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Vitamin D Knowledge Awareness and Behaviours Associated with Sunlight in the Elite Minor Hockey Community in Calgary, Alberta

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Abstract

Objective: The purpose of this study was to investigate the knowledge level of Vitamin D awareness and the behaviours associated with hours of sunlight in parents and coaches of elite youth ice hockey players living in Calgary, Alberta.

Design: Descriptive, Cross-sectional survey.

Setting: Arenas around Calgary, AB.

Participants: Coaches (n = 36) and parents (n = 92) of Bantam AA, Bantam AAA and Minor Midget AAA hockey teams in Calgary, Canada were invited to be enrolled (N=128).

Main Outcome Measurements: Twenty-seven questions measured knowledge and behaviour by hours of sunlight exposure and sunscreen usage.

Results: The mean age of the participants in years were: coaches 32.47 ± 12.5 (97% males) and parents 45.37 ± 4.5 (51% males). The overall mean of identifying the correct answer in the knowledge outcome was 3.6 out of 8. Participants had heard of vitamin D and knew it was absorbed subcutaneously through sunlight. Females (F) were significantly more likely when compared to males (M) to: 1) know that vitamin D was good for bone health (F 93.5% vs M 73.2%, p=0.005) and 2) spend only 1-2 hours outdoors during the weekdays (F 69.5% vs. M 93.5%, p=0.005) as well as on Sundays (F 67.4% vs. M 42.7%, p=0.026).

Conclusions: There was a high level of vitamin D awareness however; there was confusion on the source of vitamin D especially those of a dietary nature. Females showed a higher knowledge of bone health in relation to vitamin D but spent less time outdoors when compared to males. Based on these surveyed behaviours and to the best of our knowledge this is the first time an increased risk of vitamin D insufficiency has been identified in this population.

Keywords: Awareness; Behaviour; Knowledge; Ice Hockey Arenas; Vitamin D

Introduction

Vitamin D insufficiency is prevalent in populations living in northern latitudes where cutaneous absorption is limited in the winter months from October through to March [1-5]. Approximately 25% of the Canadian population has a serum Vitamin D [25(OH) D] less than 50 nmol/L [6]. In Calgary Alberta, the adult population has been identified has having a mean 25(OH) D that is below the recommended 75 nmol/L from Health Canada, particularity in the winter months [7]. Prolonged low levels of serum 25(OH)D have increased risk of osteoporosis [8], cancer [9-11], multiple sclerosis [12] and other diseases [13,14] and have been

well documented in the literature. These health concerns take on added significance with individuals at an increased risk based on their location when their behaviour choices or occupation results in them spending more time indoors regardless of the season.

Physical and biological risk factors for vitamin D inadequacy are known, however population-specific behaviours and attitudes that influence these risk factors, particularly among the athletic community are poorly documented. The few studies that have investigated vitamin D status in athletes demonstrate that it is variable and dependent on outdoor training time during peak sunlight, skin color, and geographic location. Population specific studies on knowledge of vitamin D show incomplete and confused knowledge, with behaviours that are associated with high risk for insufficiency.

Athletic communities and males are underrepresented in the published Knowledge, Attitudes and Practices (KAP) surveys assessing vitamin D behavior [15]. Coaches and parents of elite ice hockey players are a specific population and they spend a large portion of their time indoors during the hockey season. Elite minor hockey is played almost year-round from August until April and many players continue training in arenas throughout the summer. Players aged 13-15 are not yet able to drive themselves to the arena for games or practices based on provincial standards, therefore parents of these athletes spend an increased amount of time driving them to and from practices and games. As well, parents often stay to watch their child's practices and games. These individuals (parents and coaches), nicknamed arena dwellers, are potentially a high-risk population for vitamin D insufficiency and as such are likely unaware. The parent group is likely of higher socio-economic status since elite hockey is costly and they may have a higher level of education [16-20], which could lead to an increased knowledge and awareness of vitamin D [15,21-25].

The purpose of this study was to investigate the knowledge level of vitamin D awareness and the behaviours associated with sunlight as measured by the number of hours per day spent indoors, in parents and coaches of elite Bantam AA, AAA and Minor Midget AAA ice hockey player's living in Calgary, Alberta.

