Spinghar University- Kabul

Spinghar Journal of Biomedical Sciences (SJBS)

Vol. 1, No.1, October 2025, pp. 36-43

The Prevalence of Vitamin D Deficiency among Adolescents and Non-Pregnant Women of Reproductive Age Living in Kabul, Afghanistan in 2022

*Latifa Sadeqi

Departments of Hormones, City Medical Complex Laboratory, Kabul, Afghanistan

ARTICLE INFO

Type: Original Article
Received: 23/06/2025
Accepted: 15/09/2025

*Correspondence:
Latifa Sadeqi

E-mail address:
latifasadeqy99@gmail.com

DOI:
https://doi.org/10.64444/sjbs.1

ABSTRACT

Background: Vitamin D is essential for maintaining calcium balance, bone health, and reproductive functions. Its deficiency has been linked to numerous health issues. We assessed the prevalence of vitamin D deficiency among adolescent girls and non-pregnant women of reproductive age residing in Kabul, Afghanistan.

Methods: A retrospective, cross-sectional study was carried out at City Medical Complex in Kabul in 2022. Overall, 751 participants were included: 62 adolescents (10–19 yr) and 689 adult women (20–49 yr). Vitamin D levels were determined using the immunofluorescence method, with participants categorized based on age, vitamin D status, and sunlight exposure.

Results: Overall, 67.0% (n=503) of participants had inadequate vitamin D status, while 33.0% (n=248) had sufficient levels. Severe deficiency (<10 ng/mL) was most prevalent in the 20-24 age group (22.5%, n=25), followed by the 25-29 age group (21.1%, n=30). Among adolescents, late adolescents (17-19 yr) showed the highest rate of severe deficiency (41.5%, n=17). The combined category of deficiency and severe deficiency was highest in the 35-39 age group (50.4%). A striking pattern emerged linking sunlight exposure to vitamin D status. Among young adult women aged 20-24 and 25-29 yr, 54.0% (n=60 of 111) and 50.0% (n=71 of 142) respectively reported no sun exposure, and these groups correspondingly exhibited high rates of severe vitamin D deficiency (22.5% and 21.1%).

Conclusion: Vitamin D deficiency is widespread among adolescent girls and adult women in Kabul, primarily attributed to cultural norms restricting sun exposure. Immediate public health measures focusing on greater sunlight exposure and dietary supplementation are needed to mitigate this issue.

Keywords: Vitamin D deficiency; Adolescents; Women of reproductive age; Sunlight exposure; Afghanistan

Introduction

Vitamin D is an essential micronutrient that plays a critical role in regulating calcium homeostasis and maintaining skeletal healthy [1]. Beyond its well-documented effects on bone and mineral metabolism [2,3], vitamin D's broader biological significance is evident through the widespread presence of Vitamin D Receptors (VDRs) in various tissues throughout the body—not limited to just bones and kidneys. Notably, approximately 3% of the human genome is influenced, directly or indirectly, by 1,25-dihydroxyvitamin D (1,25$(OH)_2$D) [4]. While the role of vitamin D in bone mineralization is firmly established, the consequences of vitamin D deficiency (VDD) extend far beyond musculoskeletal health [5]. Research links VDD to a growing range of chronic conditions, including autoimmune diseases such as type 1 diabetes and multiple sclerosis, cardiovascular diseases, and certain cancers [6]. These associations highlight the necessity of maintaining adequate vitamin D levels for overall well-being and disease prevention [6,7]. This increasing body of evidence has placed a stronger focus on addressing VDD as a public health priority [8].

VDD is recognized as one of the most pervasive and underdiagnosed global health issues, affecting individuals across all demographics—regardless of age, gender, ethnicity, or geography [7]. Its widespread impact includes numerous adverse health outcomes. In children, VDD is associated with rickets, dental caries, and impaired growth, while in adults it is linked to conditions like osteomalacia, osteoporosis, reduced muscle strength, higher risk of falls, and bone fractures [7]. Global epidemiological studies estimate that VDD affects 30%-80% of children and adults alike. Among groups particularly at risk are pregnant women and women of reproductive age, raising serious implications for maternal and fetal health [9].

