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Original Article

Status of Vitamin D among People Visiting a Tertiary Care Center of Eastern Nepal: A Hospital-Based Study

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Abstract

Background

Vitamin D deficiency is a serious health-problem worldwide and the estimation of its plasma concentration is crucial. The study aims to determine the circulating levels of vitamin D in patients visiting Birat Medical College Teaching Hospital, one of the tertiary care centers of Eastern Nepal.

Materials and Methods

It was descriptive cross-sectional study conducted in the Department of Biochemistry at Birat Medical College Teaching Hospital, Nepal. From the hospital registry, clinical data of 250 patients including their age, gender and serum 25-hydroxy vitamin D was retrieved for the four months of May – August, 2021. The vitamin D status was classified as deficiency (<10 ng/mL), insufficiency (10–30ng/mL), sufficiency ≥ 30ng/mL) and toxicity (≥ 100 ng/mL).

Results

Out of total subjects (*n=250*), none of them showed toxic serum concentrations of vitamin D, 38% had sufficient, 57% had insufficient and 5% had deficient levels of this vitamin. Among affected individuals, vitamin D insufficiency had predominated in 41% population who were 41-60 years old. Gender-wise comparison of vitamin D status in the insufficiency group showed around 33% males and 67% females having insufficient levels of this vitamin.

Conclusion

With the vitmain D inssufficieny present in more than half of the study population, it becomes paramount to further scrutinize the associated factors apart from the age and gender. To this end, further studies are needed.

Key Words : *Nepal, Tertiary care, Vitamin D Deficiency*

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Introduction

Vitamin D, a lipid-soluble vitamin, avails in foods such as milk, fish, fish-liver oils, egg yolks and dairy products, apart from its production in the body depending on the sunlight exposure. Vitamin D exerts certain physiological roles that are vital [1]. For example, vitamin D helps tissues to use calcium and strengthens the bones. Rickets is a disease that affects mineralization leading to softening of bones and skeletal deformities [2]. Rickets appears if an individual suffers from vitamin D deficiency. Further, inadequacy of vitamin D retards physical growth with a risk in fracture of hip bone as individual's age advances.

Vitamin D deficiency, in addition, contributes to certain malignancies, immunological dysfunctions, diabetes mellitus and cardiovascular diseases [3, 4]. The physicians, therefore, consider vitamin D deficiency as serious health-concerned issue. Moreover, meta-analysis supports the clinical importance of vitamin D as its supplementation significantly reduces mortality rates among patients [5]. Low plasma levels of vitamin D correlates with increased risk of cerebrovascular disease [3]. Supplementation of vitamin D therefore promises to prevent strokes [6].

In spite of its wide distribution in natural foods and ability of tissues to synthesize, vitamin D deficiency however is common in children and adults. Clinicians, therefore, estimate plasma levels of vitamin D in order to determination of the status as under-deficiency or over-nutrition. The estimation of vitamin D is crucial as its deficiency is worldwide and prevalent in various stages ranging from the degree of newborn to infancy, childhood and adult [7]. However, status of vitamin D in Nepalese citizens was unknown, especially in eastern region of Nepal. In this pretext, the study was designed to determine the circulating levels of 25-hydroxy vitamin D in population who visited Birat Medical College Teaching Hospital, Nepal.

Materials and Methods

This research was hospital-based descriptive cross-sectional study carried out in the Department of Biochemistry at Birat Medical College Teaching Hospital (BMCTH), Nepal. BMCTH is one of the tertiary healthcare centers in the Eastern Nepal. The patientswho attended Birat Medical College Teaching Hospital for investigation of Vitamin D status were enrolled as subjects. Duplication of a similar participant and known patients with vitamin D supplement were excluded. The total number of cases whose vitamin D levels were measured during the study period and stored in the laboratory information system (LIS) of hospital registry was 610. Using the sample size calculation (from prevalence rate of vitamin D as 50% or p = 0.5, q = 0.5, Z = 1.98, and margin of error of 5%, or e = 0.05), a sample size of 392 was obtained. Next, using the finite population correction for the population of size 610, final sample size was calculated as 239. So, the optimum sample size considered for the present study came out to be 250, with 11 surplus samples to account for any possible exclusion of any case at the later stages of analysis. These 250 cases were randomly selected from the hospital registry, using simple random sampling based on the serially arranged laboratory identification number of each case.

