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Relationship between vitamin D deficiency and serum ferritin level in healthy women

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ABSTRACT

Vitamin D is an essential vitamin that regulates many biological processes and involved in the activity of many organs like the skin, bone, kidney, etc. ferritin is an essential marker for assessment of anemic status. The current study aimed to assess the relationship between ferritin and vitamin D3 in healthy women at various age groups. A cross-sectional study carried out in Ramadi city and involved 92 healthy women aged from 20-50 years, the participants divided into two groups according to age: group I with age 20 – 35 years and group II with age 36 – 50 years. In the present study mean vitamin D3 in group II 11.8 ± 3.5 ng/dL was significantly lower than group I (35.3 ± 12.2 ng/dL) p-value < 0.001, a similar finding observed for ferritin (19.6 ± 13.9 vs 66.7 ± 52.1, p-value <0.001). There was a direct relationship between ferritin with vitamin D. However, this relationship was only significant in group II (p-value <0.05), while in group I it was statistically significant. In conclusion, low vitamin D levels associated with low ferritin, indicating that vitamin D deficiency is associated with anemia.

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INTRODUCTION

Vitamin D deficiency show an increase trend globally (Yetley, 2008; Mithal *et al.*, 2009), several causes of vitamin D deficiency exist including reduce intake, low absorption, reduction in sun exposure, increased hepatic catabolism, or low endogenous synthesis (via the liver or the kidney) (Nair and Maseeh, 2012).

Ferritin is a large, 24 subunit protein consisting of light and heavy chains (Arosio and Levi, 2010). Ferritin represents the intracellular iron storage in the body. Also, it is an acute phase reactant (W.Wang *et al.*, 2010). Much of the iron stored in ferritin is accessible for metabolic needs (W.E.Dowdle *et al.*, 2014). When ferritin accumulates, it aggregates and is proteolyzed by lysosomal enzymes; it is then converted to an iron-rich, poorly characterized hemosiderin which releases its iron slowly and is detected in cells by the Prussian blue reaction (Vaisman *et al.*, 2000). There is a highly notable vitamin D3 deficiency in different age groups, especially in females. Vitamin D3 may affect many other parameters and functions in the body. The present study was prearranged to assess the correlation between

vitamin D3 deficiency and serum ferritin level in women.

METHODS

Study design

The observational cross-sectional study, the study included 92 healthy adult women, the candidates were classified into two groups according to age: group I with age 20 – 35 years and group II with age 36 – 50 years.

Candidate's selection criteria

After obtaining information and eliciting detailed medical and pathological history, only those who fulfilled the inclusion criteria were included in the study. The candidates were overall healthy adults female aged 20-50 years from Ramadi city. The nominees were selected from some of the students in our college, from outpatient attendants in the central laboratory in Ramadi teaching hospital for maternity and children, in addition to some of the highly confident private laboratories. Most of them have signs of vitamin D3 deficiency like muscle ache, tiredness and hair falling. Written informed consent obtained from all the participants in the study.

Inclusion criteria

- Females aged (20 – 55 years)
- Do not receive vitamin D supplementation

Exclusion criteria

- Diabetic patients
- Renal impairment
- Liver disease

Serum Preparation

Blood samples were collected aseptically by venipuncture into a dry clean and sterile white tube without anticoagulant substances and make it clot. Each tube is recognized with written information for each participant. Blood samples allowed to stand for 20-30 min for clot formation and centrifuged. The supernatant serums were taken and stored in Eppendorf tube at (-20 C to – 80 C) for subsequent analysis or use.

Laboratory tests

Measurement of serum vitamin D3 and ferritin level was done by MINI VIDAS® apparatus, which is a high quality compact automated immunoassay system based on Enzyme-Linked Fluorescent Assay (ELFA) technique. It is greatly appreciated worldwide for its simplicity, flexibility and accuracy.

Data analysis

Analysis of the result was made using mean ± standard deviation and Pearson's correlation coefficient, and one-sample t-test was used wherever applicable. The results were expressed as percentage and significance, by using Graph Pad Prism® Version 5.0 software.

RESULTS AND DISCUSSION

Vitamin D3 and serum ferritin were significantly lower in group II compared to group I, as illustrated in Table 1.

