

Prevalence, Assessment & Management of Hypovitaminosis-D in Randomly Selected Populations of Lahore

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Abstract- Objectives: The aims of this activity were to study causes, prevalence and management of hypovitaminosis D and its extent in males and females.

Methodology: An observational and questionnaire survey based study was conducted in the public and private hospitals of Lahore. Data collection form was filled during face to face interview with 50 people.

Results: Weight showed a diversified collection: among women, 11% , 22% , 38% and 29% fell under the category 30-40 kg, 41-50 kg, 51-60 kg and more than 60 kg respectively. Similarly, among men, 0%, 28%, 14% and 58% fell under the same categories respectively. 28% of the females said they do cover their skin while going out and 14% males responded yes. Usage of sunscreen among women was seen to be 19% while among men 21% of individuals used sunscreen. Among females, 3% women were diagnosed with Crohn's disease or ulcerative colitis while among males, none was diagnosed with either of two (100% responded no).

Conclusions: hypovitaminosis D has high prevalence in females due to various factors including improper diet, ovarian cycle and hormonal changes during pregnancy. Doctors educated and counselled the patients very well and appropriately but there was no significant role of Pharmacists in treatment and education of vitamin D deficient patients so pharmacists have to work hard to prove themselves in health care system.

Index Terms- Adolescence, epidemiology, prevalence, vitamin-D deficiency, parathyroid hormone, suncreening agents.

I. INTRODUCTION

Hypovitaminosis D is medically described as 'low levels of vitamin D in body'. Vitamin D is both a hormone and a mineral. The production, activation and metabolism of vitamin D may be one of the most misunderstood concepts in pharmacy. In past generations, it was uncommon to encounter vitamin D deficiency since all milk is fortified with vitamin D generation and milk consumption was high. Historically, a major reason to fortify milk was to prevent the development of rickets. However, since milk consumption has substantially declined over the years, and many people do not regularly eat foods high in vitamin D, such as cold water fish, a slight resurgence of rickets and vitamin D deficiency has occurred.^[1]

Biologically active vitamin D is a hormone since it is produced in one part of the body, viz the skin, and transported and used in other areas of the body, such as the gastrointestinal

tract and skeletal system. Vitamin D is necessary for adequate intestinal absorption of calcium. Thus, if one becomes vitamin D deficient, one is at risk of a low calcium level which can lead to osteoporosis, osteomalacia and rickets. If vitamin D levels fall too low, a compensatory release of parathyroid hormone (PTH) occurs, resulting in secondary hyperparathyroidism. This triggers the mobilization of calcium from bone and a reduction in bone mineral density. Low vitamin D levels have been linked to an increase in osteoporosis-related fractures, muscle weakness and falls, even increased risk for cardiovascular disease and certain malignancies.^[2]

Vitamin D deficiency is often clinically silent. Manifestations are shown as Children are often found to have started walking late or prefer to sit down for prolonged periods. Adults can experience chronic muscle aches and pains. Physical findings in severe vitamin D deficiency are as: In children, softening of bones & in adults, periosteal bone pain, best detected by applying firm pressure on the sternum or tibia. Measurement of serum 25-hydroxyvitamin D (25[OH] D) is the best test to determine vitamin D status. Levels of 25(OH)D are interpreted as ^[3]:lab values of range 21-29 ng/mL (normal: 52.5-72.5 nmol/L): Vitamin D insufficiency, and values < 20 ng/mL (< 50 nmol/L): Vitamin D deficiency

Alternatively, a measure of the serum parathyroid hormone (PTH) level might be helpful in diagnosis of vitamin D insufficiency. PTH levels are related as a function of indirect proportion, indicating secondary hyperparathyroidism. Clinically, physicians go for lab findings for those patients who are at a greater risk of vitamin-D deficiency, including ^[4] ^[5] ^[6] Patients with osteoporosis or with a syndrome of malabsorption, Black and Hispanic individuals, Obese persons (body mass index >30 kg/m²) ^[7] ^[8] ^[9] Patients with disorders that primarily affect the metabolism of vitamin-D and phosphate levels for example: chronic kidney disease.