Retrieved data was initially entered in Microsoft Excel 2010, where preliminary data management including data cleaning was performed. Next, final data entry and was done in the software Statistical Package for Social Sciences version 16.0 (SPSS 16.0). Categorical variables were described using frequency and percentage and illustrated with appropriate charts and diagrams.

Results

In order to describe the vitamin D status among the studyparticipants, the patients were declared deficient if they demonstrated serum levels of vitamin D is less than 10ng/mL, insufficient when concentrations resided between 10–30, sufficient when values were between 30 – 100 and toxicity if it was more than 100 ng/ml. Out of total subjects (*n=250*), none of them showed serum concentrations >100 ng/ml(Figure 1; Group 'A'). Among the subjects, 38% (*n=95*) displayed sufficient circulating vitamin D levels. (Figure 1; Group 'C'). Further we ascertained that

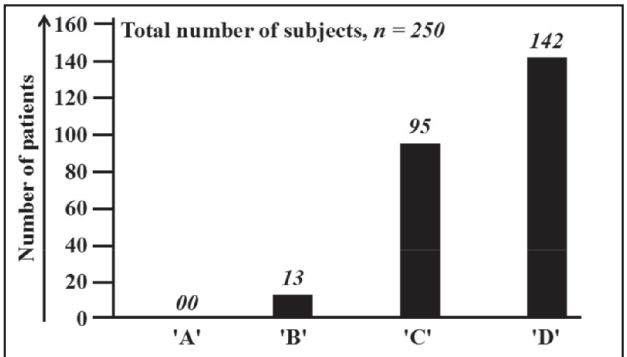

Figure 1: Bar diagram representing number of patients with plasma levels of vitamin D. Group 'A' is indicative to people with vitamin D levels > 100 ng/ml, 'B' indicates to number of patients under deficiency states with values < 10 ng/ml, 'C' represents normal subjects with sufficient levels (> 30 ng/ml) and 'D' demonstrates individuals with insufficient vitamin D levels i.e., 10-30 ng/ml

approximately 57% people (*n=142*) had serum levels within 10-30 ng/ml, indicative of the existence of vitamin D insufficiency in them (Figure 1; Group 'D'). Moreover, around 5% of the participants (*n=13*) had values <10 ng/ml, suggestive of the existence of vitamin D deficiency in these groups of people. (Figure 1; Group 'B')

Our data demonstrated that vitamin D-insufficient individuals were at varying age-groups from 3–80 years-old. We, therefore, separated vitamin D insufficient individuals into four sets (3-20, 21-40, 41-60 and 61-80 years-old) for analysis of the prevalence against age-variation.

Out of total patients who suffered from state of vitamin D insufficiency (*n=142*), we observed that 21 individuals were at age-group 0-20 years-old (Figure 2; 1st Bar). Prevalence therefore remained in approximately 15 % patients at 0-20 yearsold, indicative of lesser but significant existence of vitamin D insufficiency among children and adolescent people. Further 29 persons of 21-40 years-old ensured vitamin D insufficiency (Figure 2, 2nd Bar). As 21-40 yearsold patients grasped around 20% fraction, the prevalence of vitamin D insufficiency had significantly raised with increasing age. Further vitamin D insufficiency appeared in 34 patients with age-group 61-80 yearsold, suggesting that generality was about 24 % (Figure 2; 4th Bar). Interestingly when we had look upon a residual group holding patients with 41-60 yearsold, immensely around 41 % (*n=58*) were sufferers, suggestive of predominant existence of vitamin D insufficiency in lateadults and elder people (Figure 2; 3rd Bar).

