

# A REVIEW ON VITAMIN D WITH SPECIAL REFERENCE TO REDUCING TUBERCULOSIS IN HUMAN POPULATION

Chiranjit Majumder, Research Scholar, Nutrition, Seacom Skills University, Santiniketan, India

**Abstract :** Fat soluble vitamins are those which are dissolved in fat. Among the fat soluble vitamins, vitamin D is one of them. The main source of vitamin D is ultraviolet rays sunlight. Less amount of vitamin D is synthesized among dark skinned people than fair skinned people because the pigments within dark skin inhibit the entrance of ultraviolet radiation. Besides sunlight, humans can take vitamin D from diet. Vitamin D content foods are very few in nature. Some sea foods contain high amount of vitamin D3 like sardines, salmon and mackerel. . Some foods are fortified with vitamin D but the number of foods are very few. Some vitamin D fortified foods are cereals, some bread, milk and orange juice. The active form of vitamin D is 1,25-dihydroxyvitamin D<sub>3</sub> is known as to control calcium and phosphorus metabolism that is needed for healthy bone formation. Vitamin D has a another special role rather that formulating skeletal system. It act as a immune-modulator. It targets immune cells of various types like monocytes, macrophages, dendritic cells, as well as T and B lymphocytes, it control both innate and adaptive immunity. Now a days one of the major public health problem in India is Tuberculosis, a infectious bacterial disease named Mycobacterium Tuberculosis or MTB. Approximately 8.6 million TB cases were found globally and approximately 2 million TB cases were occurred in India. Underweight (BMI<18.5) means the weight less than normal weight. Underweight was observed in low economical group specially. Underweight is mainly seen in developing countries. A synergistic interaction was found between underweight and low level of vitamin D. It has been identified that maximum number of TB patients has very low body weight(underweight) Vitamin D is mainly beneficial for chronic infection like tuberculosis(TB). Deficiency of vitamin D occur when the people do not get enough ultraviolet B ray that come from sun light and another reason is that when the people do not get sufficient amount of vitamin D from the dietary sources. Most of the foods has very small amounts of vitamin D. Certain sea fishes are known as good sources of Vitamin D. Marine fishes should be incorporated in the diet. Fresh water fishes has moderate amount of vitamin D in their liver. Fortification of oil and wheat-flour with vitamin D may fill the gap of vitamin D deficiency.

**Keywords** - Vitamin D deficiency, Tuberculosis, Underweight, Public Health.

## I. INTRODUCTION

Vitamin D is a fat soluble vitamin. The main source of vitamin D is ultraviolet rays sunlight. When solar ultraviolet B (UVB, 290-320 nm) fall on the skin, 7 dehydrocholesterol in the skin is converted to previtamin D<sub>3</sub>. Previtamin D<sub>3</sub> is quickly converted to vitamin D in this heat process. Excess ultraviolet B rays convert previtamin D<sub>3</sub> into biologically inactive metabolites, lumisterol and tachysterol. Besides sunlight, humans can take vitamin D from diet. Vitamin D content foods are very few in nature. Some sea foods contain high amount of vitamin D3 like sardines, salmon and mackerel. Egg yolks also contain vitamin D3 but amounts are variable but egg yolks are poor source of vitamin D because of its cholesterol content. Some foods are fortified with vitamin D but the number of foods are very few. Some vitamin D fortified foods are cereals, some bread, milk and orange juice(Zhang and Naughton, 2010)<sup>[1]</sup>. The active form of vitamin D is 1,25-dihydroxyvitamin D<sub>3</sub> is known as to control calcium and phosphorus metabolism that is needed for healthy bone formation. Vitamin D has a another special role rather that formulating skeletal system. It act as a immune-modulator. It targets immune cells of various types like monocytes, macrophages, dendritic cells, as well as T and B lymphocytes, it control both innate and adaptive immunity. Vitamin D is mainly beneficial for chronic infection like tuberculosis(TB) ( Baeke et al., 2010 )<sup>[2]</sup>. Tuberculosis is caused by the bacterium named “Mycobacterium tuberculosis”. By this bacterial disease, approximately 8.6 million people are infected and it will be expected that 10 percent of population will develop TB during their lifespan. Generally this bacterial disease spread through air and it go to human when they breath with infected air. It occurs mainly in medium and low income countries like India, Pakistan, China, Saharan Africa and southeast portion of Asia, include also Indonesia. The highest prevalence of TB mainly occur in country like India and China, now a days (Schrager et al., 2018)<sup>[3]</sup>. Leucocytes are known as white blood cells (WBCs). White blood cells are those cells of our immune system that are used to protect our body against both foreign materials and infectious diseases. The production of white blood cells is from multi-potent cells in the bone marrow. This multi-potent cells are known as haemopoietic stem cells. The function of white blood cells are to ingest bacteria that are mainly disease causing and it engulf the pathogens and destroy them and it produce the antibodies that fight with the pathogens toxins. Monocytes and macrophages are two white blood cells that are mainly worked to fight against foreign materials and invading microbes. Phagocytosis is the process by which white blood cells engulf the microbes and foreign particles and digest and destruct them. After fragmentation of microbes, the fragmented portion of the microbes are accumulated to the monocytes or macrophages cell surface. This process of migration of fragmented portion of foreign particles and microbes are called as antigen presentation. T lymphocytes is activated when fragmented portion of microbes come to