Methods

In the winter months of 2013 (January and February) an I Pad survey for knowledge awareness of vitamin D and behaviours associated with sunshine was administered to parents and coaches in ice hockey rinks around Calgary Alberta to bantam AA, bantam AAA and minor midget AAA teams (players aged 13-15). The survey tool mobilEcho was employed as a mobile file management tool as it is compatibility with I Pads and downloads information into an Excel document for ease of transfer into SPSS. A maximum of 10 parents, one parent per family and three coaches per team were asked to participate. Ethical approval from the University of Calgary Conjoint Ethics Committee was received on November 21, 2012.

Participant Recruitment

All bantam AA, bantam AAA and minor midget AAA teams in Calgary and surrounding area were approached and 17 teams were enrolled (N=32); two teams declined and the remaining 13 teams were unable to be contacted. Contact information was gathered through team websites and the team manager for each team was initially sent an email. Following this a letter was sent to parents and coaches describing the details of the study and specifically the level of involvement from participants. Once a team met the minimum interest, five parents and one coach, the team manager chose either a practice or game for the Research Assistant (EH) to recruit participants. The manager provided the introductions for the research assistant to the participants once at the rink. If there was no response from the teams after the initial email and two follow up phone calls, then the research assistant approached them at arenas during regular season games. Participants were approached individually, told about the research study, the involvement needed and were asked if they were willing to participate. The research assistant then asked the new participant to point out any other coaches or parents from the team.

A total of 128 participants were enrolled, 36 coaches (C) and 92 parents (P). The overall mean age in years was 41.74 ± 9.5, the mean age of the coaches was 32.47 ±12.5 and parents were 45.37 ± 4.5 (male: 47.11 ± 4.2 and female 43.56 ± 4.1).

Survey Questions

The survey was modified from a previously validated Vitamin D knowledge survey comprised of eighteen main questions, pertaining to personal characteristics, perceptions, attitudes and behaviour toward sunlight, and knowledge about vitamin D [15]. Behaviour was assessed through 14 questions relating to the amount of time spent indoors and outdoors during different days of the week and times of the year, as well as sunscreen usage. Knowledge of vitamin D was determined through six questions related to the sources of vitamin D. We added nine questions (N=27): five demographic questions on age, ethnicity, sex, and level of education using the standard Statistics Canada categories, three behaviour questions specifically related to hockey, and one knowledge question. As surveys grow in length, survey abandon rates increase, therefore a pilot survey on a convenience sample of students (n = 51) to estimate the response time and question wording was completed. Students took approximately five minutes to complete the survey via pen and paper. After adjustments were made to the wording a pilot group of ten parents from the hockey community were also given the survey. No adjustments were made after this second group.

Outcome measures

The outcomes measured were knowledge and behaviour. Knowledge was tested through six questions, numbers 20-25 and behaviour was measured by hours of sunlight exposure and sunscreen use, numbers 6-19 (Table 1).

No.	Question
1.	What is your birth date?
2.	What is your sex?
3.	What is your position?
4.	What is your ethnicity?
5.	What is your highest level of education completed?
6.	Do you work mainly indoors?
7.	Do you like going in the sun?
8.	Do you use sunscreen products, excluding moisturizer, containing SPF > 15?
8.a.	If yes, how many times a week do you use sunscreen in summer?
8.b.	If yes, how many times a week do you use sunscreen in winter?
9.	On an average weekday, from 10am-4pm, how many hours do you spend indoors?
10.	On an average Sunday, from 10am-4pm, how many hours do you spend indoors?
11.	Do you like outdoor activity?
12.	How often do you do outdoor activities between the months of May to September?
13.	How often do you do outdoor activities between the months of October to April?
14.	On an average weekday, from 10am-4pm, how many hours do you spend outdoors?
15.	On an average Sunday, from 10am-4pm, how many hours do you spend outdoors?
16.	In the past week, how much time have you spent in the sun?
17.	In the past week, how much time have you spent in the arena?
18.	Does your player participate in a spring hockey league?
19.	Does your player participate in a summer hockey league?
20.	Do you think you get enough exposure to sunlight?
21.	Have you heard of vitamin D?
22.	To the best of your knowledge rate the sources of vitamin D (supplements, sunshine, milk, tuna, and orange juice) from 1 to 5 (1 being the most and 5 being the least)
23.	Do you know that vitamin D is good for bone health?
24.	Do you know that through sunlight your skin absorbs vitamin D?
25.	How much time do you need to spend in the sun to absorb sufficient vitamin D?
26.	Where have you learned about vitamin D?
27.	Did you enjoy completing this survey on an iPad?

