The Silent Link: Unveiling Vitamin D Deficiency as a Hidden Cause of Infertility

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Research Article

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ABSTRACT

Background: Vitamin D plays a crucial role in calcium and phosphate metabolism, which are essential for numerous physiological functions, including reproduction. Deficiency in vitamin D has been linked to infertility in both males and females, potentially contributing to unexplained fertility issues. This study aims to explore the relationship between vitamin D deficiency and infertility, focusing on its prevalence, awareness, and associated risk factors.

Methods: A cross-sectional study was conducted using survey data collected from 96 participants in Karachi and interior Sindh, Pakistan. The sample included males and females aged 20-40 with infertility or vitamin D deficiency. Data was analyzed using chi-square tests to determine associations between Vitamin D levels and infertility. Exclusion criteria included individuals on medications affecting vitamin D levels or fertility and those with conditions like kidney or liver disease.

Results: Among the participants, 90.6% of women and 9.3% of men were found to be vitamin D deficient. Approximately 59.3% of participants had vitamin D levels below the normal range, and 46.3% of these individuals experienced infertility issues. The most affected age group was 20-25 years. A significant portion (73%) had not used supplements, and 50% were unaware of the link between vitamin D deficiency and infertility. Women showed higher prevalence rates of infertility associated with vitamin D deficiency compared to men.

Conclusions: Vitamin D deficiency is prevalent and closely associated with infertility, particularly among women. Awareness and proactive measures to address vitamin D deficiency, including supplementation and dietary adjustments, are essential. Further experimental studies are recommended to confirm causation and deepen understanding of vitamin D's role in reproductive health.

Keywords: Vitamin D deficiency; Infertility; Reproductive health; Cross-sectional study; Public health awareness

INTRODUCTION

Vitamin D is a fat-soluble prohormone, often termed the "sunshine vitamin," because the body produces it in response to Ultraviolet (UV) rays from sunlight. Unlike other vitamins, vitamin D functions as a hormone, playing a pivotal role in maintaining calcium and phosphate balance, crucial for bone health and cellular functions. It is primarily synthesized in the dermis under the influence of sunlight and, to a lesser extent, obtained through dietary sources such as fatty fish, fortified dairy products, and supplements. Despite its natural availability, vitamin D deficiency is a global public health concern, with an estimated 1 billion people affected worldwide. Vitamin D is a vitamin that is well-known for its significant role in maintaining bone health, but there's more to it than that. Vitamin D is also important for regulating the immune system, muscle mass, cardiovascular function, and inflammation in the body. The only active form of vitamin D, calcitriol (1,25-dihydroxy vitamin D), is formed in the liver and kidneys [1]. This form interacts with cellular receptors of vitamin D, or VDRs, which are found in numerous cells, controlling the expression of genes as well as cell growth and maturation. Children who suffer from vitamin D deficiency are at high risk of developing rickets, adults with the deficiency may develop osteomalacia and osteoporosis, and chronic fatigue. Such individuals also have a weaker immune system, and are more easily infected. However, recent studies indicate the vitamin can be effective in preventing chronic diseases such as diabetes heart disease and certain forms of cancer. Lately, many studies on the association of vitamin D with reproductive health have emerged. It has been suggested that vitamin D has an effect on the fertility of both sexes. In females, vitamin D deficiency affects both function of ovaries and hormone processes such as implantation. In addition, vitamin D deficiency has been associated with reproductive disorders such as polycystic ovary syndrome also referred to as PCOS and endometriosis. In males, the vitamin aids in the improvement of sperm quality, sperm motility and the overall chances of reproduction having better success. Also, a vitamin D deficiency has been associated with an either small or impaired sperm count. Vitamin D has been rather neglected over the years. Vitamin D deficiency is common across much of the world especially in the regions where sunlight exposure is limited, diet has insufficient vitamin D concentration, or patients have culturally restrictive practices, such as extended indoor living or use of cloaked clothing. If we look into the population of Pakistan, a considerable number of its population is vitamin D deficient due to lack of sunlight exposure and poor nutrition, Adding fear to reproductive health issues [2].

The objective of this study is to evaluate vitamin D deficiency as one of the causes of infertility among females resident in Karachi. This research aims to find out the extent of the public health problem of lack of vitamin D as a major contributing factor for infertility women. Moreover, the study intends to add an existing evidence base that supports the claim that vitamin D which is readily available in the form of tablets does a miracle for infertility cure [3].

