

Knowledge of Polish students about vitamin D

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ABSTRACT

Introduction: The multifaceted role of vitamin D and the widespread prevalence of its deficiency worldwide make it a significant subject of research. Low blood levels of this vitamin are increasingly associated with a higher risk of various diseases, including within the Polish population. Vitamin D is involved in regulating energy metabolism in the body, as well as in the synthesis of connective tissue proteins and other proteins engaged in metabolic processes, further emphasizing its importance in maintaining homeostasis.

The aim of this study was to assess the level of knowledge about vitamin D among students of medical and non-medical disciplines. The study encompassed 2 universities in the Silesian region – the Medical University of Silesia in Katowice (SUM) and the University of Economics in Katowice (UE).

Materials and methods: The analysis included a group of 272 students, of whom 143 (52.6%) represented the SUM and 129 (47.4%) were students of the UE. The data were collected using an original, anonymous questionnaire consisting of closed-ended questions.

Results: The analysis revealed that a significant proportion of students from the SUM (42.7%) considered the number and scope of informational campaigns to be insufficient. In contrast, the most common response among students from the UE was that they had not encountered such information (44.2%). Notably, a similar percentage of respondents from both universities (19.6% from SUM and 19.4% from UE) expressed the opinion that the general public's level of knowledge about vitamin D is adequate.

Conclusions: Students of the SUM emphasize the need to intensify efforts aimed at raising public awareness of the importance of vitamin D for human health. Particular attention is drawn to the necessity of reaching older individuals, who are most at risk of vitamin D deficiency. The insufficient level of education regarding the role of vitamin D represents a significant public health issue, highlighting the need to expand the number and reach of informational campaigns. These initiatives should involve educational and medical institutions as well as the media, in order to effectively reach a broad audience.

Keywords: prevention; knowledge; vitamin D; biosynthesis; absorption; dietary sources; supplementation.

INTRODUCTION

Vitamin D belongs to the group of fat-soluble vitamins and is an isoprenoid synthesized by plants, bacteria, and fungi [1, 2]. Its intestinal absorption largely depends on the presence of bile acid salts, which is why deficiency symptoms most commonly occur in individuals suffering from malabsorption syndromes [3, 4]. The transport of fat-soluble vitamins takes place via specific carrier proteins or through plasma lipoprotein complexes. Due to their insolubility in aqueous environments, they are not excreted by the kidneys. When supplied in excessive amounts, these vitamins tend to accumulate in lipid-rich cellular structures, sometimes reaching toxic concentrations [5].

There are several compounds referred to as vitamin D. The 2 main and most commonly occurring forms are vitamin D₂ (ergocalciferol) and vitamin D₃ (cholecalciferol) [6]. The term "vitamin D" without a subscript generally refers to either of these forms individually or in combination, which is why they are collectively known as calciferol [7, 8]. These vitamins differ structurally – ergocalciferol has a double bond between carbon atoms 22 and 23, as well as a methyl group on carbon 24 – Figure 1 [9, 10]. Despite this distinction, both are converted in the body into the same biologically active compound. In the

liver, they are transformed into calcifediol, and in the kidneys into calcitriol. Collectively, they are referred to as 25-hydroxy-vitamin D (25(OH)D), which is the biologically inactive form of the hormone.

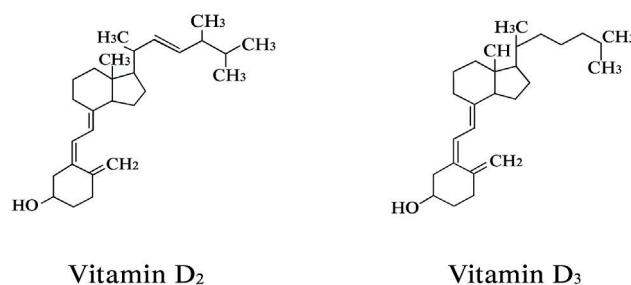


FIGURE 1. Forms of vitamin D (own elaboration based on [7])

