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Awareness of Health Consequences of Vitamin D Deficiency Among Female Employees at the University of Kirkuk

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Abstract **Background and Aims:** Despite the global prevalence of Vitamin D deficiency (VDD) even within sun-rich areas like the Middle East, the awareness remains a key concern. The aim of this study was to assess the awareness of the health consequences of VDD among female employees at the University of Kirkuk. **Methods:** This research employed a cross-sectional survey design at the University of Kirkuk, Iraq, from December 3, 2024, to March 31, 2025. A stratified random sample was used to select 300 female employees. They provided informed consent and completed a structured questionnaire covering sociodemographic factors, medical history and VDD awareness. Statistical analysis included descriptive and inferential methods, such as one-way independent t-test, performed with SPSS version 23. **Results:** Mean awareness score was 54.40±17.43. Only 14.4% of participants demonstrated full awareness, while 46.8% were partially aware and 38.8% were unaware of the health consequences of VDD. A self-reported history of VDD was reported by 78.6% of participants. Awareness was significantly associated with educational background ($p<0.001$), occupational roles ($p<0.001$) and marital status ($p = 0.016$). However, age, employment duration, residence or economic status were not associated with awareness. **Conclusion:** Awareness of VDD consequences was generally low among female employees, suggesting a weak perceived severity of the condition. Significant gaps were found among administrative staff, services staff and widowed participants. Targeted workplace education is necessary to address these gaps, focusing specifically on the wider health consequences of VDD to promote preventive behaviors.

Key Words Vitamin D Deficiency, Awareness, Female Employees, University of Kirkuk, Iraq

INTRODUCTION

Vitamin D Deficiency (VDD) is a global public health issue, affecting an estimated one billion people worldwide [1]. Although VDD is often associated with regions receiving limited sunlight, recent evidence shows it is also widespread in sun-rich areas, including the Middle East and North Africa (MENA). This indicates that factors beyond sunlight, such as cultural practices, dietary habits and awareness, contribute significantly to VDD [1-3]. In Iraq, multiple studies report high prevalence across different regions, particularly among women and young people [4,5]. Vitamin D deficiency is medically defined by serum 25-hydroxyvitamin D levels under 20 ng/ml, a concentration insufficient for proper calcium absorption, an essential element for skeletal health [6]. It is associated with numerous adverse health outcomes, including immune dysfunction, cancer, cardiovascular disease, diabetes, obesity, metabolic syndrome and autoimmune disorders such as Graves' disease [7-9]. In regions with elevated cancer rates, such as Kirkuk City [10], addressing VDD is particularly critical. Vitamin D is primarily synthesized through skin exposure to ultraviolet B radiation and supplemented through diet, especially when sunlight exposure is limited [11]. Despite its high prevalence, awareness of VDD and its health consequences remains limited in Iraq and across the MENA regions, creating a knowledge gap that impedes preventive behaviors [12,13]. According to the Health Belief Model, awareness and perceived susceptibility strongly influence individuals' preventive health actions [14]. Recent studies continue to report substantial knowledge deficits about vitamin D, even among educated populations [15-17].

Female university employees are particularly at risk for VDD due to prolonged indoor work, cultural dress codes restricting sun exposure and increased physiological demands during reproductive years [18-20]. Although educated and potentially able to serve as health promoters, awareness of VDD's health consequences and preventive measures remains insufficient [18]. Despite numerous studies on VDD prevalence in Iraq, no research has systematically examined awareness among female employees at the University of Kirkuk. Addressing this gap is essential for guiding institutional health-promotion strategies. Accordingly, this study aimed to assess awareness of VDD's health effects in this population and to identify sociodemographic factors associated with awareness. The findings provide formative baseline data to highlight knowledge deficits and inform the development of targeted educational interventions to reduce VDD risk in this high-risk group.

METHODS

Design and Setting

The study employed a cross-sectional survey design and was carried out at the University of Kirkuk from December 3, 2024, to March 31, 2025. The University of Kirkuk, a public institution located in Kirkuk City, Iraq, has been offering higher education since 2003. The university provides a range of academic programs and fosters a varied community of students and staff, creating an appropriate setting for investigating awareness of VDD among female employees.