Table 1: Knowledge awareness of Vitamin D survey questions (N=27).

Analysis

The survey results were saved as individual PDFs file on I Pads and subsequently downloaded onto an excel document which was exported into SPSS (Version 20) for analysis. All descriptive date is reported as means and standard deviations. Frequency distributions were determined for each question, and reported as percent by position (C or P) and sex. Chi-squared analysis was used to make comparisons and knowledge of vitamin D and behaviours were compared between sex, position and education. Cross tabs analysis was completed on the knowledge questions based on correct answers to the questions (Table 1) which was scored out of 8; each correct answer was given 1 and an incorrect response was given a 0.

Results

Overall 17 teams completed surveys (53%), with 36 coaches (97% males) and 92 parents (51% males) as survey participants. A total of 128 participants were enrolled, the mean age in years was 41.74 ± 9.5, the average age of the coaches was 32.47 ± 12.5 and the parents was 45.37 ± 4.5 (male: 47.1 ± 4.2 and female 43.56 ± 4.1). The participants were predominantly Caucasian (96.9%; n=124) with a very small percent being East Asian (3.1%; n=4). The majority of participants (57.8%) had a college or university undergrad degree or some college or university (21.9%) (See Table 2).

Characteristics		n (%)	
Team Quadrant	SE	26	(20.3)
	SW	19	(14.8)
	NE	22	(17.2)
	NW	37	(28.9)
	SA	24	(18.8)
Sex	Male	82	(64.1)
	Female	46	(35.9)
Position	Coach	36	(28.1)
	Parent	92	(71.9)
Ethnicity	Caucasian	124	(96.9)
Education	East Asian	4	(3.1)
	Some high school	3	(2.3)
	High school Diploma	11	(8.6)
	Some College/University	28	(21.9)
	College/University undergrad degree	74	(57.8)
	Master Degree	11	(8.6)
	PhD Degree	1	(0.8)

Table 2: Participant characteristics and Team Location (N=128).

Knowledge of Vitamin D

All participants indicated that they had heard of vitamin D (100%), and the majority knew that vitamin D is absorbed subcutaneously (95.3%). Overall 42% of the participants indicated they had enough exposure to sunlight. Coaches, however were more likely to think they had enough expose to sunlight (52.8%) compared to parents (38%) (p = 0.129). The majority of participants (80.5%) knew that vitamin D is good for bone health; however, females were more likely than males to know this (93.5% vs 73.2%, p=0.005). Participants (29.7%) indicated that 15-30 minutes in the sun was needed to absorb sufficient vitamin D, however 21% indicated 30-45 minutes, 22.9% indicated one hour and 18% indicated more than one hour was needed.

