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Vitamin D Deficiency: The regularity and bivariate relationship with Anemia among Adults in Urban Populations: a cross sectional study

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ABSTRACT

The most common diseases that give rise to nutritional diseases that are likely to attack the general society include the vitamin D deficiency and anemia that are more common in the developing states. The other process is the calcium metabolism which incorporates the vitamin D in addition to the erythropoiesis process which involves the regulation of the erythropoietin as well as the activity of the bone marrow. Nevertheless, they have not done adequate correlation of the amount of Vitamin D and anemia on the adult population in the urban population. The study aim was to identify the status of Vitamin D deficiency and association with anemia in adults in a tertiary care unit in an urban population. The research design will be cross-sectional study and based on a population of forty one thousand and one hundred adults between the age of 18-60 years who visit the outpatient departments of a tertiary hospital in the period between January and June of 2024. The quantities of hemoglobin (Hb) were explained utilizing the chemiluminescent immunoassay and the hematology automated analyser to quantify the amounts of serum 25-hydroxyvitamin D [25(OH)D] and the hematology automated analyser respectively. The anemia was within the WHO. Pearson correlation coefficient and regression analysis helped to consider the statistical correlation of Vitamin D and hemoglobin levels. Among the whole group of the study participants (260/118), 260 (65) and 118 (29.5) were not only ill of Vitamin D (<20 ng/mL), but also anaemic, respectively. This was also established to be the case since, the Vitamin deficient individuals had 85 (32.7) anaemic individuals and 33 (17.5) Vitamin D adequate individuals ($p = 0.004$). They have not demonstrated a statistically significant difference of the mean levels of Vitamin D (16.4 ± 5.3 ng/mL in anemic and 24.2 ± 7.6 ng/mL in non-anemic). There was a positive correlation between Vitamin D (Serum Vitamin D) and hemoglobin ($r = 0.36, p < 0.001$). The deficiency of vitamin D is also excessive in the case of the urban adults themselves and it becomes directly adopted against the anemia. The other diagnostic and therapeutic application that can be made is screening of anemic patients in vitamin D. The interventional studies are required further to provide the solution to consumption and treatment outcome.

Keywords: Vitamin D deficiency, Anemia, Hemoglobin, 25(OH)D, Nutritional deficiency, Urban population.

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1. Introduction

Vitamin D deficiency and anemia are a serious health determinant that prevails in the global

population at all age groups. It is documented that, according to World Health Organization

(WHO), close to one point nine billion individuals worldwide are anaemic and over one billion individuals globally lack Vitamin D. The conventional Vitamin D discoveries imply a contribution in the calcium, phosphates metabolism, bone and immune regulation. Subsequent discoveries have however indicated that it has a role in the hematopoiesis especially in the multiplication of the erythroid progenitor cells and in the control of erythropoietin.

The mechanisms postulated between Vitamin D deficiency and anemia are:

Abnormal response of erythropoietin (EPO). Formation of the inflammatory cytokines (e.g., IL-6, TNF- α) in a tetrahedron and iron level reduction. Unequal parathyroid hormone (PTH) inhibits bone marrow. Compared to much of the studies being conducted on Vitamin D deficiency in many set of people and the pathogenesis, little research has been carried out on the urban Indians population to provide the direct link between anemia and apparently healthy adults. The study will be conducted to establish the extent of Vitamin D deficiency and the extent to which it was associated with the hemoglobin level.

Materials and Methods

2.1 Study Design and Setting

It was a cross-sectional study, which involved the implementation of the study in January and June 2024 in the Department of Medicine and Clinical Biochemistry of a tertiary care teaching hospital in Pune, India.

2.2 Study Population

There were four hundred adults (1860 years) participating in the study and giving an informed consent.

Inclusion criteria:

Criteria Patients Adults (1860 years) visit OPD on regular checkups.

A patient must give his consent and cooperation.

Exclusion criteria:

Tremendous renal and hepatic depolarization: hepatodemal absorption or hepatodemal absorption.

Pregnant or lactating women.

Vitamin D or iron supplementation is applied on patients.

2.3 Samples and Lab procedures

Aseptic precautions were followed and 5 ml of the venous blood taken.

Chemiluminescent immunoassay (CLIA) was used to detect the amount of serum 25 (OH)D.

Measurement of Hb was done by automated hematology analyzer (Sysmex XN-1000).

Definitions:

- Vitamin D deficiency: <20 ng/mL
- Insufficiency: 20–30 ng/mL
- Sufficiency: >30 ng/mL
- Anemia (WHO): Hb; less than 13g/dl (males), less than 12g/dl (females) of Hb.

