different results were presented by other authors. Women had higher 25-hydroxyvitamin D levels than men in studies by Kmiec [22, 45]. Pludowski et al. found the significant associations between vitamin D deficits and male sex [18].

No statistically significant differences were found in 25(OH)D level between individuals below 60 and above 60 years of age. As previously reported, our data also showed a insignificant negative correlation between age and 25(OH)D level. However, former studies showed that the elderly have lower ability to synthesize vitamin D from UV irradiation and have a greater dependency on dietary sources to maintain optimal vitamin D status [46, 47, 48].

The results obtained here demonstrate insignificant negative correlation between 25(OH)D levels and anthropometric parameters including body weight and BMI. Insignificantly lower mean 25(OH)D levels were recorded for obese patients compared to the value observed in subjects with BMI of less than 30 kg/m^2. The associations between vitamin D deficits and excess body weight and higher BMI were found in the studies by Pludowski and Kramkowska, Kmiec [18, 22, 49]. Adipose tissue has capacity to influence level of 25(OH)D and impedes its transport to circulation and disturbs metabolic processing of the compound [50].

CONCLUSION

Our results confirm observations from other studies. We have demonstrated widespread vitamin D deficiency among surgical patients. Over half of the adults were deficient after months of high UVB radiation. The data indicate the necessity of common vitamin D supplementation and the importance of diet rich in food containing large amounts of vitamin D.

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REFERENCES

1. Christakos S, Dhawan P, Verstuyf A, Verlinden L, Carmeliet G. Vitamin D: metabolism, molecular mechanism of action, and pleiotropic effects. Physiol Rev 2016; 96 (1): 365-408.
2. Holick MF. Vitamin D deficiency. N Eng J Med 2007; 357 (3): 266-281.
3. El-Hajj Fuleihan G, Nabulsi M, Tamin H et al. Effect of vitamin D replacement on musculoskeletal parameters in school children: a randomized controlled trial. J Clin Endocrinol Metabol 2006; 91 (2): 405–412.
4. Holick MF, Binkley NC, Bischoff-Ferrari HA et al. Guidelines for preventing and treating vitamin D deficiency and insufficiency revisited. J Clin Endocrinol Metab 2012; 97 (4): 1153-1158.
5. Romagnoli E, Pepe J, Piemonte S, Cipriani C, Minisola S. Management of endocrine disease: value and limitations of assessing vitamin D nutritional status and advised levels of vitamin D supplementation. Eur J Endocrinol 2013; 169 (4): 59-69.
6. Pittas AG, Chung M, Trikalinos Tet al. Systematic review: Vitamin D and cardiovascular outcomes. Ann Intern Med 2010; 152 (5): 307-314.
7. Anderson JL, May HT, Horne BD et al. Relation of vitamin D deficiency to cardiovascular risk factors, disease status, and incident events in a general population. Am J Cardiol 2010; 106 (7): 963–968.
8. Bischoff-Ferrari HA, Dawson-Hughes B, Stocklin E et al. Oral supplementation with 25(OH)D3 versus vitamin D3: effects on 25(OH)D levels, lower extremity function, blood pressure and markers of innate immunity. J Bone Miner Res 2012; 27 (1):160-169.
9. Hewison M. An update on vitamin D and human immunity. Clin Endocrinol 2012; 76 (3): 315-325.
10. Freedman DM, Looker AC, Chang SC, Graubard BI. Prospective study of serum vitamin D and cancer mortality in the United States. J Natl Cancer Inst 2007; 99 (21): 1594–1602.
11. Lazzeroni M, Serrano D, Pilz S, Gandini S. Vitamin D supplementation and cancer: review of randomized controlled trials. Anticancer Agents Med Chem 2013; 13 (1): 118-125.
12. Miller JW. Vitamin D and cognitive function in older adults: are we concerned about vitamin D-mentia? Neurology 2010; 74(1): 13–15.
13. Slinin Y, Paudel ML, Taylor BC et al. 25-Hydroxyvitamin D levels and cognitive performance and decline in elderly men. Neurology 2010; 74 (1): 33–41.
14. Chowdhury R, Kunutsor S, Vitezova A et al. Vitamin D and risk of cause specific death: systematic review and meta-analysis of observational cohort and randomised intervention studies. BMJ 2014; 348: g1903.
15. Melamed ML, Michos ED, Post W, Astor B. 25-Hydroxyvitamin D levels and the risk of mortality in the general population. Arch Intern Med 2008; 168(15): 1629–1637.
16. Dobnig H, Pilz S, Scharnagl H et al. Independent association of low serum 25-hydroxyvitamin D and 1,25- dihydroxyvitamin D levels with all-cause and cardiovascular mortality. Arch Intern Med 2008; 168(12): 1340–1349.
17. Pludowski P, Kaczmarkiewicz E, Bayer M et al. Practical guidelines for the supplementation of vitamin D and the treatment of deficits in Central Europe — recommended vitamin D intakes in the general population and groups at risk of vitamin D deficiency. Endokrynol Pol 2013; 64(4): 319-327.
18. Pludowski P, Ducki C, Konstantynowicz J, Jaworski M. Vitamin D status in Poland. Pol Arch Med Wewn 2016; 126(7-8): 530-539.
19. Hanwell HE, Vieth R, Cole DE et al. Sun exposure questionnaire predicts circulating 25-hydroxyvitamin D concentrations in Caucasian hospital workers in southern Italy. J Steroid Biochem Mol Biol 2010; 121(1-2): 334–337.
20. Carnevale V, Modoni S, Pileri M et al. Longitudinal evaluation of vitamin D status in healthy subjects from southern Italy: seasonal and gender differences. Osteoporos Int 2001; 12(12): 1026–1030.
21. DeLuca HF. Overview of general physiologic features and functions of vitamin D. Am J Clin Nutr 2004; 80(6 Suppl): 1689S–1696S.
22. Kmiec P, Zmijewski M, Lizakowska-Kmiec M, Sworczak K. Widespread vitamin D deficiency among adults from northern Poland (54°N) after months of low and high natural UVB radiation. Endokrynol Pol 2015; 66(1): 30-38.
23. Romagnoli E, Pepe J, Piemonte S, Cipriani C, Minisola S. Management of endocrine disease: value and limitations of assessing vitamin D nutritional status and advised levels of vitamin D supplementation. Eur J Endocrinol 2013; 169(4): R59-R69.
24. Fraser WD, Milan AM. Vitamin D assays: past and present debates, difficulties, and developments. Calcif Tissue Int 2013; 92(2): 118–127.
25. Mazahery H, von Hurst PR. Factors Affecting 25-Hydroxyvitamin D Concentration in Response to Vitamin D Supplementation. Nutrients 2015; 7(7): 5111-5142.
26. Roger B. Vitamin D and extraskeletal health. UpToDate 2014.
27. Vieth R. Why the minimum desirable serum 25-hydroxyvita¬min D level should be 75 nmol/L (30 ng/ml). Best Pract Res Clin Endocrinol Metab 2011; 25(4): 681-691.
28. Bouillon R, Van Schoor NM, Gielen E et al. Optimal vitamin D status: a critical analysis on the basis of evidence-based medicine. J Clin Endocrinol Metab. 2013; 98(8): 1283-1304.
29. Brola W, Sobolewski P, Szczuchniak W et al. Association of seasonal serum 25-hydroxyvitamin D