Survey Questions	Response	Coaches n (%)	Parents n (%)	Overall n (%)
Do you work mainly indoors?	Yes	30 (83.3)	84 (91.3)	114 (89.1)
	No	6 (16.7)	8 (8.7)	14 (10.9)
Do you like going in the sun?	Yes	35 (97.2)	87 (94.6)	112 (95.3)
	No	1 (2.8)	5 (5.4)	6 (4.7)
Do you use sunscreen products containing SPF>15	Yes	27 (75)	71 (77.2)	98 (76.6)
	No	9 (25)	21 (22.8)	30 (23.4)
On an average weekday, from 10am-4pm, how many hours do you spend indoors?	1-2 hours	2 (5.6)	3 (3.3)	5 (3.9)
	2-4 hours	6 (16.7)	15 (16.3)	21 (16.4)
	4-6 hours	28 (77.8)	74 (80.4)	102 (79.7)
On an average Sunday, from 10am-4pm how many hours do you spend indoors?	1-2 hours	9 (25)	20 (21.7)	29 (22.7)
	2-4 hours	15 (41.7)	45 (48.9)	60 (46.9)
	4-6 hours	12 (33.3)	27 (29.3)	39 (30.5)
Do you like outdoor activity?	Yes	36 (100)	91 (98.9)	127 (99.2)
	No	0 (0)	1 (1.1)	1 (0.8)
How often do you do outdoor activities between the months of May and September?	Very frequent	20 (55.6)	51 (55.4)	71 (55.5)
	Frequent	7 (19.4)	24 (26.1)	31 (24.2)
	Often	8 (22.2)	13 (14.1)	21 (16.4)
	Not often	1 (2.8)	3 (3.3)	4 (3.1)
	Never	0 (0)	1 (1.1)	1 (0.8)
How often do you do outdoor activities October to April?	Very frequent	3 (8.3)	6 (6.5)	9 (7)
	Frequent	8 (22.2)	12 (13)	20 (15.6)
	Often	11 (30.6)	23 (25)	34 (26.6)
	Not often	14 (38.9)	51 (55.4)	65 (50.8)
	Never	0 (0)	0 (0)	0 (0)
Average weekday 10am-4pm how many hours do you spend outdoor?	1-2 hours	26 (72.2)	74 (80.4)	100 (78.1)
	2-4 hours	7 (19.4)	13 (14.1)	20 (15.6)
	4-6 hours	3 (8.3)	5 (5.4)	8 (6.3)
Average Sunday 10am-4-pm how many hours do you spend outdoor?	1-2 hours	18 (50)	48 (52.2)	66 (51.6)
	2-4 hours	15 (41.7)	33 (35.9)	48 (37.5)
	4-6 hours	3 (8.3)	11 (12)	14 (10.9)

In the past week, how much time have you spent in the sun?	1-2 hours	8 (22.2)	40 (43.5)	48 (37.5)
	2-4 hours	14 (38.9)	22 (23.9)	36 (28.1)
	4-6 hours	7 (19.4)	12 (13)	19 (14.8)
	6-8 hours	2 (5.6)	9 (9.8)	11 (8.6)
	8-10 hours	5 (13.9)	3 (3.4)	8 (6.3)
	10-12 hours	0 (0)	2 (2.2)	2 (1.6)
*all were ranked 0 hours	Other*	0 (0)	4 (4.3)	4 (3.1)
In the past week, how much time have you spent in the arena?	1-2 hours	0 (0)	6 (6.5)	6 (4.7)
	2-4 hours	0 (0)	9 (9.8)	9 (7)
	4-6 hours	2 (5.6)	24 (26.1)	26 (20.3)
	6-8 hours	10 (27.8)	21 (22.8)	31 (24.2)
	8-10 hours	6 (16.7)	15 (16.3)	21 (16.4)
	10-14 hours	16 (44.4)	15 (16.3)	31 (24.2)
**all were ranked >14 hours	Other**	2 (5.6)	2 (2.2)	4 (3.1)
Does your player participate in spring hockey league?	Yes	n/a	61 (66.3)	61 (47.7)
	No	n/a	31 (33.7)	31 (24.2)
Does your player participate in a summer hockey league?	Yes	n/a	22 (23.9)	22 (17.2)
	No	n/a	70 (76.1)	70 (54.7)
Do you think you have enough exposure to sunlight?	Yes	19 (52.8)	35 (38)	54 (42.2)
	No	17 (47.2)	57 (62)	74 (57.8)
Have you heard of vitamin D?	Yes	36 (100)	92 (100)	128 (100)
	No	0 (0)	0 (0)	0 (0)
Do you know vitamin D is good for bone health?	Yes	29 (80.6)	74 (80.4)	103 (80.5)
	No	7 (19.4)	18 (19.6)	25 (19.5)
Do you know that through sunlight your skin absorbs Vitamin D?	Yes	34 (94.4)	88 (95.7)	122 (95.3)
	No	2 (5.6)	4 (4.3)	6 (4.7)
How much time do you need to spend in the sun to absorb sufficient vitamin D to be healthy?	0-15 min	4 (11.1)	8 (8.7)	12 (9.4)
	15-30 min	11 (30.6)	27 (29.3)	38 (29.7)
	30-45 min	5 (13.9)	22 (23.9)	27 (21.1)
	1 hour	9 (25)	19 (20.7)	28 (21.9)
	> 1 hour	7 (19.4)	16 (17.4)	23 (18)
Did you enjoy taking this survey on an iPad?	Yes	35 (94.4)	86 (93.5)	121 (94.5)
	No	1 (5.6)	6 (6.5)	7 (5.5)

Table 3: Coaches and Parents responses to survey questions on sun exposure behaviour (n(%)).