Importantly, emerging data suggest that vitamin D plays an integral role in reproductive processes for both males and females [1]. The presence of VDRs and vitamin D-metabolizing enzymes in various parts of the female reproductive system—including the ovary, uterus, placenta, and endometrium—supports this notion. Within ovarian granulosa cells specifically, VDRs have been observed in both the nucleus and the cytoplasm, signifying their involvement in key reproductive functions [10]. Animal studies further bolster these findings. For example, mice lacking VDR experience impaired fertility, disrupted folliculogenesis, uterine hypoplasia, reduced aromatase gene expression, and gonadal insufficiency. Similar observations have been made in rats with VDD, where outcomes include altered mating behavior, decreased fertility, smaller litter sizes, and impaired neonatal growth. Interestingly, many of these reproductive issues were resolved through vitamin D supplementation rather than calcium alone—emphasizing the distinct role of vitamin D in reproductive health [11].

Nearly three-quarters of adolescents in Kabul Province suffer from some degree of VDD. Notably, studies have also identified significant gender differences in serum 25-hydroxyvitamin D [25(OH)D] concentrations in the region, with women more likely to experience severe deficiencies compared to men [12]. Despite the growing evidence of widespread vitamin D deficiency globally and the particular vulnerability of women in conservative societies, there is a significant knowledge gap regarding the specific prevalence and patterns of vitamin D deficiency among adolescent girls and women of reproductive age in Kabul. While studies have documented gender differences in vitamin D status in Afghanistan, comprehensive data on age-specific patterns, severity distribution, and the relationship with sunlight exposure among women in Kabul remain limited. Furthermore, the unique cultural context of Kabul—characterized by conservative dress codes and limited outdoor activities for women—presents distinct environmental and behavioral factors that may exacerbate vitamin D deficiency. Understanding these specific patterns is crucial for developing targeted interventions appropriate to the local context.

Therefore, we aimed to evaluate the prevalence of VDD among adolescent girls and non-pregnant women of reproductive age residing in Kabul city.

Methods

This retrospective, cross-sectional descriptive study was conducted at the City Medical Complex in Kabul, Afghanistan, over the course of 2022. As one of the largest private healthcare facilities in the city, the hospital offers a wide range of diagnostic and therapeutic services. Participants for the study were selected through consecutive sampling among all females who visited the hospital's laboratory for vitamin D testing during the specified period. Participants attended the laboratory either due to clinical suspicion of vitamin D deficiency by their physicians or for routine health screening. This sampling approach may introduce selection bias, as individuals seeking medical care may differ systematically from the general population. Overall, 751 individuals were included, comprised of 62 adolescents (ages 10–19) and 689 adult women (ages 20–49).

The inclusion criteria consisted of female adolescents aged 10–19 yr and adult women aged 20–49 yr, residents of Kabul city for at least a year prior to data collection, not pregnant at the time of testing, and voluntarily providing informed consent (with parental/guardian consent obtained for minors). Meanwhile, exclusion criteria included pregnant women or those with a history of pregnancy within the previous six months, individuals with chronic illnesses affecting vitamin D metabolism (such as chronic kidney disease, liver disorders, or malabsorption syndromes), those taking vitamin D supplements or medications influencing serum levels within the past three months, and those with incomplete medical or laboratory records.

For vitamin D assessment, venous blood samples (5 mL) were collected from each participant. Serum concentrations were analyzed using the BIOMÉRIEUX VIDAS® 3 immunofluorescence analyzer. Vitamin D levels were categorized as follows: severe deficiency (<10 ng/mL), deficiency (10–19 ng/mL), insufficiency (20–29 ng/mL), and sufficiency (≥30 ng/mL). Age groups were stratified into early adolescence (10–13 yr, n = 7), middle adolescence (14–16 yr, n = 14), late adolescence (17–19 yr, n = 41), and adults in incrementally defined age ranges: 20–24 yr (n = 111), 25–29 yr (n = 142), 30–34 yr (n = 126), 35–39 yr (n = 109), 40–44 yr (n = 96), and 45–49 yr (n = 105).

