The Association between Iron and Vitamin D Status in Female Elite Athletes [1]

Malczewska-Lenczowska J, Sitkowski D, Surała O, Orysiak J, Szczepanska B and Witek K
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The authors address an interesting question in this paper, one that has not been discussed much and merits further consideration: is there a link between the two most common pathological blood tests performed in sports medicine: iron and vitamin D status? On the one hand, vitamin D is known to be associated with a mulititude of health-related outcomes, as well performance-related ones, whilst on the other hand, iron deficiency is a frequently present change in blood parameters and is known to be directly related to oxygen-carrying capacity and enzymatic performance pathways. Could one deficit influence the other parameter as well?

Methods

219 elite female Polish athletes (age 20.0 ± 4.4) from seven sports were included (volleyball, handball, rowing, canoe sprint, cycling, speed skating and taekwondo). Those with signs of acute inflammation were excluded.

The main blood parameters of interest were measured as follows:

- 25(OH)Vitamin D (ELISA DiASource, Belgium).
- Ferritin (immunoturbidimetric method), total iron binding capacity (TIBC) and soluble transferrin receptor concentration (sTfR, immunoenzymatic assay, RammcoS-Stafford, Texas, USA).
  Iron deficiency (ID) stage were classified as: stage I = ferritin <16 μcg/L , stage II = elevated sTfR >8.3 mg/L or high TIBC >390 μg/dL, stage II = low Hb indices.

Results

Vitamin D status. 54.3% of athletes had 25(OH)D below 75 nmol/L. Measures were done year-round.
Iron deficiency. 23.3% had an iron deficit identified (7.3% in stage I, 15.1% in stage II and 0.9% in stage III with anemia).
Associations between the two deficiencies. First, vitamin D was associated with length of day, that is, sun exposure time of the year (OR 2.29, 95% CI 1.28-4.07) and iron deficiency (OR 2.96, 95% CI 1.45-6.02).
Second, iron deficiency was correlated with vitamin D deficiency (OR 2.73, 95% CI 1.32.5.62) and age (OR 0.82, 95% CI 0.73-0.91).
Figure 1 shows these two associations and it is also reported that there is stronger association with the depth ot iron deficiency: the lower ferritin is, the more prevalent is the vitamin D deficit. The reverse was not observed: no matter how low vitamin D is, iron deficiency is more prevalent. In addition, the other iron markers (TIBC, sTfR, serum iron) were affected accordingly.

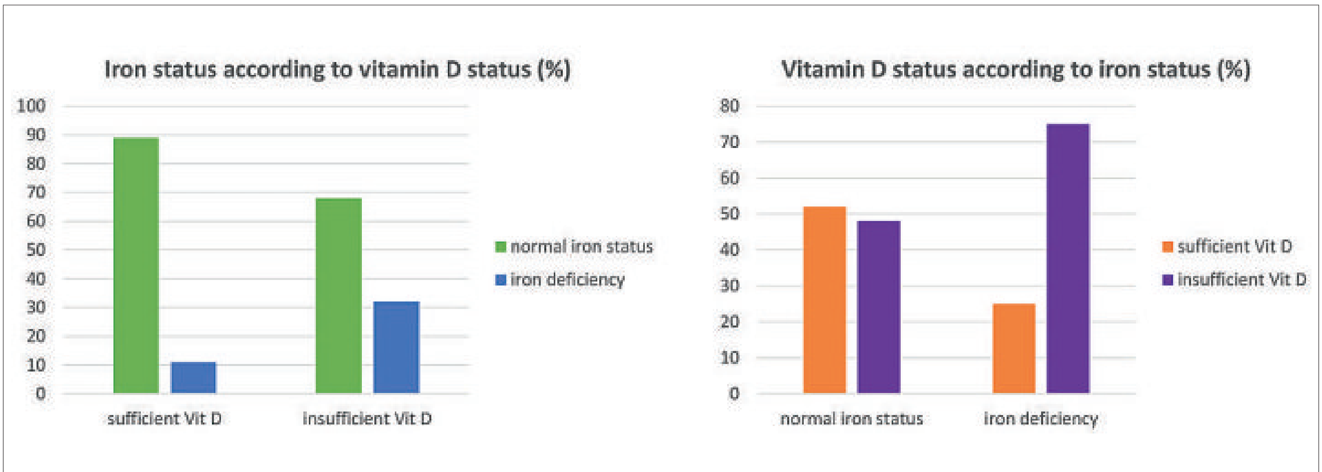


Figure 1: Association between vitamin D deficiency and iron deficiency

Discussion

The authors bring a few points in the discussion to search for possible explanations and mechanisms behind these correlations. Here are the main ones:

