Prevalence of Vitamin D Deficiency and its Awareness and Knowledge Among Parents

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ABSTRACT

Introduction: Role of vitamin D in bone related diseases has a long history but mounting scientific evidences now show serious consequences on overall health of children. Despite the close link of vitamin D with child’s health, its inadequacy is not widely recognised as a problem in our population. This study is aimed to find out the prevalence of vitamin D deficiency in children and its awareness among parents.

Methods: It is a prospective, cross-sectional study conducted in paediatric outpatient department of Kathmandu Medical College and Hospital from January to May 2020. Children of one to 15 years were included and 295 samples were taken. A pre-designed questionnaire was given to all participants. Vitamin D3 levels were tested with Chemiluminiscence Immuno Assay (CLIA) technique. The status of vitamin D was defined as deficient if vitamin D3 level less than 50 nmol/l.

Results: Vitamin D deficiency were observed in 76.9% and among which 21%, 44.7% and 11.2% were mild, moderate and severe vitamin D deficiency respectively. Vitamin D level was observed significantly higher in males, younger children, those with presence of knowledge of vitamin D and those with adequate sun exposure. On the other hand factors like skin colour, time of exposure and exposed body parts to sun did not influence vitamin D level.

Conclusions: This study shows high prevalence of vitamin D deficiency among children but awareness among parents regarding vitamin D and its deficiency was low.

Key words: Awareness; Children; Sun exposure; Symptoms; Vitamin D
Prevalence and Awareness of Vitamin D Deficiency: Kayastha P et al.

INTRODUCTION
It is well-established that prolonged and severe vitamin D deficiency leads to rickets in children. However, rickets can be considered just the tip of the iceberg. In addition to its negative impact on bone mineral density status, vitamin D deficiency also contributes to other chronic diseases, such as cardiovascular diseases, hypertension, diabetes and cancer. Its deficiency also increases the incidence of schizophrenia, depression and some inflammatory and autoimmune diseases. About one billion people worldwide are estimated to be suffering from vitamin D insufficiency. Vitamin D deficiency is an internationally recognised health problem and it is difficult to predict the magnitude of vitamin D deficiency amongst Nepalese children as no such data is available. However, few studies done in different areas of Nepal like Chitwan show the prevalence of 74.1% in children, in rural Nepal 91.1% and in Lalitpur 78.2% in young adults. Vitamin D is also called as “sunshine vitamin” as its main source is sunlight (90%). The aim of this study was to find out Vitamin D deficiency status in children and to assess parent’s awareness regarding vitamin D, which could help to guide interventions in achieving the status of an adequate level of vitamin D amongst the Nepalese children.

METHODS
This is a prospective, cross-sectional study conducted in Paediatric Outpatient Department of Kathmandu Medical College, Sinamangal, Kathmandu, Nepal from January to May 2020. Children of age one year to 15 years and their parents were included in this study by simple random sampling method. Parents of children less than one year of age, medical personnel and those who refused to give consent were excluded from the study. A total of 295 samples were randomly selected from outpatient department. From previous published data, 74.1% was taken as prevalence rate and was calculated with absolute error of 5% and at type 1 error of 5% using formula sample size = \( Z_{\alpha/2} \times \sqrt{p(1-p)/d^2} \). A written informed consent was obtained from parents. All participants were provided with a pre-designed questionnaire. It included socio-demographic data, polar questions (yes or no type questions) and multiple choice questions to get information from parents regarding knowledge about sources of vitamin D and its deficiency. Approval from Institutional research committee was taken. The blood samples of children were sent to laboratory and vitamin D3 level was measured with Chemiluminiscence Immuno Assay (CLIA) technique. On the basis of recommendation of US Institute of medicine we took cut off value of \( \geq 50 \text{ nmol/l} \) for sufficient vitamin D3 level and further divided it into mild (25.1 - 49.9 nmol/l), moderate (12.6 - 25 nmol/l) and severe deficient (0 - 12.5 nmol/l).

RESULTS
A total of 295 cases included in this study, out of which 76.9% (i.e. 227 cases) had vitamin D deficiency and only 23.1% (i.e.68 cases) had sufficient vitamin D3 level (Figure 1).

The vitamin D level ranged from 6.2 to 105 nmol/l and mean level was 29.86 ± 17.99. Table 1 show vitamin D status of study population which has been categorised as sufficient, mild, moderate and severe deficiency.

Age of children included in this study ranged from one to 15 years and mean age were 8.48 ± 4.58 years. The mean age of deficient cases were 9.96 ± 3.946 years and mean age of sufficient cases were 3.69 ± 2.942 years. Prevalence of vitamin D deficiency was encountered more in older children aged more than five years than preschool children. The association of age with vitamin D level was strongly significant with p - value of 0.000 (Figure 2).

There were 143 (48.5%) male and 152 female (51.5%) children enrolled in this study. The prevalence of vitamin D deficiency was seen more in female 57.3% (130) than male 42.7% (97) which was statistically significant with p - value of 0.000 (figure 3).