Information on sunlight exposure duration was collected through a structured questionnaire administered by trained nurses at the time of blood sample collection. Participants were asked to estimate their average daily exposure to direct sunlight over the past month, categorized as: >30 min, 10-19 min, <10 min, or no sun exposure. While this method provides valuable information about behavioral patterns, it relies on self-reporting and may be subject to recall bias.

Ethical Considerations

This retrospective, cross-sectional descriptive study was conducted at the City Medical Complex in Kabul, Afghanistan, over the course of 2022. The study was carried out in accordance with the ethical principles outlined in the Declaration of Helsinki. Since the study involved a retrospective review of existing medical records, no direct patient contact occurred. All data were anonymized before analysis to ensure confidentiality and privacy.

For statistical analyses, SPSS version 26 (IBM Corp., Armonk, NY, USA) was utilized. Descriptive statistics described frequency distributions, while Chi-square tests examined associations between vitamin D status, age brackets, and sunlight exposure. Statistical significance was determined at a P-value threshold of <0.05.

Results

Demographics and Overall Vitamin D Status

A cross-sectional study conducted at City Medical Complex during 2022 included 751 participants—comprising 62 adolescents (10-19 yr) and 689 adult women (20-49 yr)— evaluated for serum vitamin D levels. Overall, 503 of 751 participants (67.0%) had inadequate vitamin D status (combining severe deficiency, deficiency, and insufficiency), while 248 of 751 (33.0%) demonstrated sufficient vitamin D levels (≥30 ng/mL). When examining severe deficiency alone (<10 ng/mL), 143 of 751 participants (19.0%) were affected across all age groups.

Age-Specific Patterns of Vitamin D Deficiency

Analysis of vitamin D status across different age groups revealed distinct patterns. Among the vitamin D deficiency categories, the highest prevalence of severe deficiency (<10 ng/mL) was observed in the 20-24 age group (22.5%, n=25), closely followed by the 25-29 age group (21.1%, n=30). When examining adolescent subgroups specifically, late adolescents (17-19 yr) exhibited the highest rate of severe deficiency at 41.5% (n=17), compared to early adolescents (28.6%, n=2) and middle adolescents (14.3%, n=2).

For the combined category of any deficiency (severe deficiency <10 ng/mL plus deficiency 10-19 ng/mL), the 35-39 age group showed the highest prevalence at 50.4% (n=55), followed by the 40-44 age group at 46.9% (n=45), and the 45-49 age group at 46.7% (n=49) (Table 1).

The distribution of sufficient vitamin D levels (≥30 ng/mL) showed an increasing trend with age, with the 30-34 age group having the highest sufficiency rate at 38.9% (n=49), followed by the 40-44 age group at 35.4% (n=34), and the 25-29 age group at 34.5% (n=49). The lowest sufficiency rates were observed among late adolescents at 19.5% (n=8).

Table 1: Distribution of vitamin d status among adolescents and adult women at City Medical Complex, Kabul, 2022

Age Group	*Severe Deficiency (<10 ng/mL) n (%)*	*Deficiency (10-19 ng/mL) n (%)*	*Insufficiency (20-29 ng/mL) n (%)*	*Sufficiency (≥30 ng/mL) n (%)*	*Total n (%)*
Adolescents					
Early (10-13 yr)	2 (28.6)	2 (28.6)	1 (14.3)	2 (28.6)	7 (100)
Middle (14-16 yr)	2 (14.3)	4 (28.6)	5 (35.7)	3 (21.4)	14 (100)
Late (17-19 yr)	17 (41.5)	10 (24.4)	6 (14.6)	8 (19.5)	41 (100)
Subtotal Adolescents	21 (33.9)	16 (25.8)	12 (19.4)	13 (21.0)	62 (100)
Adults					
20-24 yr	25 (22.5)	33 (29.7)	24 (21.6)	29 (26.1)	111 (100)
25-29 yr	30 (21.1)	30 (21.1)	33 (23.2)	49 (34.5)	142 (100)
30-34 yr	20 (15.9)	24 (19.0)	33 (26.2)	49 (38.9)	126 (100)
35-39 yr	13 (11.9)	42 (38.5)	16 (14.7)	38 (34.9)	109 (100)
40-44 yr	15 (15.6)	30 (31.3)	17 (17.7)	34 (35.4)	96 (100)
45-49 yr	19 (18.1)	30 (28.6)	20 (19.0)	36 (34.3)	105 (100)
Subtotal Adults	121 (17.6)	189 (27.4)	143 (20.8)	235 (34.1)	689 (100)
Total	142 (18.9)	205 (27.3)	155 (20.6)	248 (33.0)	751 (100)

Note: Percentages calculated as row percentages. One participant in the 25-29 age group was excluded from percentage calculations due to data inconsistency, bringing the sufficient count to 248.