1. A deficit in vitamin D has a pro-inflammatory effect, which would elevate hepcidin levels and compromise iron absorption and availability. Studies have shown also that hepcidin levels diminish after correction of a vitamin D deficit [2].
2. A deficit in iron affects the function of various components of the cytochrome P450 superfamily, which participates in the early stages of cholecalciferol transformation to 25(OH)D. This mechanistic link is strengthened by the dose-dependant pattern present in this study (the lower the iron stores, the higher the risk of vitamin D deficit).

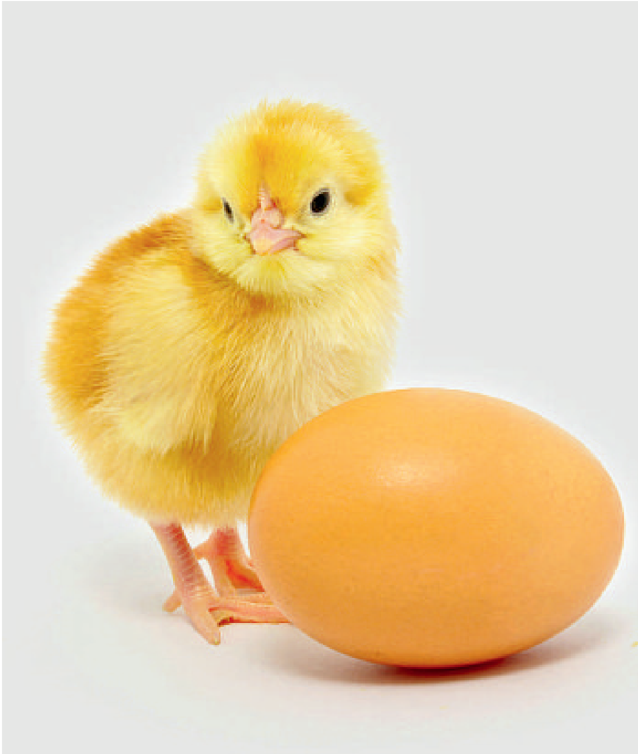
Limitations and comments

A few salient points limit the study's overall validity: it is a cross-sectional study with a one-time measurement. Hepcidin was not assessed, yet discussed as a mechanism for one association. Only female athletes were studied. The blood tests were collected year-round, yet we know of the important seasonal variation in 25(OH)D levels [3]. Lastly, no questionnaire on sun exposure, supplement intake or training intensity around blood sampling were available, all of which influence the assessed parameters.

Even though these limitations warrant caution in the interpretation of the findings, the observations are still interesting. We tend in general to analyze blood parameters in separate domains (kidney or liver function, inflammation or hormones values,…) whereas we also understand that all can be inter-connected or -dependant. Taking a look at the global picture, an athlete is an individual whose metabolism and physiology suffers from repeated stress exposures. Adaptation to those stresses lead to increased functional capacity and ultimately a capacity to maintain health and improve performance. Along the way, multiple systems are stimulated and deficiencies may arise in some of them. It would only make sense that a lot of those systems interact in health, in performance and in disease as well. This simple study asks a few new questions, and we should pay attention, since the outcome of all blood analyses we do in our athletes is the discussion on supplementation and correction.

By the way

In this issue we present two papers that look at vitamin D and iron deficiency in Swiss athletes, and when we looked briefly at the links between the two, we found a positive correlation between 25(OH)vitamin D levels and serum ferritin levels. The story repeats itself, even though the explanations are not clear for the time being. Maybe one thing to consider is the following: this correlation in our study is not present when we look at zinc-protoporphyrin levels. Are we looking at the right parameters to interpret iron deficiency? If you haven't read the article by Quadri et al in this issue [4], now is the time.



Chicken or egg?

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