



Analysis of vitamin B₁₂ and D deficiency and the effect of supplementation in patients at a tertiary care hospital

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Abstract

Vitamins are essential organic compounds for the body and the study aims to understand the extent of deficiency present among the patients tested for deficiency and the effect of supplementation. Our study also aims in understanding the effect of supplementation on treating the deficiency along with its effect on any co-morbid conditions present such as diabetes, cardiovascular disease, rheumatoid arthritis, osteoporosis and/or hypertension. Assessment was carried out in randomly selected, 500 patients from the patient pool (March 2013 to March 2015) and supplemented with vitamins at KIMS hospital, Secunderabad. Data such as biochemical measures, medications, food supplements and herbal medicines were also taken into consideration. The analysis showed improvement in symptoms associated with deficiency after supplementation. Along with this, the improvement in general health of patients with co-morbid conditions was analyzed. The study shows that patients with osteoporosis are benefited by vitamin D supplementation and supplementation seems to have helped patients with pain in case of rheumatoid arthritis. Patients with diabetes and/or cardiovascular disease did not show much improvement with supplementation. It is observed that supplementation does have a role in improvement of general health in patients with some chronic diseases.

Keywords: vitamin D; vitamin B12; deficiency; general health; supplementation

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Received 9 July 2015; Revised 11 September 2015; Accepted 22 September 2015; Published 29 September 2015

Citation: Srinivasa Rao B, Sakuntala Devi G, Kavitha A, Kanaka Bhushanam GVVS. Analysis of vitamin B₁₂ and D deficiency and the effect of supplementation on patients at tertiary care hospital. *J Med Sci Res.* 2015; 3(4):203-207.

DOI: <http://dx.doi.org/10.17727/JMSR.2015/3-039>

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Introduction

Vitamins are essential organic compounds required in trace amounts (microgram to milligram quantities/ day) and play a vital role in the normal growth and functioning of the various physiological processes in the body. Vitamin B₁₂ also known as cyanocobalamin is a water soluble hematopoietic vitamin necessary for the maturation of erythrocytes and other countless processes within the body involving DNA and cell growth. It also plays a role in cardiovascular protection and proper functioning of nervous system [1]. It plays a pivotal role in the metabolism of carbohydrates, proteins and fats [1]. Vitamin D also known as calcitriol is a fat soluble vitamin essential in the formation and maintenance of healthy bones and teeth. It also plays a key role

in absorption and metabolism of phosphorus and calcium [2]. It is necessary for proper muscle functioning, bone mineralization and stability, and has a role in multiple immune functions [2]. Vitamin D and B₁₂ can be obtained from many natural resources. Primarily the vitamin D used by the body is produced in the skin after exposure to ultraviolet light from the sunlight. It can also be found in the fatty fish. Vitamin B₁₂ is found in most animal derived foods, including fish and shellfish, meat (especially liver), poultry, eggs, milk, and milk products. The major causes of vitamin B₁₂ deficiency are nutritional inadequacy or mal-absorption and elevated levels of methylmalonic acid and homocysteine.

The aim of this study is to understand the extent of deficiency present among the patients tested for deficiency at a tertiary care hospital (KIMS Hospital, Secunderabad) and the effect of supplementation. The study also aims at understanding the effect of supplementation in treating the deficiency related signs and symptoms along with its effect on any co-morbid conditions present among the same patients.

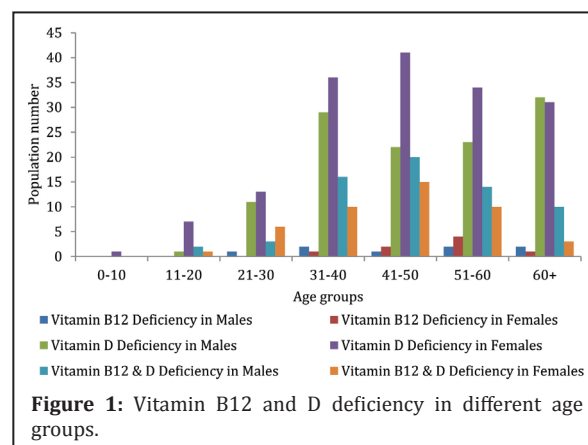
Materials and methods

The distribution of males and females in the randomly selected patient pool of 500 patients supplemented with vitamin package was estimated from March 2013 to March 2015. Biochemical measures such as vitamin D and B₁₂ levels were collected from the KIMS hospital database along with gender and age. Information on dietary intake (vegetarian/ non-vegetarian) was not collected. Medicines, information regarding exposure to sun, food supplements and herbal medicines was obtained using a questionnaire by telephonic discussion with the patients and this information was recorded.

