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RESEARCH ARTICLE
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ARE LOW VITAMIN D LEVELS FUELING ANEMIA IN YOUNG ADULT WOMEN?

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ABSTRACT

Background: Anemia and Vitamin D deficiency are among the most common health problems caused by deficiency of micronutrients. The objective of the current study is to determine the association of anemia with Vitamin D deficiency in young adult females in the Mekran division, Balochistan.

Methodology: This cross-sectional study was conducted in Teaching Hospital Turbat from August 2020 to Feburary 2021 for Six Months. A total of 144 females aged between 16-45 were included in this study after getting informed consent. After collecting sociodemographic data, 10cc blood was collected to analyse Vitamin D levels and to determine anemia.

Results: The mean age of the study participants was 26.54 $\pm$ 4.86 years. Among 143 study participants, 67 (46.5%) were suffering from anemia. Among 143 participants 89 (61.8%) suffered from Vitamin D deficiency. A significant association was found between Vitamin D deficiency and anemia in young females on the ChiSqaure test ($p < 0.005$). Hemoglobin Level and mean corpuscular volume was significantly low in Vitamin D deficient participants in comparison to Vitamin D sufficient Participants.

Conclusion: A considerable proportion of female young adults suffer from both low vitamin D levels and anemia.

Keywords: Anemia, Deficiency, Hemoglobin, Vitamin D.

INTRODUCTION

Vitamin D is a fat-soluble vitamin. A vitamin D insufficiency is characterized by a serum level of Vitamin D falling below the reference threshold of 20 ng/ml or 30 nmol/L. A vitamin D deficit is defined as a serum 25(OH)D level ranging from 30 to 50 nmol/L or 20 to 29 ng/ml. Serum 25(OH)D levels are deemed adequate upon attaining 30 ng/ml or 50 nmol/L.

According to the Endocrine Society's clinical practice standards, a serum 25(OH) vitamin D level below 20 ng/dL is classified as deficient, while a level between 20 and 30 ng/dL is deemed

inadequate.[1]

Vitamin D plays an essential function in sustaining human health. Inadequate vitamin D may cause harm to the bones and other organs. Vitamin D is crucial for several physiological activities, including immune system control, cell differentiation and proliferation, as well as the creation and maintenance of robust bones and muscles.[2-3] Deficiencies in this vitamin may lead to severe conditions such as cancer and diabetes.[4]

Anemia is a prevalent nutritional issue in public health that may exacerbate chronic conditions such as kidney and heart disease, leading to tiredness, dyspnea, and reduced physical ability, and in extreme cases, cardiovascular morbidity and death. Anemia may arise from several sources, including dietary deficiencies such as iron, folate, vitamins B12 and B6, in addition to blood loss, infection, hemoglobinopathies, and inflammation. Anemia, due to its multifaceted origin, may be categorized into many subtypes, including iron deficiency anemia, nutritional deficiency anemia, and anemia of inflammation (sometimes referred to as anemia of chronic illness). Vitamin D may positively influence anemia, especially anemia of inflammation, by down-regulating inflammatory cytokines and hepcidin.[5-6]

Research indicates that vitamin D may enhance iron availability by down-regulating pro-inflammatory cytokines and hepcidin, and there is also evidence that vitamin D may facilitate erythropoiesis.[7]

Vitamin D deficiency can impair iron metabolism by influencing hepcidin, a crucial regulator of iron homeostasis. Hepcidin is a hepatic hormone that regulates iron absorption and the mobilization of iron from bodily reserves. In vitamin D insufficiency, hepcidin expression typically rises, frequently alongside increased pro-inflammatory markers such as interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF-α), and C-reactive protein (CRP). These inflammatory cytokines enhance hepcidin synthesis, hence diminishing iron uptake and its mobilization from macrophages and hepatocytes. The diminished presence of iron in the bloodstream obstructs hemoglobin synthesis, adversely affecting red blood cell production.[8]

Elevated hepcidin levels and increased inflammation may lead to anemia in persons with vitamin D insufficiency, namely anemia of chronic disease or inflammation, characterized by the sequestration of iron and its improper utilization. Increased levels of IL-6, TNF-α, and CRP exacerbate the inflammatory condition, hence aggravating iron dysregulation and anemia. This may present as weariness, weakness, and dyspnea resulting from the diminished oxygen-carrying capacity of the blood. sufficient vitamin D can decrease hepcidin levels and mitigate inflammation, enhancing iron status and reducing the risk of anemia.[9-10]

Studies exploring Vitamin D deficiency and anemia in young females are limited especially in the region of Balochistan so the current study aimed to determine the association of Vitamin D with anemia in young females of the Mekran division, Balochistan, Pakistan.

METHODOLOGY

This cross-sectional study was conducted in Teaching Hospital Turbat from August 2020 to Feburary 2021 for Six Months. A total of 144 females aged between 16-45 were included in this study after getting informed consent. Females diagnosed with chronic diseases, on medications for Vitamin D deficiency or on medication for anemia were excluded from the study. After collecting sociodemographic data, 10cc blood was collected to analyse Vitamin D levels and to determine anemia. All the collected data was entered in SPSS version 21. Qualitative data was presented in terms of frequencies. An Independent Sample t-test was used to measure the difference in hematlogical parameters among Vitamin D sufficient and Vitamin D deficient participants. The association between Anemia and Vitamin D level was measured by applying Chi-square test. The P-value of 0.05 was considered significant.