Among the vitamin D group, vitamin D₃ is the most significant. It enters the human body via 2 main pathways: through the skin – by exposure to ultraviolet rays with wavelengths of 290–310 nm found in sunlight, which are absent in our climate zone October–March – and through the intestines, primarily by consuming animal fats, especially marine fish [8]. Once absorbed through the skin or diet, it enters the bloodstream

and is transported to the liver and kidneys, where it is converted into its biologically active form [9, 10]. Cholecalciferol undergoes 2 hydroxylation reactions: the first occurs in the liver, and the second in the kidneys, resulting in the active form 1,25-dihydroxycholecalciferol (Fig. 2), which is mostly stored in the liver as 25-hydroxycholecalciferol [11, 12].

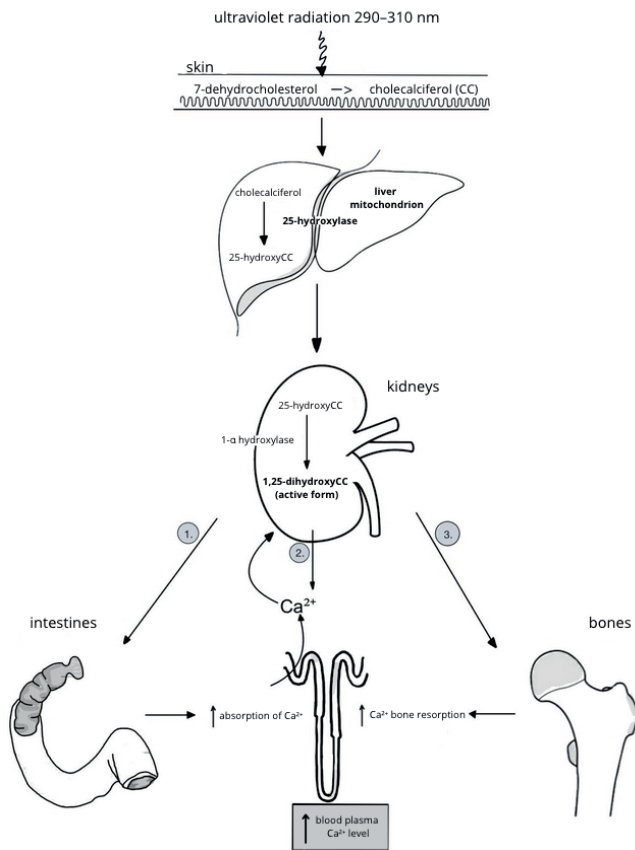


FIGURE 2. Synthesis of vitamin D in the body (own elaboration based on [14])

Vitamin D from food is absorbed in the gastrointestinal tract at a rate of 50–80%, depending on factors such as the presence of fatty acids, the condition of the intestinal mucosa, intestinal peristalsis, and parathyroid function [13]. In the small intestine, it is essential for calcium absorption via active transport, while in the kidneys it enhances the reabsorption of calcium and phosphate in the proximal tubules. A deficiency of vitamin D leads to rickets-like changes in the bones of infants and young children, and in older adults it causes bone softening, porosity, and fragility [14]. Low serum levels of vitamin D and insufficient intake significantly disrupt the body’s physiological balance and increase the risk of developing various chronic diseases [15]. Proven conditions resulting from inadequate vitamin D levels include osteoporosis, rickets, and osteomalacia [16].

In Poland, the standards for vitamin D₃ intake are established by the National Food and Nutrition Institute (Instytut Żywności i Żywienia) and the Chief Sanitary Inspectorate (Główny Inspektorat Sanitarny). These guidelines are published in Nutrition Standards for the Polish Population and Their Application (*Normy żywienia dla populacji Polski i ich zastosowanie*), which are regularly updated. The latest edition

was released in 2025 [17]. The requirement for this vitamin is shown in Table 1.