The number of cases diagnosed as having deficiency of vitamin D/B₁₂/B₁₂ & D was estimated from the patient pool (500) and the effect of supplementation with vitamin package was calculated from improvement shown in the deficiency symptoms of the patients with no co-morbid conditions. Among the selected pool of patients, the number of cases of cardiovascular disease, rheumatoid arthritis, hypertension, diabetes and osteoporosis cases were analysed and the effect of supplementation on their symptoms associated with co-morbid conditions was recorded.

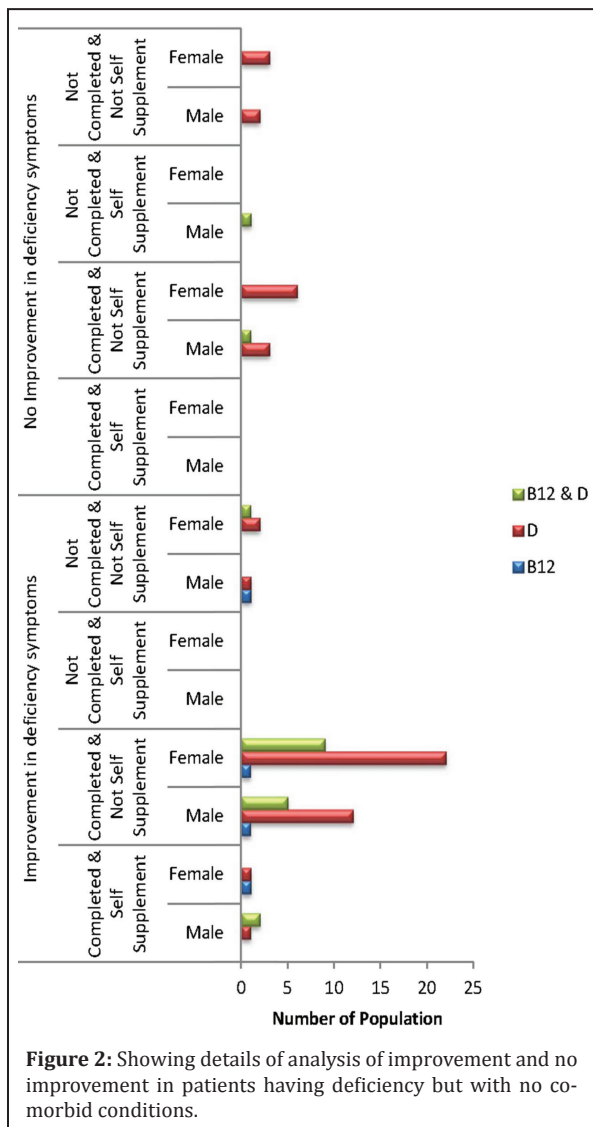
Results

The study showed that 81.62% of the male population was deficient in vitamin B₁₂ and/or D and 81.2% of females were deficient in vitamin B₁₂ and/or D. In the vitamin deficient male population, 3.41% of patients were diagnosed with vitamin B₁₂ deficiency, 50.42% with vitamin D deficiency and 27.77% with a combined deficiency of vitamin B₁₂ & D (Figure 1). In the vitamin deficient female population, 3% of patients were diagnosed with vitamin B₁₂ deficiency, 61.27% with vitamin D deficiency and 16.91% with a combined vitamin B₁₂ & D deficiency (Figure 1).

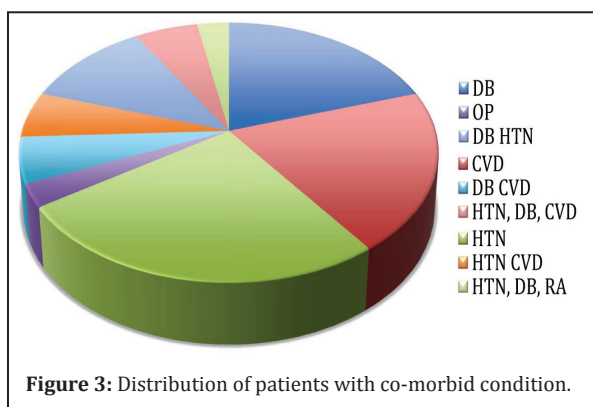


Among the patients who were diagnosed and treated for vitamin deficiency, 29.48% people responded to the follow up. The effect of supplementation was assessed by alleviation of the physical symptoms after supplementation in patients with no co-morbid conditions such as hypertension, diabetes, osteoporosis, rheumatoid arthritis and/or cardiovascular disease (Figure 2). The presence and absence of improvement among the patients was assessed along with other information like completion/ discontinuation of supplements, any additional measures taken by patients during the supplementation period such as alternative forms of medicine (Ayurveda/ Homeopathy), better diet and exposure to sun.

