

Serum 25-hydroxyvitamin D levels and intramuscular vitamin D3 supplementation among Eritrean migrants recently arrived in Switzerland

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Summary

In a cross-sectional screening programme, we assessed serum vitamin D levels in adult Eritrean refugees recently arrived in Switzerland. Median vitamin D level among 107 participants (95 males and 12 females) was 27 nmol/l (interquartile range 23–42 nmol/l), 86% had insufficient vitamin D levels (≤ 50 nmol/l) and 36% severe deficiency (< 25 nmol/l). In 29 participants who received single-dose intramuscular vitamin D substitution (300 000 IU), median vitamin D levels increased from 25 to 35 nmol/l after 3 months ($p = 0.005$); only 11 (38%) reached sufficient vitamin D levels.

Eritrean migrants should be routinely screened for vitamin D deficiency. Single-dose intramuscular supplementation appeared to be insufficient to achieve optimal levels in the majority of participants.

Key words: Eritrea, migrants, refugees, Switzerland, vitamin D

Introduction

Vitamin D plays an important role in regulating bone metabolism [1]. The body may acquire vitamin D2 or D3 (cholecalciferol) through food or, in the case of D3, synthesise it via ultraviolet B light (UVB) exposure. Both forms are hydroxylated in the liver to 25-hydroxyvitamin D, which is further hydroxylated in the kidneys to its active form, 1,25-dihydroxyvitamin D [2].

The threshold for optimum serum vitamin D levels and definitions of sufficiency are controversial [1–3]. However, several experts agree that a level below 50 nmol/l is insufficient and vitamin D deficiency is generally defined as a serum 25(OH)-vitamin D level below 25 nmol/l [4]. The World Health Organization (WHO) considers a serum vitamin D level < 50 nmol/l as insufficient [3].

Vitamin D production is greatly affected by UVB exposure and the amount of melanin pigment in the skin [1]. Thus, serum 25(OH)-vitamin D levels vary among ethnic groups. In a study conducted in the United States, mean 25(OH)-vitamin D levels in African-Americans and Caucasians were 39 and 64.5 nmol/l, respectively [5].

Several reports indicate that migrants from sub-Saharan Africa are vulnerable to vitamin D deficiency in their host countries in Europe [6–8]. During recent years Europe has faced high numbers of immigrants arriving from sub-Saharan Africa. Some European countries (Switzerland, the Netherlands, Sweden and Germany) host high numbers of Eritrean refugees [9]. Here we report the prevalence of vitamin D deficiency among Eritrean refugees newly arrived in Switzerland and changes in vitamin D level after single-dose intramuscular supplementation.

Methods

The study was conducted in two Swiss cantons (Basel-Stadt and Basel-Land). Asymptomatic healthy Eritrean refugees aged ≥ 16 years who had arrived in Switzerland between January 2014 and December 2015 were invited to participate in the study through invitation letters in English and Tigrigna (an Eritrean language), with subsequent follow-up by telephone. Recruitment was between January and October 2016.

Participants underwent a cross-sectional health check at enrolment, including measurement of circulating 25(OH)-cholecalciferol levels in plasma. Participants with insufficient vitamin D level (< 60 nmol/l) received a single-dose intramuscular supplement of 300 000 IU (1 ml vitamin D3 Streuli). Among these, 30% were recruited on a first-come basis and followed up for reassessment of vitamin D levels after substitution. Venous blood was centrifuged within 30 minutes after phlebotomy and serum samples were stored in aliquots of 50 μ l at -20°C before being analysed at

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the diagnostic laboratory of the University Hospital Basel, Switzerland.

Data were collected on paper and subsequently entered into EpiInfo version 7 (CDC, 1600 Clifton Road, Atlanta, USA). Statistical analyses were performed in Stata version 13 (StataCorp LP, 4905 Lakeway Drive, College Station, USA). Linear regression was used to assess for correlation between season of blood sampling and vitamin D level. Paired sample t-test was used to compare baseline and follow-up vitamin D levels. Linear regression was used to assess changes in baseline vitamin D levels through the recruitment period to account for changes between summer and winter months.

The study protocol was approved by the institutional research commission of the Swiss Tropical and Public Health Institute (Swiss TPH, Basel, Switzerland; reference no. FK 120; approval date: June 24, 2015) and the Ethics Committee of Northwest and Central Switzerland (reference no. EKNZ 2015-353; approval date: November 20, 2015). Participation was voluntary and people could withdraw from the study at any time without further obligations.

Results

A total of 107 Eritrean refugees were enrolled from February to November 2016. Participant characteristics are displayed in [table 1](#). Median serum 25(OH)-vitamin D level was 27 nmol/l (interquartile range [IQR] 23–42 nmol/l). Applying the cut-off of <50 nmol/l, 86% (n = 92) participants had insufficient serum vitamin D levels (median 25, IQR 21.5–34). Among the 14% (n = 15) without insufficiency, the median vitamin D level was 61 nmol/l (IQR 55–63). Vitamin D deficiency (<25 nmol/l) was present in 36% (n = 39). When the cut-off of the Endocrine Society of America (<72.5 nmol/l) was used, 97.2% (n = 104) were below the optimal level. [Figure 1](#) displays vitamin D levels by month of measurement. Levels increased significantly from January/February to September/October (coefficient 4.53, 95% confidence interval 2.39–6.68, $p < 0.001$).