To prevent vitamin D deficiency in individuals owing to insufficient exposure to sunlight, the Institute of Medicine has recommended *adequate intake* (AI) based on levels needed to have an optimum levels off vitamin-D in an individual. *The current daily AI =200 IU for infants, children, and adults younger than 51 years; 400 IU = adults 51 to 70 years of age; and 600 IU= adults older than 70 years.*^[10] However, recent research suggests that current AI recommendations for children and adults might be sub-normal levels (above 30 ng per mL) for proper calcium absorptive levels and parathyroid hormone suppressive manifestation.^[11]^[12] Based on these facts, the

American Academy of Pediatrics recently recommended the levels to be doubled up by 400 IU.^{[13][14]}

Vitamin D is a fat-soluble vitamin, and there are news about toxicity from excessive supplement intake. Widespread use of fortified food and drink from the 1930s to 1950s in the United States and Europe led to reported cases of toxicity. According to the *National Academy of Sciences*, there is little risk associated when levels rise up to 2,000 IU per day. To replenish serum 25-hydroxyvitamin D levels in persons with vitamin D deficiency, one cost-effective therapy available is oral ergocalciferol at 50,000 IU per week for eight weeks. The optimal time for reaching the prescribed levels is not stated, but the goal is to achieve a minimum level of 30 ng per mL.^{[15][16][17]}

Serum 25-hydroxyvitamin D levels should be measured again after complete course of therapy, and if values have not reached the sub-minimal or minimal level, a second eight-week course of ergocalciferol is to be prescribed. If the serum 25-hydroxyvitamin D levels still have not shown a rise, the most possible stated cause is non-adherence to therapy or malabsorption. If malabsorption is a suspected element, consultation with a gastroenterologist is given a second thought. After vitamin D levels have enough replete, a maintained dosage of cholecalciferol should be levelled at 800 to 1,000 IU per day from proper diet and supplement.^{[19][20]}

Vitamin D deficiency is now among a common reason of morbidity in Pakistan and deserves to be considered in the common differential diagnosis of backache and unexplained aches and pains. There is high prevalence of vitamin D deficiency due to improper diet, inadequate calcium intake, socialized customs and confining oneself in a four-walled room that deprives the elderly, children and female population of the useful benefit of the sunshine. The other prevailing causes other than dietary intake is also poverty, poor choice of diet and excessive cooking relatively available in diet as the sunlight. Vitamin D deficiency in Pakistan has acquired epidemic outburst levels. There is need to focus on gaining an insight into the specific factors that determine such widespread loss/deficiency of Vitamin D in Pakistani population.^{[21][22]}

II. MATERIALS AND METHODS

A questionnaire-based observational cross-sectional study was carried out from May 17, 2017 till October. We visited three hospitals: Ghurki trust teaching hospital, Jinnah hospital and Ittefaq hospital, Lahore. A convenient sample size of 50 patients was taken.

Age of 20-70 years was included along with non-discrimination of any sex and choosing healthy volunteers. People of below 20 years of age (children, adolescents, elderly) were not considered to be a part of study. It did include the postmenopause and ladies having the symptoms of

dysmenorrhea. Subjects with hepatic or renal insufficiencies were ruled out. Similarly, those who showed the symptoms of metabolic rickets and those having inability to fill questionnaire were also ruled out of the study. We evaluated gender, age of patient (according to WHO guidelines, 50+ years of age is considered to be elderly), weight status, sun exposure & its duration, use of sunscreen, diagnosis of Crohn's disease, ulcerative colitis or diarrhea and lastly, pharmacists' interactive behavior.

Data was collected in a face-to face manner with the individual covering the above aspects. Data was tabulated, and represented the form of graphs and tables.

III. RESULTS

The data was collected from 50 individuals, 36 females and 14 Males .according to the WHO considerations, *above 50 years of age, one is senescent or old*. Women 80% were young females and 20% were old. Similarly, among men, 92% were young while 8% were old.(Figure 1 & table 1)

Greater the weight, lesser will be the absorption of vitamin D; reflecting the indirect proportion relativity. Weight showed a diversified collection: among women, 11% , 22% , 38% and 29% fell under the category 30-40 kg, 41-50 kg, 51-60 kg and more than 60 kg respectively. Similarly, among men, 0%, 28% , 14% and 58% fell under the same categories respectively.(figure2 & table2)

One of the important aspects: *skin color & Exposure*. 33% females & 14% males were fair-skinned. (table3& figure3) 28% of the females said they do cover their skin while going out and 14% males responded yes (figure 4 & table 4). Usage of sunscreen among women was seen to be 19% while among men 21% of individuals used sunscreen (table 6). Sunscreen usage is a direct relevance to the hindrance as the sunlight is not absorbed, no vit-D activation. When they were questioned about the time duration of exposure to the sun, among women: 28%, 30% , 16% and 26% fell under the category of less than 5minutes, 5-15 minutes, 15-30 minutes, more than 30 minutes respectively. Similarly, among men: 28% , 37% , 28% and 7% fell under the category of less than 5minutes, 5-15 minutes, 15-30 minutes, more than 30 minutes respectively. (figure 5 & table5)

