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The Concealed Hazard: Vitamin D Deficiency, Awareness, and Its Impact on Psychological Wellness among Elderly

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Abstract:

Background: The prevalence of vitamin D deficiency and its consequences is expected to increase with ageing. Consequently, this study **aimed** to explore the prevalence of the hidden danger posed by vitamin D deficiency among the elderly, awareness and its impact on psychological well-being. **A cross-sectional study design** was employed in Najran City, using a **convenient sample** of 100 elderly. **Data collection** included socio-demographic information, serum 25 (OH) D analyses, knowledge questionnaires, and the Depression, Anxiety, and Stress Scale (DASS 21). **Results** revealed that 9% of the sample had deficient vitamin D levels (<20 ng/mL), 33% were insufficient (20-29 ng/mL), and 58% were sufficient (≥30 ng/mL). Knowledge about vitamin D was satisfactory only in 23%. Negative emotional states were mild in 40%, moderate in 31%, and severe in 29% of the sample. Correlation analysis showed a significant positive relationship between knowledge/lifestyle scores and vitamin D (p<0.0001). Moreover, a highly significant association was found between vitamin D sufficiency levels and negative psychological states (p=0.0002).
Conclusion: The findings of this study highlighted the prevalence of vitamin D deficiency among elderly individuals where about the third had vitamin D deficiency, a significant proportion of participants exhibited unsatisfactory knowledge about vitamin D (47%). The study also revealed the significant association between varying degrees of negative emotional states among the elderly and their sufficiency levels of vitamin D. **Recommendations**: perform routine screening for vitamin D levels among elderly individuals especially those at risk of deficiency due to limited sun exposure or dietary factors and raising awareness about the importance of vitamin D, sources of supplementation, and the role of adequate levels in overall health.
Keywords: awareness of elderly people, Psychological well-being, prevalence of Vitamin D deficiency,

Introduction

Compared to other micronutrient deficiencies, vitamin D deficiency (VDD) has been recognized as a global pandemic in the 21st century. There are estimates that more than 1 billion people worldwide have VDD. The prevalence of VDD in all age groups of men and women is increasing remarkably, even in areas with sufficient sunlight, including countries in the Middle East and North Africa. Vitamin D status is influenced by a number of factors including Skin color, heredity, body weight, diet, geography and other environmental factors(1).

Vitamin D, often referred to as the "sunshine vitamin," plays a crucial role in maintaining overall health and well-being. It is essential for calcium absorption, bone health, immune function, and numerous other physiological processes. However, despite its importance, there is a hidden danger lurking among the elderly population – vitamin D deficiency. This deficiency, coupled with low awareness levels about its implications, can have a profound impact on the psychological well-being of older adults (2, 3).

Increasing longevity and changing demographics are expected to make geriatric issues even more critical. Consequently, the prevalence of vitamin D deficiency and its consequences is expected to increase. Studies on this topic, especially with a focus on seniors in care facilities, are rare. The international study that was conducted by Amrein et al., 2020 explored that there were very different prevalence that ranged from 16%-98% among elderly population (4).

The ability to synthesize vitamin D from sunlight declines with aging. This decline is exacerbated by factors such as reduced outdoor activity, limited mobility, and certain health conditions that affect vitamin D absorption and metabolism. As a result, a significant portion of the elderly population is at risk for vitamin D deficiency, yet this risk often goes unnoticed or underestimated (5). The awareness about the importance of adequate vitamin D levels and the potential consequences of deficiency remains relatively low, especially among older adults and healthcare providers. Many individuals are unaware of the subtle signs and symptoms of vitamin D deficiency, such as fatigue, muscle weakness, mood changes, and impaired cognitive function. Without proper recognition and intervention, these symptoms can contribute to the decline in psychological well-being among the elderly (6).

