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The Relationship between Vitamin D Deficiency andAnemia and it's Risk in Females

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ABSTRACT

Vitamin D, a steroid hormone, is essential for human health and has a relationship with anemia this study aims to examine the relationship between serum vitamin D levels and hematological parameters, and its risk. Material and Methods: Data Collected: 248 patients were randomly selected from Ibensina Clinic in Derna City, Libya, between April 2023 and November 2023 and whose vitamin D, ferritin, and HBG, levels were checked were examined. The first set included (Sex, Age, Level of Vit D, Ferritin, and HGB). Results: Ferritin distribution shows that 45.2% of individuals have normal levels, with only 1.2% presenting high levels. However, 29.4% have low and 24.2% have severe deficiencies in ferritin, pointing to iron deficiency in about half of the sample. The mean ferritin level is 3.12 with a relatively high standard deviation (2.07), suggesting variability in iron storage across the group. A majority (62.5%) of the participants have normal hemoglobin levels, suggesting good oxygen-carrying capacity in a large part of the sample, the correlation coefficients from this dataset stack up against those in previous studies. For instance, a correlation coefficient of 0.217 for Vitamin D and Ferritin suggests a moderate positive relationship. If previous studies reported similar values, that consistency can reinforce the reliability of your findings. The P-values indicate the statistical significance of the correlations. In your dataset, Vitamin D has significant correlations with Ferritin (P = 0.001) and Hemoglobin (P = 0.047), as well as a strong negative correlation with Age (P = 0.000). Conclusion: There is a strong relationship between vitamin D deficiency, anemia and age, and the Research shows that vitamin D deficiency has risks such as deficiency and ferritin, And hemoglobin

1. INTRODUCTION

The biological functions of vitamin D are receiving current attention, which has resulted in the scientific investigation of the clinical consequences of vitamin D deficiency. Alongside its job in regulating bone and mineral metabolism, vitamin D has been linked to a broad assortment of biological actions, including strengthening muscle. (Sim et al., 2010), A public health problem is vitamin D deficiency, which may lead to bone loss in density, leading to osteoporosis, fractures, and rickets in children. (Melissa F. Young, 2023).

Lately, researchers have been looking into the impact of vitamin D on hyperandrogenism development in females. The study's results showed that for women with hyperandrogenism, the concentration of 25 (OH) D in the blood is lower than in healthy women. Lower levels of 25 (OH) D in the blood are correlated with insulin resistance. When the body becomes resistant to insulin, this condition is called hyperinsulinemia. In turn, insulin acts as a stimulant for luteinizing hormone. Under the luteinizing hormone's influence, theca cells undergo hyperplasia and produce more androgens.(Bakhtiyorovna, 2024), The World Health Organization (WHO) has defined anemia as a hemoglobin (Hb) level of less than or equal to 6.83 millimole/ liter (mmol/L) (less than or equal to 11 gram/deciliter (g/dL)) and serious anemia as one with a Hb level of less than or equal to 4.34 mmol/L (less than or equal to 7 g/dL), (Das et al., 2023), there is a relationship between kidney failure and the percentage of Ca+, Vit D, and PTH, and there is no relationship between kidney failure and Gender and age (Eljamay et al., 2024), Over the years, thick, strong, luminous hair has been associated with health and beauty. Hair loss (alopecia) is not only an indicator of probable systemic diseases but adversely affects quality of life due to its impact on beauty and self-image. (Durusu Turkoglu et al., 2024), a significant relationship between vitamin D situations, age, gender, platelet position, monocyte, MCV, neutrophil, protein, HDL, calcium, and vitamin B12 situations. Besides the treatment and clinical examinations, it's necessary to cover and estimate the vitamin D situations of the cases, as well as hematological, biochemical and endocrinological parameter changes. Keywords Vitamin D, hematological parameters, body mass indicator (Ergenc et al., 2023), 25(OH) D3 insufficiency was significantly associated with anemia in cases with ESRD. Randomized controlled trials are demanded to determine whether vitamin D supplementation can ameliorate anemia in these cases. (Kim et al., 2016.), Vitamin D insufficiency is associated with increased threat of anemia, especially iron insufficiency anemia, in healthy womanish children and adolescents. still, the association is downgraded after adaptation for iron insufficiency. (Lee et al., 2015), a close relationship between vitamin D insufficiency and anemia in diabetic cases.(M. El Hammady et al., 2024), Vitamin D & iron supplementations are fairly safe and cost-effective interventions during gestation, thus we recommend probing and treating all pregnant women for Vit D insufficiency along with anemia to help numerous complications, particularly PPD.(Nasreen et al., 2023), Prevention, identification and treatment of anemia and Vitamin D insufficiency in pregnant women feel necessary, as they're explosively associated with postpartum depression and other complications.(SZA NASREEN, 2023.), the optimal approach to treating womanish cases with CTE entails carrying a detailed memory concerning the a etiology, conducting a comprehensive physical examination, and requesting a blood test to identify implicit beginning conditions. no significant difference between the prevalence of iron, vitamin B12, and vitamin D scarcities among youthful women diagnosed with CTE and the control group. (Irem Nur Durusu Turkoglu, 2024.), Vitamin D input is n't related to anemia, while nutritive status is n't associated with anemia (p- value 0.787). inadequate iron input may increase the threat of anemia, whereas a good vitamin D and acceptable salutary position may lower this threat. thus, farther exploration is demanded on anemia knowledge education during gestation. (Baarizah Febriana Badri, 2023.), Vitamin D insufficiency is infrequently considered or treated in critically ill cases. still, we lately reported three cases of lifechanging hypocalcemia secondary to vitamin D insufficiency pressing implicit acute complications. The frequence of vitamin D insufficiency and its significance in the ferocious care unit (ICU) are unknown. (Sébastien Colette, 2009), Grounded on the weak and inconsistent correlations between CRP or AGP and 25(OH) D, there's no explanation to acclimate for these inflammation biomarkers when estimating population frequence of vitamin D insufficiency in PSC or FRA (Melissa F. Young, 2023). Relationship between, age, gender, skin color, smoking, nutrition, expose to sun, sporting, diabetes, hypertension, different type of diseases, and other type of vitamins, there is also a direct proportion between vitamin D deficiency and S. Ca+ deficiency.(Eljamay, 2022), there is a relationship between kidney failure and the percentage of Ca+, Vit D, and PTH, and there is no relationship between kidney failure and Gender and age.(Eljamay et al., 2024),

