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Knowledge, Attitude, and Practice Regarding Vitamin D Deficiency Among Health Sciences Students in Ibb, Yemen: A Cross-Sectional Study

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Research Article

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Abstract

Background

Vitamin D deficiency is a major global public health concern, particularly in the Middle East and Yemen, where regional prevalence rates exceed 77%. Despite abundant natural sunshine, health sciences students—who represent future healthcare leaders—remain vulnerable due to heavy academic schedules and specific lifestyle barriers. This study evaluated the Knowledge, Attitude, and Practice (KAP) regarding Vitamin D deficiency among medical and health sciences students at Jiblah University for Medical and Health Sciences in Ibb, Yemen.

Methods

A cross-sectional study was conducted in January 2026 using a stratified simple random sampling technique, yielding 349 valid student responses (from a total population of 1,461). Data were collected using a validated, Arabic-translated self-administered questionnaire adapted from the D-KAP-38 instrument (Cronbach's alpha = 0.72). Bloom's cut-off points (80% good/positive, 60–79% moderate/neutral, < 60% poor/low) were applied to classify KAP levels. Statistical analysis was performed using SPSS version 26, employing Chi-square tests to examine associations ($p \leq 0.05$).

Results

Among the 349 participants (50.71% male, 49.29% female; 89.68% aged 20–25 years), 40.97% demonstrated good knowledge, 35.82% moderate knowledge, and 23.21% poor knowledge (mean score: 10.63 ± 2.80 out of 15). Positive attitudes were observed in 40.69%, neutral attitudes in 55.87%, and negative attitudes in 3.44% (mean score: 38.30 ± 5.04 out of 50). Conversely, 71.06% exhibited low practice levels, 24.07% moderate practices, and only 4.87% high practices (mean score: 23.77 ± 6.02 out of 45). Significant associations were found between knowledge and college ($p < 0.001$) and study level ($p = 0.028$), and between practice levels and gender ($p = 0.025$), age ($p = 0.013$), and college ($p < 0.001$). Only 12.32% had ever tested their serum Vitamin D levels, and 69.91% were unaware of their status.

Conclusion

A profound disconnect exists between student knowledge and personal health practices regarding Vitamin D. Educational curricula should be strengthened, accompanied by targeted health promotion campaigns and subsidised screening initiatives to bridge the KAP gap among future healthcare professionals.

1. Introduction

Vitamin D plays a critical physiological role in maintaining calcium and phosphate homeostasis, bone mineralization, and neuromuscular function. Beyond its classical skeletal effects, accumulating clinical evidence highlights its crucial involvement in immune modulation, cardiovascular health, endocrine regulation, and reduced susceptibility to chronic inflammatory conditions [1, 2]. Globally, Vitamin D deficiency represents a widespread pandemic affecting over one billion children and adults across diverse geographical regions [3].

Despite the Middle East receiving abundant sun exposure throughout the year, the region paradoxically records some of the highest global prevalence rates of Vitamin D deficiency, ranging between 60% and 90% in general populations [4, 5]. In Yemen, recent epidemiological surveys indicate that serum 25-hydroxyvitamin D [25(OH)D] deficiency affects more than 77% of young adults and women of childbearing age [6]. This high prevalence is attributed to a complex interplay of cultural clothing practices (full body covering/hijab), urban indoor working environments, high ambient temperatures discouraging midday sun exposure, and limited dietary fortification [7].

Medical and health sciences students represent a vital subgroup within the healthcare ecosystem. As future medical doctors, dentists, laboratory technologists, and clinical pharmacists, their personal health behaviors, clinical awareness, and attitudes directly influence their upcoming diagnostic accuracy and patient counseling abilities [8]. However, rigorous academic schedules, prolonged indoor hospital rotations, and sleep deprivation frequently impair their health maintenance and nutritional habits [9].