Anxiety and mood changes are just two of the many elements of psychological distress. As defined by the American Psychiatric Association in its 1994 Diagnostic and Statistical Manual of Mental Disorders, depression is characterized by a persisting and widespread state of sadness or lack of interest or pleasure in virtually all activities for at least two weeks. Due to the wide variety of clinical presentations and underlying causes, the pathophysiology of mental disorders is poorly understood (7).

According to Vieth et al. (8), mental disorders are complex conditions with various subtypes and causes, including a potential involvement of vitamin D. Vitamin D receptors have been identified in numerous brain regions, particularly those associated with the onset of mental illness. Consequently, there is a recognized link between vitamin D and mental health issues. Additionally, recent research has underscored the intricate relationship between vitamin D status and mental health outcomes in older adults. Studies indicate that insufficient levels of vitamin D may contribute to a higher risk of depression, anxiety, cognitive decline, and other psychological disorders among the elderly. Recognizing the interplay between vitamin D deficiency, knowledge levels, and psychological well-being is essential for developing targeted interventions and enhancing the overall quality of life for older adults (9).In this context, this study aims to explore the prevalence of the hidden danger posed by vitamin D deficiency among the elderly, awareness and its impact on psychological well-being.

Specific objectives:

1. Explore the prevalence of vitamin D deficiency among the studied elderly
2. Assess the awareness of the elderly participant regarding vitamin D.
3. Identify the impact of vitamin D deficiency on psychological wellbeing of the elderly.

Materials and Methods

Study Design: Cross sectional study was used to achieve the aim of the study.

Setting: Najran City located in southwestern Saudi Arabia.

Sample technique: Convenient Sample

Sample size: 100 participants according to the following inclusion criteria

1. Participants ages were 60 years old and over.
2. Participants reside in Najran City, Saudi Arabia, to ensure relevance to the study's geographical location.
3. Vitamin D levels should have been assessed by the participants within the past 60 days.
4. Be capable of providing informed consent to participate in the study.

Data Collection Methods:

1-Socio demographic data as:
Age, gender, educational level, residence

2- Serum 25(OH) D Analysis:
 ➢ Deficient: <20 ng/mL or <50 nmol/L
 ➢ Insufficient: 20-29 ng/mL or 50-74 nmol/L
 ➢ Sufficient: ≥30 ng/mL or ≥75 nmol/L

3-Knowledge questionnaire

The questionnaire was composed of 16 true and false questions as True or False: vitamin D is only obtained through dietary sources, vitamin d deficiency is more common in regions with abundant sunlight, the main function of vitamin D is to promote calcium absorption in the gut, excessive sun exposure can lead to vitamin D toxicity, people with darker skin require more sun exposure to produce the same amount of vitamin D as those with lighter skin, vitamin D deficiency can contribute to weakened immune function and vitamin D is naturally found in only a few foods, such as fatty fish and fortified dairy products. . The total score ranged from 0-16 points. The cumulative points are tallied, converted into percentages, and categorized into three groups: unsatisfactory if below 50%, average if between 50% and 74%, and satisfactory if 75% or higher.

4- Depression, Anxiety, and Stress Scale (DASS 21)

It was used to assess the prevalence of psychological load among the research participants. The DASS 21 has undergone extensive international testing and approval for its reliability and validity. Specific items within the DASS 21 were designated to evaluate symptoms related to depression, anxiety, and stress. For depression assessment, items at positions 3, 5, 10, 13, 16, 17, and 21 were included. To detect anxiety, items at numbers 2, 4, 7, 9, 15, 19, and 20 were utilized. Additionally, stress levels were evaluated using 7 other items (1, 6, 8, 11, 12, 14, and 18) from the questionnaire. Each item was given a score between 0 (which did not apply to the participant over the last week) and 3 (meaning it did apply to the participant frequently).

Scoring system.

The severity of depression, anxiety, and stress was categorized based on cutoff values as follows; mild: scores ranging from 0 to 7, moderate: scores ranging from 8 to 14 and severe: scores ranging from 15 to 21.

