Vitamin D Deficiency in Indo-Canadian Population

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Abstract

Vitamin D is obtained by the body from UV radiation from the sun and is compulsory for bone formation. Insufficient intake of Vitamin D results in fragile bones. Insufficient intake is more common among immigrant populations in Canada due to decrease in sun exposure.

Immigrants and refugees from non-Western countries are more likely than the general population to suffer from vitamin D deficiency and rickets. Up to 50% of people with non-Western origins may have severe vitamin D insufficiency. Due to the sometimes overwhelming sunshine in their country of origin, they are not used to sunlight exposure. A study looked at the vitamin D status, bone mineral content, and vitamin D consumption of immigrant kids in Saskatchewan. The prevalence of inadequate intakes of calcium and vitamin D was 76% and 89.4%, respectively, in the sample. The Canadian Health Measures Survey (CHMS) also demonstrated the prevalence of the deficiency in the immigrant population in Canada. A quantitative survey was conducted with 82 participants - exploring their awareness and intake of vitamin D in daily life.

It was found that with age the diagnosis of the deficiency increased. Moreover, sun exposure had an inverse relationship with diagnosis of the deficiency. The study confirmed the work conducted by CHMS in the immigrant population from India in Oakville, Canada.

Keywords

Vitamin D, Immigrants, Deficiency, Supplements, Sun Exposure

Introduction

Vitamin D, is a fat-soluble vitamin, which increases calcium absorption, necessary for healthy bone formation and maintenance (Sizar et al., 2023). It controls over 200 genes and aids in immune system regulation, it is crucial for both skeletal and non-skeletal health. (Aranow, 2012) It is taken through dietary sources or generated by skin exposed to ultraviolet B radiation.

However, a deficient intake of Vitamin D results in a deficiency. It results in osteomalacia, or improper mineralization of the collagen matrix in bone. This collagen matrix is fragile, inadequately supports the structure, and raises the possibility of fracture. Low blood levels of 25-hydroxyvitamin D cause thin, brittle, or deformed bones and raises the risk of disorders including fibromyalgia, chronic fatigue syndrome, obesity, diabetes, and hypertension. (Mousa, 2016)

It affects people all across the world. Worldwide, over a billion individuals are vitamin D deficient or insufficient. However, no international health authority has proclaimed it a health emergency to alert the public to the urgent need for adequate vitamin D blood levels. (Naeem, 2010)

Compared to the native population, immigrants and refugees from non-Western countries are more likely to acquire the deficiency. Because they are not accustomed to the minimal sunlight exposure due to excess sunshine in their place of origin, severe vitamin D insufficiency may occur in up to 50% of people of non-Western ancestry. Moreover, immigrants require more sun

exposure since their epidermal layer has more melanin, which inhibits the skin's capacity to generate vitamin D from sunshine. (Lips & de Jongh, 2018)

The skin's 7-dehydrocholesterol is converted to previtamin D3 by ultraviolet B light. Heat isomerization transforms this previtamin D into vitamin D. The liver converts vitamin D from the food and the skin into 25-hydroxyvitamin D. (Bikle, 2021) When 25-hydroxyvitamin D is converted, 1,2,5-dihydroxyvitamin D, which binds to the vitamin D receptor, is produced. Some genes are activated as a result, whereas other genes are suppressed. then promotes intestinal absorption of calcium and phosphorus. (Wacker & Holick, 2013)

The protein in the skin that gives dark skin its color, melanin, competes for UVB with the molecule that causes the skin to begin producing vitamin D. As a result, to produce the same amount of vitamin D, those with darker skin often need more UVB exposure than those with lighter skin. (Harvard Health Publishing, 2020)

Immigrants are particularly vulnerable to the worldwide public health issue of hypovitaminosis D, which has a significant risk among those with darker skin who move from tropical regions to northern latitudes. (Palacios, 2013) Migration is a crucial factor for low S-25(OH)D levels due to lifestyle and environmental changes, such as changes in sun exposure, nutrition, clothing, and moving from low to high latitude nations. In comparison to native-born citizens of Western nations, immigrants in Canada and other Western nations have a higher incidence of vitamin D deficiency and insufficiency, with deficient prevalence ranging from 19.3 to 80% among various ethnic minorities. Other variables that contribute to the deficit include duration of residence in the host country, age upon immigration, dietary difficulties, origins, and melanin levels. The primary risk factors for vitD insufficiency were advanced age, female sex, higher latitude, winter, darker skin pigmentation, less sun exposure, poor dietary habits, and absence of vitD fortification. (Yousef, 2021)