MATERIALS AND METHODS

Study design

The present research is a cross sectional research where data is collected at one point of time. This would suggest that descriptive statistic tests were used to evaluate the infertility rates and vitamin D deficiency among women. In addition, this study's results might help in policy making decisions and serve as a basis for further investigation [4].

Inclusion and exclusion criteria

Inclusion criteria

- Participants aged 20–40 years with documented vitamin D deficiency or infertility.
- Only females who are not currently pregnant but have been trying to conceive for a specific duration.

Exclusion criteria

- Individuals with normal vitamin D levels or those on medications affecting vitamin D metabolism (e.g., antipsychotics or chemotherapy).
- Over-aged women, individuals with underlying medical conditions such as kidney or liver diseases.
- Currently pregnant women.

Survey setup

In this study, however, Karachi was the study setting among its specific populations in order to address vitamin D deficiency issue. Educational institutions and hospitals were the major sites of the survey data collection, as it was possible to collect

data in a pilot study with ease. The survey had the objective of quantifying the impact and prevalence of the responses among the targeted population [5].

Sample size

The survey, which was administered in May 2023, intended to reach at least 100 respondents. Out of these, 96 responses were collected, thus making the sample relatively moderate in terms of determining the relationships between the variables. These responses are reported because they were collected electronically using Google Forms. An internet-based method allows researchers to reach many people with minimal effort [6].

RESULTS AND DISCUSSION

The findings of this study reveal important demographic and behavioral health patterns that provide valuable insight into the role of vitamin D deficiency and its association with infertility in human is revealed.

Although food was identified as the primary source of vitamin D for half of the participants (50%), only 30.2% relied on supplements and 22.9% on specific drugs prescribed by physicians for them used. This classification suggests that relying on natural food intake can lead to vitamin D intake use. The primary approach to D-requirements remains, perhaps, to identify supplements due to the lack or absence of medical advice [7].

The study found a lack of awareness of the link between vitamin D and infertility, with only 45.8% of participants acknowledging this link. This highlights the need for targeted educational campaigns to address knowledge gaps and promote proactive measures to address scarcity.

Notably, 46.8% of participants believed that stress and overwork contributed to their reproductive health issues, and 32.3% considered this a possibility (Tables 1 and 2). This finding highlights the multifaceted nature of infertility, and the physiological effects of vitamin D deficiency are likely to be exacerbated by psychological and environmental factors [8].

While 23.9% of participants mentioned having an ailment connected to vitamin D deficiency, the bulk (72.9%) no longer had any acknowledged conditions, indicating that other factors such as lifestyle or subclinical deficiencies could be at play. Side outcomes from medications, along with high blood pressure (16.6%), pores and skin diseases (14.6%), and gastrointestinal troubles (14.6%), underscore the significance of cautious management of vitamin D supplementation and related remedies.

About 15.6% of participants pronounced experiencing miscarriage, a concerning statistic that could be partly attributed to low vitamin D levels. Furthermore, 30.2% mentioned family records of comparable problems, suggesting a capacity genetic or environmental predisposition that warrants additional investigation [9].

More than half (56.25%) of individuals believed that low vitamin D levels reduced their probability of conceiving, while 38.5% did not (Figures 1-3). These perceptions align with current research indicating the essential role of vitamin D in reproductive fitness. Among contributors, 28.1% reported unsuccessful tries at conceiving, reinforcing the need for interventions to cope with vitamin D deficiencies.

Table 1. Demographics of the participants.

Demographic feature		Frequency	Percentage
Age	Above 20	38	39.58
	25-30	34	35.42
	30-40	14	14.58
	Above 40	8	8.33
Education status	Uneducated	87	90.63
	Educated	9	9.38

Figure 1. Source of vitamin D intake especially during deficiency.

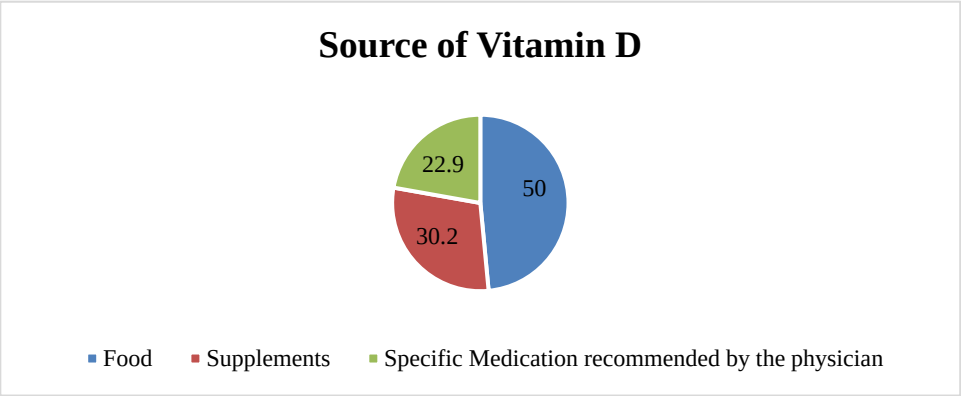


Figure 2. Awareness of connection of vitamin D and infertility.