Among females, 3% women were diagnosed with Crohn's disease or ulcerative colitis while among males, none was diagnosed with either of two (100% responded "no")(table 7). 16% of women said yes they have experienced diarrhea in the past 2 weeks and only 7% males said yes(table 8) . 22% of females responded yes to the pharmacist's being interactive while in the case of men, 28% responded yes to the pharmacist's being interactive in the counselling of the vitamin-D intake. (table 9)

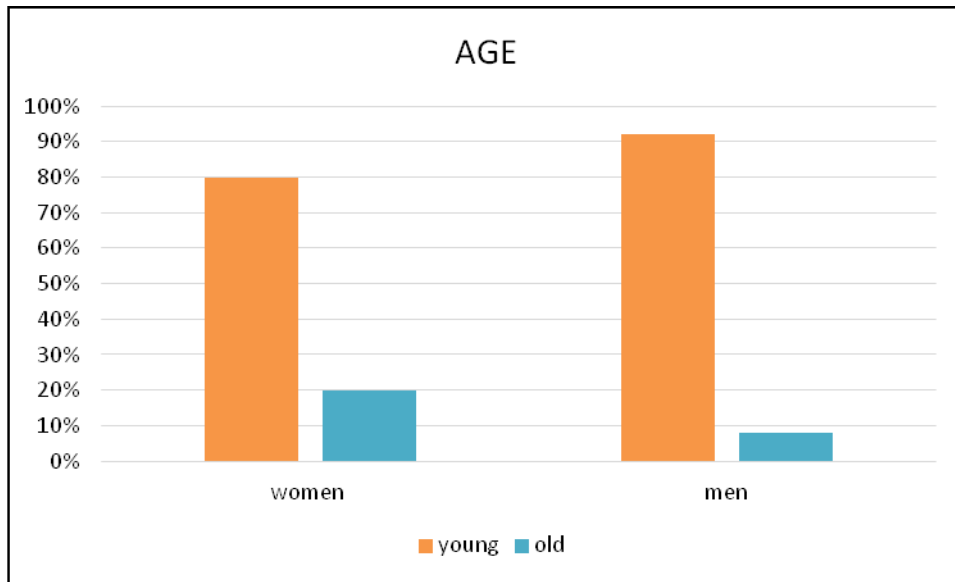


Figure 1: Age of the patients

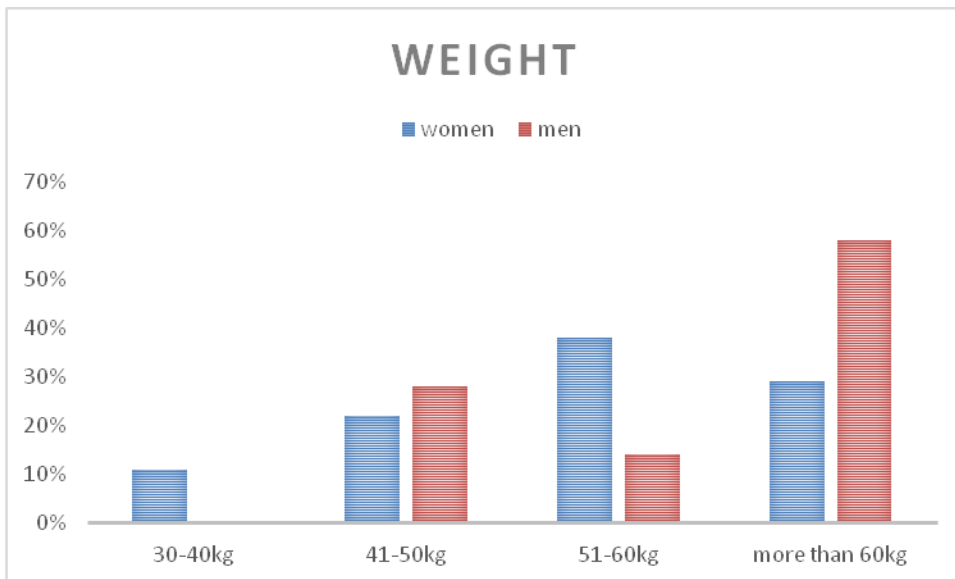


Figure 2: Weight of the individuals

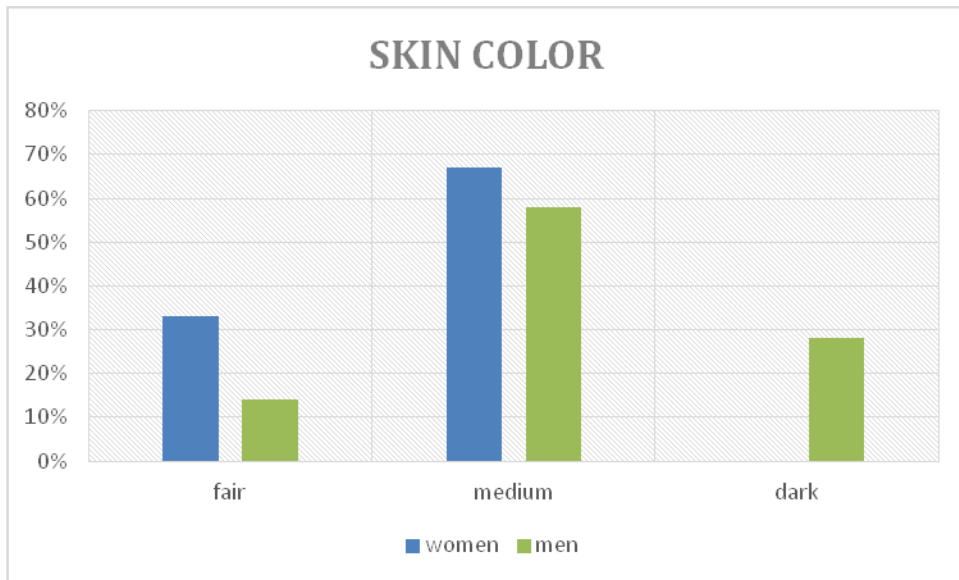


Figure 3: skin colour of the individual

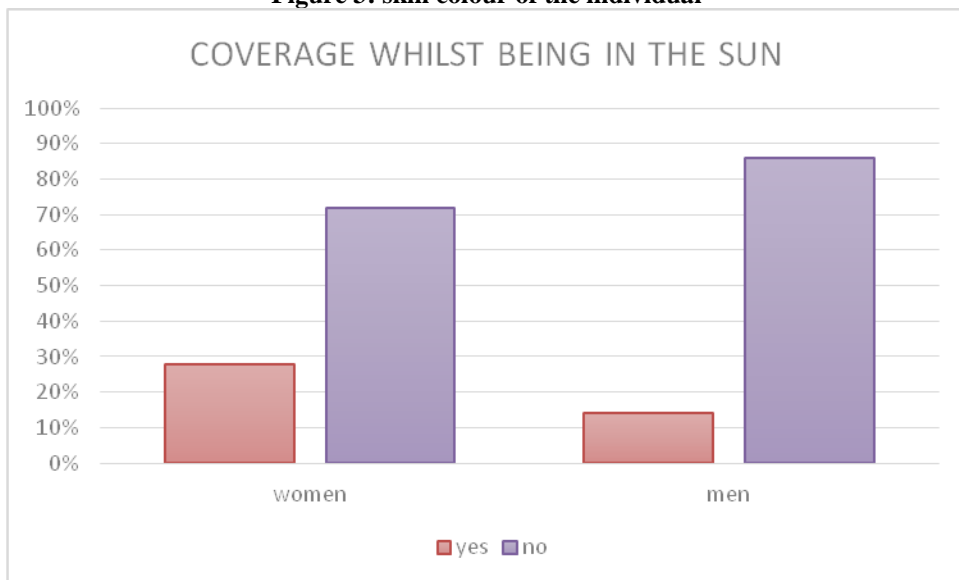


Figure 4: Coverage done by individuals

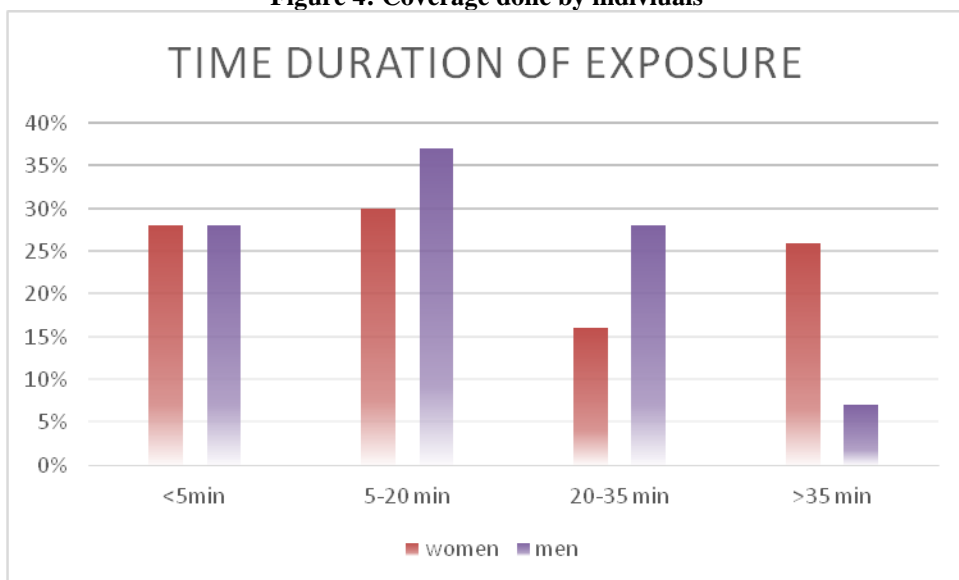


Figure 5: duration of exposure to sun

	Women % (n)	Men % (n)
Young	80% (29)	92% (13)
Old	20% (7)	8%

Table 1: young and old individuals

	WOMEN %(n)	MEN % (n)
30-40 kg	11% (4)	0% (0)
41-50 kg	22% (8)	28% (4)
51-60 kg	38% (14)	14% (2)
More than 60 kg	29% (10)	58% (8)

Table 2: weight of the individuals

	WOMEN % (n)	MEN % (n)
FAIR	33% (12)	14% (2)
MEDIUM	67% (24)	58% (8)