Methodology

Research Aim

A descriptive quantitative study was used to explore the severity of vitamin D deficiency in indo-canadian populations. This kind of research was done to evaluate and collect a variety of realities, views, viewpoints, and experiences. Instead of drawing conclusions from a circumstance, the research looks deeply into the experiences of each participant to uncover meanings, which might provide a thorough examination of the weakness being investigated..

Hypothesis:

An increase in time spent outside and supplement intake will result in an increase in vitamin D production.

Data Collection

Without harboring any preconceived ideas or biases, data was gathered while maintaining contact with the person. It promoted validity during the data collection process, yet it should be noted that researcher bias can still occur. The credibility, dependability, and authenticity of the data gathered throughout the study serve as the foundation for the validity and reliability of

quantitative research. A self reported survey was conducted online to understand how vitamin D deficiency affects various people in the Indo-Canadian community. There were 82 respondents aged 26-63.

Age group of respondents

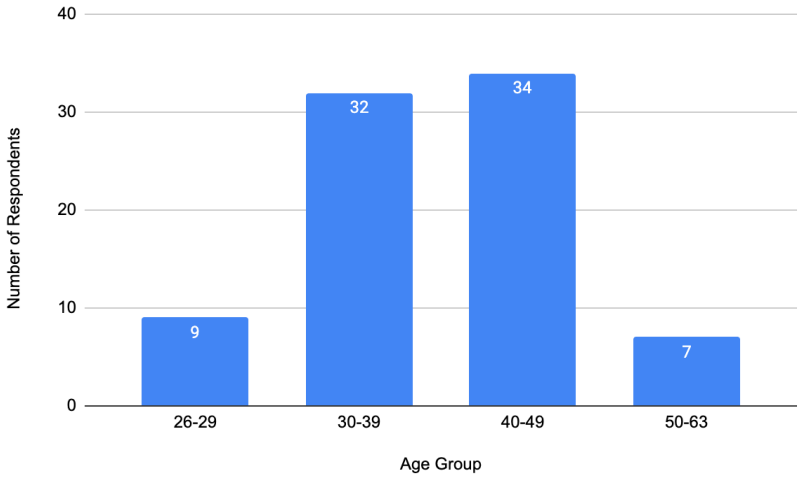

Figure 1: Age distribution of respondents

The youngest age range in the group is represented by the 26-29 age bracket. A bigger proportion of the group belongs to the age range of 30-39. A significant portion of the group is made up of people in the age range of 40 to 49. The smallest age group in the group is 50 to 63. The demographic appears to be large, with a range of experiences and viewpoints, according to the age distribution presented.

Gender of respondents

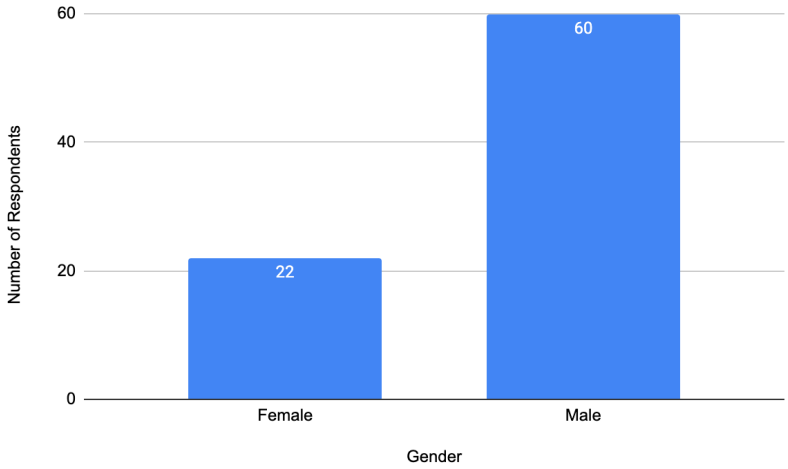

Figure 2: Gender distribution of respondents

Males make up the majority of the population, while females make up a smaller proportion of it altogether. The distribution indicates a considerable difference in numbers between the number of males and females in the group.