Sunlight Exposure Patterns

Table 2 presents the duration of direct sunlight exposure across different age groups. A striking pattern of limited sun exposure was evident among young adult women. Specifically, 54.0% (n=60) of the 20-24 age group and 50.0% (n=71) of the 25-29 age group reported no sun exposure at all. Among late adolescents, 48.7% (n=20) reported no sun exposure. In contrast, older age groups demonstrated better sun exposure patterns, with 42.8% (n=45) of the 45-49 age group and 31.2% (n=30) of the 40-44 age group reporting more than 30 min of daily sun exposure.

Association Between Sunlight Exposure and Vitamin D Status

A clear association was observed between sunlight exposure duration and vitamin D status. Participants with severe vitamin D deficiency demonstrated substantially shorter durations of sun exposure compared to those with sufficient levels. Notably, among the 20-24 age group, 54.0% (n=60 of 111) reported no sun exposure, and this group also showed a high prevalence of severe deficiency at 22.5% (n=25). Similarly, in the 25-29 age group, 50.0% (n=71 of 142) reported no sun exposure, with severe deficiency affecting 21.1% (n=30). In contrast, among older women aged 45-49 yr who reported more than 30 min of daily sun exposure (30.0%, n=32), the rate of severe deficiency was lower at 18.1% (n=19). These patterns underscore the critical role of adequate sunlight exposure in maintaining healthy vitamin D levels.

Table 2: Duration of daily direct sunlight exposure among study participants at City Medical Complex, Kabul, 2022

Age Group	*>30 min n (%)*	*10-19 min n (%)*	*<10 min n (%)*	*No sun exposure n (%)*	*Total n (%)*
Adolescents					
Early (10-13 yr)	3 (42.8)	2 (28.5)	2 (28.5)	0 (0)	7 (100)
Middle (14-16 yr)	9 (64.2)	3 (21.4)	1 (7.1)	1 (7.1)	14 (100)
Late (17-19 yr)	4 (9.7)	10 (24.4)	9 (21.9)	18 (43.9)	41 (100)
Adults					
20-24 yr	10 (9.0)	30 (27.0)	11 (9.9)	60 (54.0)	111 (100)
25-29 yr	8 (5.6)	11 (7.7)	33 (23.2)	90 (63.4)	142 (100)
30-34 yr	9 (7.1)	30 (23.8)	34 (27.0)	53 (42.1)	126 (100)
35-39 yr	10 (9.2)	11 (10.1)	28 (25.7)	60 (55.0)	109 (100)
40-44 yr	30 (31.2)	17 (17.7)	23 (24.0)	26 (27.1)	96 (100)
45-49 yr	32 (30.5)	45 (42.9)	10 (9.5)	18 (17.1)	105 (100)
Total	115 (15.3)	159 (21.2)	151 (20.1)	326 (43.4)	751 (100)

Note: Percentages calculated as row percentages. Data collected through self-reported questionnaire.

Discussion

The high prevalence of vitamin D deficiency among women, especially in developing countries and societies with sedentary lifestyles and conservative clothing regulations, has raised significant public and clinical concerns. There is an undeniable need to investigate this issue from this perspective. The findings of the present study confirm this concern; young women living in Kabul are at higher risk of vitamin D deficiency than other groups. This condition can have widespread consequences for their physical health and fertility.

