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ORIGINAL ARTICLE

Awareness of Vitamin-D and its Deficiency among A-Levels Students of Karachi: A Cross-Sectional Study

Syed Muhammad Hamza[1], Saima Akram Butt[2], Kinza Bhutto[3], Nigam Anwar[1]

1. Department of Healthcare Management, Ziauddin University, Karachi, Pakistan.
2. Department of Oral Pathology, Ziauddin University, Karachi, Pakistan.
3. Department of Surgery, Aga Khan University, Karachi, Pakistan.

ABSTRACT

Objective: To assess awareness levels of Vitamin-D deficiency among A-Level students in Karachi, Pakistan, given its crucial role in bone health and disease prevention.

Materials & Methods: A cross-sectional study was conducted involving 283 A-Level students aged 16-19 in Karachi, Pakistan. Data were collected using self-administered questionnaires and analyzed using SPSS version 16. The study was conducted from 3 to 6 months; March to August 2023.

Results: Most students (89.4%) had prior knowledge of Vitamin-D, primarily from textbooks. Only 43.5% recognized its role in mineral absorption ($p<0.05$). Understanding of Vitamin-D deficiency was limited, with 50.5% only associating it with bone pain ($p<0.05$). Many students (67.5%) linked Vitamin-D scarcity solely with rickets ($p<0.05$). A significant percentage (36.7%) spent 1-2 hours outdoors daily, mainly in the afternoon ($p<0.05$).

Conclusion: This study reveals a lack of comprehensive awareness about Vitamin-D and its deficiency among A-Level students in Karachi, highlighting the need for targeted health education programs to reduce associated health risks.

Keywords: Vitamin-D, deficiency, awareness, A-Level students, Karachi.

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Corresponding Author

Dr. Syed Muhammad Hamza
Department of Healthcare Management, Ziauddin University, Karachi, Pakistan.
hamza.syedm@gmail.com

INTRODUCTION

Vitamins are essential organic compounds required in limited amounts for an organism's proper functioning. Vitamin-D, a group of fatsoluble steroids, is crucial for human health, with a recommended daily intake of 10-15 mcg/day.[1] While approximately 90% of Vitamin-D in our body is produced in the skin through sunlight exposure (UVB wavelength 290-320 nm), dietary sources also contribute to its levels.[2,3]

The primary dietary sources of Vitamin-D include oily fish, fish liver oils (particularly cod liver oil), egg yolks, meat, and fortified dairy products.[1,4,5] Vitamin-D plays a vital role in enhancing the absorption of calcium and phosphate ions from the gastrointestinal tract, which are essential for bone remodeling and musculoskeletal growth.[6] Additionally, it strengthens the body's defense system.[7] Vitamin-D deficiency has been linked to various musculoskeletal disorders, including osteoporosis in adults and rickets in children.[8,9] Recent studies have also associated Vitamin-D deficiency with an increased risk of cancers (colon, prostate, and breast), cardiovascular diseases, diabetes (both type 1 and 2), and autoimmune infectious diseases.[10-19] Moreover, Vitamin-D deficiency has been linked to mental health deterioration.[20]

The prevalence of Vitamin-D deficiency has reached epidemic proportions globally, largely due to insufficient knowledge and awareness among populations.[10,21] Age is a significant factor contributing to reduced Vitamin-D levels, primarily due to the thinning of skin with age, resulting in decreased Vitamin-D storage capacity.[22] Among high school students, a preference for indoor activities and regular sunscreen usage for cosmetic reasons has been identified as a key factor in Vitamin-D deficiency.[10] Recent studies have highlighted the importance of Vitamin-D in oral health. Research has shown associations between Vitamin-D deficiency and various oral health issues, including dental caries, periodontal disease, and oral cancer.[23,24] These findings underscore the need for comprehensive awareness about Vitamin-D's role in overall health, including oral health.

The rationale for conducting this study stems from the increasing prevalence of Vitamin-D deficiency among young populations and its wide-ranging health implications. By assessing the awareness levels of A-Level students in Karachi, we aim to identify knowledge gaps and inform the development of targeted health education programs. The primary aim of this study is to evaluate the extent of awareness regarding Vitamin-D and its deficiency among A-Level students in Karachi, Pakistan. Additionally, we seek to determine whether there is a need to implement a health education program in institutes of Karachi to lower the level of Vitamin-D insufficiency and the associated risk of various diseases.

MATERIALS AND METHODS

Study Design and Setting

This cross-sectional study was carried out among 283 A-Level students aged 16-19 years studying in various colleges in Karachi, Pakistan. The study was conducted over six months, from April to September 2023, in Karachi, Pakistan

Ethics Approval

his study was conducted following the ethical standards set by the Declaration of Helsinki.