DARK	0% (0)	28% (4)

Table 3: skin tone of the individuals

	WOMEN % (n)	MEN % (n)
YES	28% (10)	14% (2)
NO	72% (26)	86% (12)

Table 4: coverage of exposed skin whilst being in the sun

	WOMEN % (n)	MEN % (n)
<5 minutes	28% (10)	28% (4)
5-20 minutes	30% (11)	37% (5)
20-35 minutes	16% (6)	28% (4)
>35 minutes	26% (9)	7% (1)

Table 5: time duration of exposure in the sun

	WOMEN %(n)	MEN % (n)
YES	19% (7)	21% (3)
NO	81% (29)	79% (11)

Table 6: usage of sunscreen

	WOMEN % (n)	MEN % (n)
YES	3% (1)	0% (0)
NO	97% (35)	100% (14)

Table 7: individuals diagnosed with Crohn's disease or ulcerative colitis

	WOMEN % (n)	MEN % (n)
YES	3% (1)	0% (0)
NO	97% (35)	100% (14)

Table 8: experience of diarrhea within past few weeks

	WOMEN % (n)	MEN % (n)
YES	22% (8)	28% (4)
NO	78% (28)	72% (10)

Table 9: interaction of pharmacists

IV. DISCUSSION

Vitamin-D, a secosteroid or better to be known as the sunshine hormone is essential and is an integrative part of human body. Literature review and results show that it affects women more than men. Owing to its specific specialties, it mainly affects the women (57.7%), children and adolescents.^[23] pertaining to the on-going reason, women are considered more susceptible than men as they have a more complicated physiology due to the on-going ovarian cycle as compared to men. (women:72%, men:36%)

The age affects in the similar manner as well. According to WHO guidelines, 50+ years of age shows a decline in the body levels of vitamin-D. (Above 50 years, one's considered to be old or senescent or geriatric). With the increasing age of adulthood, the levels of vitamin-D absorption increases proportionality: showing a halt or incomplete absorption in old people (20% women, 7% men of our study). The similar study done by *Lise Hnerald et.al* showed that 50-90% geriatrics had their low levels of 25-OH cholecalciferol, leading to skeletal muscle degeneration and other metabolic disorders associated with it. The study also showed that hypovitaminosis D is a *biomarker of age-related disorders like degeneration & cellular dysfunction, directly leading to therapeutic complications like polypharmacy and disabilities.*^[24] Moreover, studies reveal that despite of adequate sun exposure and vitamin-D supplements or food enriched with the vitamin-D (e.g. fortified milk, oily fish, eggs), the geriatrics are deprived of synthesizing vitamin in their bodies owing to a degrading body physiology (85.89%).^[25]