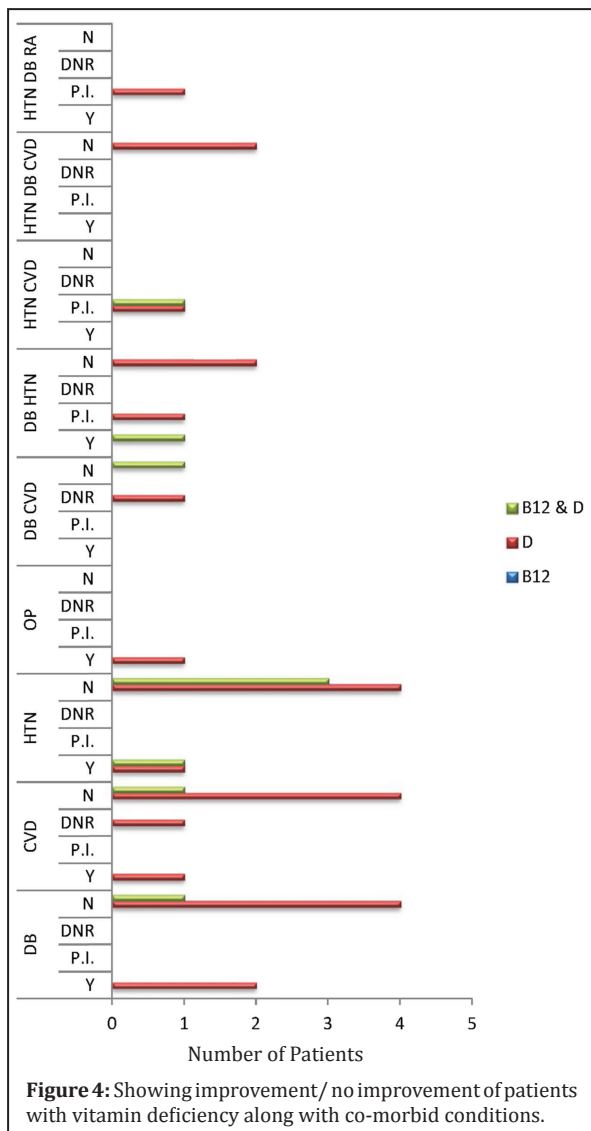
From the patient pool diagnosed with deficiency, the effect of supplementation was assessed in those with co-morbid conditions such as hypertension (HTN), diabetes (DB), osteoporosis (OP), rheumatoid arthritis (RA) and/or cardiovascular disease (CVD). The patient pool consisted of seven patients with DB and CVD each. There were nine patients with HTN and one with OP. Two patients were seen with both



DB and CVD and also HTN and CVD. Four patients were diagnosed as having both DB and HTN. Two patients had HTN, DB and CVD. One patient had HTN, DB and RA. The number of patients with co-morbid conditions was estimated (Figure 3).



Among these patients, the effect of supplementation was assessed by the improvement in their respective conditions via telephonic discussion. In DB patients, two patients with vitamin D deficiency informed improvement in their general health. Four people with vitamin D deficiency and one with B₁₂ & D deficiency did not show any improvement in their health. Among the CVD patients, one patient with vitamin D deficiency was not sure about any improvement. One patient with vitamin D deficiency showed improvement. Four people with vitamin D deficiency and one with B₁₂ & D deficiency did not show any improvement in their condition. Out of the nine patients with HTN, two patients showed improvement, one with vitamin D deficiency and the other with B₁₂ & D deficiency. The seven patients, out of which three had B₁₂ & D deficiency and four with vitamin D deficiency, showed no improvement in control of HTN. One patient with osteoporosis showed significant improvement with vitamin D supplementation. Out of the two patients suffering from both DB and CVD, one patient with vitamin D deficiency was not sure of noting any significant improvement and the one with B₁₂ & D deficiency stated that there was no improvement, after supplementation. Four patients had both DB and HTN, out of which only one patient with B₁₂ & D deficiency stated that there is improvement after supplementation. One patient with vitamin D deficiency stated that the effect of supplementation was evidently seen in HTN but did not help in controlling DB. Two patients, both with vitamin D deficiency did not show any improvement. Out of the patient pool, two patients had both HTN and CVD. Both patients had shown improvement with regards to HTN but not CVD. One of them was supplemented for vitamin D deficiency and the other for vitamin B₁₂ and D deficiency. Two patients who were diagnosed as having vitamin D deficiency had HTN, DB and CVD. Both of them did not show any improvement with vitamin D supplementation. One patient with HTN, DB, and RA stated that the vitamin D supplementation helped in managing RA but not in controlling DB and HTN. The overall effect of supplementation among these conditions was summarized (Figure 4). It is observed that the deficiency symptoms were alleviated as treatment progressed and the patients who took additional measures such as sun exposure and better diet were able to sustain their vitamin levels for longer period. Depending on the patient requirement and their lifestyle factors, multiple supplementations may be required to sustain the normal levels.