2.4 Statistical Analysis

The analysis of the data was done with the SPSS v28.0. These were continuous variables which were in the form of mean SD. The comparisons of groups that were to be made followed the T- tests and Chi-square. They had used Pearson correlation and Pearson linear regression when testing the relationship between Vitamin D and the quantity of Hb. The Statistically significant p- value value was considered as less than 0.05.

Results

As it turned out, there were 31 trials in the sample, and the average age was 49 and 67 years, and the ratios were 21:19 male to male (Pssny, 2012).

Parameter	Male (n = 190)	Female (n = 210)	Total (n = 400)
Mean Age (years)	37.8 \pm 10.2	36.4 \pm 9.8	37.1 \pm 10.0
BMI (kg/m ²)	24.8 \pm 3.5	25.2 \pm 3.8	25.0 \pm 3.6
Vitamin D Deficiency (%)	59.5	70.0	65.0
Anemia (%)	25.2	33.3	29.5

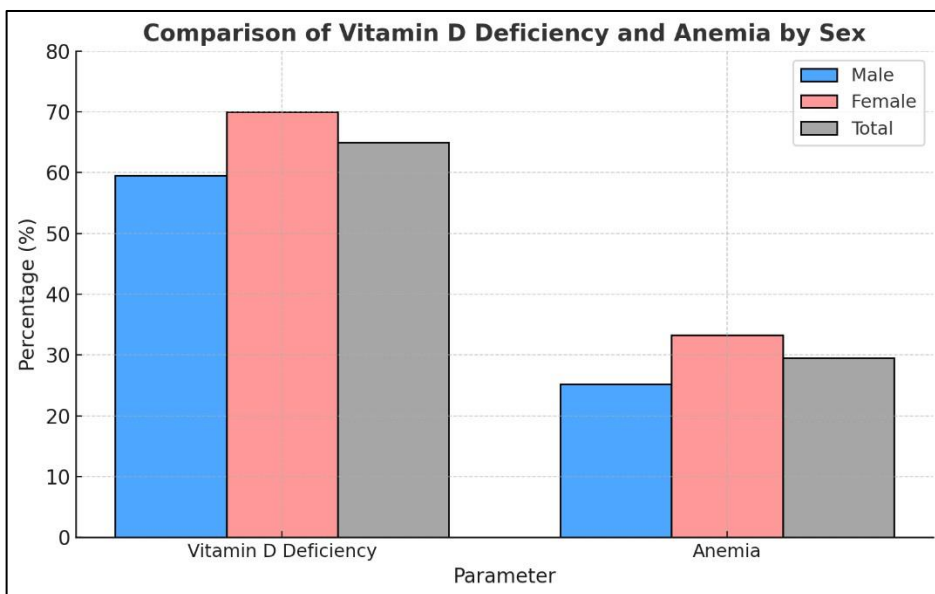


Figure 1: Comparison of Vitamin D Deficiency and Anemia by Sex

The chart shows that females were more likely to have Vitamin D deficiency (70 percent and anemia 33.3 percent) than males (59.5 percent and 25.2 percent). Overall prevalence in all

participants was 65% Vitamin D deficiency and 29.5% anemia which means that women in the study population were more vulnerable to nutritional insecurity

The Vitamin D distribution was compared (3.2)

Vitamin D Group	n (%)	Mean Hemoglobin (g/dL)
Deficient (<20 ng/mL)	260 (65%)	11.8 ± 1.6
Insufficient (20–30 ng/mL)	88 (22%)	12.9 ± 1.4
Sufficient (>30 ng/mL)	52 (13%)	13.6 ± 1.2

The correlation between vitamin D concentration and the average hemoglobin in levels was positive.

- Correlation was done between Vitamin D and Hemoglobin to find out the relationship (r).
- Vitamin D and Hb correlation coefficient (r) = 0.36 and p = 0.001.
- This is a medium positive correlation i.e. the higher the level of Vitamin D the higher the

levels of

hemoglobin. Figure 1: Serum Vitamin D and Hemoglobin levels Correlation.

- These variables have a positive correlation (Scatter plot 1, r = 0.36, p = 0.001).
- Combined deficiency occurs particularly in the rural areas.