Immigrant Generation

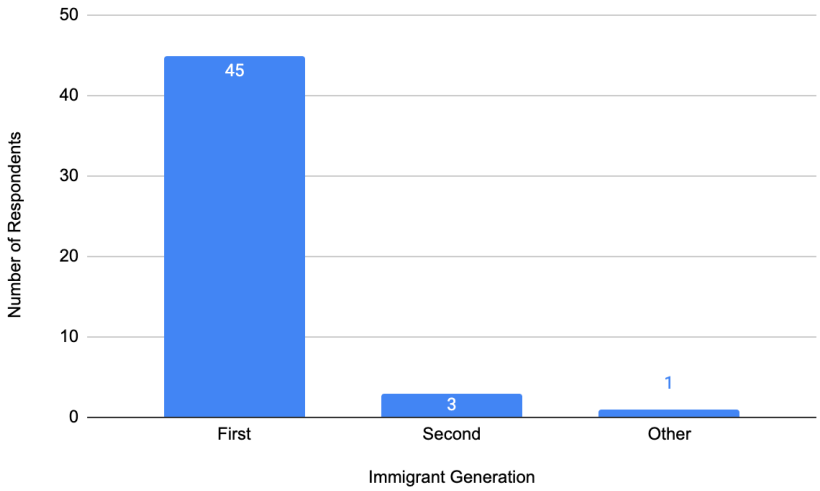

Figure 3: Immigrant generation distribution of respondents

The distribution shows that first-generation immigrants make up the bulk of the population, followed by second-generation immigrants in lower numbers. Only one individual falls under the "other generations" category, indicating that the majority of people are either directly related to immigrants or have an immigrant history. This distribution draws attention to the group's varied generational experiences, with a clear preference for first-generation immigrants.

Variables

Table 1 : Independent and dependent variables taken during the study.

Type	Variables
Independent Variable	Gender, Age, Sun exposure
Dependent Variable	Supplement intake, Symptoms of deficiency and Diagnosis of deficiency.

The study's variables are listed in the following table. One may analyse and draw conclusions about how these factors interact and influence one another by looking at the relationships between the independent variables (gender, age, sun exposure) and the dependent variables (supplement consumption, deficiency symptoms, deficiency diagnosis).

Ethics

The respondents recorded their response voluntarily. Any personal information of the respondents will not be displayed in the research paper and will not be used for any commercial purpose.

Results and Discussion

Gender

Supplements Intake

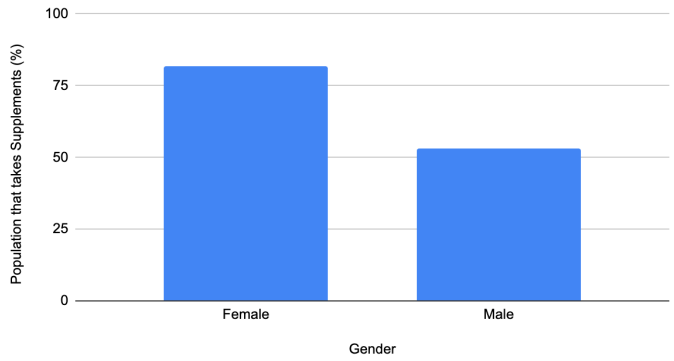

Figure 4: Response on the basis of Gender for the question “Do you take Vitamin D Supplements”

As evident from the above graph, female respondents took more Vitamin D supplement then male respondents.

Symptoms of Deficiency

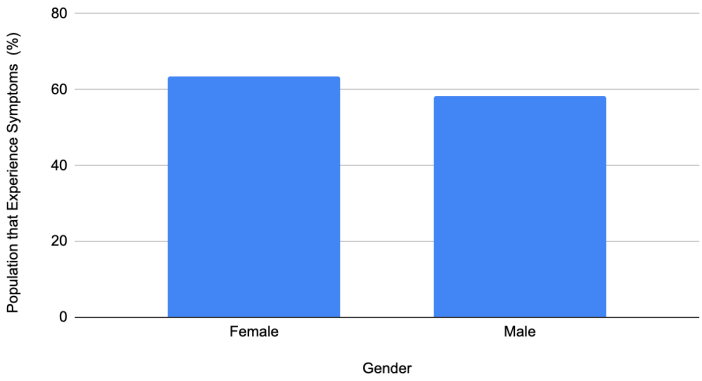

Figure 5: Response on the basis of Gender for the question “Do you Experience Vitamin D deficiency symptoms?”