levels with disability and relapses in relapsing-remitting multiple sclerosis. Eur J Clin Nutr 2016; 70(9): 995-999.
30. Bogaczewicz J, Karczmarewicz E, Pludowski P, Zabek J, Wozniacka A. Requirement for vitamin D supplementation in patients using photoprotection: variations in vitamin D levels and bone formation markers. Int J Dermatol 2016; 55(4): 176-183.
31. Godala M, Materek-Kusmierkiewicz I, Moczulski D et al. Estimation of plasma 25(OH)D vitamin deficiency in patients with metabolic syndrome. Pol Merkur Lekarski 2016; 40(239): 288-291.
32. Pludowski P, Jaworski M, Niemirska A et al. Vitamin D status, body composition and hypertensive target organ damage in primary hypertension. J Steroid Biochem Mol Biol 2014; 144: 180-184.
33. Wierzbicka E, Szalecki M, Pludowski P, Jaworski M, Brzozowska A. Vitamin D status, body composition and glycaemic control in polish adolescents with type 1 diabetes. Minerva Endocrinol 2016; 41(4):445-55.
34. Godala M, Materek-Kusmierkiewicz I, Moczulski D et al. Estimation of plasma 25(OH)D vitamin level in residents of Lodz Pol Merkur Lekarski 2016; 40(237): 160-163.
35. Godala M, Materek-Kusmierkiewicz I, Moczulski D et al. Evaluation of prevalece of plasma 25(OH)D vitamin deficiency in residents of Lodz. Pol Merkur Lekarski. 2016; 40(237): 164-167.
36. Kim WW, Chung SH, Ban EJ et al. Is Preoperative Vitamin D Deficiency a Risk Factor for Postoperative Symptomatic Hypocalcemia in Thyroid Cancer Patients Undergoing Total Thyroidectomy Plus Central Compartment Neck Dissection? Thyroid 2015; 25(8): 911-918.
37. Tripathi M, Karwasra RK, Parshad S. Effect of preoperative vitamin D deficiency on postoperative hypocalcemia after thyroid surgery. Thyroid Res 2014; 7: 8.
38. Edafe O, Antakia R, Laskar N, Uttley L, Balasubramanian SP. Systematic review and meta-analysis of predictors of post-thyroidectomy hypocalcaemia. Br J Surg 2014; 101(4): 307-320.
39. Underbjerg L, Sikjaer T, Mosekilde L, Rejnmark L. Cardiovascular and Renal Complications to Postsurgical Hypoparathyroidism: A Danish Nationwide Controlled Historic Follow-Up Study. J Bone Miner Res 2013; 28(11): 2277-2285.
40. Underbjerg L, Sikjaer T, Mosekilde L, Rejnmark L. Postsurgical Hypoparathyroidism—Risk of Fractures, Psychiatric Diseases, Cancer, Cataract, and Infections. J Bone Miner Res 2014; 29(11): 2504-2510.
41. Kasahara AK, Singh RJ, Noymer A. Vitamin D (25OHD) Serum Seasonality in the United States. PLoS One 2013; 8(6): e65785.
42. Webb AR, Kift R, Durkin MT et al. The role of sunlight exposure in determining the vitamin D status of the U.K. white adult population. Br J Dermatol 2010; 163(5): 1050–1055.
43. Tylavsky FA, Cheng S, Lyytikäinen A, Viljakainen H, Lamberg-Allardt C. Strategies to improve vitamin D status in northern European children: exploring the merits of vitamin D fortification and supplementation. J Nutr 2006; 136(4): 1130–1134.
44. Webb AR, Kline L, Holick MF. Influence of season and latitude on the cutaneous synthesis of vitamin D3: exposure to winter sunlight in Boston and Edmonton will not promote vitamin D3 synthesis in human skin. J Clin Endocrinol Metab 1988; 67(2): 373–378.
45. Kmiec P, Sworczak K. Vitamin D deficiency in early autumn among predominantly non-elderly, urban adults in Northern Poland (54°N). Postepy Hig Med Dosw (Online) 2015; 69: 918-924.
46. Heaney RP. Barriers to optimizing vitamin D3 intake for the elderly. J Nutr 2006; 136(4): 1123-1125.
47. Macdonald HM, Mavroeidi A, Barr RJ, Black AJ, Fraser WD, Reid DM. Vitamin D status in postmenopausal women living at higher latitudes in the UK in relation to bone health, overweight, sunlight exposure and dietary vitamin D. Bone 2008; 42(5): 996-1003.
48. Burgaz A, Akesson A, Oster A, Michaëlsson K, Wolk A. Associations of diet, suplement use, and ultraviolet B radiation exposure with vitamin D status in Swedish women during winter. Am J Clin Nutr 2007; 86(5): 1399-1404.
49. Kramkowska M, Grzelak T, Walczak M, Bogdanski P, Pupek-Musialik D, Czyzewska K. Relationship between deficiency of vitamin D and exponents of metabolic syndrome. Eur Rev Med Pharmacol Sci 2015; 19(12): 2180-2187.
50. Wang C. Role of Vitamin D in cardiometabolic diseases. J Diabetes Res 2013; 2013: 243934.