TABLE 1. Polish standards for vitamin D (own work based on [17])

Group (gender, age)	µg cholecalciferol/person/day
Infants 0–11 months	10
Children 1–9 years	15
Boys 10–18 years	15
Girls 10–18 years	15
Men 19–75+ years	15
Women 19–75+ years	15

To assess the level of knowledge about vitamin D among students of the Medical University of Silesia in Katowice (SUM) and the University of Economics in Katowice (UE), a survey was conducted using a proprietary online questionnaire. The specific objectives included evaluating students’ understanding of the role of vitamin D, its biosynthesis, the recommended intake standards in Poland, and the health risks associated with abnormal levels of the vitamin in the body (hypovitaminosis and hypervitaminosis D).

MATERIALS AND METHODS

The study was conducted using a proprietary questionnaire consisting of 18 questions: 4 related to demographic data (including age) and 14 substantive questions. The substantive questions addressed topics such as sources of vitamin D, its role in the human body, and recommendations regarding supplementation. The CAWI (Computer-Assisted Web Interview) technique was applied, allowing participants to complete the survey independently via the Internet. This method enabled fast and convenient access to a large group of respondents, ensuring anonymity and comfort during the response process.

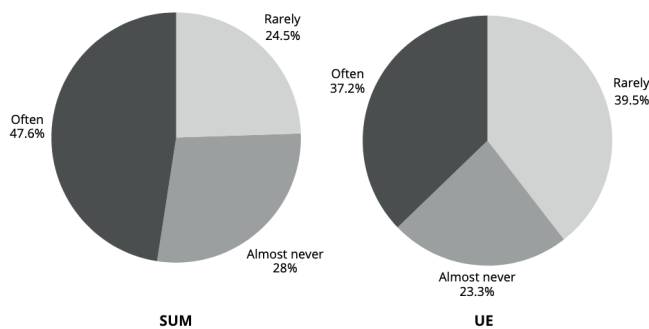
The questionnaire was available online through the Google Forms platform from September 11–25, 2023. Respondents from both universities were recruited using the snowball method. The survey link was shared with the authors’ acquaintances and distributed via social media platforms such as Messenger and Instagram, accompanied by a request to participate. Additionally, the survey was posted in various Facebook groups and pages where users exchange advice, information, and experiences. The data collected during the study were entirely anonymous and did not contain any personally identifiable information. Therefore, no personal data were stored.

It should be emphasized that the study has certain limitations due to the lack of detailed statistical data. The analysis was based on general results, which makes it impossible to conduct an in-depth verification and detailed comparisons between groups. The use of a proprietary survey that was not previously standardized also carries the risk of reducing the reliability of the results, and the relatively small number of participants affects the generalization of the results obtained, as does the small number of questions in the survey.

RESULTS

After analyzing and processing the responses to the survey questions, the results were presented in the form of pie charts generated, with additional color modifications to ensure a consistent visual presentation. The study confirmed a significant correlation between the respondents' level of knowledge about vitamin D and their familiarity with medical topics. The analysis of the collected data allowed for verification of the participants' declared knowledge regarding intake standards, deficiency effects, absorption processes, and supplementation guidelines for vitamin D. The results clearly indicate a higher level of awareness about vitamin D among students of the medical university compared to students from non-medical faculties.

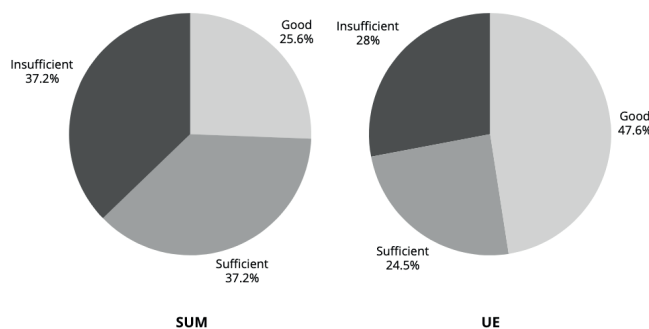
In response to the first substantive question – regarding the frequency of encountering information about vitamin D – 47.6% of medical university students answered “often”. In contrast, the most common response among non-medical university students was “rarely” (39.5%) – Figure 3.



