Original Article

Pakistan Journal of Public Health
https://doi.org/10.32413/pjph.v14iSpecial.NI.1300
www.pjph.org

Status of Vitamin D levels in Reproductive Age Women of Quetta, Pakistan

Mir Abdul Qadir[1], Nadeem Rashid[2], Yasir Saud Sadiq[3], Muhammad Nasimullah[4], Zia ud Din[5], Imran Khan[1], Ehsan Ladak[1], Safia Mengal[1]

Abstract

Background: This study aimed to assess the Vitamin D status among reproductive-age women in Quetta. No notable studies in recent years have evaluated Vitamin D levels in this population. This study seeks to report the Vitamin D status in this demographic and set the foundation for future strategies to address this issue.

Methodology: This cross-sectional study was conducted on women aged 15-49 years. Demographic information was collected using a proforma, and blood samples for Vitamin D assessment were obtained with consent by trained lady health visitors. Data were analyzed using SPSS 20 and Microsoft Excel 2010.

Results: The results showed that 78.4% of the women were deficient in Vitamin D, 15.3% had insufficiency, 6.4% had sufficient levels, and none had Vitamin D intoxication. Additionally, 61.6% of the participants were illiterate, and 78.4% had a household income of less than Rs 10,000 per month. There was a significant correlation between literacy levels and Vitamin D levels, as well as between income and Vitamin D levels.

Conclusion: There is a consistent trend of suboptimal Vitamin D levels among reproductive-age women, as indicated in previous studies. This study concluded that Vitamin D status in this population is alarmingly low, necessitating immediate attention to improve maternal and neonatal health through educational and interventional strategies.

Keywords: Maternal health; micronutrient deficiency; Vitamin D; women of reproductive age; low-middle income country

How to cite this article: Qadir MA, Rashid N, Sadiq YS, Nasimullah M, Din Z ud, Khan I, et al. Status of Vitamin D levels in Reproductive Age Women of Quetta, Pakistan. Pak J Public Health 2024 Aug. 5; 14(Special.NI):144-9. Available from: https://pjph.org/pjph/article/view/1300 DOI: https://doi.org/10.32413/pjph.v14iSpecial.NI.1300

[1] Institute of Public health, Quetta, Pakistan

[2] University of Balochistan, Quetta, Pakistan

[3] Balochistan Institute of Psychiatry and Behavioural Sciences, Quetta, Pakistan

[4] Balochistan Medical Support Program

[5] Quetta Institute of Medical Sciences Quetta Cantt

Correspondence:
Mir Abdul Qadir
drmirqadir@gmail.com

Submitted: 31-08-2023
Revised: 14-03-2024
Accepted: 29-03-2024
Published: 05-08-2024

Introduction

In many countries throughout the world, status of Vitamin D levels has been a cause is a major public health concern owing to its deficiency in populations and it has been linked not only to deficiency diseases such as rickets, but to a range of common chronic diseases in adulthood including diabetes, cancer, infectious diseases, cardiovascular health, and autoimmune diseases (1). Vitamin D is a fat-soluble seco-steroid that is sometimes referred to as a prohormone rather than a vitamin, because it has the ability to be synthesized under the skin from sunlight (2). Vitamin D is a nutrient that body needs for building and maintaining healthy bones. That's because human body can only absorb calcium, the primary component of bone, in the presence of Vitamin D, Vitamin D regulates the absorption of calcium and phosphorus and facilitating normal immune system function (2). Getting enough Vitamin D is important for typical growth and development of bones and teeth, as well as improved resistance to certain diseases (3, 4).

However, the evidence suggest that Vitamin D has recently been discovered to have an effect on almost all body systems and overall health (5, 6). Vitamin D plays a key role in homeostasis as well as regulation of body functions and its deficiency has been associated with different disorders (7, 8). The common risk factors of altered Vitamin D levels are poverty, not taking proper diet, poor calcium intake, dark pigmented skin, avoiding sunlight and social norms such as indoor living (9, 10). It has been reported that despite abundance of sunlight in South Asia, there is Vitamin D deficiency. The deficiency of Vitamin D is a public health issue in Pakistan and its prevalence in different areas of Pakistan ranges from 70% to 90% (11).

Pakistan currently ranks as the 6th most populated country in the world with highest growth rate of 2.8% in Asia (12). According to the National Nutritional Survey of Pakistan 2011, 68% of pregnant women in Pakistan are found with vitamin D deficiency (13). An overwhelming number of reproductive age women (79.7%) are affected by vitamin D deficiency, with (54.0%) experiencing

moderate vitamin D deficiency and (25.7%) experiencing severe vitamin D deficiency. Vitamin D deficiency is more common in urban (83.6%) than in rural settings (77.1%) (14).