There was a direct relationship between ferritin with vitamin D. However, this relationship was only significant in the group II (p-value <0.05), while in group I it was statistically significant, as illustrated in Table 2 and Figure 1.

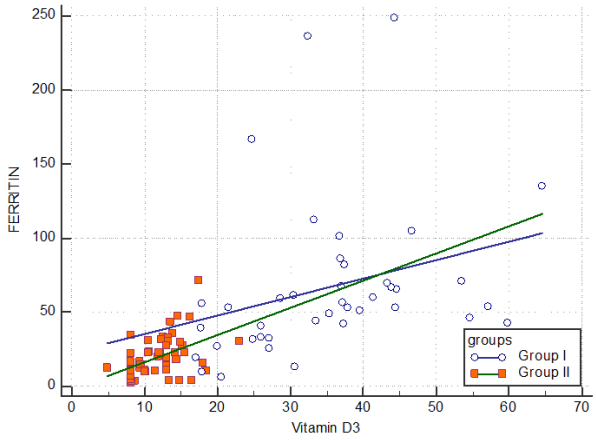

Figure 1: Scatterplot of the relationship between ferritin with vitamin D_3

Through the last decade, vitamin D has gained considerable interest in health and biomedical research (M.F.Holick *et al.*, 2011). Globally, vitamin D deficiency is widespread and is considered a pandemic (Chen and Holick, 2008). The MENA regions, including Iraq, are not spared from this micronutrient deficiency, these countries have one of the highest frequency of low vitamin D3 in the globe (Maalouf *et al.*, 2007; Chakhtoura *et al.*, 2018). Among the most common risk factors for low vitamin D include female gender and their clothing style, multi-parity, sedentary lifestyle, urban living and socio-economic status for adults, and longer than average breastfeeding (Bassil *et al.*, 2013).

In the present study mean vitamin D3 in the older women group (group II) 11.8 ± 3.5 ng/dL was significantly lower than younger women (group I) 35.3

Table 1: Assessment of vitamin D_3 and ferritin

Variables	Group I	Group II	p-value
Variables	Group I	Group II	p-value
Number	40	52	-
Vitamin D3 (ng/dL), mean ± SD	35.3 ± 12.2	11.8 ± 3.5	<0.001 [S]
Ferritin (ng/mL), mean ± SD	66.7 ± 52.1	19.6 ± 13.9	<0.001 [S]
SD: standard deviation, S: significance			

Table 2: Correlation between ferritin with vitamin D_3

Variables	Ferritin			
	Group II		Group I	
	r	p-value	r	p-value
Vitamin D3	0.464	0.001 [S]	0.290	0.070
r: regression coefficient				

± 12.2 ng/dL (p-value < 0.001), similar finding observed for ferritin (19.6 ± 13.9 vs. 66.7 ± 52.1, p-value <0.001), additionally there was significant direct correlation between ferritin and vitamin D3 in group II. Similar findings observed in other studies, (Sim *et al.*, 2010) was in agreement with present study in which low vitamin D (<30 ng/dL) associated with elevated Ferritin compared to normal vitamin D (≥30 ng/dL) [364 vs. 189 ng/ml, p-value = 0.01] (Sim *et al.*, 2010; Syed *et al.*, 2017) study, in linear regression models, vitamin D insufficiency was associated with increased hepcidin levels (β [SE] = 0.6 [0.2], P = 0.01) and reduced hemoglobin (β [SE] = -0.9 [0.5], P = 0.046), suggesting that the concentrations of 25(OH)D ≥30 ng/mL are associated with lower hepcidin and higher hemoglobin levels (Syed *et al.*, 2017).

Vitamin D appears to be associated with anemia; though the mechanism is unknown. One possibility is that vitamin D modulates the level of systemic cytokine production, thus reducing the inflammatory milieu that leads to anemia of chronic disease. Both in vivo and in vitro studies have demonstrated that vitamin D3 reduces cytokine production (Blazsek *et al.*, 1996). Also, vitamin D stimulates erythroid precursors, vitamin D receptors have been recognized in bone marrow tissues (Reichel *et al.*, 1989; Norman, 2006).

CONCLUSION

Low vitamin D levels associated with low ferritin, indicating that vitamin D deficiency is associated with anemia

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