Although several international studies have evaluated Vitamin D literacy among healthcare trainees, empirical data regarding the Knowledge, Attitude, and Practice (KAP) of health sciences students in Yemen remain extremely limited. Furthermore, the ongoing humanitarian and socio-economic challenges in Yemen have exacerbated food insecurity and restricted access to routine laboratory diagnostic testing [10]. Therefore, this study aimed to assess the levels of Knowledge, Attitude, and Practice regarding Vitamin D deficiency among medical and health sciences students at Jiblah University for Medical and Health Sciences in Ibb, Yemen, and to analyze the socio-demographic predictors influencing these domains.

2. Methods

2.1 Study Design and Setting

A institutional cross-sectional study was carried out in January 2026 at Jiblah University for Medical and Health Sciences (JUMHS), located in Ibb Governorate, Republic of Yemen. JUMHS is a specialized public medical university providing professional education across medicine, dentistry, pharmacy, and allied health sciences.

2.2 Study Population and Sampling

The target population comprised all undergraduate medical and health sciences students enrolled at JUMHS during the academic year 2025–2026 (N = 1,461). The minimum required sample size was calculated using Cochran's formula for finite populations:

n = [N * Z^2 * p * (1-p)] / [d^2 * (N-1) + Z^2 * p * (1-p)]

Assuming a 95% confidence level (Z = 1.96), an estimated prevalence (p) of 50% to yield maximum sample size, and a margin of error (d) of 5%, the required sample size was 305. To accommodate potential non-response or incomplete submissions, 370 questionnaires were distributed using a stratified simple random sampling method proportional to enrollment size across colleges and academic levels. A total of 349 fully completed questionnaires were returned, representing a high response rate of 94.32%.

2.3 Data Collection Instrument

Data were collected using a structured, self-administered questionnaire adapted from the standardized D-KAP-38 survey instrument [11] and contextualized to local Yemeni cultural norms. The instrument was translated into Arabic by bilingual expert translators and back-translated into English to ensure semantic equivalence. An English version of the adapted questionnaire is provided as Supplementary File 1. The tool comprised four distinct sections:

1. Socio-demographic Information: 5 items capturing age, gender, academic college, academic year, and residential status (urban vs. rural).
2. Knowledge Domain: 15 questions addressing Vitamin D synthesis, physiological functions, dietary sources, deficiency symptoms, high-risk groups, and consequences. Correct answers received 1 point, while incorrect/unknown responses received 0 points (maximum score: 15).
3. Attitude Domain: 10 5-point Likert scale statements evaluating perceptions toward sunlight exposure, supplementation, fortified foods, and routine screening (ranging from 5 = Strongly Agree to 1 = Strongly Disagree; maximum score: 50).
4. Practice Domain: 9 items measuring daily outdoor sun exposure duration, dietary consumption of Vitamin D-rich foods, supplement utilization, and diagnostic testing history (maximum score: 45).

2.4 Instrument Validation and Reliability

The questionnaire underwent content validation by a panel of five expert reviewers (two endocrinologists, two public health professors, and one medical educator). A pilot study was conducted on 30 health sciences students (excluded from the final sample) to evaluate readability and clarity. Internal consistency reliability was confirmed, with Cronbach's alpha coefficients yielding 0.76 for knowledge, 0.71 for attitude, 0.70 for practice, and 0.72 for the overall scale.

2.5 KAP Classification Criteria (Bloom's Cut-off Points)

According to modified Bloom's cut-off points [12], cumulative scores were classified into three levels:

- Good Knowledge / Positive Attitude / High Practice: Score ≥ 80% of the maximum domain total.
- Moderate Knowledge / Neutral Attitude / Moderate Practice: Score 60% – 79% of the total.
- Poor Knowledge / Negative Attitude / Low Practice: Score < 60% of the total.