2. METHOD

Data Collected: 248 patients sample randomly selected from Ibensina Clinicin Derna City, Libya, between April 2023 and November 2023 and whose vitamin D, ferritin, and HBG, levels were checked were examined. And the first set included (Sex, Age, Level of Vit D, Ferritin, HGB).

The blood sample: examined for vit by 25(OH) Vitamin D ELISA kit is a Competitive ELISA kit for the measurement of 25(OH) Vitamin D in Human in Plasma, Serum samples, and for ferritin-by-Ferritin ELISA Kits.

Using ELISA kit Tips and tricks and how to run an Invitrogen ready to use coated ELISA kit Invitrogen ELISA kits allow you to measure target-specific proteins with confidence. In this video we will show you how to run a typical ready to use Invitrogen ELISA kit.

The specific protocol sheet for the kit you plan to run, Instrument Colorimetric Microplate Reader.
For HBG, assay has been validated whole blood and RBCs from human, chicken and dogfish. Samples containing visible particulate should be centrifuged prior to using.
Whole Blood HB% Whole blood must be diluted ≥ 1:2 with Hemoglobin Sample Diluent prior to running in the kit.
Red Blood Cell/Erythrocytes
RBC samples should be lysed with Hemoglobin Sample Diluent prior to running in the kit.
For Serum and Plasma: Use the Detect X® Hemoglobin High Sensitivity Detection Kit, K013-HX1/HX5.
Use all samples within 2 hours of dilution. Hemoglobin Meter Hemoglobin Test Meter Hemoglobin Test Kit Hemoglobin Analyzer
Statistical analysis: Data analysis was done with SPSS 27.0 and results were evaluated at 95% confidence level. In the study, while the relationship between the age and Level of Vit D, Ferritin, HGB, was analyzed with the P-Value test, the normal distribution of quantitative variables was examined with the descriptive
statistic

3. ETHIC APPROVAL

For research to be considered ethical, We collected data from a private medical laboratory after permission by the lab manager to use the data

4. RESULT

Table (1) show that the Predominant Age Group: The highest proportion (22.6%) falls within the 26-30 years age group, indicating a strong representation of young adults. Balanced Distribution Across Other
Groups: There's a fairly balanced distribution in the other age brackets, especially between 16-20 years (12.1%) and 36-40 years (12.9%), suggesting a relatively even spread among adults. Limited Representation of Very Young and Elderly: Both the youngest group (10-15 years) and the oldest group (over 81 years) are minimally represented, each at 0.4%. This suggests a focus on middle-aged and younger populations. Decline in Older Age Groups: Representation noticeably decreases after the age of 50, with percentages falling to 6.5% and lower, indicating fewer older participants.