Validity and reliability

The questionnaire was validated by 5 professors in community health nursing and medical surgical nursing. The consistency by Cronbach's Alpha coefficient test was 0.84 for knowledge questionnaire and the depression, anxiety, and stress scale (DASS 21) was translated into Arabic and Cronbach's Alpha coefficient test was 0.81.

Pilot Study:

The researcher will conduct the study on 10% of the sample to evaluate the questionnaire the participants in the pilot study will not be included in the study

Field of the work

1. The data collection phase for "The concealed Hazard: Vitamin D Deficiency, Awareness, and its impact on psychological wellness in older adults in Najran city took place from November 2023 to February 2024, providing an extensive timeframe to gather a thorough exploring the prevalence of vitamin D deficiency awareness and the psychological wellbeing of elderly participants.

2. To select study participants, the researcher, selected 2 primary health care centers in Najran city.

3. The researchers meet the participants in Wednesday and Thursday at these centers, the selected participants were informed about the study's purpose, procedures, and potential benefits. They were then asked to provide informed consent before proceeding with any data collection activities.

4. The interviews with participants were conducted in a private and confidential setting within the health centers. During these interviews, participants were given the opportunity to ask questions and seek clarification about the study. This approach ensured that participants felt comfortable and understood the nature of their involvement in the research.

Ethical Consideration:

We adhered to all principles of research ethics throughout the study. We thoroughly explained the study's objectives and methodology, obtaining verbal consent from each participant. Participants were assured of their right to decline participation, the confidentiality of their data, and that there were no costs involved in participating in the study.

Statistical analysis:

The Statistical Software for the Social Sciences, version 23 (IBM SPSS Inc., Chicago, IL, USA) will be used to enter and analyze the acquired data. Frequencies and percentages were used appropriately to present the data. Participants' answers to questions about their vitamin D status

were compared. To further investigate the role of vitamin D deficiency in the development of psychiatric disorder, the DASS score was compared with vitamin D deficiency status. To determine the statistical significance of differences in proportions for categorical data, the Pearson Chi-Square test was performed. P values less than 0.05 were considered significant.

Results

The results in table (1) present the frequency distribution of studied patients based on their socio-demographic characteristics, including gender, age, educational level, and residence. The data shows that the sample consisted of a higher proportion of male patients (72%) compared to female patients (28%). The majority of patients fell within the age range of 60-70 years (67%), while a smaller proportion were in the age range of 71-80 years (33%). The data reveals that a significant portion of the patients had a primary level of education (45%), while a slightly higher percentage had a secondary level of education (55%). The distribution based on residence shows that 31% of patients resided in rural areas, while a larger proportion (69%) lived in urban areas.

Table (1): Frequency distribution of studied sample according to their socio-demographic characteristics (n = 72)

Items	N	%
Gender		
Male	72	72
Female	28	28
Age/ years		
60->70	67	67
71-80	33	33
Educational level		
Primary	45	45
Secondary	55	55
Residence		
Rural areas	31	31
Urban	69	69

The results in table (2) reveal the frequency distribution of the studied sample based on their medical history. The data shows that diabetes is the most prevalent medical condition among the studied sample, with 45% of participants reporting a history of diabetes. Following diabetes, hypertension is the second most prevalent medical condition, with 31% of participants. About 28%

of the studied sample reported a history of arthritis. Chronic Obstructive Pulmonary Disease (COPD) was reported by 21% of participants.

Table (2): Frequency distribution of studied sample regarding to their medical history

Items	N	%
Diabetes	45	45
hypertension	31	31
Arthritis	28	28
COPD	21	21

Table (3) the frequency distribution of the studied sample based on the sufficiency of vitamin D levels. The data shows that 9% of the studied sample falls into the deficient category, with vitamin D levels below 20 ng/mL. Approximately 33% of the studied sample is categorized as insufficient, with vitamin D levels ranging from 20 to 29 ng/mL. The data added that more than the half of the studied sample, (58%) falls into the sufficient category.