Ethical approval was obtained from the Institutional Review Board of Ziauddin University Dental College (Approval No: ZUIRB- 2022-1256). Informed consent was obtained from all participants, and confidentiality was maintained throughout the research process.

Questionnaire Design and Distribution

Data was collected using a self-administered questionnaire. The questionnaire was initially self-constructed based on relevant literature and expert input. Content validity was assessed by a panel of experts in public health and education to ensure that the questions were comprehensive and relevant to the study objectives. Following this, a pilot study was conducted with a sample of 30 A-Level students who were not part of the final study sample. Feedback from the pilot was used to refine question clarity, wording, and structure. Reliability was assessed using Cronbach alpha, yielding a satisfactory internal consistency score (α=0.823) for the knowledge and attitude sections. It included sections on demographics, knowledge of Vitamin-D and its deficiency, and attitudes towards sun exposure. The questionnaire was distributed in person at selected A-Level schools across Karachi to ensure a diverse sample. Trained research assistants provided guidance on completing the questionnaire and collected responses immediately after completion. Additionally, to enhance accessibility, an online version was shared with participants via email and school social media groups, allowing students the flexibility to complete it at their convenience. The inclusion criteria for this study comprised A-Level students

aged between 16 and 19 years. Conversely, exclusion criteria included individuals who were unwilling to participate, those who were unwell, and students who were either above 19 years or below 16 years of age. Additionally, students enrolled in programs other than A-Levels were also excluded from participation.

Statistical Analysis

All gathered information was analyzed using SPSS version 16. Descriptive statistics were used to summarize demographic data and responses to knowledge and attitude questions. Chi-square tests were used to assess associations between demographic variables and knowledge levels. A p-value < 0.05 was considered statistically significant.

RESULTS

Demographic Characteristics

A total of 283 students participated in the study. The mean age of participants was 17.5 years ± 0.8. Among the participants, 149 (52.7%) were males and 134 (47.3%) were females. The majority of candidates (174, 61.5%) were from AS Level, while 109 (38.5%) were from A2 Level (Table 1).

Table1 : Demographic characteristics of A-Level student participants

Demographic Variable	Measure	Frequency (n)	Percentage (%)
Total Participants		283	100
Gender	Male	149	52.7
	Female	134	47.3
Education Level	AS Level	174	61.5
	A2 Level	109	38.5
Mean Age	17.5 years ± 0.8		

A significant majority of participants (89.4%, p<0.05) had some prior knowledge about Vitamin-D, with textbooks being the primary source of information (70.7%, p<0.05). Regarding the function of Vitamin-D, 43.5% considered absorption of calcium and phosphate ions as its sole purpose (p<0.05), 25.4% identified both absorption and bone remodeling/growth as its roles (p<0.05), and 18.0% had no perception of its function (p<0.05). While 74.6% of respondents were aware that Vitamin-D is stored in the body (p<0.05), 38.9% did not know where it is tored. Additionally, 57.2% correctly identified sunlight as the activating factor for Vitamin-D (p<0.05). Regarding symptoms of Vitamin-D deficiency, 50.5% considered bone pain to be the only symptom (p<0.05), while 23.7% recognized tiredness, depression, muscle fatigue, along with bone pain as symptoms (p<0.05). In terms of diseases associated with Vitamin-D deficiency, 67.5% identified rickets as the sole disease linked to deficiency (p<0.05), and only 4.6% correctly identified cardiovascular disease, cancer, and diabetes, along with rickets, as associated diseases (p<0.05). Concerning sun exposure, 36.7% of participants reported spending 1-2 hours under

Table 2: Awareness, understanding, and attitudes towards Vitamin-D among participants

Category	Measure	Percentage (%)	p-value
Awareness and Information Sources	Participants with prior knowledge about Vitamin-D	89.4	<0.05
	Primary source of information: Textbooks	70.7	<0.05
Functions of Vitamin-D	Calcium and phosphate ion absorption as sole purpose	43.5	<0.05
	Calcium absorption and bone remodeling/growth	25.4	<0.05
	No perception of function	18.0	<0.05
Storage Awareness	Aware Vitamin-D is stored in the body	74.6	<0.05
	Unaware of where Vitamin-D is stored	38.9	<0.05
Activation Awareness	Correctly identified sunlight as an activating factor	57.2	<0.05

Category	Measure	Percentage (%)	p-value
Understanding of Deficiency Symptoms	Bone pain as the only symptom	50.5	<0.05
	Recognized tiredness, depression, muscle fatigue, and bone pain as symptoms	23.7	<0.05
Diseases Linked to Deficiency	Rickets as the only disease linked to deficiency	67.5	<0.05
	Correctly identified CVD, cancer, diabetes, and rickets as linked diseases	4.6	<0.05
Attitudes Towards Sun Exposure	Spent 1-2 hours under the sun daily	36.7	<0.05
	Primarily exposed to the sun in the afternoon	67.1	<0.05
	Avoided sunlight due to hot weather	53.3	<0.05

the sun daily ($p<0.05$), with 67.1% primarily exposed to sunlight in the afternoon ($p<0.05$). The most common reason for avoiding sunlight was hot weather (53.3%, $p<0.05$) Table 2.