Table (1) frequency and percentage of age group

Age	N(%)
10 - 15 years	1(0.4)
16 - 20 years	30(12.1)
21 - 25 years	36(14.5)
26 - 30 years	56(22.6)
31 - 35 years	31(12.5)
36 - 40 years	32(12.9)
41 - 45 years	26(10.5)
46 - 50 years	16(6.5)
51 - 55 years	9(3.6)
61 - 65 years	5(2.0)
66 - 70 years	4(1.6)
76 - 80 years	1(1.6)
> 81 years	1(0.4)
Total	248(100)

The data from Table 2 presents the frequency and percentage distribution, along with mean and standard deviation, for Vitamin D, Ferritin, and Hemoglobin (HGB) levels in a sample of 248 individuals. Here's a discussion of the findings: Nearly half (46%) of the individuals have severely low Vitamin D levels, while only a small percentage (2.4%) have high levels. The mean Vitamin D level is quite low (4.44) with a standard deviation of 1.81, indicating that a significant portion of the sample might have deficiencies. This highlights a potential concern for widespread Vitamin D deficiency in this population, which could lead to health issues related to bone and immune health. Ferritin distribution shows that 45.2% of individuals have normal levels, with only 1.2% presenting high levels. However, 29.4% have low and 24.2% have severe deficiencies in ferritin, pointing to iron deficiency in about half of the sample.
The mean ferritin level is 3.12 with a relatively high standard deviation (2.07), suggesting variability in iron storage across the group. A majority (62.5%) of the participants have normal hemoglobin levels, suggesting good oxygen-carrying capacity in a large part of the sample. However, 23% have moderately low and 6% have severely low HGB levels, indicating anemia in a substantial minority of the population. The mean HGB level is 2.48, with a standard deviation of 1.95, suggesting some participants experience considerably low HGB levels.

Table (2) frequency, percentage, Mean, Std. Deviation of Vit D, Ferritin, and HGB

	Normal	High	Low	Moderate Low	Sever Low	Mean	Std. Deviation
Vit D	42(16.9)	6(2.4)	72(29.0)	14(5.6)	114(46.0)	4.4435	1.80554
Ferritin	112(45.2)	3(1.2)	73(29.4)	0(0.0)	60(24.2)	3.1169	2.06926
HGB	155(62.5)	0(0.0)	21(8.5)	57(23.0)	15(6.0)	2.476	1.9465
Total	248(100.0)						

In table (3) Correlation Strength: Examine how the correlation coefficients from this dataset stack up against those in previous studies. For instance, a correlation coefficient of 0.217 for Vitamin D and Ferritin suggests a moderate positive relationship. If previous studies reported similar values, that consistency can reinforce the reliability of your findings. The P-values indicate the statistical significance of the correlations. In your dataset, Vitamin D has significant correlations with Ferritin (P = 0.001) and Hemoglobin (P = 0.047), as well as a strong negative correlation with Age (P = 0.000). Comparing these significance levels with previous datasets can help determine if your findings align with established research. Differences in how Vitamin D, Ferritin, and Hemoglobin levels were measured can also impact the results. Consistency in measurement techniques across studies can lend credibility to comparisons.

Table (3) Correlations between Vit D, Ferritin, and HGB

	Correlations	Vit D
Ferritin	R	0.217**
	P-Value	**0.001**
HGB	R	0.126*
	P-Value	**0.047**
Age	R	-0.254-**
	P-Value	**0.000**
	N	248
**. Correlation is significant at the 0.01 level (P-Value).		
*. Correlation is significant at the 0.05 level (P-Value).		