Diagnosis of Deficiency

In figure 2, it can be noticed that males reported marginally more deficiency than females. deficiency.

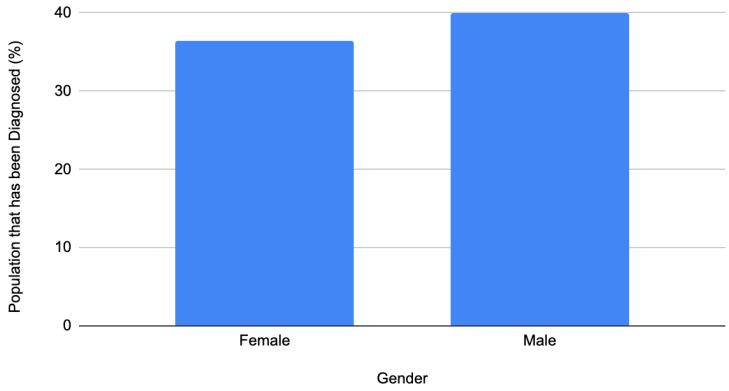

Figure 6: Response on the basis of Gender for the question “Have you been diagnosed with Vitamin D deficiency?”

The majority of the women in the study are in their late 40s, which could mean they have hit menopause. This can affect their estrogen levels which can affect the body's ability to absorb and use Vitamin D. By enhancing dietary calcium absorption from the intestines, estrogen controls calcium metabolism. (Chu, 2021) However, there may be a decrease in calcium absorption and an increase in bone resorption after menopause, when estrogen levels start to diminish. Lower calcium levels in the body and a higher risk of osteoporosis, a disorder characterized by fragile and weaker bones, may result from this. (Christakos, 2011) Additionally, estrogen has an impact on the way vitamin D is metabolized. Vitamin D which is inactive (25-hydroxyvitamin D) is converted to its active form (1,25-dihydroxyvitamin D) in the kidneys by estrogen. The active form increases the absorption of calcium from the intestines. However, these processes are hampered when estrogen levels fall after menopause. Lower estrogen levels result in less calcium being absorbed from the intestines and less vitamin D being activated. As a result, there is less calcium available for bone mineralization, which aids in osteoporosis development. (Gallagher, 1980) With less calcium in their systems, they can face weakness, bone/ joint pain, osteoporosis and headaches which are all symptoms of the deficiency.

During pregnancy and breastfeeding, women have higher nutritional requirements, however, they may not be meeting them, causing them to either develop a deficiency or have symptoms of one. (Khadilkar, 2013) Calcium is more frequently needed throughout pregnancy to promote the fetal skeleton's growth. Vitamin D deficiency in the mother may disrupt the baby's bone development and raise the risk of illnesses like rickets or slowed skeletal development. Additionally, the mother's vitamin D reserves may be depleted by the developing fetus and the transfer of nutrients to breast milk during breastfeeding. (AC, 2011) With less nutrients in the body, women may feel dizzy, headaches, bone pain which are symptoms for the deficiency. Furthermore, the immune system and general health depend on vitamin D. Adequate vitamin D levels during pregnancy and lactation are associated with a lower risk of some problems,

including gestational diabetes, preeclampsia, and premature birth. During these phases, vitamin D insufficiency may also have an effect on the mother's and the baby's immune systems. (Mahadevan, 2012)

Furthermore, women tend to be more covered than males due to clothing choices and cultural practises, which can have an impact on vitamin D levels. (Lips & de Jongh, 2018) Less skin surface area is exposed to sunlight when it is covered by clothing, which lowers the generation of vitamin D. There may be a higher risk of vitamin D insufficiency in societies where women typically cover a substantial portion of their bodies with clothing, such as in several Middle Eastern or South Asian nations. This is particularly true in areas with little sunlight or in the winter such as Canada, when there is less overall sun exposure. (Aucoin, 2013)

Age

Supplements Intake

As age increased, participants were more likely to take supplements to improve bone health. Only 44.4% participants aged 26-29 took supplements whereas, 64.6% of participants aged 40-49 took supplements.