Participants and Sampling

The study included female employees working at the Presidency of the University of Kirkuk. To determine the required sample size, the study employed the formula for a single population proportion. Key parameters included a 50% expected awareness prevalence, a 95% confidence level and a 5% margin of error. This initial calculation yielded a sample of n = 384. Using the finite population correction formula for N = 1,050, the required adjusted sample size was approximately 287. A final sample size of 300 participants was chosen to ensure a statistically powered study.

A stratified random sampling method was used to ensure representativeness. Employees were categorized into four groups: administrative, teaching, technical and services staff. A proportional random sample was selected from each category, reflecting the proportional distribution of staff at the university's presidency. To select the final sample of 300, a simple random sampling procedure was applied within each stratum (category).

Instrumentation

Data were collected using a structured, self-reported questionnaire explicitly designed to assess VDD awareness among female employees at the Presidency of the University of Kirkuk. The questionnaire was arranged into three main parts. The first part focused on sociodemographic variables, including age, educational level, occupation, years of work, marital status, residence, economic status, smoking status and related habits. The second part addressed chronic diseases and self-reported VDD history. The final part assessed VDD awareness using 20 knowledge-based questions.

The awareness assessment used 20 questions, which were originally rated on a 5-point Likert scale (from "Not at all aware" (1) to "Extremely aware" (5)). For the purpose of analysis, the awareness score was treated as a knowledge-based cumulative score. Each knowledge item was scored dichotomously (1 point for a correct answer, 0 for an incorrect answer), yielding a raw score from 0 to 20. The resulting raw score (0-20) was then transformed into a percentage score (0-100, where higher percentages reflected greater VDD awareness. Awareness levels were categorized using an equal interval approach: Unaware (20-46), Partially Aware (47-73) and Fully Aware (74-100).

To guarantee fidelity, the questionnaire underwent a translation process (English to Arabic) followed by back-translated, subsequently. A panel of public health experts reviewed the questionnaire to ensure content validity, clarity of language and cultural appropriateness. The instrument was piloted on 20 female employees from various groups (administrative, teaching, technical and services staff); these participants were excluded from the final sample. Reliability was assessed, producing a Cronbach's alpha coefficient of 0.82, demonstrating high internal consistency.

Data Collection Procedure

Researchers collected data were collected in person over a period of four months. The process began by obtaining necessary administrative permission before visiting the relevant administrative departments. Eligible participants were then approached individually in a private setting. The procedure involved three key steps: (1) Providing a brief oral explanation of the study, (2) Securing oral informed consent from the participants and (3) Supervising the self-administered completion of the questionnaire. Participants were given sufficient time (approximately 15 minutes) to complete the instrument. The researchers maintained a non-intrusive presence to clarify questions but strictly avoided influencing responses, ensuring participants' privacy and data integrity.

Ethical Approval

The study received ethical approval from the Research Ethics Committee at the College of Nursing/University of Kirkuk (approval number 1, issued on December 2, 2024). Furthermore, all individuals provided consent before their participation and data collection began.

Statistical Analysis

SPSS version 23 was utilized for all data processing and analysis, which involved a combination of descriptive and inferential methods. Descriptive statistics (Means±SD and frequencies/percentages) summarized participants' profiles and awareness scores. To investigate the association between awareness scores and sociodemographic variables, inferential analysis was performed. An independent t-test was applied for comparing two groups and one-way was used for multiple group comparisons. Analysis of Variance (ANOVA) was applied when comparing more than two groups. Prior to these parametric tests, key assumptions were evaluated: The Kolmogorov-Smirnov test checked the normality of awareness and Levene's test confirmed the homogeneity of variance. When ANOVA indicated a statistically significant difference, Tukey's Honestly Significant Difference (HSD) post-hoc test was performed to identify specific group differences. Statistical significance was defined as a p-value of less than 0.05.

RESULTS

A total of 299 female employees were included in the study out of a target sample of 300, representing an exceptionally high response rate of 99.7%. participants' ages ranged from 23-60 years, averaging 36.67±8.27 years, with participants ranging in age from 23 to 60 years.

The mean total awareness score for all 299 participants was 54.40±17.43. The distribution of awareness regarding the consequences of VDD among female employees was as follows (Figure 1):

- The highest level of awareness observed was Partially Aware, with 140 participants (46.8%)
- 116 participants (38.8%) were categorized as Unaware
- Only 43 participants (14.4%) were categorized as Fully Aware

A history of VDD was self-reported by 235 female employees, accounting for 78.6% of the study participants. Hypertension, diabetes mellitus and hypothyroidism were also noted among the participants, with 34 (11.4%), 27 (9.0%) and 23 (7.7%) cases, respectively (Table 1).

