Original Article

# Hypovitaminosis D: Association of Clinical Disease with Risk Factors and Attributes in Adult Patients

Hypovitaminosis D

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## ABSTRACT

**Objective:** To find the causes of hypovitaminosis D, and its association with different risk factors.
**Study Design: C**ross-sectional study
**Place and Duration of Study:** This study was conducted at the Department of Medicine, Rehman Medical Institute Peshawar from May 2017 to April 2018.
**Materials and Methods:** Four hundred participants between 13-90 years were included. Those with chronic renal disease, hepatic disease, rheumatologic disease and those patients who were bed-ridden and hospitalized were also excluded.
**Results:** There were 128 (32%) males while 272 (68%) were females. 78% of the participants had hypovitaminosis D, most of them didn't get enough sunlight exposure due to indoor activities (74.50%), or were observing parda (55.3%). A positive correlation was seen between vitamin D levels and nature of job ($r=0.48$, $p<0.05$), sun exposure ($r=0.65$, $p<0.001$), egg consumption ($r= +0.312$, $p<0.01$) and fish intake ($r= +0.306$, $p<0.05$) in diet. However, no significant correlation was seen between vitamin D levels and milk intake ($r= +0.03$, $p>0.05$) and gender ($r=0.094$, $>0.05$).
**Conclusion:** Vitamin D deficiency is also an important issue of Pakistani population, which needs to be dealt with appropriate steps.
**Key Words:** Hypovitaminosis D, Risk factor, Cause, Association

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## INTRODUCTION

Vitamin D is a fat-soluble vitamin, which not only helps in calcium absorption from the intestine but also of magnesium and phosphate.[1] It is also essential for different physiological processes in the body and its deficiency causes multiple problems not only in musculoskeletal system but in all other systems of the body as well.[2] From central nervous system to respiratory, cardiovascular and gastrointestinal health, vitamin D plays a beneficial role.[1] It boosts our immunity, has anti-aging effect, helps in combating cancers and prevents pre-eclampsia of pregnancy.[1,3] Hypovitaminosis D has become a global concern; affecting all age groups and both genders.[4]

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South Asian populations have specifically very high prevalence rates. A study in Denmark showed South Asian immigrants having very low hydroxyvitamin D3 levels.[5] Similarly a study in Karachi identified very low levels of hydroxyvitamin D3 in Pakistani adults.[6] Vitamin D is called sunshine vitamin because of sun being the main source of its production in the body. In our region, despite having optimum sunshine throughout the year, lack of vitamin D levels in general population raises a concern. Increasing urbanization, increasing trend of using sun blocking creams, living in densely populated apartments, malnourishment, poverty, illiteracy, lack of awareness, social restraints of women observing pardah and staying indoor, cultural restrain of infants, old staying indoor and adults working from dawn to dusk are the contributing factors of vitamin D deficiency in our population.[7,8] A study done in Lahore determined association of hypovitaminosis D with lifestyle factors but it did not take into account risk factors and attributes other than sunshine and primarily evolved around different lifestyle factors confronting with sunlight exposure.[9] Therefore this study is designed to find the association of low hydroxyvitamin D3 levels with different risk factors and attributes in adult patients coming to OPD of Rehman Medical Institute, after having adequate

chances of sunlight exposure throughout the year naturally.