Figure 1 illustrated that the graph displays the relationship between Vitamin D levels and Ferritin levels across different categories. Here's a detailed analysis, Among participants with normal Vitamin D, the majority (30 individuals) also have normal Ferritin levels., A smaller number (6 individuals each) have low and severe low Ferritin levels, suggesting that while normal Vitamin D often corresponds to normal Ferritin, some cases still show Ferritin deficiency despite adequate Vitamin D, Few individuals have high Vitamin D, and within this group, there is a sparse distribution across Ferritin levels (1 each in normal and high, 2 in low, and 2 in severe low), This limited representation indicates that high Vitamin D is rare and its relationship to Ferritin levels is not clear due to the small sample size, Participants with low Vitamin D show a range of Ferritin levels, have normal Ferritin, indicating that low Vitamin D does not always result in low Ferritin., However, a significant portion has low (19) or severe low (18) Ferritin levels, suggesting a trend where low Vitamin D is often associated with lower Ferritin levels This group has fewer participants overall, but most have normal Ferritin (7 participants), while a few have low (5) and severe low (2) Ferritin, This category indicates a mixed outcome where moderate Vitamin D deficiency sometimes correlates with normal Ferritin, though cases of low Ferritin still appear, The largest group with severe low Vitamin D has the highest occurrences of both normal and low Ferritin, 40 participants have normal Ferritin, but 41 have low Ferritin, and 32 have severe low Ferritin, This pattern suggests a strong association between severe Vitamin D deficiency and poor Ferritin levels. While some with severe low Vitamin D still maintain normal Ferritin, the majority have insufficient Ferritin, hinting at a significant link between the two deficiencies.