Skin color also shows diversification: fair people tend to boost up their cholecalciferol (inactive form of vitamin-D that activates after exposure to the sunlight by process of hydroxylation) than medium or dark skin-colored people as the melanin underneath our skin literally tends to reflect the sunlight, causing a hindrance to the absorption of vitamin-D (women:33%, men: 21%). Reviewing the literature, it was evident that the dark skin is unable to photoactivate vitamin-D to its activated, useable form and darker skin bioactivates six times lesser vitamin-D as compared to that of pale skin.^[26]

Some similarities were also seen as in the case of covering the skin. For the people who has an ethnic value of covering the whole body, as the Muslim women, lower levels of vitamin-D is manifested by weaker bones and muscular cramps on a daily basis.(28% women and 14% men do covering of body) Studies done earlier show that the women or men who wear long robes or tend to cover their skin in any possible manner tend to receive inadequate levels of vitamin-d in the body.(25.5%)^[27] Another study also reveals the same fact that Asian women prefer indoor activities more as compared to men reasoning the aesthetic concern that directly implies that vitamin-D concern men less crucially as that of women (11.5% activation of vitamin-D)^[28]

Obesity, a leading cause of many chronic diseases, also plays a vibrant role in determination of vitamin-D deficiency. A relation to study done (29% women, 58% men were overweight) with that of prior studies reveal that obesity is inversely related to vitamin-D deficiency, where obesity is directly proportional to increased weight (34.7%).^[29]

Amongst one of the vital factors that affect vitamin-D levels, one is the time duration of one's body being exposed in the sun; Longer the duration, greater is the vitamin-D levels (that's why some people love to have a sun bath in summers!). A comparison of study being carried out (26% women, 7% men for a maximum exposure of more than 30minutes) and that of previous studies stated a clear-cut aspect that the human body should be exposed to sun for at least 5-30 minutes, for a proper processing of cutaneous conversion of pro-vitamin D to its activated form. It was clearly evident that even the seasonal changes for example, autumn and mid-winters have an occlusion to the provision of vitamin-D synthesis. To add it up, decreased intensity of sunlight and cold temperature also plays a pivotal role for hindrance (10.02%)^[30] Similar was the case with the usage of sunscreen. Use of sunscreen or sunblock, a nevertheless-ever-demanding cosmetic product, literally reflects back or in others words, completely or partially blocks the UV-B rays that reach our skin. A study done by *Chi-Heising Huang et.al* revealed that people who use sunscreen practically put one at a crucial, low levels of vitamin-D. Similarly, a study done by *Diehl & Chiu 2010* says that suboptimal intake of vitamin-D, decreased activity and concomitant use of sunscreen will put this world to a pandemic outbreak of vitamin-D insufficiency. (11.5%).^[31]

Liver or kidneys, the vital organs of human machinery, tend to work 24x7 hours a day. Losing their genuineness, the tendency of absorption of vitamins & minerals is also lost like, as in, diseased states (e.g. Crohn's disease, ulcerative colitis) (3% women only suffered from Crohn's disease. Besides being essential for bone homeostasis and mineralization (balance of calcium & phosphorus) it is an innate inflammatory mediator too, an autoimmune disease mediator to be precise like that of the Crohn's disease (10% decreased absorption of vit-D) (*Marco Adresia et.al*).^[32] Our gut wall i.e. stomach is also very efficient in absorption process owing to its increased surface area. Poor gut conditions e.g. diarrhea, constipation, provides efficient blockade system to a process like absorption. Moreover, to quote, *dr. Fred Arnold* says that the vitamin-D insufficiency also leads to bowel problems (constipation, diarrhea or both) & urinary tract problems (urinary urgency etc.).^{[33][34][35]}

Pharmacists, a person who is well-known for his interactive behavior and counselling, should continue as such. Strong bones ends up with a beautiful, strong and endured life. That's why it is said, to synthesize vitamin-D, your shadow should be lesser than your height! Being interactive and having a open-body language for counselling comes up with a better outcome: a change in one's life!

V. CONCLUSION

Hypovitaminosis-D is becoming *one of the most undetectable yet most alarming pandemic conditions*. This study revealed that muscle strain, poor bone mineralization, low exposure to sunlight & increased usage of sunscreen and poor eating habits trigger the condition & muscle pain was found to be most observed among symptoms. Majority of individuals didn't seek any medical advice or had taken supplements. A large amount of population had different symptoms gone unnoticed like muscular cramps, pelvic pain etc. Hypovitaminosis-D was also seen in patients with concomitance of smoking habit. Thus, pharmacist has his role here; in counselling and motivation in taking vitamin-D supplement for a better bone care!

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