

## Do Professional Soccer Players have a Vitamin D Status Supporting Optimal Performance in Winter time?

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### Abstract

**Background:** Vitamin D is well known for its role in calcium homeostasis and bone metabolism. In addition 25 (OH) vitamin D3 (25OHD3) deficiency is correlated with muscle pain and weakness, hence there is increasing interest in optimal 25OHD3 levels for athletes. We investigated the prevalence of 25OHD3 deficiency and the ethnical variation in 25(OH)D concentrations among professional soccer players in the winter season.

**Methods:** Cross-sectional survey of 87 professional soccer players (aged 18-35) from one Belgian and two Dutch first division soccer clubs. Blood samples were collected from October 2009 till March 2010. 25OHD3 was measured using an electro-chemiluminescence immunoassay (Roche), reference interval: 50-130 nmol/L.

**Results:** For 47 players (54%) of the total group the 25OHD3 was <50 nmol/L. For 16 subjects (18.4%) concentrations <30 nmol/L were found. All black players (n=20) had blood levels <50 nmol/L and 9/20 <30 nmol/L. In Latin-American players 10 out of 15 had 25OHD3 <50 nmol/L and 5/15 <30 nmol/L. For Caucasian players, 21/52 players were <50 nmol/L and 2/52 <30 nmol/L.

**Conclusion:** The vitamin D level in professional soccer players at the end of the summer and during the winter season in West-Europe is obvious below optimal, for Caucasians 40% were deficient (<50 nmol/L), but all black athletes were deficient or severely deficient (<30 nmol/L). Especially dark skinned soccer players, as well as other athletes may improve their physical performance by keeping their 25OHD3 level above 75 nmol/L all year round.

**Keywords:** Professional soccer players; Vitamin D; Deficiency; Cross sectional survey

### Introduction

Unlike other vitamins, the main part of our needs for vitamin D is produced by exposure of our skin to sunlight. Clothing, indoor sports activities, use of sun screen or a darker skin tone limits the dermal synthesis of vitamin D. Furthermore it is known for 25(OH)D levels to have a seasonal variation due to insufficient ultraviolet (UV) B radiation from November till April at around 52° northern latitude [1].

Vitamin D deficiency leads to muscle pain and weakness [2], and hence it has been suggested that for optimal performance and endurance for athletes their vitamin D status should be optimal. So measuring the athlete's vitamin D level is desirable. Recent studies suggested a vitamin D deficiency in indoor athletes [3] and middle-eastern sportsmen [4], on the contrary outdoor cyclists had an adequate vitamin D level [5].

In our study, we evaluated the 25(OH)D status in Dutch and Belgian soccer players in autumn and winter, since the soccer season starts in August and ends in May. Furthermore we examined ethnicity as confounder of vitamin D levels.

### Methods

We conducted a cross-sectional survey of 87 professional soccer players (aged 18-35) in four soccer teams from one Belgian and two Dutch first division soccer clubs (two teams from one of the Dutch clubs). Blood samples were collected from October 2009 until March 2010. Three athletes were excluded because they were absent the day of the blood sampling due to injury. Data were collected on age, self-declared ethnicity, training hours (usually in the morning), multivitamin use, height and weight. All athletes had undergone a routine pre-season physical examination by their team physician and were considered in good health. All participants gave their informed consent.

The soccer stadiums are situated in Brussels, Belgium at latitude 50.5° N and Amsterdam or Utrecht in The Netherlands at latitude 52.2°N and 52.5° N, respectively. The 25OHD3 was measured using by the ROCHE method at that time (electro-chemiluminescence immunoassay using the polyclonal antibody), having an inter-assay CV of 6.9% at 25.5nmol/L 25(OH)-vitamin D3 and 3.2% at 72.5 nmol/L.

The reference interval is 50-130 nmol/l, we consider levels below 30 nmol/l as severe deficient.

## Results

Demographic characteristics of our study group are presented in Table 1. The reported use by 20 players of vitamin D3 (in multivitamins) intake was 2 µg/day (80 iU), which is considered neglectable.

Demographic Characteristics	Subjects (n=87)
Age (years)	25 ± 4
Sex (male)	87
BMI (Kg/m <sup>2</sup> )	23.2 ± 2.0
Ethnicity Caucasian	52
African American	20
Latin-American	15
Physical activity (hours/week)	12
Multivitamin	
Yes	20
No	67
Recent visit sunny country	
Yes	2
No	85

Table 1: Characteristics of study subjects (data are presented as means ± standard deviation or absolute figures)

Results split up for the teams and the actual sampling month are given in figure 1. The 25(OH)D concentration changed significantly across time and averaged 53.8 ± 18.1 nmol/L in October and 31.2 ± 14.4 nmol/L in March. In 47 subjects (54%) a 25(OH)D3 level below 50 nmol/L was found and in 16 athletes (18%) the 25(OH)D3 was <30 nmol/L.