# MATERIALS AND METHODS

This is a cross-sectional study was carried out at Department of Medicine, Rehman Medical Institute Peshawar from 1st May 2017 to 30th April 2018 and included a total of 400 participants of the age group 13 to 90 years. The criteria for the family status are considered as very good: monthly income Rs. >300,000; good –monthly income between 150,000 to 300,000; satisfactory - monthly income between Rs. 40,000 to 150,000 and poor- monthly income <Rs. 40,000. The consent was taken from all of the participants before including them in the study. Weight was evaluated without shoes by using a digital weight machine. Vitamin D level is measured by CMIA 4th generation Elisa Test. Vitamin D levels ≥30ng/ml was considered normal for all the participants, while it was insufficient between 20ng/ml to 30ng/ml and deficient if <20ng/ml. Demographic information, medical history and drug history were collected by a questionnaire. Patients aged between 13 to 90 years were included. However, patients already suffering with chronic renal disease, hepatic disease, established rheumatologic diseases, bed-ridden and hospitalized were excluded. The data was entered analyzed through SPSS-23. The Eta test was used to find the correlation between dependent variable (vitamin D) and independent variables (sex, use of egg, milk and fish in diet) for nominal (sex, use of egg, milk and fish in diet) by scale data (vitamin D levels) and the p-value <0.05 was considered significant. On the other hand Pearson's correlation test was used to find the correlation between ratio or interval scales such as vitamin D levels and time of sun exposure and the p-value <0.01 was considered significant.

# RESULTS

There were 128 (32%) males while 272 (68%) were females. In our study, There were 283 (70.8%) were married peoples. About 79.6% of the participants weighed between 50kg to 80kg. It is also clear from table 1 that 50% of the people felt that vitamin D was beneficial, while 4.8% thought that it is hazardous for health whereas 45.3% didn't have any knowledge about the effect of vitamin D on the body. Although most of the people belonged to the families having good (37%) or satisfactory (54.5%) living standards were from urban (42.8%), plain areas (76%) [Table 1]. The frequency of hypovitaminosis D was still very high (75.8%). The percentage of the people with vitamin D levels <20 ng/ml was more (44.3%) among females as compared to those among males (17%). Despite of the fact that 53.3% of the people were familiar with vitamin D as compared to those having no knowledge of vitamin D (46.7%). It was also observed that majority worked or performed indoor activities (74.25%) and/or observed pardah (55.25%). Therefore, many of them remained deprived of the proper sun exposure (67%) [Table 2]. The percentage of people with hypovitaminosis D (Vit D levels below 30ng/ml) was greater (86.5%) in those working indoors than those working outdoors (44.7%). Furthermore, people taking egg and fish in diet had better vitamin D levels in comparison to those not taking eggs and fish in their diets on regular basis. Of the 54.04% who did take fish in their diet, did so only occasionally (Table 3). Thus a positive correlation was seen between vitamin D levels and nature of job ($r=0.42$, $p<0.05$), sun exposure ($r=+0.65$, $p<0.001$), and egg ($r=+0.312$, $p<0.05$) and fish ($r=+0.306$, $<0.05$) consumption in diet. However, no significant correlation was seen between vitamin D levels and milk in diet ($r= 0.045$, $p>0.05$), and gender ($r=0.09$, $p>0.05$) [Table 4].

**Table No.1: Demographic information of the patients (n=400)**

| Variable | No. | % |
|---|---|---|
| **Gender** | | |
| Male | 128 | 32.0 |
| Female | 272 | 68.0 |
| **Family** | | |
| Very good | 18 | 4.5 |
| Good | 148 | 37.0 |
| Satisfactory | 218 | 54.5 |
| Poor | 16 | 4.0 |
| **Area of population** | | |
| Urban | 171 | 42.8 |
| Per-urban | 99 | 24.8 |
| Rural | 130 | 32.4 |
| **Marital status** | | |
| Single | 92 | 23.0 |
| Married | 283 | 70.8 |
| Divorced | 12 | 3.0 |
| Widowed | 11 | 2.8 |
| Separated | 2 | 0.2 |
| **Latitude** | | |
| Hilly area | 96 | 24.0 |
| Plain area | 304 | 76.0 |
| **Vitamin D levels (ng/dl)** | | |
| <20 | 245 | 61.3 |
| 20-29 | 58 | 14.5 |
| ≥30 | 97 | 24.3 |
| **Knowledge of effects of vitamin D on body** | | |
| Beneficial | 200 | 50.0 |
| Hazardous | 19 | 4.8 |
| Do not known | 181 | 45.2 |
| **Weight** | | |
| <50 | 31 | 7.7 |
| 50-59 | 75 | 18.7 |
| 60-69 | 117 | 29.3 |
| 70-79 | 126 | 31.5 |
| 80-89 | 43 | 10.8 |
| >80 | 8 | 2.0 |