Gender wise description of the subject with

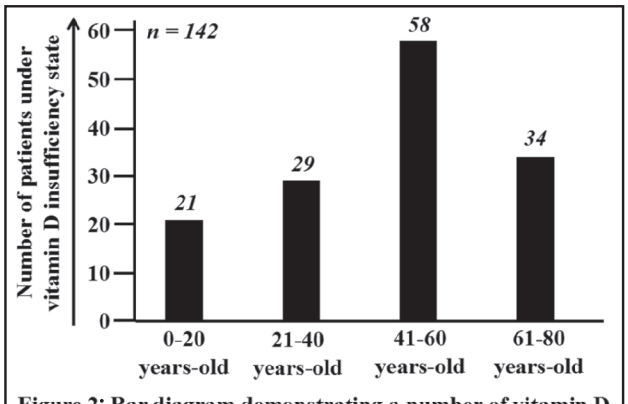

Figure 2: Bar diagram demonstrating a number of vitamin D insufficient patients as agewise.

insufficient levels of this vitamin revealed that about 33% males and approximately 67% females lodged in under the state of insufficiency, indicating that for the most of women had associated complaints of vitamin D (Figure 3).

In order to further describe the proportions of vitamin D insufficient participants according to age and gender together, we further divided four age groups, each into two gender groups. Out of total vitamin D insufficient individuals (*n=142*), 7 (5%), 9 (6%) and 10 (7%) males resided in agegroups 0-20, 21-40 and 61-80 yearsold, respectively. (Figure 4; Black bars in 1st, 2nd and 4th sets). Further 21 males at age-group 41-60 years showed vitamin D levels in the range of 10-30 ng/ml (Figure 4; Black bar in 3rd set). As they hold about 15% fraction, our data indicated that prevalence of vitamin D insufficiency was significant in late-adult males. On the other hand, among vitamin D insufficient females, 14 subjects were 0-20 years-old, indicating that prevalence of vitamin D insufficiency was around 10 % (Figure 4, Gray bar in 1st set). Further 20 and 24 women who suffered from vitamin D insufficiency were 21-40 and 61-80 yearsold, respectively, suggestive of significant generality around 14 and 17 % (Figure 4; Gray bars in 2nd and 4th sets). Next we observed that 37 women with age-group 41-60 years were under state of vitamin D insufficiency, suggesting that prevalence was immense about 26 % (Figure 4; Gray bar in 3rd set). Late-adult and elder women at 41-60 years of age were, therefore, more susceptible to vitamin D insufficiency.

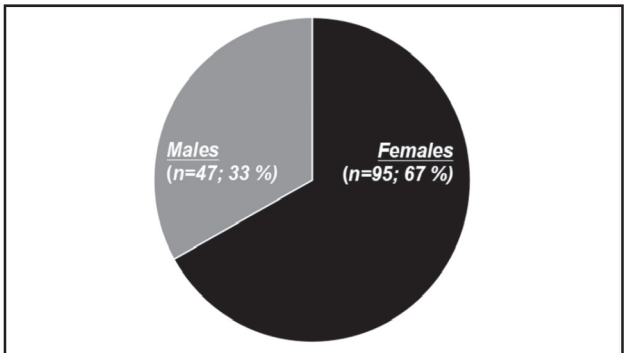

Figure 3: Pie-chart representing number of vitamiv D insufficient males and females among 142 affected individuals

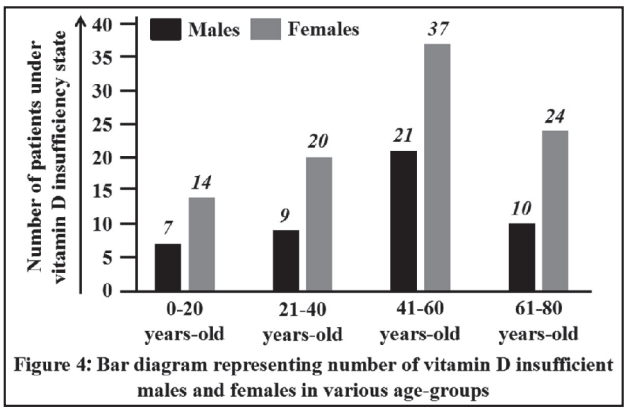

Figure 4: Bar diagram representing number of vitamin D insufficient males and females in various age-groups