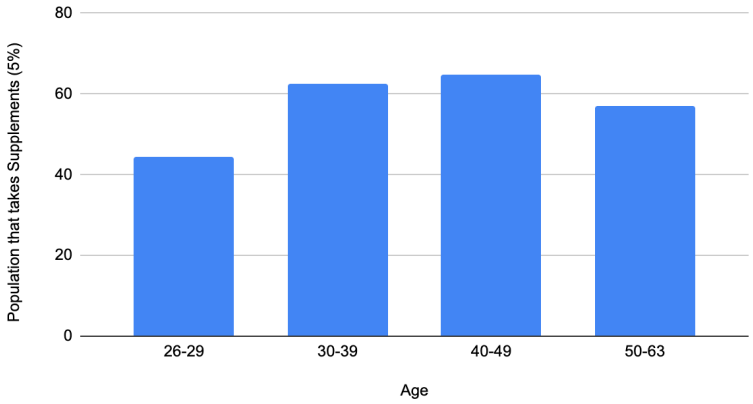

Figure 7: Response on the basis of age for the question “Do you take Vitamin D Supplements?”

Symptoms of Deficiency

As seen in this graph, symptoms reportedly decrease with age. 66.7% of participants aged 26-29 showed symptoms whereas, only 42.9% of participants aged 40-49 showed them.

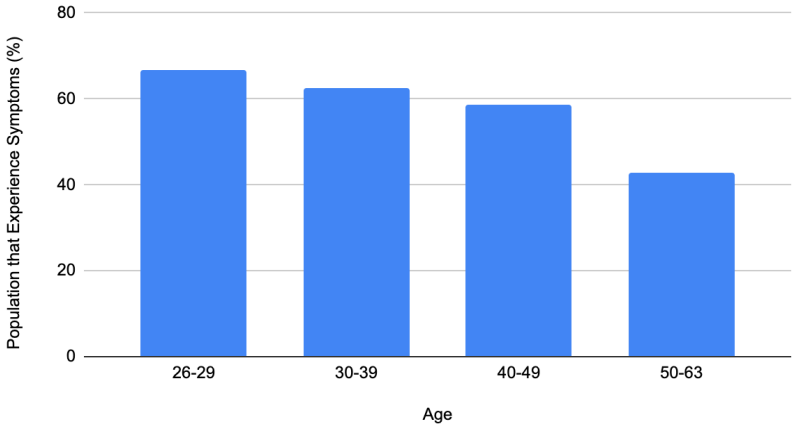

Figure 8: Response on the basis of Age for the question “Do you Experience Symptoms?”

Diagnosis of Deficiency

22.2% of participants aged 26-29 reported the deficiency whereas, 44.1% of participants aged 40-49 reported it. However the age group with the largest population of diagnosis of the deficiency was ages 30-39 with 62.5% of them reportedly diagnosed. This could be possible because with age the diagnosis of the deficiency increased. Thus participants were more likely to take supplements to stop the deficiency.

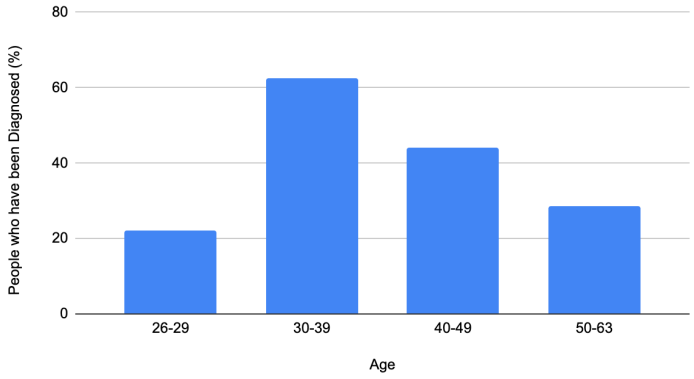

Figure 9: Response on the basis of Gender for the question “Have you been diagnosed with Vitamin D deficiency?”

