

# Vitamin D status of the elderly in the Vaal region, South Africa

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Vitamin D status was determined in a sample of 79 elderly people and the results showed that 38% of the elderly had inadequate vitamin D status that was accompanied by various symptoms associated with vitamin D insufficiency/deficiency.

**Keywords** elderly, symptoms, vitamin D

## Introduction

Vitamin D insufficiency or deficiency has been recognised as a global public health problem.<sup>1</sup> Although the major source of vitamin D for most individuals is cutaneous photosynthesis from ultraviolet-B radiation through sunlight exposure (80%), many countries with adequate sun exposure have reported vitamin D insufficiencies/deficiencies. This is especially true for people with dark skin, whose increased melanin production may result in lower vitamin D synthesis.<sup>2</sup> The elderly are particularly at risk of developing vitamin D deficiency (VDD),<sup>3</sup> because of age-related declines in vitamin D production from sun exposure and limited dietary vitamin D sources.<sup>2,3</sup> Poor vitamin D intakes have been observed among the elderly in the Vaal region of Gauteng, South Africa.<sup>4</sup> Many VDD studies have focused on adults and the elderly during the last decade, but there is little information concerning the prevalence of VDD among the elderly in South Africa (SA). The aim of this study was to determine the prevalence of Vitamin D insufficiency and deficiency as well as identify symptoms associated with inadequate vitamin D status among black elderly individuals living in the Vaal region.

## Methods

This study was carried out in July 2018 using a convenience sample of 79 of the surviving community-dwelling participants from a longitudinal study carried out since 2008.<sup>4</sup> All the respondents were homogeneous in age ( $\geq 60$  years) and race (black). The study protocol was approved by the Vaal University of Technology Senate Research Innovation and Ethics Committee (20140827mns). All the participants completed and signed the informed consent forms for voluntary participation.

Trained fieldworkers assisted with data collection in one-on-one interviews with each of the participants. Measurements included age, gender and a questionnaire measuring various self-reported symptoms frequently associated with VDD. Fasting blood samples were collected by a qualified phlebotomist and serum aliquots stored at  $-80^{\circ}\text{C}$  until analyses. All assays were analysed in the Biomedical Research Laboratory at the Vaal University of Technology. Concentrations of 25-hydroxyvitamin D<sub>2</sub> [25(OH)D<sub>2</sub>] (plant-derived) and 25-hydroxyvitamin D<sub>3</sub> [25(OH)D<sub>3</sub>] (animal-derived) were analysed using high performance liquid chromatography (HPLC). Both of these forms of vitamin D are stored in the liver as 25-

hydroxyvitamin D (calcidiol) (25[OH]D). Serum concentration of 25(OH)D is, therefore, the best indicator of vitamin D status. Serum concentrations of  $< 30$  nanogram/millilitre (ng/ml) 25(OH)D were considered insufficient and  $< 20$  ng/ml as deficient.<sup>1–3</sup> Severe VDD is defined as  $< 10$  ng/ml 25(OH)D serum levels. The more stable 25(OH)D<sub>3</sub> levels from animal origin are reported in the results.<sup>2</sup>

IBM SPSS, version 26 (IBM Corp, Armonk, NY, USA) was used for all analyses including descriptive (means, standard deviations [SDs], frequencies) and inferential statistics (Pearson and chi-square correlations, and analysis of variance). A  $p$ -value of less than 0.05 was considered significant for inferential statistics.

## Results

The mean  $\pm$  SD age of the participants was  $73 \pm 30$  years and 78.4% were women. The mean  $\pm$  SD 25(OH)D<sub>3</sub> was  $24.8 \pm 10.5$  ng/ml. The majority of the respondents (62.0%;  $n = 49$ ) had adequate serum 25(OH)D<sub>3</sub> levels whereas 32.9% ( $n = 26$ ) had insufficient and 5.1% ( $n = 4$ ) deficient serum 25(OH)D<sub>3</sub> levels. Respondents with an adequate serum 25(OH)D<sub>3</sub> were significantly ( $p = 0.011$ ) more likely to be men (81.8% versus 51.1% women). This was reflected in the higher mean  $\pm$  SD serum 25(OH)D<sub>3</sub> levels of men ( $29.6 \pm 9.5$  ng/ml) compared with the women ( $23.3 \pm 11.8$  ng/ml) ( $p = 0.015$ ). The ANOVA results in Table 1 showed that significantly higher prevalence of fatigue ( $p = 0.029$ ) and low back/joint pain ( $p = 0.035$ ) were experienced by the insufficient and VDD respondents compared with those who had adequate vitamin D status. In addition, the chi-square correlation analysis showed only one significant association ( $p = 0.036$ ), namely between 25(OH)D<sub>3</sub> levels and low back/joint pain.