Our study revealed that 67% of adolescent girls and non-pregnant women of reproductive age in

Kabul had inadequate vitamin D status (combining severe deficiency, deficiency, and insufficiency), with only 33.0% achieving sufficient levels. The highest prevalence of severe vitamin D deficiency (<10 ng/mL) was observed in the 20-24 age group (22.5%), followed closely by the 25-29 age group (21.1%). Among adolescents specifically, late adolescents (17-19 yr) demonstrated the highest rate of severe deficiency at 41.5%. When examining the combined category of any deficiency (both severe and moderate), the 35-39 age group showed the highest prevalence at 50.4%. This result is consistent with a study of Afghan adolescents in Kabul, which found that girls have significantly lower levels of vitamin D than boys. The main factors associated with this lower level include the type of clothing, insufficient exposure to sunlight, and insufficient consumption of foods rich in this vitamin [13].

The findings of the present study are also similar to a study in southern Thailand, which found that 34.1% of non-pregnant women of childbearing age were vitamin D deficient. Risk factors in this group included higher body mass index, higher education level, and higher income, as these groups spent less time outdoors and were more likely to engage in indoor activities [14]. In comparison, our study found a substantially higher prevalence of deficiency (67% with inadequate status), suggesting that the cultural and environmental factors specific to Kabul—particularly conservative dress codes and restricted outdoor mobility for women—may create a more severe public health challenge than in other South Asian contexts.

Other similar studies have raised this concern. For example, in Indonesia, vitamin D deficiency was very common among both pregnant and non-pregnant women. A sedentary lifestyle, full body coverage, and insufficient sun exposure were identified as major risk factors [15]. Similarly, in Pakistan, in addition to vitamin D deficiency, iron and vitamin A deficiencies were also reported among women of childbearing age, suggesting that micronutrient deficiencies are common in this population [16]. These regional studies collectively highlight that vitamin D deficiency is not an isolated phenomenon but part of a broader pattern of micronutrient deficiency affecting women's health across South and Central Asia.

One particularly notable finding in our study was the pattern of sunlight exposure across age groups. While 54.0% of the 20-24 age group and 50.0% of the 25-29 age group reported no sun exposure, older women (40-49 yr) demonstrated significantly better sun exposure patterns, with 31.2% and 30.0% reporting >30 min of daily exposure. This age-related difference may reflect generational shifts in lifestyle patterns, with younger women potentially facing greater restrictions on outdoor mobility or spending more time in indoor educational or domestic settings. Alternatively, older women may have more autonomy or different household responsibilities that require outdoor activities. This pattern warrants further qualitative investigation to understand the underlying behavioral and cultural determinants.

Overall, the results of various studies and our own investigations indicate the importance of factors such as sedentary lifestyle, limited clothing, low consumption of vitamin D-rich food sources, and reduced exposure to sunlight in causing vitamin D deficiency among women. The complications of this deficiency can affect bone health, immune system function, and even women's reproductive ability. Therefore, implementing intervention programs such as vitamin D fortification of foods, health education about the value of sunlight, and providing targeted nutritional recommendations can be a vital step to reduce this problem in developing countries.

Study Limitations

Several limitations of this study warrant consideration. First, the use of consecutive sampling from a single private hospital in Kabul introduces potential selection bias. Participants who sought vitamin D testing may differ systematically from the general population—they may have been more symptomatic, more health-conscious, or of higher socioeconomic status than non-participants. This limits the generalizability of our findings to all women in Kabul. Second, sunlight exposure data were collected through self-reported questionnaires, which are subject to recall bias and may not accurately reflect actual exposure. Future studies should employ more objective measures such as sun exposure diaries or dosimeters. Third, the cross-sectional design precludes causal inference regarding the relationship between sun exposure and vitamin D status. Longitudinal studies are needed to establish temporal relationships. Fourth, we did not collect data on dietary vitamin D intake, body mass index, skin tone, or socioeconomic factors, all of which may influence vitamin D status. Finally, seasonal variation in vitamin D levels was not assessed, though this may be particularly relevant in Kabul's climate.

Conclusion

This study provides important data on vitamin D status among adolescent girls and non-pregnant women of reproductive age in Kabul city. The results reveal an alarming prevalence of inadequate vitamin D status, affecting nearly two-thirds (67%) of the study population. Severe deficiency was most prevalent among late adolescents (41.5%) and young adult women in the 20-24 age group (22.5%). The primary factor contributing to this deficiency appears to be severely limited sun exposure, with more than half of young women (20-29 yr) reporting no sun exposure at all—a pattern largely influenced by cultural clothing norms and restricted outdoor mobility for women.

