VITAMIN D STATUS OF ELITE ATHLETES WITH A SPINAL CORD INJURY RELATIVE TO DIET AND LIFESTYLE FACTORS

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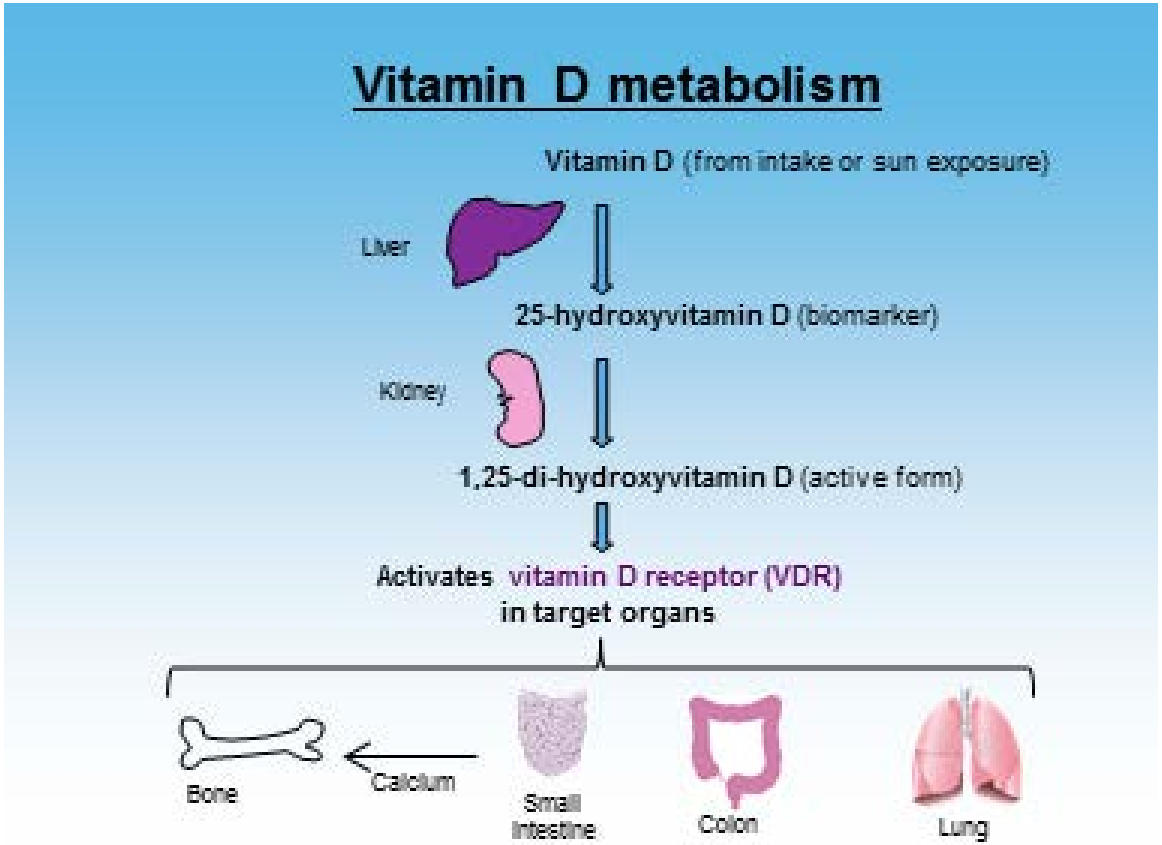
Introduction



Introduction

- Vitamin D deficiency is a growing international concern, with over 77% of Americans considered Vitamin D insufficient.
- Vitamin D absorption from the sunlight varies with:
  - Skin pigmentation (darker skin requires more prolonged exposure to elicit the same Vit D concentrations in circulation)
  - UVB exposure, which changes with
    - Latitude
    - ozone layer
    - season
    - time of day
  - Use of sunscreen
  - Body fat levels (lower absorption with higher body fat levels)
- Vitamin D also achieved through dietary intake – oily fish, eggs, fortified cereals and dairy, shitake mushrooms.

Introduction

- Individuals with a spinal cord injury (SCI) may be at increased risk for Vitamin D insufficiency due to inadequate diet, anticonvulsant medications and reduced sunlight exposure (as a result of reduced functional mobility, impaired thermoregulation, covering more skin surface area with clothing and / or sunscreen)

- Vitamin D receptors are found in numerous organs including muscle, immune cells, vascular tissues, bone, intestine and pancreas
- Vitamin D deficiency has been scientifically linked to:
  - Reduced bone density and strength
  - Reduced muscle strength and recovery of muscle function
  - Immune cell dysfunction (both innate and adaptive) and increased upper respiratory tract infections
  - Mood disturbances / depression
  - Reduced testosterone levels in men with SCI
  - Playing indoor sports
- SCI also associated with suppressed parathyroid hormone, which already reduces bone density and strength

Purpose

- To examine the Vitamin D status of elite athletes with a SCI at the end of summer
- To determine whether lifestyle factors are related to this Vitamin D status

Definitions:

- Normal 25(OH)D >32 ng/mL
- Insufficient 25(OH)D 20-32 ng/mL
- Deficient 25(OH)D <20 ng/mL

Methods

- Recruited from Canadian Wheelchair Sports Association, British Columbia Wheelchair sports association, and US Olympic committee Paralympic programs
- Informed consent
- Inclusion criteria: spinal cord impairment, elite athlete
- Exclusion criteria: diagnosed fat malabsorption, thyroid, kidney or bone disease
- Fall (USA / Canada September and October)
- Outdoor sports – tennis (1), athletics (14)
- Indoor sports – WC rugby (12), WC basketball (12)

- Testing session included height, weight, injury level and history of injury
- Serum 25(OH)D concentration – blood spot method (ZRT laboratory)
- Dietary and lifestyle questionnaire

Methods

- Dietary and lifestyle questionnaire included:
  - 24 hr dietary recall (Vit D focused)
  - Gender, age ethnicity
  - Supplement use
  - UVB exposure (past 3 months) including sunscreen use and clothing worn
  - Injury and illness history (3 months)
  - Dietary intake of Vit D-containing foods (Vit D content calculated from USDA database and food labels).