2.6 Ethical Considerations

Ethical approval was granted by the Research Ethics Committee at Jiblah University for Medical and Health Sciences (Reference No. JUMS–2025–10–3)The study was conducted in accordance with the guidelines of the Declaration of Helsinki. Participation was completely voluntary, and written informed consent was obtained electronically prior to completing the survey. Participant confidentiality was strictly maintained through anonymized identification codes.

2.7 Statistical Analysis

Data were verified, cleaned, and analyzed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (frequencies, percentages, means, and standard deviations) were calculated for categorical and continuous variables. Bivariate analysis using the Pearson Chi-square (χ^2) test was executed to evaluate associations between socio-demographic variables and KAP domain levels. Statistical significance was established at $p \leq 0.05$.

3. Results

3.1 Socio-Demographic Characteristics

The final study sample consisted of 349 health sciences students. Males constituted 50.71% (n = 177) and females 49.29% (n = 172) of the sample. The vast majority of participants belonged to the 20–25 years age group (89.68%, n = 313). Regarding academic specialization, 48.14% (n = 168) were enrolled in the Faculty of Medicine, 24.36% (n = 85) in Dentistry, and 27.51% (n = 96) in Pharmacy and Health Sciences. Students were distributed across all five academic years, with 69.05% (n = 241) residing in urban areas and 30.95% (n = 108) in rural areas.

[Insert Table 1 **here: Socio-demographic characteristics of the study participants]**

Table 1
Socio-demographic characteristics of the study participants (N = 349)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	177	50.71%
	Female	172	49.29%
Age Group	< 20 years	21	6.02%
	20–25 years	313	89.68%
	> 25 years	15	4.30%
Academic College	Medicine	168	48.14%
	Dentistry	85	24.36%
	Pharmacy & Health Sciences	96	27.51%
Academic Year	1st Year	42	12.03%
	2nd Year	88	25.21%
	3rd Year	105	30.09%
	4th Year	81	23.21%
	5th Year	33	9.46%
Residence Status	Urban	241	69.05%
	Rural	108	30.95%

3.2 Assessment of Knowledge Domain

The mean overall knowledge score was 10.63 ± 2.80 out of 15 (70.87%). Based on Bloom's classification, 40.97% (n = 143) exhibited good knowledge (score ≥ 12), 35.82% (n = 125) had moderate knowledge (score 9–11), and 23.21% (n = 81) demonstrated poor knowledge (score < 9). Most students correctly identified sunlight as the primary source of Vitamin D (88.54%) and recognized rickets and osteomalacia as primary deficiency manifestations (82.23%). However, knowledge gaps were identified regarding optimal midday synthesis timing and dietary non-sun sources.

[Insert Table 2 **here: Knowledge scores and Bloom's classification regarding Vitamin D deficiency]**

Table 2
Assessment of Knowledge Domain and Bloom's Classification (N = 349)

Knowledge Level	Bloom's Score Cut-off	Frequency (n)	Percentage (%)	Mean ± SD
Good Knowledge	≥ 80% (12–15 points)	143	40.97%	10.63 ± 2.80
Moderate Knowledge	60% – 79% (9–11 points)	125	35.82%	(Out of 15)
Poor Knowledge	< 60% (< 9 points)	81	23.21%	
Total	100.0%	349	100.0%	70.87% Overall

3.3 Assessment of Attitude Domain

The overall mean attitude score was 38.30 ± 5.04 out of 50 (76.60%). Overall, 40.69% (n = 142) held positive attitudes, 55.87% (n = 195) maintained neutral attitudes, and 3.44% (n = 12) exhibited negative attitudes. A high proportion agreed that Vitamin D deficiency is a serious health concern in Yemen (84.24%) and supported public food fortification policies (78.22%).