DISCUSSION

This study provides valuable insights into the current understanding of Vitamin-D among A-Level students in Karachi and their perspectives towards daily sunlight exposure.

Our findings reveal that whil e a significant number of students were aware of Vitamin-D, their in-depth knowledge was limited.

Our results show that textbooks were the primary source of information about Vitamin-D for most students. This finding contrasts with Aljefree et al.,[24] who found media to be the key source in Saudi Arabia. This discrepancy suggests that educational curricula play a crucial role in shaping students' knowledge about Vitamin-D in our study population.

However, the reliance on textbooks alone may limit students' exposure to the most current research and recommendations regarding Vitamin-D. While most students recognized the role of Vitamin-D in calcium absorption, there was a significant lack of understanding about its broader functions and the consequences of its deficiency. This limited grasp of Vitamin-D's importance aligns with the findings of Mendes et al.,[26] highlighting a global challenge in educating young people about this crucial nutrient.

Our study found that a majority of students spent time under the sun during the afternoon, which is beneficial for Vitamin-D production. This practice aligns with previous research suggesting that Vitamin-D is not produced effectively during morning or late afternoon exposures, even in tropical regions.[27] However, the avoidance of sunlight due to hot weather, as reported by many participants, could potentially lead to insufficient Vitamin-D synthesis.

Our study participants' awareness level was lower than that found by Hagger et al.[25] among young females in Australia. This difference could be attributed to variations in educational systems, cultural practices, or public health campaigns between the two countries. This study provides valuable insights into Vitamin-D awareness among a specific demographic (A-Level students) in Karachi, which can inform targeted educational interventions. The inclusion of questions about sun exposure habits offers a more comprehensive understanding of factors influencing Vitamin-D status in this population. The questionnaire did not include open-ended questions, which might have limited the depth of data collected.The sample size was relatively small and focused on A-Level students, potentially limiting the generalizability of the findings to the broader youth population in Karachi.The study did not assess actual Vitamin-D levels, which could have provided a more comprehensive picture of the relationship between awareness and Vitamin-D status. Future research should Include a larger, more diverse sample of students from different educational backgrounds and areas of

Karachi.
Incorporate open-ended questions to gather more nuanced data on students' understanding and attitudes. Consider measuring Vitamin-D levels to correlate knowledge with actual Vitamin-D status. Explore the effectiveness of different educational interventions in improving Vitamin-D awareness and status among young people.

CONCLUSION

This study reveals a significant lack of comprehensive awareness regarding Vitamin-D and its deficiency among A-Level students in Karachi, Pakistan. While participants possessed basic knowledge of Vitamin-D, many displayed limited understanding of its broader health implications and the necessity of adequate sun exposure. These findings emphasize the urgent need for targeted health education programs that cover the multiple roles of Vitamin-D beyond bone metabolism, the consequences of its deficiency, and safe sun exposure practices for optimal synthesis.
Implementing such initiatives, alongside mass media campaigns and enhanced educational content in school curricula, could help reduce the disease burden associated with Vitamin-D deficiency.

Authors contribution
SMH: Contributed to study design, data collection, data analysis, manuscript drafting, critical revision, and final approval of the manuscript.
NA: Contributed to statistical analysis, manuscript drafting, critical revision, and final approval of the manuscript.
SAB: Performed study supervision, contributed to manuscript drafting, critical revision, and final approval of the manuscript.
KB: Assisted in data collection, data entry, preliminary analysis, manuscript drafting, and final approval of the manuscript.

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This study was conducted following the ethical standards set by the Declaration of Helsinki.
Ethical approval was obtained from the Institutional Review Board of Ziauddin University Dental College (Approval No: ZUIRB- 2022-1256). Informed consent was obtained from all participants, and confidentiality was maintained throughout the research process.

Informed Consent
The written consent was obtained from all participants in this study.

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Availability of data and materials
The data supporting this study's findings are available from the corresponding author upon reasonable request

Consent for publication
Not applicable.

Disclaimer of using AI tools
Not utilized. All ideas, arguments, and conclusions presented in the letter, however, are entirely the authors' original work. The authors take full responsibility for the accuracy and integrity of the content.

Conflict of interest
No conflict of interest.

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