SUM – Medical University of Silesia in Katowice; UE – University of Economics in Katowice

TABLE 2. Prevalence of information regarding vitamin D (own elaboration)

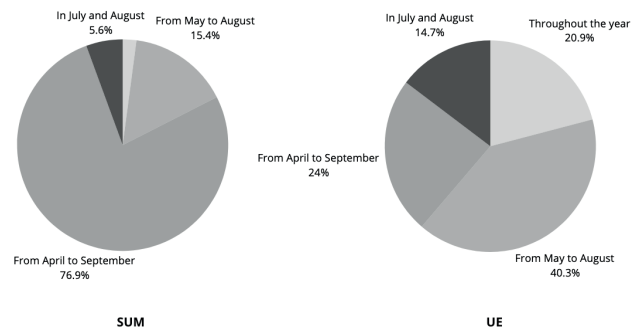
In response to the question regarding self-assessment of knowledge, an equal proportion of students from the SUM (37.2%) rated their knowledge as sufficient and insufficient. In contrast, the majority of students from the UE assessed their knowledge as good (Fig. 4).



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FIGURE 3. Self-assessment of knowledge level (own elaboration)

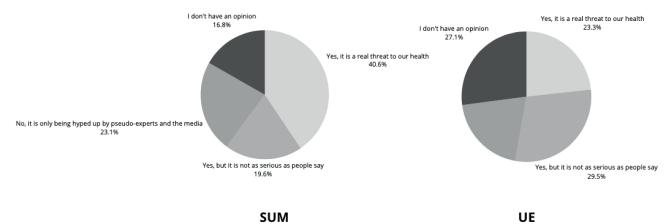
A significant majority of students from the SUM (74.8%) provided the correct answer to the question regarding cutaneous synthesis at our geographic latitude. In contrast, at the compared university, only about ¼ of respondents answered correctly (Fig. 5).



SUM – Medical University of Silesia in Katowice; UE – University of Economics in Katowice

FIGURE 4. Influence of geographic latitude on vitamin D synthesis (own elaboration)

The most common response among students of the SUM was that abnormal levels of vitamin D pose a real threat to human health (40.6%). A smaller proportion (23.1%) believed that the issue is merely exaggerated by pseudo-experts and the media. Students from the UE most frequently selected the option stating that the threat is not as serious as it is portrayed (29.5%), while 27.1% of respondents had no opinion on the matter (Fig. 6).



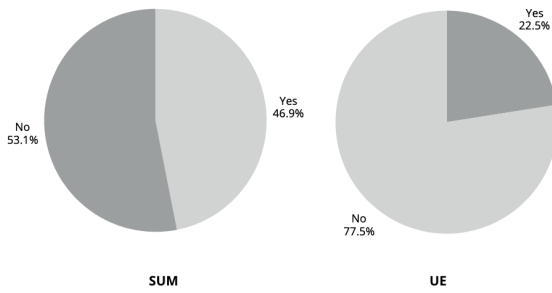
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FIGURE 5. Abnormal vitamin concentration and its actual health risk (own elaboration)

Among the surveyed participants in both study groups, the majority (53.1% and 77.5%) selected the response indicating that they do not know the current dietary intake standards for specific age groups (Fig. 7).