## Discussion

A compromised vitamin D status was prevalent in a large percentage of the elderly. Many adverse associations have been reported between poor vitamin D status with chronic diseases and poor general health.<sup>1,3</sup> The elderly represent the fastest growing segment of the global population with a projected increase of 64% in Africa during the next two decades. Although this is a success story due to improvements in health care and hygiene, it also causes a burden for the healthcare and social security systems. Most of the symptoms associated with inadequate vitamin D status are also symptoms associated

Table 1: Prevalence of self-reported associated symptoms among vitamin D status categories as analysed with ANOVA

Symptoms	Vitamin D status categories			Total group	Significance of differences between VD categories p
	Deficient n (%)	Insufficient n (%)	Adequate n (%)		
Fatigue	3 (75.0)	17 (65.4)	30 (61.2)	50 (63.3)	0.029
Low back/joint pain	3 (75.0)	9 (34.6)	14 (28.0)	26 (32.9)	0.035
Mood swings	3 (75.0)	16 (61.5)	1 (59.2)	20 (25.3)	0.820
Muscle cramps	1 (25.0)	4 (15.4)	6 (12.0)	11 (13.9)	0.580
Irritable bowel (abdominal pain, cramping or bloating that related to passing a bowel movement)	4 (100.0)	5 (19.2)	7 (14.0)	16 (20.3)	0.631
Weight gain	3 (75.0)	6 (23.1)	13 (26.0)	22 (27.8)	0.912

with old age, which makes it difficult to differentiate. In addition, although optimal levels of vitamin D result in less functional decline and fewer negative outcomes,<sup>1,3,5</sup> it is not clear from the body of evidence whether low levels of vitamin D are a cause or a consequence of poor health.<sup>6</sup>

### Conclusion and recommendations

Although this study had a small sample size, this is one of the first studies reporting on vitamin D status of community-dwelling elderly in SA and confirms poor vitamin D status as also observed among the elderly in other countries. A need thus exists for awareness and nutrition education programmes through which the elderly can be advised to increase their intake of vitamin-D-rich sources and motivated to spend more time outside in the sun.

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### References

- Pereira M, Ribas de Farias Costa PR, Miranda Pereira E, et al. Does vitamin D deficiency increase the risk of obesity in adults and the elderly? A systematic review of prospective cohort studies. *Public Health*. 2021;190:123–31.
- Sakem B, Nock C, Stanga Z, et al. Serum concentrations of 25-hydroxyvitamin D and immunoglobulins in an older Swiss cohort: result of the senior labor study. *BMC Med*. 2013;11:176. <http://www.biomedcentral.com/1741-7015/11/176>.
- Jungert A, Neuhäuser-Berthold M. Dietary vitamin D intake is not associated with 25-hydroxyvitamin D3 or parathyroid hormone in elderly subjects, whereas the calcium-to-phosphate ratio affects parathyroid hormone. *Nutr Res*. 2013;33:661–7.
- Oldewage-Theron WH, Kruger R. Food variety and dietary diversity as indicators of the dietary adequacy and health status of an elderly population in Sharpeville, South Africa. *J Nutr Elder*. 2008;27(1–2):101–33. doi:10.1080/01639360802060140.
- Löhr J-M, Panic N, Vujasinovic M, et al. The ageing pancreas: a systematic review of the evidence and analysis of the consequences. *J Intern Med*. 2018;283:446–60.
- Guessous I. Role of vitamin D deficiency in extraskeletal complications: predictor of health outcome or marker of health status? *Biomed Res Intl*. 2015; 13. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4436443/pdf/BMRI2015-563403.pdf>.

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