the monocytes or macrophages cell surface and then monocytes and macrophages give immune security against antigen. Vitamin D has an important role for our immune system. It strong our immunity, thereby any foreign materials and microbes can not attack so easily (Baeke et al., 2010).

## II. PREVALENCE OF TUBERCULOSIS IN WORLDWIDE AND INDIA

Now a days one of the major public health problem in India is Tuberculosis, a infectious bacterial disease named Mycobacterium Tuberculosis or MTB. Approximately 8.6 million TB cases were found globally (Rao et al., 2018)<sup>[4]</sup> and approximately 2 million TB cases were occurred in India (Karoli et al.,2015)<sup>[5]</sup>.

## III. DEFICIENCY OF VITAMIN D

Deficiency of vitamin D occur when the people do not get enough ultraviolet B ray that come from sun light and another reason is that when the people do not get sufficient amount of vitamin D from the dietary sources. Many expert says that when the less than 20 ng/millilitre (50 nmol/litre) is seen in test, that means vitamin D deficiency. An insufficiency of vitamin D occur when the level of 25 hydroxyvitamin D, between the range of 21 to 29 ng/milliliter (52-72 nmol/litre) is happened. According to the Institute of Medicine of the US National Academy of Sciences recommended a new intake level for vitamin D in 1997. They recommended the vitamin D intake level for child and adult up to 50 years of age is 200 IU. To the view of Institute of Medicine of the US National Academy of Sciences, the level of vitamin D recommended for adults between the age of 51 to 70 years is 400 IU and 600 IU for adults above the age of 70 or older. However, a huge number of studies said that children and adults needs to intake 800 to 1000 IU per day without adequate sun light exposure.( Zhang and Naughton, 2010 )<sup>[1]</sup>

## IV. WORLDWIDE VITAMIN D DEFICIENCY

In short, vitamin D deficiency is termed as VDD. Vitamin D deficiency (VDD) is a very common situation now a days in the world. It has been counted that approximately 50% of both adults and children living in the Asia, Europe, New Zealand, Australia, Canada, Mexico and United States have deficiency of vitamin D. Mainly 90% of pigmented population(Asians, Blacks, and Hispanics) suffer from vitamin D deficiency. Dark skin type reduces the amount of ultraviolet ray to uptake to the skin.89% Of adult patients of Northern Pakistan have in vitamin D insufficiency. The burden of vitamin D deficiency is increased with age. Postmenopausal women and old people can not get enough amount of vitamin D even staying in sunlight area. A study in Brazil found rickets and osteomalacia in severe vitamin D deficiency patients(Dini et al, 2012).<sup>[6]</sup>

## V. MECHANISMS OF ACTION OF VITAMIN D

Mechanisms of action are not clear completely that how to modulate the immune system when tuberculosis causing bacteria attack our immune system. There are two possible mechanism that are believed most likely. Vitamin D can reduce the durability of TB disease. Vitamin D diminish the viability of TB infection by increasing the fusion between phagosome and lysosome in infected microphages. Besides that, vitamin D can increase the production of an antimicrobial peptide of the cathelicidin family named LL-37. Another antimicrobial peptides such as cathelicidin and defensin are engaged as a first line of defences for the prevention of infections, including MTB(Venturini et al., 2014).<sup>[7]</sup> Several Clinical study says that vitamin D rich sources like vitamin D rich foods such as sea foods and its oil is effective to reduce the burden of M. Tuberculosis. The maximum level of vitamin D is found from sunlight that can reduce the signs and symptoms of TB infection.