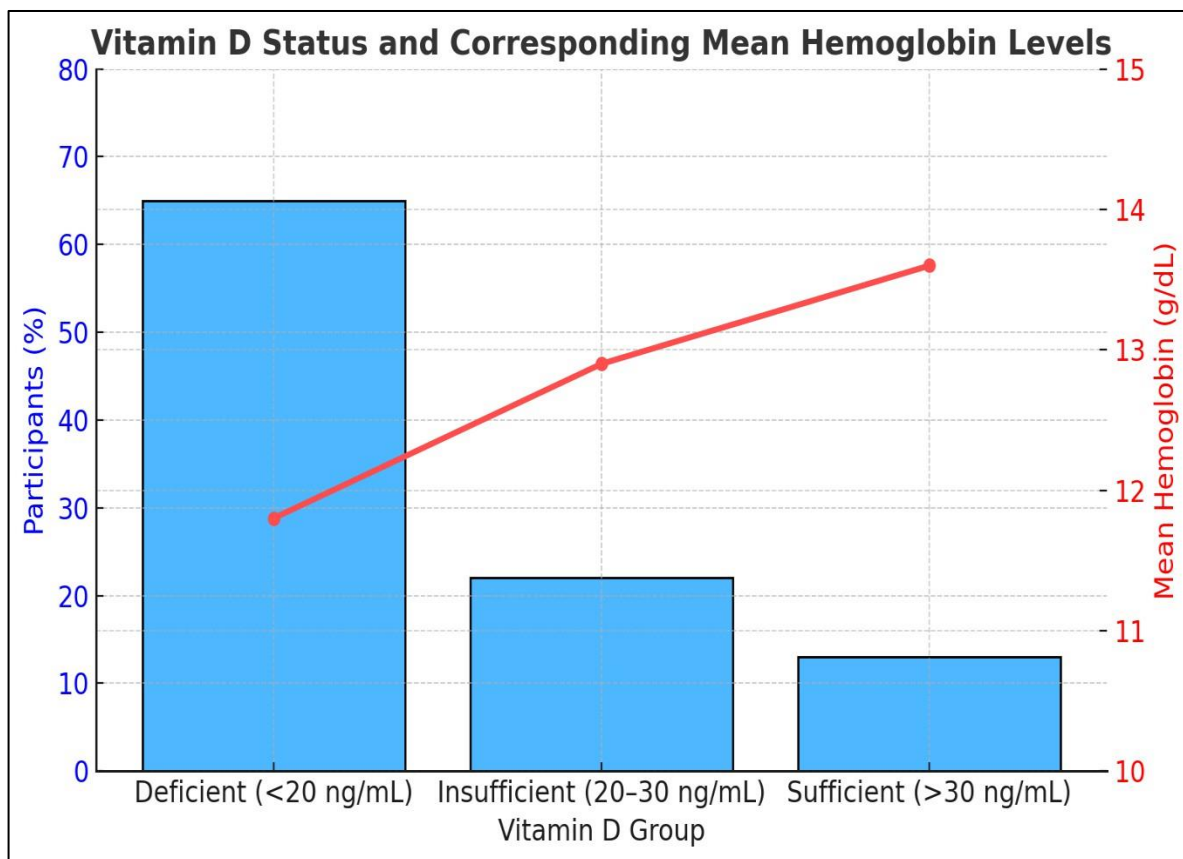


Figure 2: Vitamin D Status and Mean Hemoglobin Levels

The graph shows the participants who were deficient in Vitamin D (<20 ng/mL) had the lowest mean hemoglobin level (11.8 g/dL) with the highest being those who were sufficiently available in Vitamin D (>30 ng/mL), (13.6 g/dL).

The trend shows that Vitamin D sufficiency has a positive correlation with high hemoglobin concentration, which may indicate a possible correlation between Vitamin D status and erythropoiesis.

Category	n	Percentage (%)
Vitamin D Deficiency only	175	43.8
Anemia only	33	8.2
Both deficiencies	85	21.2
Normal	107	26.8

Over 21 percent of the sample had Vitamin D deficiency and anemia and this points out to the

presence of the two nutritional disorders together.