**Table No.2: Vitamin D levels of different variables (n=400)**

| Variable | Vitamin D levels (ng/ml) | | |
|---|---|---|---|
| | <20 | 20-29 | ≥30 |
| **Gender** | | | |
| Male | 68 (17%) | 20 (5%) | 40 (10%) |
| Female | 177 (44.3%) | 38 (9.5%) | 57 (14.2%) |
| **Knowledge about Vitamin D** | | | |
| Yes | 139 (34.7%) | 33 (8.3%) | 41 (10.3%) |
| No | 106 (26.5%) | 25 (6.3%) | 56 (14%) |
| **Nature of job** | | | |
| Indoor | 221 (55.3%) | 36 (9%) | 40 (10%) |
| Outdoor | 24 (6%) | 22 (5.5%) | 57 (14.3%) |
| **Sun exposure** | | | |
| Yes | 39 (9.8%) | 29 (7.2%) | 64 (16%) |
| No | 206 (51.5%) | 29 (7.2%) | 33 (8.3%) |
| **Pardah observing** | | | |
| Yes | 165 (41.3%) | 27 (6.7%) | 68 (17%) |
| No | 80 (20%) | 31 (7.7%) | 97 (24.3%) |

**Table No.3: Vitamin D levels cross tabulated with diet**

| Variable | Vitamin D levels (ng/ml) | | |
|---|---|---|---|
| | <20 | 20-29 | ≥30 |
| **Egg consumption in diet (n=400)** | | | |
| Yes | 101 (25.3%) | 51 (12.8%) | 70 (17.4%) |
| No | 144 (36%) | 7 (1.8%) | 27 (6.7%) |
| **Fish in diet (n=400)** | | | |
| Yes | 94 (23.5%) | 30 (7.5%) | 74 (18.5%) |
| No | 151 (37.8%) | 28 (7%) | 23 (5.7%) |
| **Frequency of Fish consumption (n=198)** | | | |
| Alternate day | 6 (3%) | 2 (1.0%) | 11 (5.5%) |
| Twice weekly | 6 (3%) | 3 (1.5%) | 31 (15.6%) |
| Once weekly | 11 (5.5%) | 3 (1.5%) | 18 (9%) |
| Occasionally | 71 (35.8%) | 22 (11.1%) | 14 (7%) |
| **Milk in diet (n=400)** | | | |
| Yes | 159 (39.7%) | 43 (10.8%) | 65 (16.3%) |
| No | 86 (21.5%) | 15 (3.7%) | 32 (8%) |

**Table No.4: Correlation of vitamin D with different variables**

| Variable | Correlation coefficient 'r' | P value |
|---|---|---|
| Time of sun exposure | r= +0.69 | <0.001 |
| Use of egg in diet | r= +0.312 | <0.05 |
| Fish in diet | r=+0.306 | <0.05 |
| Nature of job | r= +0.416 | <0.05 |
| Milk in diet | r= +0.045 | >0.05 |
| Gender | r= +0.09 | >0.05 |

# DISCUSSION

Hypovitaminosis D is one of the less recognized major global health threats that humans of this age are facing. People with a variety of biophysical features and ethnic backgrounds, health status and risk factors, and lifestyles have low Vitamin D levels. It is thought that almost a billion people around the world may be suffering from low levels of vitamin D. According to studies, as much as 40–100 percent of the populations in the US are vitamin D deficient.[10] Similar numbers are reported from Europe, Africa, and South Asia.[11] In the UAE, 65.1% adolescents only in one city were either vitamin D deficient or insufficient.[12] When it comes to developing countries such as Pakistan, the situation gets even more worrisome. A study in 2016 showed that only as few as 15.3% of a large sample of people chosen across various age groups, life styles, genders, and locations had normal vitamin D levels.[13] Mansoor et al[14] determined through their study done on healthy male and female population in Pakistan that 69.9% of the subjects were found deficient and 21.1% showed insufficient levels of vitamin D.