However, there were no statistically significant association observed between vitamin D3 level with children’s skin colour and weight for age (p - value of 0.077 and 0.030 respectively).

Few parents who participated in the study declared that the main source of vitamin D was sunlight...
(31.9%) but almost half of the parents did not know about any dietary sources of vitamin D (Table 2). Most frequently mentioned dietary sources were dairy products/milk (12.2%) and mistaken response was dominated by fruits (10.5%) and vegetables (10.2%).

82% of parents were unaware about need of vitamin D for calcium absorption and 52.9% aware of vitamin D in relation to growth whereas 56.3% of them mentioned absence of vitamin D in breastmilk. Among all, 66.8% of parents did not know about symptoms of vitamin D deficiency.

Most frequently mentioned symptoms were related to bone symptoms like bow leg, bone pain, delayed walking and bone fracture (Table 2). Most of the participants marked educational subject and least number marked public awareness and social media as their source of knowledge of vitamin D. There were strong association of vitamin D level with duration of sun exposure and exposure of body parts. Vitamin D level was found to be higher in children with parents having knowledge about vitamin D. Table 3 shows the association between level of vitamin D with knowledge of parents and habit of sun exposure.

**DISCUSSION**

In this study, we observed high prevalence (76.9%) of vitamin D deficiency in children, the result is similar to that recorded by Regmi et al. and Shrestha et al. where 74.1% and 78.2% were reported respectively.4,5 A few other studies that have investigated vitamin D status in different groups of population of Nepal were 73.68% in adults of western region as well as Kathmandu valley and 59.8% in lactating mothers of Bhaktapur.8 Most of the other Asian countries like India (84-100%), Saudi Arabia (98.1%), Malaysia (35.3%), Korea (59.1%) also had high prevalence of Vitamin D deficiency.7,9 The Asian diet with its paucity of foods containing vitamin D and high phytate content may be the cause of rise in vitamin deficiency.
Prevalence and Awareness of Vitamin D Deficiency; Kayastha P et al.

Table 2. Variables describing awareness of Vitamin D, its sources and deficiency among parents

| Variables                                | Number (%)   |
|------------------------------------------|--------------|
| Sources of vitamin D                     |              |
| Sunlight                                 | 94 (31.9%)   |
| Dietary supplements                      | 28 (9.5%)    |
| Healthy foods                            | 74 (25.1%)   |
| None                                     | 99 (33.5%)   |
| Vitamin D in breast milk                 |              |
| Yes                                      | 129 (43.7%)  |
| No                                       | 166 (56.3%)  |
| Vitamin D for Calcium absorption         |              |
| Yes                                      | 53 (18%)     |
| No                                       | 242 (82%)    |
| Symptoms of vitamin D deficiency         |              |
| Bow leg                                  | 30 (10.2%)   |
| Delayed walking                          | 16 (5.4%)    |
| Bone fracture                            | 21 (7.1%)    |
| Bone pain                                | 30 (10.21%)  |
| Tooth ache                               | 1 (3%)       |
| I don’t know                             | 197 (66.8%)  |
| Dietary sources of vitamin D             |              |
| Fruits                                   | 31 (10.5%)   |
| Vegetables                               | 30 (10.2%)   |
| Fatty fish                               | 13 (4.4%)    |
| Milk/dairy products                      | 36 (12.2%)   |
| Cod liver oil                            | 8 (2.7%)     |
| Eggs                                     | 15 (5.1%)    |
| Nuts                                     | 5 (1.7%)     |
| Selected cereals                         | 8 (2.7%)     |
| Meat                                     | 5 (1.7%)     |
| I don’t know                             | 144 (48.8%)  |
| Reason for inadequate exposure to sun    |              |
| Not enough information                   | 176 (59.7%)  |
| Fear of skin cancer/burn                 | 11 (3.7%)    |
| Weather issue                            | 14 (4.7%)    |
| Physical issues                          | 94 (31.9%)   |
| Sources of knowledge about vitamin D     |              |
| Social media                             | 9 (3.1%)     |
| Public awareness campaign                | 7 (2.4%)     |
| Doctors/nurses                           | 21 (7.1%)    |
| Relatives / friends                      | 20 (6.8%)    |
| Educational subjects                     | 35 (11.9%)   |
| None                                     | 203 (68.8%)  |