Pakistan is a country with a lot of sunlight exposure across the year which makes it possible for skin to produce Vitamin D. Although there is sunlight exposure throughout the year but still the prevalence of Vitamin D deficiency (VDD) among females is unusually high in Pakistan, that is: 66.8% for non-pregnant females versus 68.9% for pregnant as per the data of National Nutritional Survey of Pakistan 2011. Vitamin D Deficiency is prevalent nationwide and in all the provinces of Pakistan (54.6-80.9%) including Kashmir and Gilgit Baltistan, and the situation is worse in urban areas (72.5% in urban versus 64.3% in rural) (13).

A study was conducted in Quetta, Pakistan in 2021, which included women of reproductive age from all ethnicities in the area. It showed that the housewives in Quetta, Pakistan the risk of Vitamin D deficiency is quite high because stay at home women usually spend most of their day time in cleaning, washing, cooking, managing daily groceries, and other household chores (1).Thus, for women who are busy in household work there is little time spared for self-care and outdoor activities. Cultural factors also have an influence because they wear hijab and have very little exposure to sunlight. In addition, their diet is deficient in Vitamin D rich food items, rendering them at high risk of VDD (15).

VDD is highly prevalent (58.9%) in housewives of Quetta Pakistan (15). Deficiency symptoms of Vitamin D were observed in 58.9% housewives had VDD whereas 41.1% housewives were found non-deficient of Vitamin D in the said study in Quetta (15).

These previous findings in addition to the current Vitamin D status can be helpful in ensuring that the sufficient Vitamin D level for Pakistani pregnant women be maintained during pregnancy in order to ultimately to achieve positive maternal and neonate's health outcomes (16).

Methodology

It was a cross-sectional study that was conducted in November 2018 to October 2019 of the target household. This study design was selected due to its convenience in data collection and accuracy.

Study Population

The women of reproductive age from 15 to 49 years old were included in the study in Quetta. The childbearing age (15-49 years) women were further divided in to 7 sub age groups; Quetta rural and urban halqas (areas) comprise 148,093 and 128,618 households respectively.

Inclusion Criteria

Female residing in a household with in the reproductive age (15-49 years) and willing to participate in the study were included.

Study Duration

The study was conducted from November 2018 to October 2019.

Sample size

A samples of 425 women were randomly collected. The sample size was assessed by employing the formula previously used by Gross, Kielmann, Korte, Schoeneberger, & Schultink, (1997). Formula along with calculated sample size is given below;

$n = \{(4 \times p \times (100-p)\}/ 25$

Where,

n = Sample Size

P= expected prevalence of malnutrition

If expected prevalence is 50% then n= 400

P = Prevalence rate of Malnutrition

In the current study instead of taking calculated sample size (n= 400), 425 reproductive age women were randomly selected to get more reliable data.

Data Collection

The study was conducted on a cross section of the target household. The data for this study was collected from the randomly selected households/women by house to house visits with the help of Lady Health Workers (LHWs). The data regarding socio demographic information and serum biochemistry were collected by trained clinical staff.

Socio demographic information:

Interviews were carried out and a pretested well-structured proforma was used to collect the information from the population which included their age, marital status, pregnancy status, their household income and other related information (NNS, 2001-2002).

Vitamin D estimation

Blood samples were collected and preserved by trained lady health workers after consent. Serum Vit D was determined using Cobas e 411 analyzers (Roche Diagnostics, Germany). Using commercial kits including Vitamin D Total (Series Lot43548301, Ref. 05894913 190, Germany) and Cal Set (Series Lot.27896205. Ref. 05894921 190, Germany) according to manufacturer's instructions.

Data Analysis tools

Statistical software SPSS.20 and Microsoft excel 2010 for windows was used. (17). Statistics of the software used in this study include descriptive analysis.

Ethical Approval

Ethical approval was taken from the ethical committee of University of Balochistan. The purpose of study was explained to the family head thereafter to the respondent individual and with full consent of family head and respondent data was obtained.

Results

Demographic Characteristics of the Population

The demographic characteristics of the population are shown in Table 1.