As a standard, vitamin D deficiency is defined as 25-hydroxyvitamin D level of less than 20 ng/ml, while values between 21 ng/ml to 29 ng/ml fall in the category of vitamin D insufficiency. Similarly, a level of 30 ng/dl and more are said to have adequate vitamin D.[1] The same cut off values were used in our study.

Even though Pakistan is a country which has widespread availability of direct sunlight, however, data shows Pakistani population is more deficient in vitamin D compared to countries such as Iran, Turkey, Somalia and Norway.[15,16] Pakistan's National Nutrition Survey 2011 also revealed a high prevalence of vitamin D deficiency.[17]

Among the different sources of vitamin D, sunlight is the most important one. Naturally, it depends on a number of factors to reach the skin to form vitamin D, for instance, the geographical location, terrain, weather etc. In our study, participants were residents of the city of Peshawar. Peshawar, even though is a valley, most people live in the general level base of the valley with ample sunshine receiving around 2887 hours of sunshine in a year.[18] However, those deprived of it, be it due to the nature of their jobs, or other cultural factors, developed vitamin D deficiency as recorded in our study. Data collected from a population in Bahrain showed levels to be lower in those following a conservative lifestyle which is exactly what our studies supported whereby most women who observed Pardah were more likely to have hypovitaminosis D.[19] Fish is considered as another excellent source of vitamin D particularly more oils ones such as Salmon and Mackerel after sunlight.[20] Likewise, it was noted among the school going children who took at least half an egg every day before going to school had adequate amounts

of Vitamin D in their blood.[21] Results revealed by our study a positive correlation between dietary consumption of fish and eggs and Vitamin D levels. It is a common misconception that raw milk is a rich source of vitamin D. On contrary, our studies did not reveal any correlation between milk intake and vitamin D deficiency. This is supported by a study published in European Journal of Nutrition pressing the need for further milk fortification with vitamin D because of its poor impact on raising vitamin D levels in the blood of young men.[22]

When it comes to gender, studies from across the world have different results. Our study revealed that among the people from Peshawar valley, women were more likely to suffer from vitamin D deficiency as compared to males most likely due to less body area exposure to sun and a decreased time spent outdoors. These results are supported from data published from Kashmir[23], North India[24] and Karachi.[14,23,24] However, many other studies for instance one done on Saudi adults have the opposite result showing more prevalence among the male.[25] We also shed some light on people having adequate knowledge of vitamin D but yet had developed deficiency of vitamin D slightly more commonly than those who did not know much.

There are other possible theories too about the risk factors leading to vitamin D deficiency such as air pollution, altered vitamin D metabolism, lack of food fortification and intake of supplements etc., but the scope of our study does not look into these factors. In order to clarify the significance of each of possible etiologic factor, large scale randomized studies need to be done across various communities.

# CONCLUSION

Vitamin D deficiency is a global health problem and its causes are multi-factorial. Adequate and effective steps need to be adopted to address this important health issue, like public education, national screening programs, prevention through food fortification, and treatment with vitamin D supplementation. In conclusion vitamin D deficiency is epidemic worldwide, Pakistan and many other sunny countries are no exception. Keeping in mind the consequences of vitamin D deficiency on Pakistani population, this health issue should be addressed with due attention and concrete steps.

**Author's Contribution:**

| | |
|---|---|
| Concept & Design of Study: | Humaira Achakzai |
| Drafting: | Shahzada Imran Khan, Shahzada Bakhtyar Zahid |
| Data Analysis: | Atif Ibrahim, Hammad Shah, Muhammad Yasin |
| Revisiting Critically: | Humaira Achakzai, Momena Faryal |
| Final Approval of version: | Humaira Achakzai |

**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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