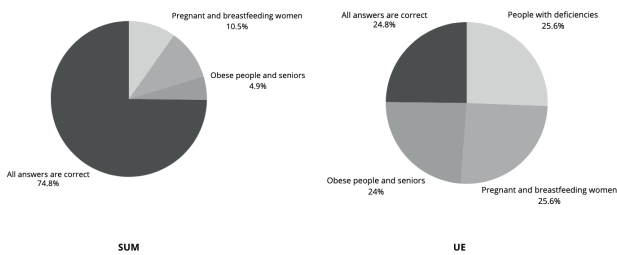
Nearly ¾ of medical students provided the correct answer to the given question. In contrast, at the compared university, the percentage distribution across individual responses was similar, but only 24.8% selected the correct answer (Fig. 8).

The majority of respondents from the compared universities (46.2% and 55.8%) do not take dietary supplements containing vitamin D. In contrast, 28% of students at the SUM and 17.1% regularly take vitamin D supplements (Fig. 9).



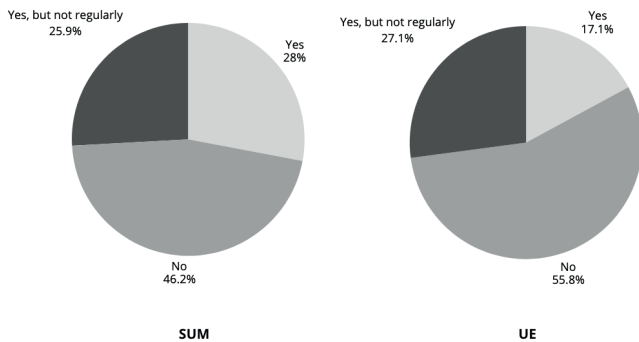
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FIGURE 6. Recommended intake standards for different age groups (own elaboration)



SUM – Medical University of Silesia in Katowice; UE – University of Economics in Katowice

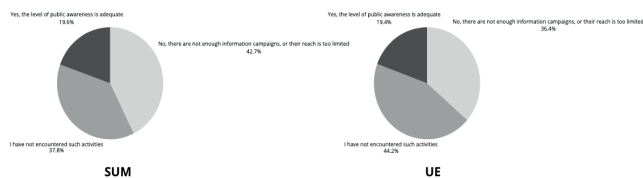
FIGURE 7. Especially recommended supplementation (own elaboration)



SUM – Medical University of Silesia in Katowice; UE – University of Economics in Katowice

TABLE 3. Use of supplementation (own elaboration)

In both surveyed groups, the majority of respondents believe that informational campaigns are either insufficient or have too limited a reach (42.7%, 36.4%) – Figure 10.



SUM – Medical University of Silesia in Katowice; UE – University of Economics in Katowice

FIGURE 8. Informational activities (own elaboration)