Table 1. Demographic Characteristics of the Population

Demographic Characteristic	Frequency (%)
Age (years)	
15-19	68 (16)
20-24	63 (14.8)
25-29	65 (15.3)
30-34	69 (16.2)
35-39	67 (15.8)
40-44	48 (11.3)
45-49	45 (10.6)
Status of Literacy	
Illiterate	262 (61.6)
Literate	163 (38.4)
Monthly Household Income	
Up to 10000	333 (78.4)
More than 10000	65 (15.3)
More than 25000	27 (6.4)
Educational Level	
Primary	28 (6.6)
Matric/Madrassa	79 (18.6)
Graduate	48 (11.3)
Postgraduate	8 (1.9)

Status of Vitamin D Levels

Status of Vitamin D levels between the period November 2018 to October 2019 in the reproductive age women residing in the municipal area of Quetta is presented in Figure 1. Serum Vitamin D status-based data of reproductive age women (n=425) revealed that 78.40 % of the observed population could be classified as Vitamin D deficient. The data further indicated that 15.30 % of observed population has been present with Vitamin D insufficiency. Only 6.40% reproductive age women could be classified as Vitamin D sufficient whereas no participant fall under the category of Vitamin D intoxication.

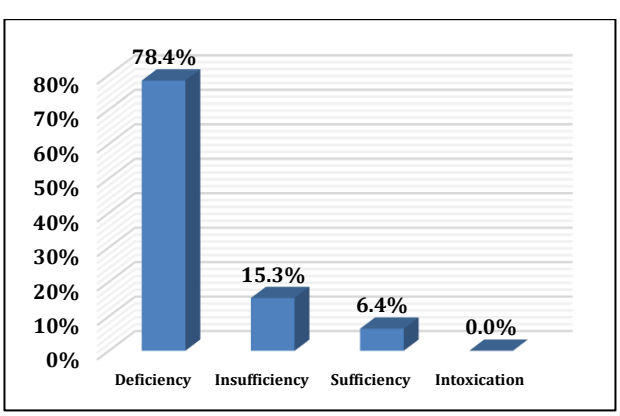

Figure 1. Status of Vitamin D among reproductive age women in Quetta (November 2018 to October 2019)

Reference ranges for Vitamin D (Holick, 2007)
Deficiency (20ng/ml or less)
Insufficiency (Between 21-29ng/ml)
Sufficiency (>30ng/ml)
Intoxication > 150ng/ml

Table 2. Elaborated status of Vitamin D with age group wise distribution in the Quetta municipal area residing reproductive age women

Age Groups	(Vit-D) Deficiency	(Vit-D) Insufficiency	(Vit-D) Sufficiency
	Freq.(%)	Freq.(%)	Freq. (%)
15-19	52(12.2)	13(3.1)	3(0.7)
20-24	43(10.1)	16(3.8)	4(0.9)
25-29	55(12.9)	7(1.6)	3(0.7)
30-34	62(14.6)	5(1.2)	2(0.5)
35-39	53(12.5)	9(2.1)	5(1.2)
40-44	39(9.2)	4(0.9)	5(1.2)
45-49	29(6.8)	11(2.6)	5(1.2)
Total	333(78.4)	65(15.3)	27(6.4)

Vitamin D status of reproductive age women residing in the municipal area of Quetta according to age groups is presented in Table 2 and Mean serum Vitamin D levels in Table 3. The data showed that highest (14.6) percentage of reproductive age women with mean (mean±SD) values (10.10±4.57) pertaining to deficiency were recorded in the age group 30-34, followed by the women of 25-29 years of age with the percentage 12.9 and mean value (9.10±3.75). The least percentage (6.8) with mean value (11.77 ± 5.31) of Vitamin D deficiency indicating women were observed in the age group 45-49.

Highest population (3.8%) with mean value (25.51±3.70) of Vitamin D Insufficient women was observed in the age group 20-24 whereas the least percentage (0.9) of the same category with value (22.45±0.85) was observed in the age group 40-44.

Table 3. Serum concentration of 25(OH)D data (mean ±SD) of reproductive age women residing in the municipal limits of Quetta

Age Groups	(Vit-D) Deficiency	(Vit-D) Insufficiency	(Vit-D) Sufficiency
15-19	10.54 ± 4.38	23.56 ± 2.99	30.82 ± 1.15
20-24	10.12±4.67	25.51±3.70	30.67 ± 0.43
25-29	9.10±3.75	23.24±2.09	25.47 ± 2.94
30-34	10.10±4.57	22.40±2.54	31.10±0.40
35-39	9.76 ± 4.19	24.25 ± 2.68	41.89±14.61
40-44	9.84±5.17	22.45±0.85	33.08±1.95
45-49	11.77 ± 5.31	23.57±2.67	36.37±4.85
Overall	10.18± 0.77	23.57± 1.00	32.77± 4.79

The data regarding women having sufficient levels of blood Vitamin D were recorded highest (1.2%) along with mean values (41.89±14.61,33.08±1.95, 36.37±4.85) in the age group 35-39, 40-44, 45-49. On the other hand, the least 0.5% sufficient Vitamin D levels were observed in the age groups 30-34 along with mean value 31.10±0.40. There was no reported intoxication of Vitamin D in this population.