Abbreviations: Y= yes; N = no; P.I = partial improvement; DNR= did not respond

Discussion

The occurrence of the deficiency of vitamin D among the patients was much higher than B₁₂ and similar results have been concurred by multiple studies. One of the first studies to understand the prevalence of vitamin D was carried out among healthy infants and toddlers [3]. Multiple studies were carried out among Turkish, Moroccan, Indian and sub-Sahara African populations in Europe and their countries of origin [4]. The vitamin D status of studied populations in Turkey and India varied and was similar to the immigrant populations in Europe (low) and similar to or even higher than the indigenous European populations (high) [4]. Vitamin D deficiency is

commonly seen among Indians and can be used as lifestyle markers to study risk association of cancer, TB, autoimmune disorders and diabetes among the population. Studies have shown the effect of vitamin D on bone health and the need for supplementation for the normal physiological maintenance of the body [2]. Our study showed that 81.62% of the male population is deficient in vitamin B₁₂ and/or D and 81.2% of females are deficient in vitamin B₁₂ and/or D. Among the male population, most patients were diagnosed with vitamin D deficiency followed by vitamin B₁₂ & D deficiency and the least were associated with vitamin B₁₂ deficiency. Similar pattern of deficiency was also observed in the female population. The study showed that the majority of the population was either vitamin D deficient or has B₁₂ deficiency along with D. Vitamin D deficiency can possibly be associated with inadequacy of exposure to sun due to lifestyle factors. This life style factor also involves processed food consumption, which contributes to nutritional inadequacy leading to B₁₂ deficiency. Another study in the South Indian population has shown the association of vitamin D deficiency with hyperthyroidism [6]. Since hyperthyroidism is associated with increased rate of bone remodeling & changes in mineral homeostasis, the study establishes that therapeutic vitamin D and calcium supplementation in addition to anti-thyroid medication would be ideal for bone health. Recent research is focused on the development of diagnostics and also modes of treating the deficiency. The prevalence among the south Indian population has not been studied in all areas and it has been found that a high proportion of participants have low B₁₂ intake, especially among those from rural and semi-urban areas [7, 8]. Among the patients with no co-morbid conditions, the effect of supplementation was seen to improve the levels of vitamin B₁₂ and D. The supplementation consisted of either tablet, intramuscular or intravenous injections. Almost 75% of the patients mentioned improvement stating alleviation in their deficiency symptoms after completion of the prescribed course. Similar results were shown in various other studies [9]. This proves the efficiency of supplementation in restoring the normal levels of vitamins in the body.

The aim was to observe if any effect was seen with supplementation in patients with co-morbid conditions such as diabetes, cardiovascular disease, hypertension, rheumatoid arthritis and osteoporosis. The parameters considered for these patients were improvement in general health and relief from

their symptoms. Varied results were obtained in patients with other co-morbid conditions where a few patients stated improvement in their symptoms. The patient with osteoporosis showed consistent improvement with supplementation, which concurs with vitamin D deficiency treatment. A study on the vitamin D status of immigrant populations in Europe showed poorer levels compared to the vitamin D status in indigenous European populations. The positive effect of supplementation has been demonstrated to improve cardiovascular health in such people [5]. However in this study most patients with cardiovascular disease also had diabetes and hypertension, and did not show much improvement with supplementation. Only one patient with vitamin D supplementation was observed having improvement in general health. The number of patients with hypertension was the highest among the patients with co-morbid conditions. The improvement observed was less than 20%. In the case of patient with arthritis, improvement was only seen with respect to reduction in pain but not the disease itself. Patients with either diabetes or cardiovascular disease along with hypertension reported improvement only in physical symptoms related to hypertension but not the others. This improvement was seen in less than 50% of the population and the rest did not show any. Patients with all the three did not show any improvement.

Conclusion

The study concurs with multiple studies that showed deficiency among the patients is much higher with respect to vitamin D than B₁₂ and vitamin supplementation helps improve the symptoms. Although supplementation helps alleviate deficiency symptoms in most patients, significant impact cannot be seen on general health in patients with co-morbid conditions such as diabetes, cardiovascular disease and hypertension. Relief in pain was observed in rheumatoid arthritis and significant improvement was observed in osteoporosis patients.

Acknowledgements

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Conflict of interest

Authors declare no conflict of interest.

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