RESULTS

The mean age of the study participants was 26.54 $\pm$ 4.86 years. Among 143 study participants, 67 (46.5%) were suffering from anemia while 77 (53.5%) were non anemic. Among 143 participants 89

(61.8%) were suffering from Vitamin D deficiency while 55 (38.2%) participants had sufficient levels of Vitamin D. A significant association was found between Vitamin D deficiency and anemia in young females on the ChiSqaure test ($p < 0.005$).

Table I: Association of Vitamin D Level with Anemia.

Variable	Sufficient Vitamin D (n = 55)	In Sufficient Vitamin D (n = 89)	Chi-square X^2	p - Value
GENDER				
Anemic	13 (9%)	54 (37.5%)	18.74	**0.000***
Non Anemic	42 (29.2%)	35 (24.3%)		

Table II: Mean difference in the hematological parameters among Vitamin D sufficient and Vitamin D Deficient Participants.

Parameter	Sufficient Vitamin D Mean + S.D (n = 55)	In Sufficient Vitamin D Mean ± S.D (n = 89)	p-value
WBCs (per mm^3)	8.23 ± 4.01	8.57 ± 3.55	0.599
RBCs (million/mm^3)	5.21 ± 1.63	5.06 ± 3.73	0.205
Hb (g/dl)	12.32 ± 1.32	11.25 ± 1.44	**0.000***
Hct (%)	38.30 ± 6.66	36.26 ± 7.82	0.124
MCV (µm^3)	80.02 ± 11.25	74.91 ± 14.11	**0.025***
MCH (pg)	26.60 ± 5.93	25.56 ± 6.95	0.294
MCHC (%)	37.63 ± 17.58	31.54 ± 13.05	0.182
PLT (10^9/L)	286.16 ± 66.2	304.73 ± 82.69	0.161
LYM (%)	34.72 + 20.56	32.20 + 12.26	0.138
NEUT (%)	51.59 + 14.16	54.43 + 14.62	0.164

DISCUSSION

Inadequate levels of vitamin D and iron are often found together. Among the most common nutrient deficiencies, vitamin D and iron are two of the most common. These associations may have their roots in the fact that iron and vitamin D metabolism interact mechanistically. Several clinical observations have also hinted at vitamin D's involvement in erythropoiesis. Both the direct and indirect associations between vitamin D and hemoglobin, mediated by erythropoietin, could account for the strong relationship between the two.Hepcidin, a hepatic hormone that rises in response to iron excess and inflammation, may play a role in maintaining vitamin D and iron homeostasis by inhibiting the absorption and release of iron from reticuloendothelial macrophages.

Vitamin D insufficiency increases the risk of anemia, particularly iron deficiency anemia, in otherwise healthy teenage girls and young women, according to research by Lee et al.[11] Vitamin D2 supplementation in children with chronic kidney disease (120,000 or 240,000 IU over 3 months) considerably decreased the requirement for erythropoiesis-stimulating agents, according to Rianthavorn et al.[12]

Additionally, the study by Sim J. J. et al. showed that there is a strong correlation between vitamin D levels and anemia in pregnant women.[13] Our findings are consistent with a prior Egyptian study that found a higher incidence of vitamin D deficiency in Egyptian teenage girls with iron deficiency anemia compared to healthy controls. Vitamin D status has been linked to higher Hb concentrations and lower risk of anemia, especially inflammatory anemia, according to a systematic review.[14]

Vitamin D insufficiency is substantially linked to iron deficiency and/or anemia, according to a large-scale retrospective study of patients who sought out regular checkups at the family medicine polyclinics of a training hospital.[15] Our study's findings corroborate those of alaswad et al., who found that pharmacy students with anemia also suffer from vitamin D deficiency.[16]

Many factors contribute to the high prevalence of anemia and vitamin D insufficiency in young women, making them serious health concerns. The increased nutritional demands of adolescence,

along with factors like menstruation and poor dietary intake, make this population prone to anemia, especially iron-deficiency anemia. Fatigue, weakness, and vertigo are some of the symptoms of this condition that can have a major impact on daily functioning and overall quality of life. Conversely, vitamin D deficiency is common, particularly in areas where people don't get enough sun or eat enough vitamin D-rich foods. Vitamin D deficiency is worrisome because it affects immune function, mood regulation, bone health, calcium absorption, and immune function. Osteomalacia and other bone problems, as well as an increased risk of osteoporosis in the long run, can affect young women who do not get enough vitamin D. Optimal health promotion and the prevention of problems later in life require addressing both anemia and vitamin D deficiency.

CONCLUSION

This study's findings reveal a substantial correlation between vitamin D insufficiency and anemia in young females, underscoring the necessity of addressing vitamin D levels as a potential component in the management and prevention of anemia. Approximately 50% of participants experienced anemia, and over 60% displayed vitamin D insufficiency, highlighting the extensive prevalence of these disorders among the investigated community. The role of vitamin D in erythropoiesis and the regulation of iron metabolism, via its anti-inflammatory properties and effect on hepcidin levels, indicates that sufficient vitamin D levels may beneficially affect anemia, especially in areas such as Balochistan, where both deficiencies are common. These findings necessitate additional research to investigate the therapeutic efficacy of vitamin D supplementation in the prevention and management of anemia. Public health initiatives must prioritize enhancing vitamin D consumption and awareness among young females to reduce the likelihood of vitamin D insufficiency and anemia, hence improving their overall health outcomes.

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