Many participants rated sunshine as the highest source of vitamin D (73.4%) and parents were more likely to do so over coaches (76.1% vs. 66.7%, p=0.044) (Table 4). Most people rated tuna as either the 4th or 5th (78.1%) source, and milk as either 2nd or 3rd source (58.6%) (Table 4). Both orange juice and supplements showed a wide range of responses for their source of vitamin D. Participants reported that they learned of this knowledge about vitamin D through the media (70.3%) or a physician (60.2%) (Table 5).

Source	1 (most) n (%)	2 n (%)	3 n (%)	4 n (%)	5 (least) n (%)
Supplements	19 (14.8)	54 (42.2)	26 (20.3)	17 (13.3)	12 (9.4)
Sunshine	94 (73.4)	23(18)	3 (2.3)	0 (0)	8 (6.3)
Milk	5 (3.9)	31 (24.2)	44 (34.4)	24 (18.8)	24 (18.8)
Tuna	6 (4.7)	4 (3.1)	18 (14.1)	51 (39.8)	49 (38.3)
Orange Juice	4 (3.1)	16 (12.5)	37 (28.9)	36 (28.1)	35 (27.3)

Table 4: Participant's rating on vitamin D sources.

Source	n (%)
Media	90 (70.3)
Physician	77(60.2)
Friend	34 (26.6)
Child	2 (1.6)
Parent	15 (11.7)
Teacher	16 (12.5)
Other	18 (14.1)

Table 5: Participant's knowledge on vitamin D sources.

None of the participants scored 8 out of 8 on the five knowledge questions and the overall mean score for knowledge was 3.6. No significant difference was found when comparing males' mean knowledge score to the females' score (M: 3.46 ± 1.34 vs. F: 3.89 ± 1.29). There was also no significant difference found between the parents' and coaches' overall mean knowledge score (P: 3.63 ± 1.34 vs. C: 3.58 ± 1.34).

Behaviours Towards Sunshine

Participants worked mainly indoors (89.1%) and on weekdays between 10am and 4pm 79.7% of participants spent 4-6 hours indoors. On Sundays 46.9% of participants indicated that they spent between 2-4 hours indoors. Females were significantly more likely to report that they spend only 1-2 hours outdoors during the weekdays (69.5% vs. 93.5%, p=0.005) as well as on Sundays (67.4% vs. 42.7%, p=0.026) when compared to males who were more likely to report that they spend more time outside. However, both males and females said they enjoyed outdoor activity (99.2%) and going out in the sun (95.3%). Participants indicated that they did outdoor activities very frequently or frequently between the months of May to September (55.5% and 24.2%). However, during the winter months of October to April participants reported that they do outdoor activities less often (50.8 %). When asked how much time they had spent in the sun in the past week 37.5% said they only spent 1-2 hours in the sun and 28.1% stated they had spent 2-4 hours. The parents were significantly more likely to answer that they spent 1-2 hours in the sun when compared to coaches (p=0.036). In comparison coaches were more likely to indicate that they spent more time in an arena than parents with 44.4% spending 10-14 hours in an arena in a week compared to only 16.3% of parents (p=0.002). Interestingly 76.6% of participants indicated that they use sunscreen products >15 SPF with most wearing it 1-2 days per week during both summer and winter (34.4% and 64.1%). Lastly, 66.3% of parents surveyed stated that their player participates in a spring hockey league, in comparison to only 17.2% who participate in the summer league.