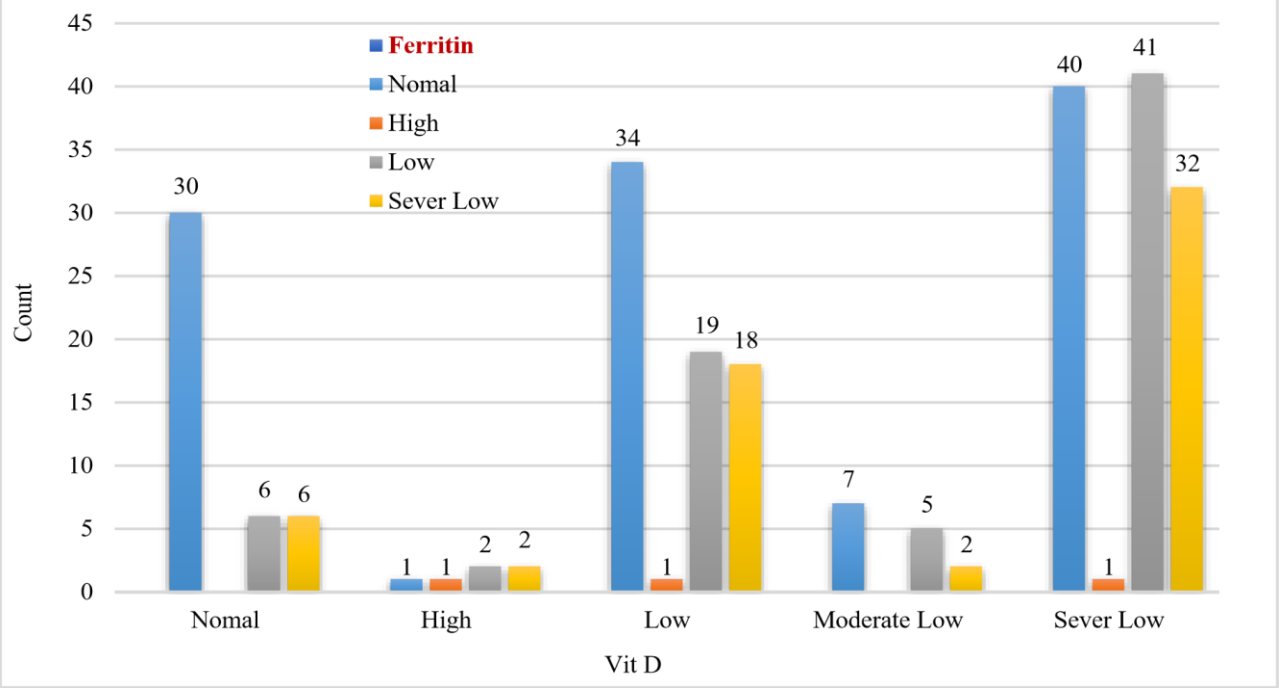

Figure (1) relationship between Vitamin D and Ferritin

The data presented in Figure 2 suggests an association between Vitamin D levels and HGB (hemoglobin) levels, with varying degrees of impact across different Vitamin D categories. For individuals with normal Vitamin D, most also have normal HGB, suggesting that sufficient Vitamin D is generally associated with adequate HGB. However, a minority within this group show moderate or low HGB levels, indicating that normal Vitamin D alone does not prevent all cases of reduced HGB. In individuals with high Vitamin D, the sample size is small, limiting strong conclusions. While most have normal HGB, the presence of a few with low or severely low HGB suggests that higher Vitamin D does not guarantee higher HGB levels. Participants with low Vitamin D display a broader range of HGB levels. Many maintain normal HGB, but a larger subset has reduced HGB, suggesting that low Vitamin D may elevate the risk of anemia or reduced HGB for a substantial portion of this group. Similarly, the moderate low Vitamin D group shows variability, with a slight increase in moderate low HGB cases, though most retain normal HGB levels.

The severely low Vitamin D group shows a more pronounced trend: while a significant number maintain normal HGB, there is a notable increase in participants with moderate to severe low HGB.

This pattern suggests a stronger association between severe Vitamin D deficiency and the likelihood of lower HGB levels, although exceptions exist. Overall, the data indicate that while normal or higher Vitamin D levels are generally associated with normal HGB, deficiencies in Vitamin D, especially severe, appear to correlate with an increased risk of reduced HGB, though many individuals still maintain normal levels across categories.

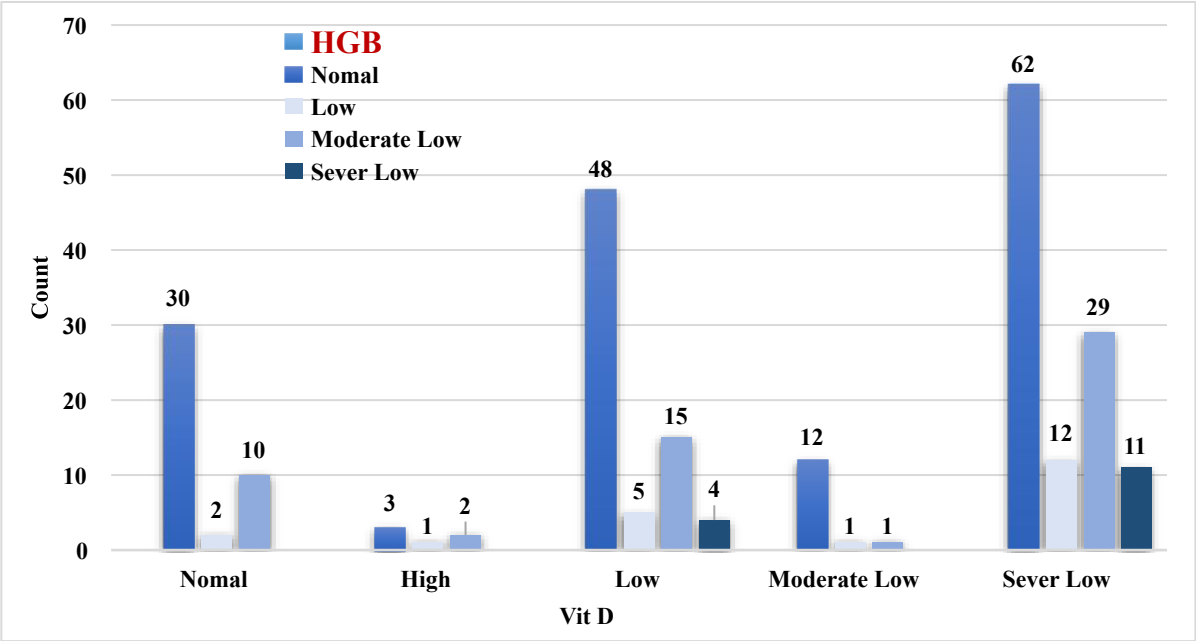

Figure (1) relationship between Vitamin D and HGB

5. DISCUSSION

The sample size of 248 individuals is relatively robust. If previous datasets had smaller sample sizes, this could add weight to your findings. Conversely, if previous studies had larger sample sizes, it may prompt further investigation into the consistency of your results.

Demographic Differences: Consider any differences in the demographics of the participants in your dataset compared to previous studies. Factors such as age, gender, ethnicity, and health status can influence vitamin levels and their correlations with Ferritin and Hemoglobin.