These findings underscore an urgent need for comprehensive public health interventions tailored to the unique cultural context of Kabul. Recommended strategies include: 1) vitamin D fortification of staple foods such as flour, oil, and dairy products; 2) culturally sensitive health education campaigns emphasizing the importance of vitamin D and safe sun exposure within the bounds of cultural norms; 3) provision of vitamin D supplementation programs targeting high-risk groups, particularly adolescents and women of reproductive age; and 4) further research to develop context-appropriate interventions that respect cultural values while addressing this critical health issue.

Acknowledgements

The authors would like to express their sincere gratitude to the management and laboratory staff of the City Medical Complex Laboratory, Kabul, for their kind cooperation and technical support during the study. We also extend our heartfelt appreciation to all the adolescent girls and non-pregnant women who voluntarily participated in this research.

Conflict of Interest

The authors declare that there is no conflict of interests.

References

1. Lerchbaum E, Rabe T. Vitamin D and female fertility. Curr Opin Obstet Gynecol. 2014;26(3):14550.
2. Holick MF. The Vitamin D Deficiency Pandemic: a Forgotten Hormone Important for Health. Public Health Reviews. 2010;32(1):267-83.
3. Kennel KA, Drake MT, Hurley DL. Vitamin D deficiency in adults: when to test and how to treat. Mayo Clin Proc. 2010;85(8):752-7; quiz 7-8.
4. Zadeh-Vakili A, Ramezani Tehrani F, Daneshpour MS, Zarkesh M, Saadat N, Azizi F. Genetic polymorphism of vitamin D receptor gene affects the phenotype of PCOS. Gene. 2013;515(1):193-6.

5. G R, Gupta A. Vitamin D deficiency in India: prevalence, causalities and interventions. Nutrients. 2014;6(2):729-75.
6. Andıran N, Çelik N, Akça H, Doğan G. Vitamin D deficiency in children and adolescents. J Clin Res Pediatr Endocrinol. 2012;4(1):25-9.
7. Mozos I, Marginean O. Links between Vitamin D Deficiency and Cardiovascular Diseases. Biomed Res Int. 2015; 2015:109275.
8. Grundmann M, von Versen-Höynck F. Vitamin D - roles in women's reproductive health? Reprod Biol Endocrinol. 2011; 9:146.
9. Looker AC, Pfeiffer CM, Lacher DA, Schleicher RL, Picciano MF, Yetley EA. Serum 25hydroxyvitamin D status of the US population: 1988-1994 compared with 2000-2004. Am J Clin Nutr. 2008;88(6):1519-27.
10. Shahrokhi SZ, Ghaffari F, Kazerouni F. Role of vitamin D in female reproduction. Clin Chim Acta. 2016; 455:33-8.
11. Rudick B, Ingles S, Chung K, Stanczyk F, Paulson R, Bendikson K. Characterizing the influence of vitamin D levels on IVF outcomes. Human Reproduction. 2012;27(11):3321-7.
12. Azizi S, Tariq TM. Vitamin D deficiency among Afghan adolescents in Kabul. Journal of the College of Physicians and Surgeons Pakistan. 2019;29(11):1072-7.
13. Azizi S, Tariq TM. Vitamin D deficiency among Afghan adolescents in Kabul. J Coll Physicians Surg Pak. 2019 Nov 1;29(11):1072-7.
14. Jaruratanasirikul S, Boonrusmee S, Kasemsripitak S, Saengkaew T, Chimrung K, Sriplung H. Vitamin D status in non-pregnant women of reproductive age: a study in Southern Thailand. Scientific Reports. 2023 Sep 14;13(1):15264.
15. Setiarsih D, Wirjatmadi B, Adriani M. Bone density status and vitamin D and calcium concentrations in pregnant and non-pregnant women. Makara Journal of Health Research. 2016 Jun 14;20(3):1.
16. Habib MA, Raynes-Greenow C, Soofi SB, Ali N, Nausheen S, Ahmed I, Bhutta ZA, Black KI. Prevalence and determinants of iron deficiency anemia among non-pregnant women of reproductive age in Pakistan. Asia Pacific Journal of Clinical Nutrition. 2018 Jan;27(1):195-203.