## VI. ROLE OF VITAMIN D

Vitamin D is very good for our skeletal growth that we all know. In many studies, it has been known that besides to its traditional role, a variety of process is controlled by vitamin D. The processes that are modulated by vitamin D include host defense, inflammation, immunity and repair. Vitamin D is needed for calcium homeostasis that we already know . Current literature focus on function of vitamin D deficiency in diseases rather than the metabolic bone disorders(Rao et al., 2018).<sup>[4]</sup>

## VII. INTERACTION BETWEEN VITAMIN D AND UNDERWEIGHT

Underweight (BMI<18.5) means the weight less than normal weight. Underweight was observed in low economical group specially. Underweight is mainly seen in developing countries.<sup>[8]</sup> A synergistic interaction was found between underweight and low level of vitamin D (Wang et al.,2002).<sup>[8]</sup>

## VIII. ASSOCIATION BETWEEN VITAMIN D AND TUBERCULOSIS

Epidemiological studies described that higher occurrence of tuberculosis with decreased 25-hydroxyvitamin D [25(OH)D]s. It is believed that the association between vitamin D and tuberculosis is stayed. TB infection is decreased by intake of sufficient amount of vitamin D rich sources like sea fishes. Vitamin D helps to find out latent tuberculosis and it also convert latent TB to

active tuberculosis. Vitamin D also diminish the durability of treatment and treatment outcome is also improved(Wang et al.,2017).<sup>[9]</sup>

## IX. CONCLUSION

In previous literature, deficiency of vitamin D was noticed in all patients with active TB specially. There are certain connection between vitamin D deficiency (VDD) and tuberculosis (TB).Vitamin D deficiency can cause tuberculosis. Healthy people also suffer from TB and bone pain. This is occurred due to vitamin D deficiency in their daily diet and due to not increased sun light exposure. Generally, any symptoms is not observed from vitamin D deficiency. If any signs and symptoms is observed, it indicate deficiency is severe (less than 5 ng).

## X. RECOMMENDATION

Urgently Improvement of diet is required. Diet will improve when diet will be balanced by all food stuffs. It is proved that vitamin D deficiency is common now a days, worldwide. Most of the foods has very small amounts of vitamin D. Certain sea fishes are known as good sources of Vitamin D. Marine fishes should be incorporated in the diet. Fresh water fishes has moderate amount of vitamin D in their liver. Fortification of oil and wheat-flour with vitamin D may fill the gap of vitamin D deficiency.

## XI. ACKNOWLEDGEMENTS

I, express my sincere gratitude to all the contributors of this paper. Special thanks to all the authors of the papers mentioned below in reference list.

## REFERENCES

1. Zhang and Naughton, 2010, Vitamin D in health and disease: Current perspectives, *Nutrition Journal*,9:65.
2. Baeke et al., 2010, Vitamin D: modulator of the immune system, *ScienceDirect*,10:482-496.
3. Schragar et al., 2018, Global report on tuberculosis vaccines, WHO funded.
4. Rao et al., 2018, Research on tuberculosis in tribal areas in India: A systematic review, *Indian Journal of tuberculosis*, 65:8-14.
5. Karoli et al.,2015, Vitamin D Deficiency in Medical Patients at a Teaching Hospital in North India, *Journal of The Association of Physicians of India*, 63:35-39.
6. Dini et al, 2012, The potential role of vitamin D for prevention and treatment of tuberculosis and infectious diseases, *Ann Ist Super Sanita*, 3(48):319-327.
7. Venturini et al., 2014, Vitamin D and tuberculosis: a multicenter study in children, *BMC Infectious Diseases*, 14:662.
8. Wang et al, 2002, Trends of obesity and underweight in older children and adolescents in the United States, Brazil, China, and Russia, *The American journal of Clinical Nutrition*, 6(75)971-977.
9. Wang et al.,2017, Is low serum 25-hydroxyvitamin D a possible link between pulmonary tuberculosis and type 2 diabetes?, *Asia Pacific Journal of Clinical Nutrition*, 26(2):241-246.