Table 3. Association of vitamin D3 status with variable of knowledge of Vitamin D and habit of sun exposure

| Variables                                | Vitamin D3  | P value | Odd ratio; 95% Confiden ce Interval |
|------------------------------------------|-------------|---------|------------------------------------|
|                                          | Deficient   | Sufficient |                                  |
| Knowledge of vitamin D                   |             |          |                                    |
| No                                       | 177 (78%)   | 26 (38.2%) | 0.000                             |
|                                          | (78%)       | (38.2%)   | 3.56; 2.33 - 5.43                 |
| Yes                                      | 50 (22%)    | 42 (61.8%) |                                    |
|                                          | (22%)       | (61.8%)   |                                    |
| Time of exposure to Sun                  |             |          |                                    |
| Morning                                  | 162 (71.4%) | 58 (85.3%) | 0.013                             |
|                                          | (71.4%)     | (85.3%)   | 1.066-3.68                        |
| Evening                                  | 65 (28.6%)  | 10 (14.7%) |                                    |
|                                          | (28.6%)     | (14.7%)   |                                    |
| Duration of sun exposure                 |             |          |                                    |
| < 30 Minutes                             | 137 (60.4%) | 12 (17.6%) | 0.000                             |
|                                          | (60.4%)     | (17.6%)   | 7.1204; 3.607-13.991              |
| > 30 Minutes                             | 90 (39.6%)  | 56 (82.4%) |                                    |
|                                          | (39.6%)     | (82.4%)   |                                    |
| Exposed body parts                       |             |          |                                    |
| Hand / Face                              | 158 (69.6%) | 14 (20.6%) | 0.000                             |
|                                          | (69.6%)     | (20.6%)   | 8.832; 4.6-16.95                  |
| Face                                     | 69 (30.4%)  | 54 (79.4%) |                                    |
|                                          | (30.4%)     | (79.4%)   |                                    |

D deficiency in this region. On the other hand, the prevalence in Sweden (3%), US (9%), Netherland (23.6%) were lower but in Turkey it was seen in 40% however their cutoff values varied from that of our cutoff values. The controversy over cutoff value of vitamin D status as well as wide difference in latitude, altitude, cloud cover and air pollution in different geographical variations may also have contributed for wide variation in the data. Among total deficient cases of our study we found least number (11.2%) of cases in severe deficiency category. The other two studies done by Avagyan et al. and Voortman et al. reported similar data from their research. The mean vitamin D level recorded in this study was 29.86 ± 17.99 nmol/l,
but much lower mean value (19.93 ± 6.6 nmol/l) was observed in an Indian study done in 2017. In our study, a higher prevalence was observed in school going children however, no association of vitamin D level with age was seen in Roh et al. and Anitha et al. study.\textsuperscript{14,19} There was no difference in mean age of deficient (10.2 ± 4.2) and sufficient (10.09 ± 4.09) cases in Alshamsan et al. study but in our study mean age of deficient cases were 9.96 ± 3.94 years and mean age of sufficient was 3.69 ± 2.94 years.

This study observed vitamin D deficiency higher in girl child. Multiple other studies reported higher prevalence of vitamin D deficiency in females.\textsuperscript{9-11} On contrary there are also studies which do not show association of gender with vitamin D level.\textsuperscript{4,6,10,14} Multiple factors like use of sunscreen, shades during outdoor activities and more hours of screen time may have affected vitamin D level in these groups of children.

In the study done by Anitha et al., skin colour was not found to be associated with vitamin D status which was comparable with our study.\textsuperscript{19} But in Al-Shaikh et al.’s study, children with dark skin had lower concentrations of vitamin D.\textsuperscript{22} A study done in Australia and Saudi showed low level of knowledge of Vitamin D among participant.\textsuperscript{10,22} In contrast to our study, in Jeddah population majority had heard about vitamin D. In our study, reasons for inadequate exposure to sun were mostly not enough information (59.7%) and physical issues (31.9%) whereas in Australian population it was for fear of skin cancer, sun burn and extreme weather condition.\textsuperscript{24} In Jeddah population 65.5% recognised work or weather issues as major cause of inadequate exposure to sun.\textsuperscript{25}

Similar to our study, a survey in Poland showed that the most frequently mentioned sources of vitamin D was dairy products and mistaken responses were dominated by fruits and vegetables.

But source of information about vitamin D varied as compared to our study.\textsuperscript{24,25}

In Saudi, only 50% of patients were aware of heath implication of vitamin D.\textsuperscript{20} 66.8% of our participants also was unaware of any symptoms of vitamin D deficiency. In Zadka et al.’s study the respondents mostly declared vitamin D property as structure of bones and teeth (66%) and the report corresponds to our result as our respondents also only mentioned bone symptoms for vitamin D deficiency.\textsuperscript{26} Knowledge of vitamin D, duration of sun exposure and exposed body parts were only found to be associated with vitamin D status in our study which is in congruence the study done in Pune by Mandlik et al.\textsuperscript{23} Although our study is a novel study in our country, being hospital based, our results may not represent the status of the entire population. Another important drawback of our research is that we have not correlated vitamin D status with other laboratory parameters like serum calcium, phosphorus and parathyroid hormones which could have important significance. However, we expect that further, larger, prospective studies in the future would be able to shed more light upon this area.

**CONCLUSIONS**

High prevalence of vitamin D deficiency and its lack of knowledge in parents were identified in our study. Fortification of food and vitamin D supplementation along with spreading awareness to parents by conducting large scale information campaigns should be the key elements in counteracting the widespread vitamin D deficiency in children of Nepal.

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