DISCUSSION

The results obtained in the study provide insight into the current state of knowledge about vitamin D among young adults who are university students living in Poland. The findings described above are consistent with other similar studies conducted in various countries across different age groups. In 2024, Saudi Arabia published a report on knowledge, attitudes, and practices related to this topic. Most participants in that study (88.1%) knew that vitamin D is essential for healthy bones. Approximately 75.3% of respondents indicated that vitamin D deficiency may be associated with muscle pain. Only 4.16% of participants were unable to identify sources of vitamin D. The most common form of vitamin D intake was skin synthesis (83.9%), followed by dietary supplements (80%). Other sources included eggs (30.95%), milk (26.78%), and fatty marine fish (14.88%) [18]. For most people, the primary source of vitamin D is its synthesis in the skin through exposure to UVB radiation, as also noted in France. In that study, a significant portion of respondents (72%) reported meeting their vitamin D needs in this way [19]. A study published in “Nutrients” showed that women had better knowledge of available sources of this vitamin than men. Individuals who had previously used supplements to balance vitamin D levels in the body demonstrated better knowledge of dietary sources, as did those who were concerned about having insufficient levels. From the participants 78% associated vitamin D with healthy bones, 74% with osteoporosis, and 62% with rickets [20]. On the African continent, in Ghana, the majority (61%) of study participants were aware of vitamin D and reported receiving information about it mainly from school (48.3%) and healthcare workers (28.2%). The importance of vitamin D was positively assessed by 67% of participants, and 62.5% indicated its benefits for bone health. Regarding sources of vitamin D, 53% identified sun exposure, followed by diet (42.7%) and supplements (21.2%). As for vitamin D supplements, most participants (55.9%) were willing to take them if a deficiency was diagnosed [21]. Among health subject teachers, nearly all participants (99.6%) were familiar with vitamin D and considered it important for their health. Furthermore, 75% of teachers in human health-related subjects were able to identify sources of vitamin D, including appropriate food products, sun exposure, and supplements. Additionally, 94% of teachers were aware that vitamin D is important for maintaining proper bone structure, and 27% knew that it may help prevent heart disease. Most participants correctly identified individuals at risk of vitamin D deficiency, although only a few (3%) knew that people with darker skin may be more susceptible to developing a deficiency [22]. In December 2022, 399 students at Sultan Qaboos University in Muscat, Oman, were surveyed. Their knowledge of vitamin D was assessed using a 38-point KAP questionnaire (D-KAP-38); 68.2% of respondents correctly identified that vitamin D is produced in the skin, and 83.2% associated its deficiency with bone pain. Most students agreed that current education on the benefits of sun exposure for adequate skin synthesis is insufficient [23]. In a study conducted by Australian family doctors, 39% of their

patients were found to be deficient in vitamin D, and the vast majority of patients (97.1%) were prescribed appropriate vitamin D supplements to achieve the recommended blood levels. In addition, exposure to sunlight was recommended in 82% of cases [24]. Boland et al. assessed the knowledge of undergraduate students about vitamin D. The students demonstrated a low level of knowledge (the percentage of correct answers was 29%), which is a cause for concern. They were unable to identify sources of this vitamin in food and did not use dietary supplements to achieve optimal concentrations due to the inability to synthesize it for about 6 months due to Canada's high geographical location. Only 8% of respondents indicated the recommended intake of vitamin D, and 14% correctly answered the question about the time needed to produce vitamin D through skin synthesis [25]. In a study conducted in northern Poland, 44% of participants declared that they supplemented at least one type of vitamin D, while only 56% of the same group admitted to taking supplements daily. The most commonly selected diseases associated with vitamin D were: osteoporosis (48%), depression (43%), and rheumatoid arthritis (30%) [26]. In a survey conducted in the UK, 99% of respondents believed that vitamin D levels could be increased through exposure to sunlight, and 89% believed that this could be achieved by taking appropriate dietary supplements. Participants were asked who they thought was most at risk of vitamin D deficiency, with the majority (87%) responding that it was people who do not spend enough time outdoors. When asked what the recommended daily intake of vitamin D is, more than a third of respondents said it was 10 µg (400 IU), and a further 27% said 25 µg (1000 IU), but almost a quarter of respondents (24%) said they did not know. When asked about taking dietary supplements containing vitamin D, 37% have been taking them for several years, and 20% say they do not take any dietary supplements. In addition, more than half (57.0%) of respondents also take other vitamins or supplements [27].

CONCLUSIONS

The analysis of the study results and consideration of key aspects of the topic have led to several important observations. First and foremost, it was noted that students of the SUM demonstrate significantly broader and more up-to-date knowledge about vitamin D compared to their peers from the UE. A better understanding of the impact of environmental factors on the biosynthesis of this vitamin in the body is particularly evident among medical students, who are also more frequently aware of seasonal changes in vitamin D synthesis levels and the need for supplementation during the autumn and winter months.

At the same time, the study results point to serious deficiencies in public education – not only in Poland but also in other countries – regarding the importance of vitamin D for health. The insufficient number of informational campaigns and their limited reach contribute to the topic remaining inadequately

present in public awareness. To address this issue, it is necessary to implement extensive educational initiatives that should encompass both the education system – including schools and universities – and mass media.

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