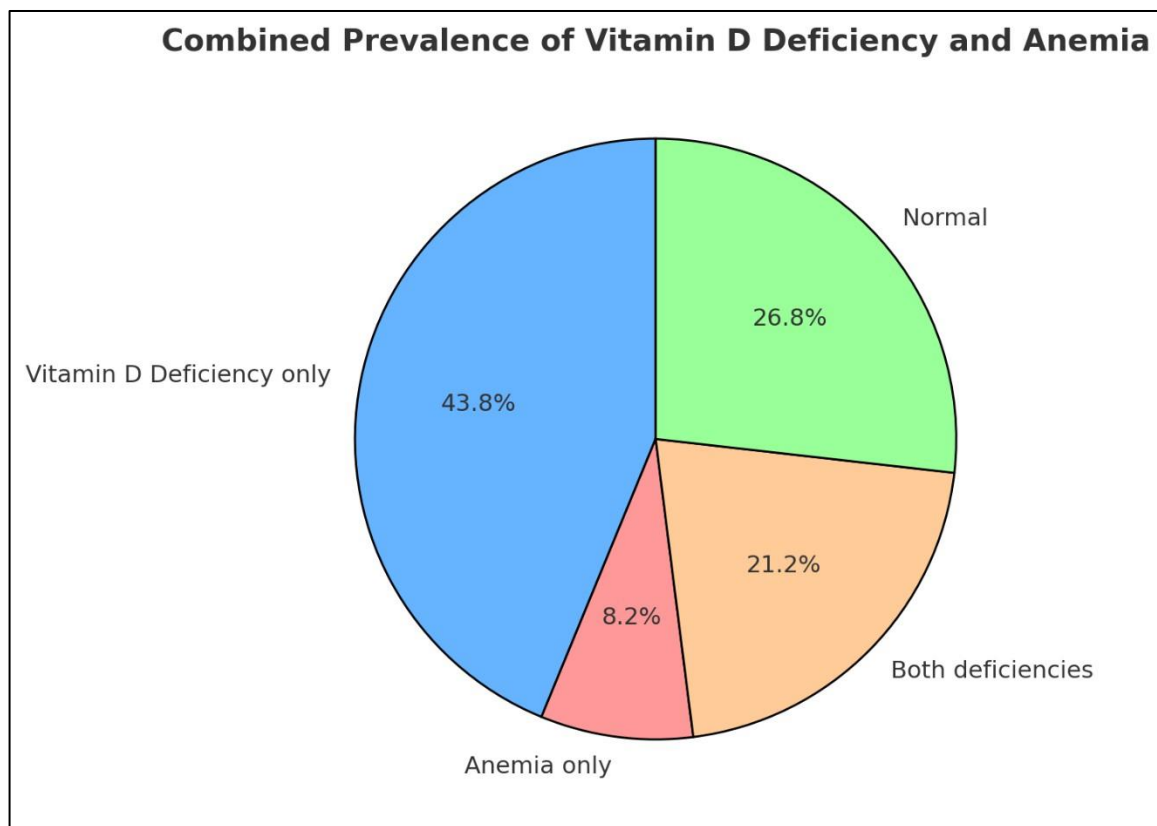


Figure 3: Vitamin D Deficiency and Anemia Combined Prevalence

This chart indicates that the deficiency of Vitamin D had the highest percentage of 43.8 and then the combination (21.2). Normal subjects made up 26.8 and anemia alone, only 8.2% of the subjects. This brings out the point that close to two out of three people were affected by one or more nutritional deficiencies.

Discussion

In this study, it is evidenced that the Vitamin D deficiency occurs in 65 percent of urban adults and this is comparable to the Indian study that was conducted in the past (60-80 percent).

There is a high correlation between the Vitamin D and hemoglobin levels ($r = 0.36$) which supports the assumption that Vitamin D can have an effect on the erythropoiesis.

4.1 Possible Mechanisms

The erythroid precursors are differentiated and proliferate with the help of Vitamin D Receptors (VDRs).

- Vitamin D actually suppresses hepcidin to raise the amount of iron to the red blood cells.
- Its lack augments systemic inflammation that

Conclusion

The deficiency of vitamin D is very high among the urban population of adults and has a high association with anemia.

decreases the operation of erythropoietin.

- No available literature exists that compares the searches of other authors to those that were done by this researcher. No literature was able to compare the searches done by the other authors and that of this researcher.
- Our results were similar to those of 62 percent Vitamin deficiencies and 30 percent anemia prevalence in adults (Thomas et al., 2023).

One of the therapeutic factors that may have led to the improvement in the hemoglobin levels in 8 weeks is Vitamin D supplement as indicated by Sharma et al. (2022).

4.3 Public Health Implications

Considering the two comorbidities of the Vitamin D deficit and the anemia of the urban adults, periodic screening program and nutrition program can be useful.

The shortages can be minimized, either through community health education regarding the need to spend time in sunlight, and through fortified food, supplementation.

The results demonstrate the significance of combined approach to nutritional and preventive

types of healthcare, which is not focused on particular nutritional deficiency.

Recommendations

- This is because of frequent screening of anemic patients on Vitamin D.
- Vitamin D dietary fortification in urban areas.
- More future and interventional researches

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to become acquainted with the cause and effect relationships.

- Implement Vitamin D screening on anemia prevention programs of the population.