To compare this data with previous datasets, you would typically look at the following aspects: Age Group Distribution (Table 1), Predominant Age Group, the most represented age group is 26-30 years, comprising 22.6% of the population. This suggests the study's focus is largely on young adults.

Balanced Distribution, Other age groups, such as 16-20 years (12.1%) and 36-40 years (12.9%), have similar representation, indicating a generally balanced adult distribution.

Limited Representation of Youngest and Oldest Groups, Both the 10-15 years and over 81 years groups are minimally represented at just 0.4%, showing that the study has a focus primarily on middle-aged and younger populations.

Decrease in Older Age Groups, Participation decreases notably for those over 50, with proportions below 6.5%. This may reflect either study design or reduced participation/availability among older adults.

Vitamin D, Ferritin, and Hemoglobin (HGB) Levels (Table 2)

- A significant portion (46%) of participants have severe low Vitamin D levels.
- Only 16.9% of participants show normal Vitamin D levels, indicating a prevalence of deficiency or insufficiency.

Ferritin, nearly half (45.2%) of the participants have normal ferritin levels, while 29.4% are low, and 24.2% are severely low.

- Hemoglobin (HGB), Hemoglobin levels are mostly normal in 62.5% of the population, though 23% fall within the moderate low range and 8.5% have low levels.

These findings highlight a trend of Vitamin D deficiency or insufficiency as the most common issue among participants, whereas ferritin and hemoglobin levels are generally closer to normal ranges but still present low levels in a significant subset of the population.

Correlations Between Vitamin D, Ferritin, and Hemoglobin (Table 2), Vitamin D and Ferritin**: A positive correlation ($R = 0.217$) was found between Vitamin D and ferritin levels, significant at the 0.01 level ($p = 0.001$). This suggests that as Vitamin D levels increase, ferritin levels may also tend to increase, though the relationship is moderate.

Vitamin D and Hemoglobin (HGB), A weaker but significant positive correlation ($R = 0.126$), ($p = 0.047$) indicates a slight association between Vitamin D and hemoglobin levels. Vitamin D and Age, A negative correlation ($R = -0.254$), ($p < 0.001$) was observed between Vitamin D and age, indicating that older participants are more likely to have lower Vitamin D levels. Visual Representation (Figures 1 and 2), Vitamin D and Ferritin, the visual representation shows that severe low levels of Vitamin D correspond with low and moderate low levels of ferritin. This graphical pattern aligns with the observed positive correlation, suggesting that improvements in Vitamin D could potentially relate to ferritin level improvements.

Vitamin D and HGB, Similarly, the relationship chart shows that participants with severe low Vitamin D often also show moderate or low levels of hemoglobin.

Implications and Discussion, the findings suggest that Vitamin D deficiency is a notable issue in this population, which could have broader health implications, including potential impacts on bone health, immunity, and energy levels. Additionally, the correlation between Vitamin D and ferritin suggests an interconnectedness that might imply mutual influences or shared dietary and environmental factors. Since age correlates negatively with Vitamin D levels, targeted interventions for older individuals could help address this deficiency.

Ther are many researchers agree with our study in The Relationship between Vitamin D deficiency and anemia and it's risk in Females as (Eljamay, 2022), (Al Hinai et al., 2024), (Das et al., 2023), (Ergenc et al., 2023), (Kim et al., 2016.), (M. El Hammady et al., 2024), (Nasreen et al., 2023), and our study not agree with (Arpita Das, 2023.) and not agree with (Baarizah Febriana Badri, 2023.) which conclouded that the

Insufficient iron intake may increase the risk of anemia, while proper vitamin D levels and adequate dietary intake may reduce this risk. Therefore, further research is necessary on education regarding anemia during pregnancy, and (Paul Lee, 2009)

6. CONCLUSION

In conclusion, this study highlights a significant relationship between Vitamin D levels and hemoglobin (HGB) among participants, indicating that those with severely low Vitamin D levels often also have moderate or low hemoglobin levels. The implications of these findings are substantial, as Vitamin D deficiency within this population may impact overall health, with potential consequences for bone health, immune function, and energy levels. Additionally, the correlation between Vitamin D and ferritin suggests an interconnectedness that may arise from shared dietary or environmental factors. Given the observed negative correlation between age and Vitamin D levels, targeted interventions for older adults could be beneficial in addressing Vitamin D deficiency, ultimately supporting improved health outcomes across the population.

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