Discussion

This survey assessed the knowledge and behaviours surrounding vitamin D in the elite youth ice hockey community in Calgary. Among the participants confusion existed with respect to vitamin D knowledge in the surveyed elite youth ice hockey community in Calgary, AB. Participants (95.3%) were aware of vitamin D absorption. There was, however some confusion around dietary intake sources particularly regarding levels of vitamin D in tuna, orange juice and supplements. The highest dietary source of vitamin D is in cod liver oil, containing 1360 IU (international units) of vitamin D; tuna, which is also a natural source, provides 200 IU when it is canned in oil [26]. Only 14.1% of the participants knew that tuna ranked third on the list of sources provided. Following this fortified orange juice is the next highest source with 142 IU, but does depend on the brand and lastly fortified milk contains 98 IU [26]. Most supplements contain 400IU - 1000IU due to health Canada's recommended minimum intake of 600IU for adults and an upper limit of 4000IU [27]. This lack of knowledge of food sources may be due to low media where participants (70.3%) gathered their information on tuna and orange juice. However, there is more media attention towards milk products in Canada perhaps leading these individuals to believe that milk is a better source of vitamin D [28].

There was confusion regarding the amount of time needed to spend in the sun to absorb enough vitamin D. Even though 95.3% of those surveyed reported that they knew that vitamin D was absorbed through their skin only 29.7% knew the proper amount of time to spend in the sun (15-30 minutes). In Calgary during the summer months we only need 15-20 minutes between the hours of 10:30am-4:00pm of sun exposure to absorb enough vitamin D [5].

A finding that highlighted differences in knowledge between males and females was that females were significantly more likely to know that vitamin D was good for bone health (93.5% vs. 73.2%, p=0.005). This may be due to females being more aware about osteoporosis and bone health due to their increased risk [29]. Osteoporosis is a common bone disease that is characterized by brittle bones, decreased bone strength, making them predisposed to fractures and is four times more likely to occur in female compared to males [29-30]. In Canada 10% of Canadians aged 40 and older are diagnosed with osteoporosis [30], which is similar to the age of the population studied (41.74 ± 9.5)). Other research suggests that women are more likely to be concerned about health and safety; therefore, they may be more aware of risks toward their own health [31]. As well research in the United States has shown that women are more likely to seek out preventative health care than males [32].

Males were more likely to report that they spend more time outside than females during week days (p=0.005) and Sundays (p=0.026). This finding maybe partially supported by the literature that shows males regardless of age, have higher levels of physical activity when compared to females. One US study reported that males spend a significantly higher amount of time outdoors during the weekend and weekday, however for the population under 60 years, which is similar to the coaches and parents we studied, there was no difference between males and females [33]. Further investigation into quantifying the differences between male and female outdoor activity is needed.

A study strength was the utilization of the I Pad format which decreased both the administration and participant burden with an approximate survey completion time of 3 and ½ minutes. Limitations included a potential selection or non-response bias, as certain individuals within the population may have chosen to not participate due to the voluntary nature of the study [34-35]. Characteristics of these non-responders may differ from the study participants leading to an over or under estimation of certain behaviours or knowledge level. Survey participants may have provided responses that were socially desirable or responses that they perceived the researchers to be looking for. A differential, or non-random, misclassification bias may have been present due to the measurement tool used or by the personal attitudes of the researchers introduced while analyzing data. This could have led to either an overestimation or underestimation of association. There were many questions that had dichotomized responses leaving little room for varied answers, such as questions 8, 9, 10, 15, 24, 25, 27 and 28 (Table 1). As well question 26 leaves much room for interpretation as participants may or may not assume that the milk and orange juice are fortified with vitamin D. Finally, since the study population was confined to Calgary, there is limited external validity.

Conclusion

This survey shows some of the current trends in knowledge and behaviour in this potentially at-risk population. It also highlights the increased amount of time spent indoors as a parent or coach involved in youth ice hockey. Overall there is high awareness of vitamin D and its effects; however, the specific sources of dietary vitamin D are less well recognized. Females are more likely to know about vitamin Ds effect on bone health, which may be due to their knowledge of their increased risk of osteoporosis. However, even though these females have knowledge of this they are still more likely to spend less time outdoors absorbing vitamin D to aid in their bone health.

These parents and coaches are at high risk of vitamin D insufficiency due to their increased amount of time spent indoors as well their decreased absorbance in the winter months based on the latitude at which they live. Therefore, further understanding with a broader population to determine the knowledge and behaviours of other Canadian populations is needed. This would help determine if the level of knowledge in elite youth ice hockey parents is higher or lower than the general population.

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