Table (3): Frequency distribution of studied sample regarding to sufficiency of vitamin D

Items	N	%
➢ Deficient: <20 ng/mL	9	9
➢ Insufficient: 20-29 ng/mL	33	33
➢ Sufficient: ≥30 ng/mL	58	58

The results presented in table (4) show the frequency distribution of the studied sample based on their levels of knowledge about vitamin D. The data indicates that 23% of the studied sample falls into the satisfactory category in terms of their knowledge about vitamin D. Approximately 30% of the studied sample is categorized as having average knowledge about vitamin D. less than the half of the studied sample, (47%) falls into the unsatisfactory category regarding their knowledge of vitamin D.

Table (4): Frequency distribution of studied sample regarding to their levels of knowledge about of vitamin d

Items	N	%
➢ Satisfactory	23	23
➢ Average	30	30
➢ Unsatisfactory	47	47

The results presented in table (5) display the frequency distribution of the studied sample concerning their negative emotional states as measured by the DASS-21. The data reveals that 40% of the studied sample falls into the mild category for negative emotional states, 31% of the studied sample is categorized as having moderate negative emotional states. The results show that 29% of the studied sample experiences severe negative emotional states according to the DASS-21.

Table (5): Frequency distribution of studied sample regarding to negative psychological states according DASS-21

Items	N	%
➢ Mild	40	40
➢ Moderate	31	31
➢ Severe	29	29

The results presented in table (6) outline the frequency distribution of the studied sample concerning their lifestyle habits aimed at avoiding vitamin D deficiency. The results reveal that 41% of the studied sample reported engaging in activities to ensure they receive sufficient sun exposure, 34% of the participants indicated that they consume foods rich in vitamin D. Only 17% of the studied sample reported taking vitamin D supplements. A significant portion, 46% of the participants, mentioned engaging in regular physical activity. A substantial majority, 57% of the studied sample, reported consulting their healthcare provider.

Table (6): Frequency distribution of studied sample regarding to their life style to prevent vitamin D deficiency

Items	N	%
Get adequate sun exposure	41	41
Consume vitamin d-rich foods	34	34
Take vitamin d supplements	17	17
Exercise regularly	46	46
Consult your healthcare provider	57	57

The results presented in table (7) show the correlation between the knowledge and lifestyle scores of the studied sample with their measures of vitamin D. The correlation coefficient (R) between

knowledge and measures of vitamin D is 0.61, with a significant p-value of .0001. It suggests that individuals with higher knowledge about vitamin D tend to have better measures of vitamin D in their bodies. Similarly, the correlation coefficient (R) between lifestyle scores and measures of vitamin D is 0.69, with a significant p-value of .0001. It implies that individuals who follow healthier lifestyle practices, such as adequate sun exposure, dietary choices, and regular exercise, are more likely to have optimal vitamin D levels.

Table (7): correlation between knowledge and lifestyle score of the studied sample with their measures of vitamin D

Items	measures of vitamin D	
	R	**P**
➢ Knowledge	0.61	.0001
➢ Life style	0.69	.0001

Table 8 shows a highly significant association between vitamin D sufficiency levels and negative psychological states where the chi-square (X2) value is 26.4 with a corresponding p-value of 0.0002. This finding suggests that there may be a meaningful relationship between vitamin D status and the severity of psychological symptoms within the studied population. The severity of negative psychological states decreases as the sufficiency of vitamin D increases.