[Insert Table 3 **here: Attitude scores and Bloom's classification toward Vitamin D deficiency]**

Table 3
Assessment of Attitude Domain and Bloom's Classification (N = 349)

Attitude Level	Bloom's Score Cut-off	Frequency (n)	Percentage (%)	Mean ± SD
Positive Attitude	≥ 80% (40–50 points)	142	40.69%	38.30 ± 5.04
Neutral Attitude	60% – 79% (30–39 points)	195	55.87%	(Out of 50)
Negative Attitude	< 60% (< 30 points)	12	3.44%	
Total	100.0%	349	100.0%	76.60% Overall

3.4 Assessment of Practice Domain

In stark contrast to knowledge and attitude levels, the overall mean practice score was 23.77 ± 6.02 out of 45 (52.82%). The vast majority of participants—71.06% (n = 248)—demonstrated low practice levels. Moderate practices were observed in 24.07% (n = 84), while only 4.87% (n = 17) engaged in high practice behaviors. Less than one-third of students reported regular direct sun exposure for at least 15 minutes daily (28.37%), and routine consumption of Vitamin D-rich foods was limited.

[Insert Table 4 **here: Practice scores and Bloom's classification regarding Vitamin D behaviors]**

Table 4
Assessment of Practice Domain and Bloom's Classification (N = 349)

Practice Level	Bloom's Score Cut-off	Frequency (n)	Percentage (%)	Mean ± SD
High Practice	≥ 80% (36–45 points)	17	4.87%	23.77 ± 6.02
Moderate Practice	60% – 79% (27–35 points)	84	24.07%	(Out of 45)
Low Practice	< 60% (< 27 points)	248	71.06%	
Total	100.0%	349	100.0%	52.82% Overall

3.5 Cross-Analysis and Bivariate Associations

Bivariate Chi-square analysis revealed significant socio-demographic variations across KAP domains:

- Knowledge was significantly associated with the academic college ($\chi^2 = 22.41$, $p < 0.001$) and academic year ($\chi^2 = 17.25$, $p = 0.028$), with senior medical students achieving higher knowledge scores.
- Attitude was significantly related to academic college ($\chi^2 = 13.28$, $p = 0.010$), where medical students expressed higher agreement on screening necessity.
- Practice levels were significantly associated with gender ($\chi^2 = 7.36$, $p = 0.025$), age ($\chi^2 = 12.64$, $p = 0.013$), and academic college ($\chi^2 = 25.12$, $p < 0.001$). Male students demonstrated significantly higher sun exposure practice scores compared to female students.

[Insert Table 5 **here: Association between socio-demographic factors and KAP levels]**

Table 5
Association between Socio-Demographic Factors and KAP Levels (Chi-Square Test)

Socio-Demographic Variable	Knowledge (p-value)	Attitude (p-value)	Practice (p-value)	Significance Summary
Gender (Male vs. Female)	0.412	0.318	0.025*	Significant for Practice
Age Group	0.185	0.621	0.013*	Significant for Practice
Academic College	< 0.001*	0.010*	< 0.001*	Significant across all KAP
Academic Year / Level	0.028*	0.144	0.089	Significant for Knowledge
Residence (Urban vs. Rural)	0.531	0.782	0.342	Not Significant

** Statistically significant at p ≤ 0.05 level (Pearson Chi-square test).*

3.6 Serum Testing and Awareness Gap

Evaluation of diagnostic testing practices revealed that only 12.32% (n = 43) of participants had ever performed a laboratory test for serum 25(OH)D. Consequently, 69.91% (n = 244) were completely unaware of their personal Vitamin D status. Among students who had never tested, the primary reason reported was the high cost of diagnostic testing (54.15%), followed by absence of perceived symptoms (32.38%).