Independent t-test and ANOVA revealed a significant association between awareness scores and several sociodemographic variables (Table 2). Educational level was a highly significant predictor of VDD awareness ($p<0.001$). specifically, post-hoc tests indicated that the awareness scores of postgraduate employees were significantly higher than those with either primary ($p = 0.002$) or secondary ($p = 0.010$) education. Awareness levels also differed significantly between occupational groups ($p<0.001$). Administrative staff exhibited the lowest awareness scores, being significantly lower compared to technical staff ($p<0.001$) and academic staff ($p<0.001$). Academic staff also demonstrated significantly higher awareness than services staff ($p = 0.020$).

The study further identified a significant link between VDD and marital status ($p = 0.016$), with widowed participants had significantly lower awareness than both single ($p<0.001$) and married ($p<0.001$). However, key sociodemographic variables such as age group ($p = 0.258$), years of employment ($p = 0.582$), residence ($p = 0.677$) and economic status ($p = 0.073$) were not significantly associated with VDD awareness (Table 2).

Table 1: Distribution of the Study Sample (N = 299) According to Certain Clinical Factors

Clinical factors	Number	Percentage
Vitamin D deficiency	235	78.6
Hypertension	34	11.4
Diabetes mellitus	27	9.0
Hypothyroidism	23	7.7

Clinical history data: Self-reported by participants, indicating previous or current diagnoses of clinical conditions

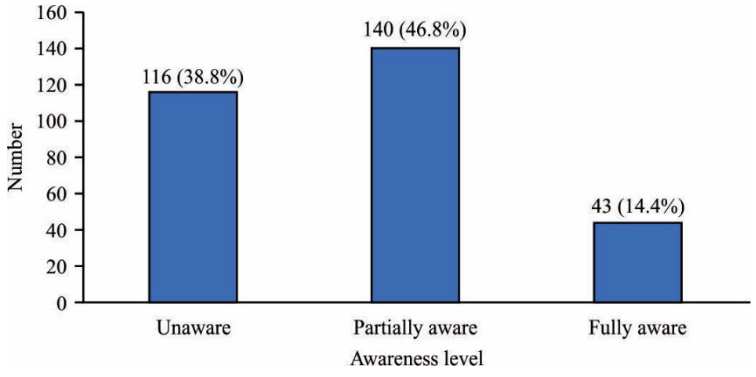

Figure 1: Distribution of the Study Sample (N = 299) According to Their Awareness Levels of VDD

*Unaware= scores (20-46), Partially aware= scores (47-73), Fully aware = scores (74-100)

Table 2: Association Between Certain Sociodemographic Characteristics of the Sample (N = 299) and their Awareness Regarding the Consequences of Vitamin D Deficiency

Variables	N	Mean	SD	p-value	Post Hoc
Age (Years)					
23-32	113	54.01	17.51	0.258	-
33-42	109	52.89	17.71		
43-52	60	58.32	17.30		
≥53	17	52.88	14.61		
Educational Level					
Primary School Completed	12	47.42	9.10	<0.001*	Postgraduate>Primary (p = 0.002) Postgraduate>Secondary (p = 0.010)
Secondary School Completed	11	46.73	14.23		
Diploma/Technical Institute	40	49.95	16.40		
Bachelor's Degree	164	53.28	17.10		
Postgraduate Degree (Master's/Ph.D.)	72	61.76	18.12		
Occupational Categories					
Administrative Staff	120	48.57	15.55	<0.001*	Administrative<Technical (p = <0.001) Administrative<Teaching (p = <0.001) Teaching>Services (p = 0.020)
Technical Staff	96	57.13	17.14		
Teaching Staff	72	61.76	18.12		
Services Staff	11	46.09	10.25		
Years of Employment					
1-5	110	54.64	18.86	0.582	-
6-15	123	53.00	16.68		
16-25	54	56.91	16.55		
>25	12	55.33	15.56		
Marital Status					
Single	101	53.31	18.13	0.016*	Widow<Single (p = <0.001) Widow<Married (p = <0.001)
Married	177	55.89	17.33		
Divorce	10	56.00	12.82		
Widow	11	39.09	4.76		
Residence					
Urban	277	54.52	17.36	0.677**	-
Suburban	22	52.91	18.61		
Economic Status					
Sufficient	173	54.78	18.03	0.073	-
Partially sufficient	113	55.06	16.63		
Insufficient	13	43.62	13.06		