Discussion

In the present study we investigated status of vitamin D among 250 subjects in a tertiary care center of Eastern Nepal. In an earlier study, vitamin D status wasassessed among 50 individuals in Nepal at 'Lalitpur' District [8].In this survey, the authors reported that vitamin D insufficiency was prevalent in 58% people who were above 50 years of age and 42% under 50 years. In our study, it was interesting that none had shown serum levels of vitamin D in excess of 100 ng/ml (Figure 1; Group 'A'). Adjacently, 38% people displayed their vitamin D levels within reference range. Thus we inferred that these individuals were healthyand had sufficient circulating levels of vitamin D (Figure 1; Group 'C'). Both dietary sources and sunlight exposure derive vitamin D in blood. It is, therefore, difficult to define adequate vitamin D nutrition. However, serum levels of vitamin D remain stable over weeks. Circulating levels of Vitamin D, therefore, serve as biomarkers of adequate supplementation [9].

Clinicians specify situation as deficient if patients show vitamin D levels were less than ten (< 10 ng/ml) [10, 11,12]. Our data demonstrate that vitamin D insufficiency was prevalent in 57 % people (Figure 1; Group 'D') and residual 5 % lodged in under regime of deficiency (Figure 1; Group 'B'). Thus majority of people in this area suffered from state of vitamin D insufficiency. The vulnerability of sunlight is marginal in Northern latitudes. People from Northern latitudes are, therefore, at risk of vitamin D deficiency [9,13,14]. The kingdom of Nepal lies between East and North latitudes, and deviates from Northern one [15]. So, less exposure of sunlight in Nepal is difficult to evaluate as underlying cause of vitamin D insufficiency. In this nation, regular diet consists of rice and lentils with seasonal access to green leafy vegetables that lack vitamin D [16]. Meat, milk, fish, fish-liver oils, egg yolks and dairy products are main sources of vitamin D that Nepalese diet usually needs. Nepalese in addition lack access to fortified foods. Thus it is plausible that regular consumption of nutritious diet by only a few Nepali would be the underlying cause for prevalence of vitamin D insufficiency in about 57 % people at eastern Nepal (Figure 1; Group 'D').

Vitamin D is essential for strong bones as it helps body to use dietary calcium. A person having inadequate vitamin D in circulation, therefore, exhibits symptoms of bone and muscle pains.[17 – 20] Among affected individuals, vitamin D insufficiency was predominant in 41 % with 41-60 years of age (Figure 2; 3rd Bar). In next, vitamin D insufficiency was prevalent in around 26 % females who were 41-60 (Figure 4; Gray bar in 3rd set). Our data, therefore, demonstrate that lateadults and elder women predominantly suffered from vitamin D insufficiency.

Some of the obvious drawbacks of the study include study design, small sample size, and consideration of only a few variables to account for the status of the vitamin. A chart review such as this clearly limits a researcher towards the inclusion of methodically sufficient number of variables. Nevertheless, the finding of the study definitely points towards the necessity of further studies (for example, longitudinal studies with many relevant variables) to account for the necessary associations.

Conclusion

In the present study, we described status of vitamin D among people in eastern region of Nepal. Here, we observed that vitamin D insufficiency was prevalent in more than half of the study participants. Among the affected individuals, vitamin D insufficiency had predominated in around two-fifth of the population middle-aged to elderly population. In this regard, further studies are warranted to bring about other factors responsible for this global health concern.

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Conflicts of interests: All authors declare no conflict of interest.

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