[Insert Table 6 **here: Diagnostic serum Vitamin D testing history and awareness status]**

Table 6
Diagnostic Serum Vitamin D Testing History and Awareness Status (N = 349)

Diagnostic Parameter	Category	Frequency (n)	Percentage (%)
Ever Tested Serum 25(OH)D	Yes	43	12.32%
	No	306	87.68%
Awareness of Personal Vitamin D Status	Known Status	105	30.09%
	Unknown Status	244	69.91%
Primary Reason for Not Testing (n = 306)	High Cost of Diagnostic Test	166	54.15%
	Lack of Symptoms / Unaware	99	32.38%
	Lack of Time / Clinic Access	41	13.47%

4. Discussion

This study provides a comprehensive evaluation of Vitamin D literacy among medical and health sciences students in Ibb, Yemen. The most salient finding is the dramatic gap between theoretical awareness and personal health practice: while over 76% of students demonstrated moderate-to-good knowledge and 96.5% possessed positive or neutral attitudes, an alarming 71.06% exhibited poor health practices regarding Vitamin D optimization.

The high level of knowledge observed among senior medical students aligns with international literature from Saudi Arabia [13], Jordan [14], and Malaysia [15]. Medical education naturally enhances physiological understanding of Vitamin D metabolism and disease pathology. However, high academic knowledge failed to translate into protective personal behaviors. This 'KAP disconnect' is particularly acute among female students, whose practice scores were significantly lower than males ($p = 0.025$). Cultural clothing practices in Yemen, where females wear full-body black abayas and face veils outdoors, restrict cutaneous UV-B exposure [16]. Furthermore, societal norms and limited female-only outdoor recreational spaces in Ibb reduce opportunities for safe sun exposure [17].

Academic barriers also play a significant role. Medical students spend long hours inside lecture halls, laboratories, and hospital wards during peak solar UV-B hours (10:00 AM – 3:00 PM). Similar pattern of low sun exposure due to demanding hospital schedules has been documented among healthcare workers across the Middle East [18].

Socio-economic factors exacerbate this deficiency trap. More than half of the students (54.15%) cited the high cost of diagnostic testing as the primary reason for never measuring their serum 25(OH)D

levels. Yemen's ongoing economic instability has severely eroded purchasing power, rendering elective diagnostic tests and daily Vitamin D supplementation unaffordable for many university students [19]. Consequently, nearly 70% of participants were unaware of their physiological status, creating a hidden reservoir of unmanaged deficiency.

4.1 Study Limitations

This study has several limitations. First, the cross-sectional design precludes establishing causal relationships. Second, reliance on self-reported questionnaire data may introduce recall bias or social desirability bias regarding sun exposure and diet. Third, due to resource constraints in Yemen, objective biochemical measurement of serum 25(OH)D levels could not be performed for all participants.

5. Conclusion and Recommendations

In conclusion, despite satisfactory theoretical knowledge and positive attitudes toward Vitamin D, health sciences students at Jiblah University in Ibb, Yemen, exhibit remarkably poor lifestyle practices and very low diagnostic testing rates. To address this critical gap, the following targeted interventions are recommended:

1. Curriculum Enhancement: Integrate practical lifestyle counseling and preventative self-care modules into early health sciences curricula.
2. Institutional Sun-Exposure Protocols: Schedule outdoor campus breaks during optimal UV-B windows and design culturally appropriate, private outdoor spaces for female students.
3. Subsidized Screening Initiatives: Establish subsidized or university-sponsored serum 25(OH)D screening drives and affordable supplementation programs for healthcare trainees.
4. Public Health Policy: Advocate for national food fortification policies (such as fortifying wheat flour and dairy products with Vitamin D) to combat widespread deficiency across Yemen.

Declarations

Ethics approval and consent to participate Ethical approval for this study was obtained from the Ethics Committee of Jiblah University for Medical & Health Sciences (Reference No. JUMS-2025-10-3). All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee. Informed consent to participate was obtained from all participants included in the study.

Consent for Publication

Not applicable.

Availability of Data and Materials

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Competing Interests

The authors declare that they have no competing interests.

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Authors' Contributions

MAB and AA conceived and designed the study. AD, FA, and RM coordinated and performed data collection. SN, SAM, and WAA contributed to data entry and preliminary analysis. MAB performed the statistical analysis and drafted the manuscript. All authors read, critically reviewed, and approved the final manuscript**.**

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