In the subgroup (n = 29) with follow-up assessment, median vitamin D levels increased from 25 nmol/l (IQR 20–44 nmol/l) to 35 nmol/l (IQR 21–67 nmol/l) after intramuscular supplementation with 300 000 IU vitamin D3 ($p =$

0.005). Median time between supplementation and follow-up measurement of vitamin D level was 12 weeks (IQR 12–12). Of the 29 individuals, only six and five, respectively had sufficient (≥ 50 nmol/l) and optimal (≥ 72.5 nmol/l) vitamin D levels after substitution ([fig. 2](#)).

Figure 1: Median 25(OH)-vitamin D levels among recently arrived Eritrean refugees (n = 107) in Switzerland.

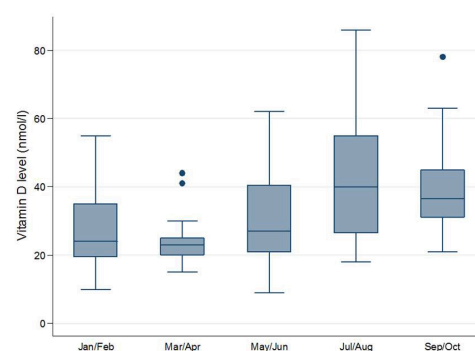


Figure 2: Serum 25(OH)-vitamin D levels before and after a single intramuscular supplement of 300 000 IU (1 ml vitamin D3 Streuli) among a randomly selected subgroup (n = 29).

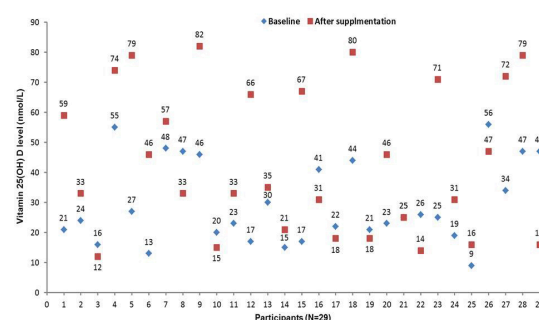


Table 1: Characteristics of study participants.

	Total n = 107
Female gender, n (%)	12 (11.2%)
Marital status, n (%)	
Single	73 (68%)
Married	33 (31%)
Divorced	1 (1%)
Education, n (%)	
Primary	44 (41%)
Secondary	51 (48%)
Tertiary	12 (11%)
BMI, kg/m ² (IQR)	21 (20–23)
Wearing long dress / veil, n (%)	0 (0%)
Awareness of vitamin D deficiency, n (%)	
Yes	4 (3.7%)
No	7 (6.5%)
Do not know	96 (89.7%)
Regular sporting activity, n (%)	57 (53.3%)
Outdoor sporting activity, n (%)	9 (8.4%)

BMI = Body mass index; IQR = Interquartile range

Discussion

Among adult Eritrean immigrants recently arrived in Switzerland, 86% had vitamin D insufficiency (<50 nmol/l) and 36% deficiency (<25 nmol/l) as per commonly used thresholds, and single-dose intramuscular supplementation failed to achieve optimal levels in the majority of participants.

Our results are in line with previous studies. In a study from Australia, 87% and 44%, respectively, of East African migrants had insufficient and deficient serum 25(OH)-vitamin D levels [10]. Eggemoen and colleagues reported a median serum 25(OH)-vitamin D level of 28 nmol/l among recently migrated Eritreans in Norway [6]. In our study, as shown in [figure 1](#), median vitamin D levels were higher during summer-time owing to longer UVB exposure. However, even in July/August 50% had vitamin D levels below 40 nmol/l.

A single intramuscular supplement increased levels significantly, but 62% of participants still had suboptimal vitamin D levels. Similarly to our data, one intramuscular vitamin D administration in a German population led to a significant increase of serum levels at 3 months but more than half of participants' vitamin D level remained below 50 nmol/l [11].

Thresholds for vitamin D deficiency in African populations are still under debate and studies among African-Americans failed to show a correlation between low vitamin D levels and bone mineral density [12]. The clinical significance of vitamin D deficiency in Eritrean migrants should be a target for further investigations.

Our study had several limitations. First, we had no detailed information on dietary habits and duration of daily sun exposure. Second, the serum calcium level of participants was not measured. Third, since the half-life of vitamin D3 is around 10 weeks, follow up 12 weeks after Vitamin D3 substitution may have slightly underestimated the effect of intramuscular single-dose supplementation.

In summary, in our study 86% of adult Eritrean refugees in Switzerland had insufficient vitamin D levels according to the definition of WHO [3], and in the majority of participants a single intramuscular supplement did not result in sufficient vitamin D levels 12 weeks later. Assessing vitamin D levels and adequate substitution if indicated should be considered for routine care of migrants from Eritrea living in Europe. Further research is needed to determine ideal vitamin D levels in migrants of African origin and define optimal schemes for substitution in the case of deficiency.

Financial disclosure

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Competing interests

No potential conflict of interest relevant to this article was reported.

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