Significance level set at p<0.05, Post hoc comparisons (Tukey HSD) were conducted only for variables analyzed with one-way ANOVA when significant differences were detected, *One-way ANOVA, **Independent t-test

DISCUSSION

The ultimate objective of public health research is to guide effective interventions and a person's awareness of health conditions is a critical factor in motivating behavioral change [12]. This cross-sectional survey aimed to assess female employees' awareness of VDD consequences at the University of Kirkuk, providing formative data necessary to develop targeted health education programs. In the study, less than one-fifth of female employees demonstrated high awareness of the consequences of VDD, while the majority showed only partial or low awareness. This demonstrates a significant knowledge gap, consistent with findings from regional studies reporting limited awareness of VDD in countries such as Saudi Arabia [15] and Syria [16], where considerable proportions of adults were unable to identify the health risks associated with deficiency. According to the Health Belief Model, this lack of knowledge directly lowers the perceived severity of VDD, making individuals unlikely to adopt preventive behavior like increasing exposure or taking supplements. This necessitates targeted educational programs to enhance awareness and encourage the adoption of a healthy lifestyle. A high proportion of participants also reported a prior history of VDD. Although self-reported data cannot confirm biochemical deficiency, similar prevalence rates have been documented in neighboring countries, where indoor lifestyle and limited sun exposure are common [21-23]. This alignment with other studies reinforces concerns about the widespread nature of VDD in sun-rich environments and emphasizes the importance of improving awareness to support preventive behavior. Educational attainment emerged as one of the strongest predictors of awareness, with participants holding postgraduate degrees demonstrating significantly higher awareness than those with lower level of education. This finding is supported by several regional and international studies reporting that individuals with higher education tend to have better health-related literacy, greater access to health information and more frequent exposure to health-related discussion [1,15,17,24]. These factors likely contribute to improved understanding of VDD and its consequences. However, the findings of this study indicate that education alone is insufficient; even within this relatively educated workforce; awareness gaps persist, suggesting that targeted health education remains necessary regardless of formal educational background. Occupational differences in awareness were also evident, with Administrative Staff exhibiting significantly lower awareness than Technical and Academic Staff. This suggests that simply being an educated

employee in a university setting is not sufficient; rather, occupation dictates access to certain information channels and time for self-directed health maintenance. Targeted workplace health programs must therefore prioritize administrative and service staff to fill this information gap.

A statistically significant association was also observed between marital status and awareness; however, widowed participants demonstrated lower awareness than single or married employees. This finding contrasts with another study reporting higher knowledge among widowed individuals [24]. This inconsistency highlights the need for cautious interpretation and suggests the value of future qualitative research to better understand how marital transitions influence health awareness.

No significant associations were found between awareness and age, years of employment, residence or economic status. These findings contrast with previous studies that identified age and socioeconomic status as significant predictors of awareness [7,16]. The lack of an association in this study may be explained by relatively widespread access to health information in Iraq, the homogeneity of the sample (female university employees) and potentially stronger influence of education and occupation. Overall, these results highlight the importance of contextual factors and caution is required when attempting to generalize health literacy outcomes to diverse populations.

The study declared some limitations. One of them, as noted in another study by Ghalib and Mahmood [24], is its cross-sectional design, which makes it difficult to identify whether awareness came before or after particular sociodemographic factors. Additionally, the use of self-reported questionnaires may introduce recall bias for certain clinical factors, particularly VDD, which could affect the accuracy of the findings. Moreover, as the study was performed at a university in Kirkuk, the results may not be generalizable to a larger population.

CONCLUSIONS

Awareness of the health consequences of VDD among female employees at the University of Kirkuk was generally low, suggesting a weak perceived severity of the condition as outlined by the Health Belief Model. Awareness was significantly influenced by education level, occupation and marital status, with Administrative Staff, Services staff and Widowed participants demonstrating the greatest gaps. These findings highlight the need for targeted, occupation-specific health education programs that address identified knowledge deficits and promote preventive behaviors. Given the high self-reported prevalence and potential long-term health consequences of VDD, improving awareness among these groups should be considered an important public health priority.

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