LIST OF TABLES

TAB. 1. THE AGE RANGE OF RESPONDENTS.

Parameter	Women (n =44)		Men (n =22)		Total (n =66)	
	mean (SD)	median (min–max)	mean (SD)	median (min–max)	mean (SD)	median (min–max)
age, y	56.02 (14.98)	57.50 (22-86)	60.95 (16.70)	63.50 (24-87)	57.67 (15.62)	59.50 (22-87)
height, cm	162.80 (6.87)	162.00 (150-186)	174.41 (4.46)	175.50 (164-181)	166.67 (8.25)	166.00 (150-186)
weight, kg	74.02 (15.03)	73.00 (47-110)	85.32 (15.37)	82.00 (58-110)	77.79 (15.96)	77.00 (47-110)
BMI, kg/m^2	27.83 (4.92)	27.76 (18.83-38.10)	27.87 (4.22)	28.01 (19.27-34.02)	27.84 (4.66)	27.94 (18.83-38.10)
25(OH)D, ng/ml	19.23 (6.76)	19.05 (4.80-43.20)	20.27 (7.52)	20.35 (7.20-36.80)	19.58 (6.98)	19.15 (4.80-43.20)

Abbreviations: BMI, body mass index; 25(OH)D, 25-hydroxyvitamin D

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