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**Received:** 07 November, 2017

**Accepted:** 04 January, 2018

**Published:** 05 January, 2018

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**Keywords:** Dietary intake; Vitamin D; Questionnaire; Adolescents

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### Research Article

## Dietary intake of vitamin D in the Moroccan adolescents

### Abstract

**Aims:** Most epidemiological studies show that vitamin D deficiency is frequent in the general population including adolescents. The aim of our work is to evaluate the dietary intake of vitamin D in the Moroccan adolescents.

**Methods:** This study included 257 Moroccan adolescents who performed a vitamin D questionnaire (VDQ), covering the consumption of four foods with high vitamin D content (fish, milk, margarine and yoghurt).

**Results:** The average dietary vitamin D intake was 4.6µg/day. This observational study on Moroccan adolescents indicates a high prevalence of insufficient vitamin D intake, and below the recommended consumption values, particularly in girls.

**Conclusion:** Inadequate vitamin D intake is common among the adolescents. To fight against this situation, initiatives must be implemented, including improved population education, lifestyle and vitamin D supplementation, in order to avoid serious adverse health consequences of bone.

### Introduction

Vitamin D is recognized as an important actor in bone and phosphocalcium metabolism. In recent years, epidemiological and clinical studies have revealed new functions for this vitamin. Vitamin D thus plays an essential role in the functioning of several organs and systems, including the cardiovascular, endocrine, and immune systems. In humans, vitamin D comes in two forms, vitamin D<sub>3</sub> or cholecalciferol, of animal origin, and vitamin D<sub>2</sub> or ergocalciferol of plant origin. There are rare dietary sources of vitamin D<sub>3</sub>, especially marine fatty fish, vitamin D<sub>3</sub> supplementation or vitamin D<sub>2</sub>. The skin can synthesize vitamin D<sub>3</sub>, from 7-dehydrocholesterol, under the action of ultraviolet B (UVB) radiation which represents the main natural source of vitamin D [1-3]. Vitamin D deficiency is common in the general population, which results from many factors, including insufficient sun exposure, reduced cutaneous synthesis of vitamin D, and poor nutrition [4]. Dietary intake of vitamin D might be difficult to be evaluated because it is irregular, with a large daily variation [5-6], and no food evaluation method is as perfect and out of errors, although it is considered as a method Standard [7]. Most epidemiological studies show that vitamin D deficiency is common in the adolescents [8-10]. We performed this work in order to evaluate the dietary intake of vitamin D in the Moroccan adolescents.

### Methods

This study included 257 adolescents aged between 14 and 17 years old, to describe the dietary intake of vitamin D in the Moroccan adolescents. All participants performed a vitamin D questionnaire (VDQ), covering the consumption of four foods with high vitamin D content (fish, milk, margarine and yoghurt).

The VDQ was carried out as an interview by trained personnel. Subjects were asked about their usual food intake behavior in the six months prior to the study. Questions were asked on how often foods were consumed and the amount of a typical serving as listed in table 1. For milk, yoghurt/sour milk and margarine, questions on the fat content were also asked. Dietary intakes were calculated using computer software Dietist XP version 3.1. Vitamin D supplement use was not included in the analysis. The subject's daily energy requirements were calculated using FAO/WHO/UNU's equation based on body weight and age group [11].

**Table 1:** Intakes of vitamin D as reported in vitamin D questionnaire by food group.

Intake of vitamin D (µg/day)	Fish			Milk			Yoghurt			Margarine		
	T	M	F	T	M	F	T	M	F	T	M	F
	1.8	2	1.6	1.5	1.5	1.5	0.9	0.8	1	0.4	0.4	0.3

T: Total, M: Male, F: female.

## Results

Our series included 257 adolescents. 43% female (n = 111), 57% of male (n = 146). The average age is  $16.42 \pm 8.47$ . The average dietary vitamin D intake was  $4.6 \pm 1.1$   $\mu\text{g/day}$ ,  $4.8 \pm 1.21$   $\mu\text{g/day}$  in male, and  $4.4 \pm 0.97$   $\mu\text{g/day}$  in female. The average energy intake reported in the VDQ was  $8.05 \pm 1.27$  MJ. The dietary intakes of vitamin D by food group are presented in table 1.

## Discussion

Vitamin D is a nutrient obtained from limited products in the Moroccan diet. In addition, in Morocco some food products such as milk products or oils are supplemented with vitamin D at low doses [12]. Despite the problem of vitamin D deficiency in the general Moroccan population including adolescents, no questionnaire validated or specified to the frequency of consumption of foods rich in vitamin D has been designed or applied in Morocco so far. The recommended daily vitamin D intake is confused and varies according to age, physiological state, season and geographical location [13].

The results of this observational study in Moroccan adolescents indicate a high prevalence of insufficient vitamin D intake, and below the recommended consumption values. The World Health Organization recommends 5  $\mu\text{g/day}$  for adolescents; on the other hand the Institute of Medicine (IOM) recommends 15  $\mu\text{g/day}$  vitamin D intake, up to 100  $\mu\text{g/day}$  [14], in agreement with The Society for Adolescent Health and Medicine (SAHM), which suggests vitamin D intakes of up to 250  $\mu\text{g/day}$  [15], but taking into account the signs of vitamin D intoxication, such as hypercalciuria and hypercalcemia.

The Endocrine Society recommends a dose of vitamin D supplement of at least 25  $\mu\text{g/day}$  for high-risk adolescents. Higher doses might be suggested in the case of obesity, anticonvulsant therapy or multiple risk factors associated with hypovitaminosis D [15].

The results of our study show that daily vitamin D intakes are lower in females than in males, these results are consistent with the results of Moore *et al.* that show that vitamin D intake from food and dietary supplements in adolescents (14-18 years) in the United States is  $5.25 \pm 0.23$   $\mu\text{g/day}$  in females and  $7.75 \pm 0.4$   $\mu\text{g/day}$  in males [16].

For vitamin D supplementation in adolescents, SAHM recommends vitamin D supplementation of 15  $\mu\text{g/day}$  for all healthy adolescents. This dose can reach up to 25  $\mu\text{g/day}$  for adolescents at high risk of hypovitaminosis D [15].

The lower median intake of vitamin D can be explained by the VDQ covered only four foods. The VDQ was included only four foods with high vitamin D content (fish, milk, margarine and yoghurt/sour milk). Although the amount of vitamin D obtained from supplements was not specified in this study. There are many limitations in our study design. The study

was observational in its nature. The results might be biased by the selection of participants who consented to the study and contacted the interviewers, adolescents participants may be more aware of their health needs, compared to others who did not agree to participate. This disparity may have led to an underestimation of the actual level of vitamin D deficiency in Moroccan adolescents. In addition, the results of the study are based on the patient's self-assessment, which is subject to the influence of memory and other subjective factors.

## Conclusion

Inadequate vitamin D intake is common among the Moroccan adolescents. To fight against this situation, initiatives must be implemented, including improved population education, lifestyle and vitamin D supplementation, in order to avoid serious adverse health consequences of bone.

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