Table 4. Education and Vitamin D Status

Education	Vitamin D Deficiency	Vitamin D Insufficiency	Vitamin D Sufficiency	P Value
Illiterate	51.5%	7.3%	2.8%	0.001*
Literate	26.8%	8%	3.5%	

**Correlation is significant at the 0.01 level (2-tailed)*

Table 5. Monthly Income and Vitamin D Status

Monthly Income	Vitamin- D			P Value
	Deficiency	Insufficiency	Sufficiency	
10000PM	28.7%	1.4%	0.2%	0.000*
20000PM	20.9%	2.8%	0.7%	
30000PM	16.5%	4.5%	2.4%	
>30000PM	12.2%	6.6%	3.1%	

Discussion

The present study assessed the status of the Vitamin D levels among the reproductive age women in Quetta, Balochistan. Vitamin D is an important micronutrient which is not only crucial to maintain appropriate blood calcium and phosphorus levels, but it may also help to prevent a wide range of chronic diseases. Maintenance of sufficient Vitamin D levels is important for human health (18). Data of present study revealed shocking picture that 94% population of the area under study had below the desirable level of Vitamin D. The elaborated status in respect of Vitamin D further indicated that alarmingly 78.4 % could be categorized as Vitamin D deficient. Vitamin D deficiency has been recognized as a global health concern and is considered to have reached epidemic levels in different parts of the world, affecting more than one billion people (19, 20). According to some studies, the prevalence of Vitamin D deficiency in Pakistan could as high as 70-92% (21). The results of the present study are also supported by the findings of other studies such as a study reported that low prevalence of sufficient level of Vitamin D status among women in Karachi, Pakistan, where it was reported that 84% of participants had serum 25(OH)D <30ng/ml) (22). It is evident that as much as 69%-82% of the South Asian populations in India had 25(OH)D levels in plasma less than the minimum acceptable levels of 20 ng/ml. Another study has reported that 91% of participants had serum concentrations of Vitamin D <20ng/ml (23). Studies conducted elsewhere in Asia have reported similarly high rates of Vitamin D deficiency among women (24-26). Another study conducted in Lahore also reported that inadequate Vitamin D levels are very common among healthy women of child bearing age living in Lahore, Pakistan, only 10% of participants in that study had optimal Vitamin D status of serum 25(OH)D ≥30 ng/ml) (27). Additionally, Vitamin D deficiency and insufficiency are associated with increased risks of pregnancy complications such as gestational diabetes, preeclampsia, and requirement of a primary Caesarean section (28, 29). It is important to note that this is the reproductive age and will predispose the infants of these females to the risk of hypovitaminosis- D and its complication (30). Vitamin D insufficiency may increase the risk of osteoporotic fracture later in life (31) and has been associated with an increased risk of a number of non-skeletal outcomes such as falls, diabetes and rheumatoid arthritis, poor dental health and certain types of cancer (32, 33).

The major source of Vitamin D is the sunshine exposure but globally high levels of prevalence of Vitamin D Deficiency are persistent, even in the regions which are exposed to sunshine throughout the year such as Asian regions. Despite its sub-tropical location and sunny climate, Vitamin D deficiency has been reported to be very common in Pakistan, especially among women: a recent study reported that 90 % of pre-menopausal females had serum 25-hydroxyVitamin D 25(OH) D concentrations (20 ng/mL) (23). A growing literature points to the importance of adequate maternal Vitamin D status in protecting against a wide range of adverse obstetric and neonatal outcomes, including pre-term birth, foetal neurodevelopment and neonatal infection (34, 35).

Although there is no doubt that sunlight is a key contributor to an individual's vitamin D level, their dietary intake can also provide Vitamin D, which is important when exposure to sunlight is limited for any reason (36, 37). However, this can be problematic due to the small number of Vitamin D from food sources; only some oily fish, fish liver oils, and egg yolk contain Vitamin D (38).