Table (8): association of sufficiency of vitamin D of the studied sample with the negative psychological states

Items	Mild		moderate		Severe		X^2	P
	N	**%**	**N**	**%**	**N**	**%**		
➢ Deficient: <20 ng/mL	1	11.1	1	11.1	7	77.8	26.4	0.0002
➢ Insufficient: 20-29 ng/mL	9	27.3	8	24.3	16	48.4		
➢ Sufficient: ≥30 ng/mL	30	51.7	22	37.9	6	10.4		

Discussion

The findings from the study indicated that about one third of the studied sample have insufficient, vitamin D levels ranging from 20 to 29 ng/mL. In the same line **Ramason et al., (2014)** who conducted their study in Singapore on elderly patient with hip fracture, revealed that about the third of the studied patients had insufficient vitamin D(9). While the prevalence of current study was lower than Boettger **etal., (2018)** who conducted their study on elderly hospitalized patients. They reported that Almost 96% of patients had serum 25-hydroxyvitamin D (25-OH-D) concentrations below desirable concentrations of ≥30 ng/ml(10). Additionally, **Santiago etal., (2012)** found that 92.7% of Portuguese hospitalized patients presented with vitamin D deficiency and only 7.3% had concentrations > 20 ng/ml(11). The difference in our study may be due to the studied sample were not hospitalized patients and exposed to the sun on their daily activities.

The present study indicated that about one quarter of the studied sample had satisfactory knowledge about vitamin D and less than the half of the studied sample, falls into the unsatisfactory category regarding their knowledge of vitamin D. the current study was supported by **Oudshoorn et al., (2012)** who found that about one third of the studied sample had good knowledge (12). In the same line the study of **Suryadinata et al., (2018)** supported the current study (13). On the other hand **Uzrail et al., (2021)** and the study of **Mohamed et al., (2021)** reported that the majority of the studies sample had satisfactory knowledge. The differences could be attributed to variations in the study populations, sample size and geographical and cultural differences (14, 15).

The current study showed a highly significant association between vitamin D sufficiency levels and negative psychological states where the chi-square ($X2$) value is 26.4 with a corresponding p-value of 0.0002. This finding suggests that there may be a meaningful relationship between vitamin D status and the severity of psychological symptoms within the studied population. The severity of negative psychological states decreases as the sufficiency of vitamin D increases. Our results were supported by **Zaromytidou et al., (2022)** who concluded that the deficiency in vitamin D is associated with mood depression among elderly people (16). In the same line **Amani et al., (2019)** reported association between mood status and vitamin D deficiency (17). On the other hand **Park, Ah and Yu (2023)** reported no association between Vitamin D and psychological symptoms. Variations in cultural backgrounds, religious beliefs, and lifestyles can significantly influence psychological well-being, potentially impacting the relationship between vitamin D levels and mental health outcomes (18).

The present study suggested that individuals with higher knowledge about vitamin D tend to have better measures of vitamin D in their bodies. Similarly, the correlation coefficient (R) between lifestyle scores and measures of vitamin D is 0.69, with a significant p-value of .0001. It implies that individuals who follow healthier lifestyle practices, such as adequate sun exposure, dietary

choices, and regular exercise, are more likely to have optimal vitamin D levels. The current study was supported by various studies (19, 20).

Limitations of the study

The study utilized a convenient sample of 100 elderly individuals from Najran City, which may not be representative of the broader elderly population. The cross-sectional study design which was used in this research provided a snapshot of the association between vitamin D deficiency, knowledge levels, and psychological states at a single point in time. This design does not allow for the establishment of causal relationships or the assessment of changes over time.

Conclusion

The findings of this study highlighted the prevalence of vitamin D deficiency among elderly individuals where about the third had vitamin D deficiency, a significant proportion of participants exhibited unsatisfactory knowledge about vitamin D (47%). The study also revealed the significant association between varying degrees of negative emotional states among the elderly and their sufficiency levels of vitamin D.

Recommendations

- ➢ Perform routine screening for vitamin D levels among elderly individuals, especially those at risk of deficiency due to limited sun exposure or dietary factors.
- ➢ Raise awareness about the importance of vitamin D, sources of supplementation, and the role of adequate levels in overall health.

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