Exposure Supplements Intake

Sun exposure had an inverse relationship with supplement intake. 61.1% of the people who spent 0-10 mins outside would take supplements, however only 47.4% of the people who spent 30-45 mins outside each day took supplements.

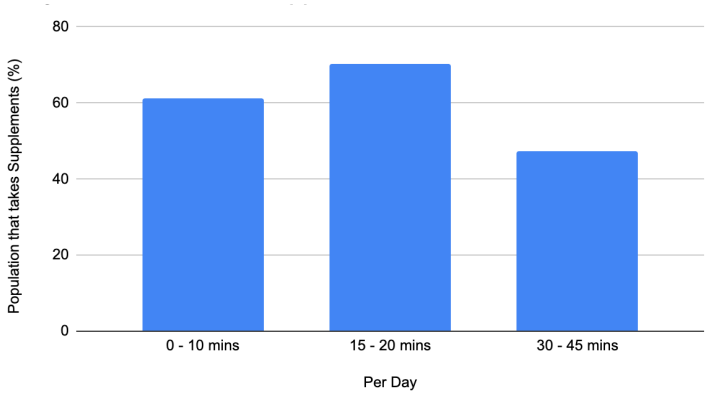

Figure 10: Response on the basis of Age for the question “Do you take Vitamin D Supplements?”

Symptoms of Deficiency

Symptoms also had an inverse relationship with sun exposure. The group of individuals spending the shortest duration of time (0-10 mins) reported the highest incidence of symptoms at 69.4%, followed by 63% of people who spent 15-20 mins outside. Those who spent the longest time outdoors (30-45 mins) experienced the lowest rate of symptoms at 36.8%. Thus, it can be indicated that with more exposure, the chances of showing symptoms decreases.

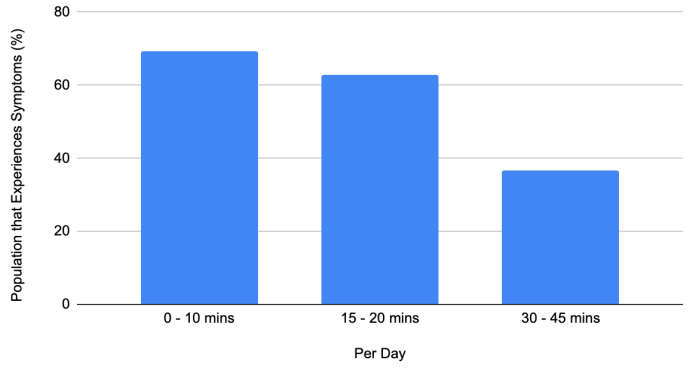

Figure 12: Response on the basis of Gender for the question “Do you Experience Symptoms?”

By looking at the graph, it can be seen that by spending more time outside per day, the chance of experiencing symptoms decreases. Spending more time outside can reduce vitamin D deficiency because sunlight is the primary source of vitamin D for most people. When your skin is exposed to ultraviolet B (UVB) radiation from sunlight, it produces a precursor molecule called 7-dehydrocholesterol, which is converted to vitamin D3 in the skin. Vitamin D3 then enters the bloodstream and is transported to the liver and kidneys, where it is converted to its active form, 1,25-dihydroxyvitamin D. (Michael, 2023)

Research has shown that spending time outside during peak UVB hours, which vary depending on geographic location, can increase vitamin D production in the skin. The peak UVB hours are typically between 11:00 AM and 3:00 PM local time in the summer. It's crucial to remember that variables like latitude, altitude, weather, and ozone levels can have an impact on the precise time and strength of UVB radiation. For precise and current information on peak UVB hours in your particular region within Canada, it is advised to check local weather predictions or refer to UV index statistics. Since more sunlight exposure increases vitamin D production it reduces the risk of developing the deficiency as well as reduces the symptoms. (Wacker & Holick, 20130)