A study reported from Beirut, Lebanon that prevalence of Vitamin D inadequacy was 82.3% in females (39). The same study observed a significant association between Vitamin D levels and age. The highest prevalence (71.2%) was found in females in the age group of 19-39 years (39). The findings of the present study are similar to the above stated prevalence as the results of the present study reported the cumulative percentage of Vitamin D inadequacy to be 75.1% in the age groups between 15 to 39 years as presented. The results of the present study showed that there was no participant aged 15-19 years and 25-29 years who had sufficient levels of the Vitamin D. To reflect from the previous literature, a study from Boston by Tangpricha (8) reported that young adults have an equal to greater risk of Vitamin D insufficiency than do older adults. Therefore, in regard to our results where no participant aged 15-19 and 25-29 years, was found with sufficient levels of Vitamin D, it can be stated that the young adults in Pakistani population are also prone to greater risk to Vitamin D deficiency as they were from the reported study of (8).

There are number of factors that are responsible for hypovitaminosis D such as female gender, inadequate Vitamin D or poor choice of diet excessive cooking, urban dwelling, veiling and parity in women (40), inadequate use of Vitamin D supplements in postmenopausal women (41), dress code covering arms, BMI, and low educational levels. Low Vitamin D status attributed to the traditional Islamic type of dressing has been reported previously (42-44). A study on Lebanese adult population has shown that veiled women had almost a three times higher prevalence of severe hypovitaminosis-D (40) than non-veiled women. As it has been previously reported that all age groups of women may

face deficiency for different reasons such due to factors associated with as dietary intake (45) and pregnancy (46) or due to traditional wear (39), therefore in this present study the same reasons could be quoted because other studies conducted in culturally Muslim countries reported the same. However, another study that was conducted in Bangladesh argued that Vitamin D inadequacy was prevalent regardless of age, lifestyle, clothing and cultural influences (47). Therefore, it further needs investigation to ascertain the reasons of this prevalence of hypovitaminosis-D in Quetta city.

In this present study the reference value for blood serum were taken against the standard value where 20ng/ml or less is classified as deficiency, Between 21-29ng/ml as Insufficiency, >30ng/ml as Sufficiency and > 150ng/ml as Intoxication (48). The mean and standard deviation of Vitamin D deficient women of all groups were recorded to be 10.49± 4.61 for deficient, for insufficient levels 23.11± 2.40, 23.32± 0.66 of Vitamin D sufficient, 23.74± 0.02 for optimal levels and 19.70±0.27 for intoxication levels of Vitamin D.

The data in relation to education status and Vitamin D status is presented in table 15 Analysis of observations revealed that among Illiterate reproductive age women 51.5 % were Vitamin D deficient, 7.3% showed insufficiency and 2.8% were recorded as Vitamin D sufficient. The data further revealed that among literate child bearing age women 26.8% were Vitamin D deficient, 8% with the signs of insufficiency and 3.5% confirmed as Vitamin D sufficient.

It is also necessary to note that during the analysis of results it was also observed that women with the higher household incomes had better status of serum Vitamin D than those who had lower household income. Beside other factors, it indicates that household with higher income have better access to the nutritional food to fulfil the dietary needs of the women of reproductive age in those households. A study from Boston (8) also suggests that low income individuals may be at higher risk of lower vitamin D serum levels than others but the said study accounts for other factors as well and does not only solely attribute better Vitamin D serum levels to the higher income. Another study (49) from China also supports the findings of this study that income has an association with Vitamin D levels as it explains that with the lower income index and poor Vitamin D status are significantly associated. However, contrary to the findings to present study and other reported studies above, another study (50) from Karachi reported that they did not find any association between the income and Vitamin D serum levels although that study was carried out in low income peri-urban community in Karachi. But since the results of this study show that with the increase in household income the levels of Vitamin D serum improve in women of reproductive age in Quetta, therefore it needs further investigation to account the factors that play role in women of reproductive age in Quetta which other reported populations lack along with the household income.

Conclusion

Vitamin D deficiency is a chronic problem in reproductive age women as from the previous studies it can be observed that there is a consistent trend of Vitamin D deficiency in women. This study also concluded that the status of vitamin D in reproductive age women is alarmingly low and there is deficiency of vitamin D which calls for an immediate attention to address this problem to improve maternal and neonatal health through educational and interventional strategies.

Ethical Approval:

This study was approved by the ethical committee of University of Balochistan.
Ref. No. 32/CASVAB Date: 13-02-2019

Financial support and sponsorship: The authors received no source of funding in thesis writing or in the publication of this article.

Conflict of interest: None declared.

Authors' Contribution:

MAQ & NR: Design and concept of the study.
MAQ & YSS: Data collection and analysis
MAQ, NR & YSS: Drafting of the manuscript.
MN, ZD, IK, EL & SM: Revisions

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