- Statistics: SPSS for Windows version 18.0
  - Pearson r correlations to examine relationship between 25(OH)D levels and Vit D intake.
  - Spearman rank correlations to assess relationship between serum 25(OH)D levels and noncontinuous variables
  - One-way repeated measures ANOVA to test differences between sports teams with Tukey post hoc test in case of significance.

Results – Vitamin D concentrations

n=39 (19 M, 20 F; 30 Caucasian, 1 African American, 3 Asian, 1 white hispanic)
Mean ± S.D. Height 131.5 ± 13.6cm, Weight 59.5 ± 13.5kg, Age 27.7 ± 6.5 y

Mean ± S.D. 25(OH)D for all athletes 27.9 ± 7.9 ng/mL (range 12-43 ng/mL)

- 15.4% were deficient (25(OH)D < 20ng/mL)
- 51.3% were insufficient (25(OH)D 20-32 ng/mL)

OUTDOOR SPORTS: 6% deficient, 60% insufficient
INDOOR SPORTS: 21% deficient, 46% insufficient

No differences between sports, gender or lesion level.

Results – Vitamin D concentrations

Table 1. Mean 25(OH)D concentration for different sports

Outdoor		Indoor		P-value
Athletics (n=14)	Tennis (n=1)	Basketball (n=12)	Rugby (n=12)	
30.6 ± 2.1	19	28.2 ± 2.3	25.2 ± 2.3	P = 0.23

Mean ± S.D. No difference between indoor and outdoor sports

Table 2. Mean 25(OH)D concentration according to level of SC lesion

C level (n=11)	T1-T6 (n=10)	T7-T12 (n=11)	Lumbar (n=5)	P-value
22.6 ± 9.9	30.1 ± 7.2	30.6	29.8	P = 0.15

Mean ± S.D. No difference between level of SC lesion, lesion level missing for 2 athletes

Results – Dietary Intake / Sunlight Exposure

- Average dietary intake from food sources 121.1 ± 9.8 IU/d (cf RDA 600 IU/d)
- Vitamin D status correlated with milk consumption ($r=.27$, $p<0.05$)
- 2 athletes reported multivitamin intake
- 4 athletes reported Vit D supplement intake (2 with insufficiency, 2 with normal Vitamin D status – 1000IU/d, 2000IU/d and 2 dose not specified)
- Primary Vitamin D-containing foods consumed were fortified milk/dairy, fortified cereals, fortified orange juice, whole eggs, salmon

- Reported leisure time spent outdoors 5.5 ± 1.6 h/wk
- Significantly correlated with Vitamin D status ($r=.41$, $p<0.05$)
- Time of day spent outdoors, reported tanning bed use (n=1), geographical location, sunscreen use and SPF factor of sunscreen not correlated with 25(OH)D status.

Discussion

- 66% of athletes with a SCI were had either deficient or insufficient Vitamin D concentrations, even at the end of summer
  - Lower than reports in sedentary individuals with an SCI (81%, Oleson et al. 2006)
  - Lower than reported in the US general population from 2001-2004 (77%, Ginde et al 2009)
  - Similar to reports in able-bodied athletes (Halliday et al. 2010; Storlie et al. 2011)

- A higher proportion of indoor athletes were clinically deficient in Vitamin D compared to outdoor athletes, who were more likely to be classed as insufficient.
  - Comparative literature in able-bodied athletes is mixed, but indicates indoor athletes are more likely insufficient in Vitamin D than outdoor athletes

Discussion

- Leisure time spent outdoors during summer was associated with Vitamin D status
  - In contrast, geographical location and gender were not major risk factors for Vit D insufficiency
  - This, together with higher incidence of deficiency in indoor sports, indicates lack of sun exposure can increase risk of deficiency.
  - Quadriplegic athletes who live in hot summer climates often report reduced sun exposure during summer due to their restricted thermoregulatory capacity

- Dietary Vitamin D intake was low.
  - Reasons for this uncertain but may be related to reduced energy requirements
  - Supports previous reports on dietary intakes of Canadian athletes with a SCI (87-166 IU/d, Krempien et al. 2009)
  - NHANES data (2014) suggests only 9.4% of individuals with a disability meet recommendations for Vitamin D intake from food alone

Conclusion

- A substantial proportion of elite athletes with a SCI have insufficient Vitamin D status even after the summer months
- Higher proportion of indoor athletes are clinically deficient in Vitamin D
- Important to encourage athletes with a SCI to spend more leisure time outdoors during summer months, exposing skin surface to sunlight in a safe manner without excessive use of sunscreen
- Athletes with quadriplegia living in hot / humid climates may require Vitamin D supplementation during summer more so than winter
- Dietary intakes of Vitamin D were low in this population, the reason for which requires further investigation
- Further investigation is required as to the appropriate level of Vitamin D supplementation required in athletes with a SCI

Gracias por su atención

U.S. PARALYMPICS