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Vitamin D Status of Hong Kong Athletes

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Introduction

Vitamin D is essential for musculoskeletal health as it promotes calcium absorption from the bowel, enables mineralization of newly formed osteoid tissue in bone and plays an important role in muscle function. It has been suggested that inadequate vitamin D levels may negatively affect protein synthesis, cell growth, immune function, and exercise related inflammation[1]. However, no recommendation of optimal serum vitamin D levels to maximise athletic performance has been established. Currently, a paucity of data about vitamin D status of athletes can be found. The purpose of this study is to investigate the vitamin D status of athletes in Hong Kong.

Methodology

Serum 25-hydroxyvitamin D [25(OH)D] is the best indicator of vitamin D status[2]. Athletes (n = 185) from 21 sports who entered the Hong Kong Sports Institute (HKSI) scholarship program between 2011 and 2013 were screened for serum 25(OH)D (Architect i-1000SR, Abbott Diagnostic, Illinois, USA). The guidelines from the Institute of Medicine was used to categorize vitamin D status into deficiency, insufficiency, sufficiency and potential adverse effects of high level according to serum 25(OH)D level[3]. Athletes were divided into groups according to age, nature of sport and gender (Table 1) for statistical analyses. All statistical analyses were performed using PASW Statistics 17 (SPSS inc., Chicago, Illinois, USA).

Results and Discussion

Adolescents' serum 25(OH)D level is significantly lower than adults. In addition, outdoor sport and males had a significantly higher mean serum 25(OH)D level than indoor sport and females respectively (Table 1).

Table 1. Mean serum 25(OH)D level in different groups

	Category	No. of athletes	Mean 25(OH)D (ng/mL)
Age 9-17 years	Adolescent	121	21.4 ± 7.4
Age 18-54 years	Adult	64	25.0 ± 7.3#
Nature of sport	Indoor	97	18.4 ± 5.0
	Outdoor	88	27.3 ± 7.0*
Gender	Male	94	24.3 ± 7.6
	Female	91	21.0 ± 7.1†

Mean serum 25(OH)D level in adults is significantly higher than adolescent ($p < 0.01$)
* Mean serum 25(OH)D level in outdoor sports is significantly higher than indoor sports ($p < 0.01$)
† Mean serum 25(OH)D level in male is significantly higher than female ($p < 0.01$)

In this study, 68 athletes (36.9%) had vitamin D insufficiency and 6 athletes (3.2%) had vitamin D deficiency according to the guidelines given by the Institute of Medicine (Table 2). All athletes with vitamin D deficiency status were under 18 years old and participated in indoor sports. Among the insufficiency group, 50 (73.5%) out of 68 athletes were adolescent and 53 (77.9%) were indoor sport athletes. Over 50% of female athletes had vitamin D insufficiency or deficiency, while male athletes were only about 30%. No one had abnormally high serum 25(OH)D level. Young athletes may have an inadequate daily intake of vitamin D since dietary source of vitamin D is limited and fortified foods may not be adequately consumed. However, after considering the nature of sport, age is not the most significant factor leading to low serum 25(OH)D level. When exposed to sunlight, vitamin D can be produced through endogenous synthesis under the skin. Minimal exposure to sunlight is the most probable reason of poor vitamin D status in athletes as reflected in results in indoor sport. In addition, females may apply extensive sunscreen and cover skin with clothing during outdoor training which result in a significantly lower serum 25(OH)D level than males due to insufficient ultraviolet B exposure.

Table 2. Vitamin D status in athletes

Vitamin D status 25(OH)D (ng/mL)	Deficiency <12	Insufficiency 12-19.9	Sufficiency 20-125	Potential adverse effects of high level >125
All athletes (n=185)	6	68	111	0
Adolescent (n=121)	6	50	65	0
Adult (n=64)	0	18	46	0
Indoor sport (n=97)	6	53	38	0
Outdoor sport (n=88)	0	15	73	0
Male (n=94)	1	27	66	0
Female (n=91)	5	41	45	0

Mean serum 25(OH)D level in various sports were shown in Table 3. Almost all outdoor sports had higher mean serum 25(OH)D levels than indoor sports except cricket which was the lowest among outdoor sports. Cricket had the lowest mean serum 25(OH)D level among outdoor sports which may due to the fact that 38% of cricket athletes are of Indian origin and skin pigmentation decreases its ability to manufacture 25(OH)D.

Table 3. Mean serum 25(OH)D level in various sports

Sport	Nature of sport	Number of athletes (%)	Mean 25(OH)D (ng/mL)
Gymnastics	Indoor	24 (13.0%)	16.2
Fencing	Indoor	14 (7.6%)	16.9
Karatedo	Indoor	6 (3.2%)	17.8
Tenpin Bowling	Indoor	3 (1.6%)	18.5
Table Tennis	Indoor	11 (5.9%)	19.1
Badminton	Indoor	12 (6.5%)	19.6
Squash	Indoor	2 (1.1%)	19.6
Billiard Sports	Indoor	3 (1.6%)	20.4
Swimming	Indoor	17 (9.2%)	20.8
Wushu	Indoor	2 (1.1%)	21.8
Cricket	Outdoor	21 (11.4%)	22.5
Diving	Indoor	2 (1.1%)	23.9
Athletics	Outdoor	5 (2.7%)	26.0
Cycling	Outdoor	5 (2.7%)	27.5
Tennis	Outdoor	7 (3.8%)	27.5
Archery	Outdoor	3 (1.6%)	27.6
Sailing	Outdoor	3 (1.6%)	27.9
Rugby	Outdoor	17 (9.2%)	28.9
Windsurfing	Outdoor	14 (7.6%)	29.1
Rowing	Outdoor	10 (5.4%)	29.9
Triathlon	Outdoor	3 (1.6%)	35.2

Although little is known about the direct impact of vitamin D status on athletic performance, Cannell *et al* [4] suggested that adequate treatment of vitamin D-deficient athletes may improve their athletic performance including physical fitness, neuromuscular function and increment in type II muscle fibers, the largest improvement probably occur when levels increase from 15 to 30 ng/mL. In order to correct athletes' deficiency and improve insufficiency, adequate consumption of vitamin D rich food including fortified dairy products, fruit juices and breakfast cereals, fatty fish, egg yolks and regular safe sun exposure to promote endogenous production should be emphasized especially for indoor sports, adolescent and female athletes.

Conclusion

Athletes with vitamin D insufficiency and deficiency tended to be young, female and indoor sport athletes in Hong Kong as shown in this study. Given the important role of vitamin D in musculoskeletal health and maintaining immunity, regular assessment on vitamin D status for high risk groups, education regarding adequate dietary intake of vitamin D and regular safe sun exposure should start from young age. Further investigation on athletes' vitamin D dietary intake and the need of supplementation are essential to improve vitamin D insufficiency and deficiency conditions.

Reference

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