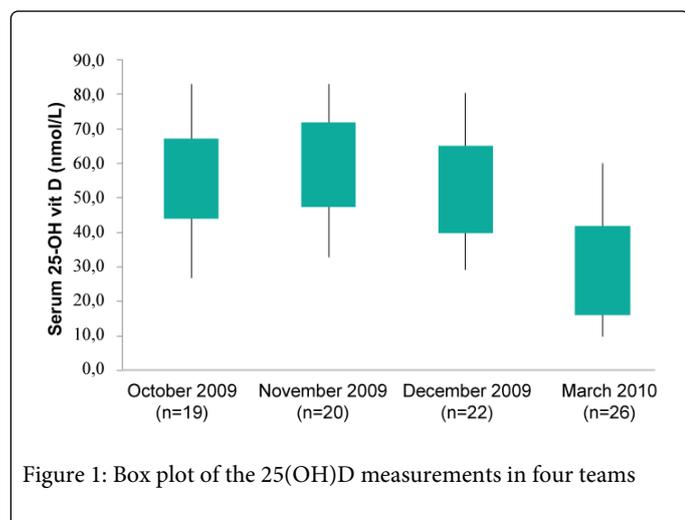


Figure 1: Box plot of the 25(OH)D measurements in four teams

As shown in Figure 2, the vitamin D concentrations were consistently lower for the black athletes (n=20): all of them had levels

<50 nmol/L and in 9/20 we found a severe deficiency (level <30 nmol/L). Of the Latin-American athletes 67% had a 25(OH)D3 values <50 nmol/L and 5/15 (33%) <30 nmol/L. Among the Caucasians, 17/52 players (33%) had a vitamin D deficiency at 50 nmol/L and 2/52 (4%) a severe deficiency.

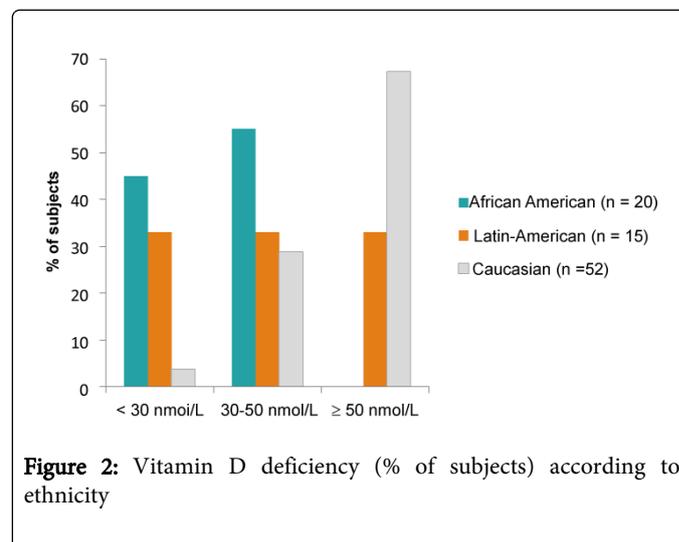


Figure 2: Vitamin D deficiency (% of subjects) according to ethnicity

## Discussion

The prevalence of 25OHD3 deficiency in professional soccer players was rather high for subjects spending much time outdoors, even shortly after the summer season. For comparison, the prevalence of deficiency (<50 nmol/l 25OHD3) in a Caucasian Dutch population is about 23% in summertime [6]. The 25OHD3 level decreases in wintertime as expected, since on our latitude UV radiation is insufficient for vitamin D formation in the skin from November up till and including March [1].

Galan et al. studied 28 Spanish football players and found 64% below 75 nmol/L in February [7]. In a study by Morton of 20 Premier League soccer players, 18 Caucasians, showed a similar decrease in vitamin D status in December [8], however they did not measure the nadir that will be reached in March as we showed. The disadvantage of high melanin content in the dark skinned soccer players at our latitude, may be in combination with life-style and diet, is clearly illustrated in our study by the deficiency of all black athletes (25OHD3<50 nmol/L).

What effects of vitamin D deficiency may be of interest for athletes and coaches? Angeline et al. found in 89 players from an American team that those who suffered from muscle injuries had a significantly lower vitamin D level than the uninjured players [9]. Similar results were reported of beneficial effects on muscular performance and injury occurrence in elite ballet dancers [10]. Further, when patients suffering from chronic kidney failure (with or without the need for dialysis) were supplemented with vitamin D an improvement of muscle strength, functional ability and balance was observed [11]. Muscle strength and performance for elderly was reported to be best for levels >75 nmol/L [12].

Possible explanations of the role of vitamin D in muscle function and metabolism has recently been discussed in a review [2]. Very recently the beneficial effect of vitamin D on oxidative

phosphorylation was shown, giving a clue for the possible mechanism of vitamin D associated fatigue and muscle weakness [13].

What could be an optimal level for athletes? Studies on physical performance improvement by vitamin D suppletion most often do not present the initial status, the most significant improvements are seen especially when the baseline level was below 25 nmol/l [2]. However athletes need and search for optimal performance. We suggest that especially dark skinned athletes, may improve their performance by keeping their 25OHD3 level above 75 nmol/L all year round. To maintain a 75 nmol/l level in wintertime, an end of summer level of approximately 125 nmol/l has been suggested [7,14] or a suppletion with 1000-2000 iU/day, depending on the original base line level [15].

For soccer players with severe vitamin D deficiency (levels below 25 nmol/l) suppletion will lead to substantial endurance improvement. For soccer players with vitamin D mild deficiency (levels 25-50 nmol/l) smaller effects are to be expected after suppletion. For optimal physical performance 25OH vitamin D3 levels of 75-125 nmol/l have been advised [16]. We found 130 nmol/l being the upper level of the reference interval for Caucasians in Dutch summers.

More research is needed on the musculoskeletal effect of vitamin D in healthy athletes and on fine-tuning the level of serum 25OHD3 corresponding with optimal physical performance and endurance.

## Conclusion

Especially for athletes an optimal condition of their muscles is an essential for top performance in all seasons. We showed that the vitamin D level in professional soccer players in West-Europe, during the winter season is far below optimal, especially in dark players. Supplementation may improve their performance and endurance.

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