Diagnosis of Deficiency

Diagnosis of the deficiency also had an inverse relationship with sun exposure. 42.4% of people who spent 0-10 mins outside, 40.7% of people who spent 15-20 mins , 26.3% of people who spent 30-45 mins reportedly developed the deficiency. This indicates that with more exposure, the chances of developing the deficiency decreases. A specific amount of sun exposure helps the body to naturally create vitamin D. As a result, those who spend more time outside and often get exposure to sunshine have a lower risk of developing vitamin D insufficiency than people who only get occasional contact. Vitamin D is synthesized in the skin as a result of sun exposure, which helps to keep levels of this nutrient at their ideal levels. (Wacker & Holick, 2013)

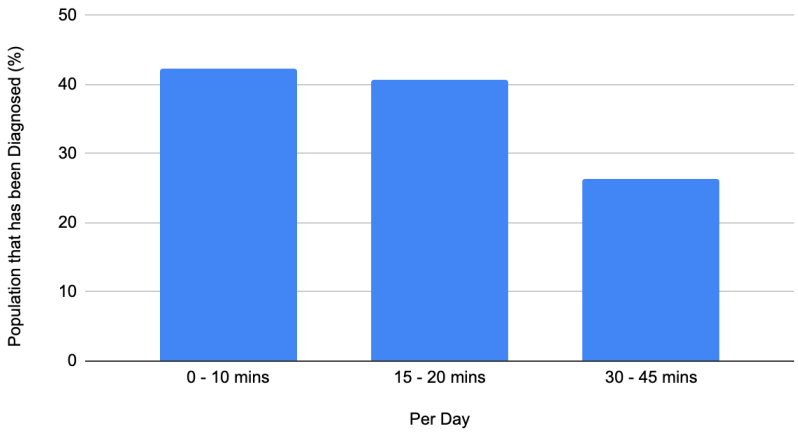

Figure 11: Response on the basis of Gender for the question “Have you been diagnosed with Vitamin D deficiency?”

Conclusion

In conclusion, vitamin D insufficiency affects bone health and general well being significantly, making it a global public health concern. Due to decreased sun exposure and restricted nutritional intake, non-Western immigrants and refugees, especially those with darker skin color, are more likely to acquire the deficiency. This study examined the self-reported consumption and status of vitamin D in immigrants from India who moved to Canada. The results showed that the subjects had a significant frequency of insufficient calcium and vitamin D intakes. Age and sun exposure were also found to have a significant impact on the deficiency's diagnosis and symptoms. (Webb, 2018)

The findings showed that vitamin D deficiency diagnosis rose with age, emphasizing the necessity for tailored interventions and supplementation plans among older people. The study also showed a negative correlation between sun exposure and the diagnosis and symptoms of the insufficiency, highlighting the significance of sunshine as the main source of vitamin D synthesis.

These results support earlier research and show once again how susceptible immigrant communities are to vitamin D deficiency. A larger scale study was conducted in Canada to compare vitamin D levels among first-generation immigrants and native Canadians. Data from the national Canadian Health Measures Survey (Cycles 3 and 4) (11,579 individuals aged 3-79 years) were used in this cross-sectional investigation. According to the findings, immigrants had higher blood calcium and phosphorus levels than non-immigrants (17.08 vs. 16.29, $p = 0.004$) and their weighted mean melanin levels were greater than those of non-immigrants. Immigrants showed lower S-25(OH)D levels than non-immigrants (62.72 vs. 51.23 nmol/L, p 0.001). (Yousef, 2021)

Particularly among immigrants from non-Western nations, it is imperative to spread knowledge of the significance of appropriate vitamin D intake and to advance efforts to increase sun exposure. To address the high prevalence of vitamin D deficiency in these groups, healthcare professionals and policymakers should think about introducing targeted treatments, such as education programmes, dietary recommendations, and public health efforts.

However, there was a limitation to this study. There were insufficient studies to provide evidence for males. Due to the lack of studies, firm conclusions or make broad generalizations regarding the findings particular to males are difficult to make. To address this gap, more research on men's experiences and reactions to the factors looked at in this study is required. A deeper understanding of the subject will result from additional study in this area, which will also help to guarantee that interventions and therapies are appropriate for both men and women.

Overall, this research adds to our understanding of the relationship between vitamin D deficiency, immigration status, and bone health. The long-term effects of vitamin D insufficiency and the efficacy of therapies in enhancing vitamin D status and lowering associated health risks in immigrant communities call for more investigation.

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