Abstract

Assessment of Vitamin D Intake and Status in Slovenian Premenopausal and Postmenopausal Women †

Vid Vičič 1,*, Petra Pavlič 1, Valentina Rok 1, Saša Kugler 2,Andreja Kukec 1,2 and Ruža Pandel Mikuš 1

1 Department of Biomedicine in Healthcare, Faculty of Health Sciences, University of Ljubljana, 1000 Ljubljana, Slovenia; petra.pavlic@gmail.com (P.P.); ms.valentina.rok@gmail.com (V.R.); andreja.kukec@mf.uni-lj.si (A.K.); ruza.pandel@zf.uni-lj.si (R.P.M.)
2 National Institute of Public Health, Trubarjeva cesta 2, 1000 Ljubljana, Slovenia; sasa.kugler@nijz.si
* Correspondence: vidvicic@gmail.com

Abstract: Background and objective: The main source of Vitamin D is the synthesis of cholecalciferol (D3) from 7-dehydrocholesterol in the skin when exposed to ultraviolet radiation. A significant intake can be obtained from supplementation and fortified foods and to a lesser extent from fatty fish and eggs. The objective of our study was to assess vitamin D intake and status in Slovenian premenopausal and postmenopausal women. Methods: A cross-sectional study was conducted between March and May 2021, involving 319 women aged 44 to 65 years. After considering exclusion criteria and the completeness of data, 176 participants were included in the final analysis. Vitamin D status was determined by measuring the concentrations of total 25-hydroxyvitamin D (25(OH)D), vitamin D-binding protein (DBP), and albumin and by calculating bioavailable and free 25(OH)D. Vitamin D intake from fish (fatty and lean separately), eggs, and food supplements or drugs was assessed using a vitamin D-focused food frequency questionnaire (FFQ). In addition, sun exposure, menstrual status, socio-demographic characteristics, and health status were assessed. Results: Vitamin D insufficiency (total 25(OH)D < 75 nmol/L) was observed in 77% of premenopausal and 62% of postmenopausal women. Premenopausal women had 12% lower total 25(OH)D and 32% lower bioavailable 25(OH)D compared to postmenopausal women. The average milk and yoghurt consumption was 135 ± 161 mL/day; egg consumption was 3.2 ± 2.4 eggs/week. The mean vitamin D intakes from food and supplementation were 2.2 ± 1.3 µg/day and 21.7 ± 26.2 µg/day, respectively. In total, 61% of the participants supplemented with a mean dose of 35.4 ± 25.3 µg/day, with no statistically significant differences between premenopausal and postmenopausal women. The odds ratio (OR) for vitamin D insufficiency (25(OH)D < 75 nmol/L) among participants who did not supplement with vitamin D was 6.23; p ≤ 0.001. Premenopausal women had a statistically non-significant lower supplementation rate. Discussion and conclusions: Vitamin D status among Slovenian postmenopausal women is significantly more favourable than among premenopausal women. Despite a high supplementation rate, vitamin D insufficiency is still present in the majority of the population. With limited milk consumption, milk fortification alone is not feasible. However, egg biofortification could offer a viable contribution to increasing vitamin D intake.

Keywords: vitamin D; 25(OH)D; postmenopausal; premenopausal; epidemiological study

Author Contributions: Conceptualization, V.V., A.K., and R.P.M.; investigation: V.V., P.P., V.R. and S.K.; writing: V.V. and S.K.; reviewing: V.V., A.K., R.P.M., P.P., V.R. and S.K.; supervision: A.K. and R.P.M. All authors have read and agreed to the published version of the manuscript.

Funding: The study was financed by: Department of Public Health, Faculty of Medicine, University of Ljubljana research program ARRS grant No. P3-0360, Slovenian research programme for comprehensive cancer control SLORapro and University Medical Centre Ljubljana, The Division
of Gynaecology and Obstetrics, research program ARRS grant No. P3-0360 P3-0124, Metabolic and hereditary factors of reproductive health, delivery II.

**Institutional Review Board Statement:** The study protocol was approved by the Slovenian National Medical Ethics Committee (Ministry of Health, Republic of Slovenia), identification number KME 0120-68/2019/9 (approval letter ID 0120-68/2019/9, date of approval: 22 March 2019).

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** The data presented in this study are available on request from the corresponding author.

**Conflicts of Interest:** The authors declare no conflict of interest.

**Disclaimer/Publisher’s Note:** The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.