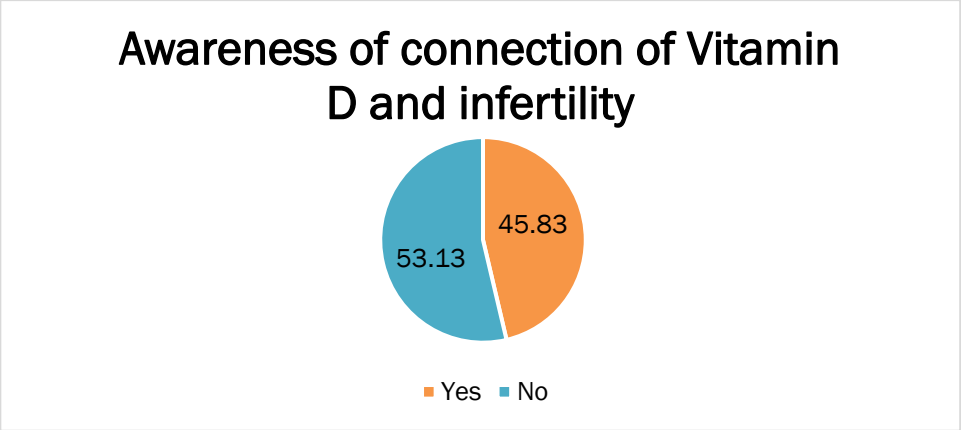


Table 2. Identifying the reason for vitamin D deficiency.

Do you think you are facing this problem due to stress and workload?		
Response	**Frequency**	**Age (%)**
Yes	45	46.875
No	19	19.7917
Maybe	31	32.2917
Do you have any disease-causing vitamin D deficiency?		
Response	**Frequency**	**Age (%)**
Yes	23	23.9583
No	70	72.9167
Have you suffered any side-effects while taking medication?		
Response	**Frequency**	**Age (%)**
Hypertension	16	16.6667
Skin disease	14	14.5833
GI problem	14	14.5833

Table 3. Considering the connection of miscarriages or infertility with vitamin D deficiency.

Have you ever suffered from miscarriage?		
Response	**Frequency**	**Age (%)**

Yes	15	15.625
No	79	82.2917
Do you think low level of vitamin D decrease chances of conceiving?		
Response	**Frequency**	**Age (%)**
Yes	54	56.25
No	37	38.5417
Have you ever tried to conceive but were unsuccessful?		
Response	**Frequency**	**Age (%)**
Yes	27	28.125
No	62	64.5833
Has anyone in your family history experienced this problem?		
Response	**Frequency**	**Age (%)**
Yes	29	30.2083
No	61	63.5417

CONCLUSION

The study highlights the prevalence of vitamin D deficiency and its ability to link to infertility, revealing an attention gap, highlighting the need for public health campaigns, highlighting pressure and workload as contributing elements, and the need for comprehensive healthcare.

FUTURE DIRECTIONS

This observation gives a basis for similar research into the fundamental relationship between vitamin D deficiency and infertility. Longitudinal studies and experimental trials are needed to affirm those findings and discover the effectiveness of nutrition D supplementation in improving reproductive consequences. Public fitness strategies, which include focus campaigns and routine screening for vitamin D ranges, could help mitigate the impact of this deficiency on fertility. By addressing both organic and behavioral factors, a multifaceted method can enhance reproductive fitness results and decrease the load of infertility related to vitamin D deficiency.

SIGNIFICANCE STATEMENT

The study showed a strong association between vitamin D deficiency and infertility, especially in women. The study highlights the need of increased awareness and preventive measures, addressing the vitamin D deficiency through supplementation, dietary intervention and most importantly through educating general population. These measures can be very helpful in improving reproductive health outcome among general population.

DECLARATION OF INTEREST

The authors declare no conflicts of interest related to this study.

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DATA AVAILABILITY

The authors declare that all the data supporting the findings of this study are contained within the paper.

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