ASSOCIATION OF VITAMIN D DEFICIENCY WITH DEMOGRAPHIC FACTORS AND SOCIO ECONOMIC STATUS OF PARENTS OF INDIAN CHILDREN UNDER 5 YEARS OF AGE

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ABSTRACT

Background: Except for a few studies, inadequate data exists on the association of hypovitaminosis D in children aged 6 months to 5 years with socioeconomic (household income, number of family members, and parents' education level) and demographic factors. Looking at the magnitude of problem, the following study was conceptualized. **Materials and Methods:** The present study was a hospital based cross sectional study conducted on 80 children from 6 months to 5 years of age attending OPD in department of Pediatrics, JLN Medical College and were diagnosed of hypovitaminosis D. Vitamin D was estimated using commercially available kit by chemiluminiscence technique (CLIA). For categorisation of the population into rural or urban, criterion proposed by department of census (2011) Government of India was used. Assessment of SES was done by modified BG Prasad classification (2013).**Results**: A significantly higher percentage of hypovitaminosis was seen in female child as compared to the male child. The mean vitamin D levels were lower in children with uneducated or poorly educated mothers than in children with low and highly educated mothers. 60% belonged to class II & III socioeconomic status. Among the vitamin D deficient children 57% were from class II+ class III. The deficient and insufficient vitamin D status was found in lesser percentage of children belonging to class IV and V. No significant difference was seen in rural or urban children regarding vitamin D status. **Conclusion**: Vitamin D deficiency is more prevalent in infants and children (less than 5 yrs of age) of upper socio-economic strata in the Indian population, probably linked to lesser sunlight exposure. In view of this high prevalence of hypovitaminosis D, judicious sun exposure should be encouraged by active outdoor lifestyle in school and home as well as promotion of dietary foods and supplements rich in vitamin D. Further larger studies are needed to evaluate the role of vitamin D supplements as well as the role of sunlight exposure in this group of children.

Key words : hypovitaminosis, supplements, hypophosphatemia. sunlight exposure.

INTRODUCTION:

Vitamin D is a prohormone that has several important functions. The most vital are regulating the absorption of calcium and phosphorous from the gastrointestinal tract, and facilitating normal immune system function. Vitamin D is important for normal growth and development of bones and teeth, as well as improved resistance against certain diseases. Deficiency of vitamin D leads to hypocalcemia and hypophosphatemia that result in rickets in children and osteomalacia in adults. Only 10% of Vit D is derived from dietary sources and supplements and major quantity of Vitamin D is synthesized by a cutaneous reaction in the skin after exposure to ultraviolet radiation,

specifically UVB (1). In contrast to the adults who derive Vit D through fatty fish or oral supplements, the major dietary sources of vitamin D in the pediatric population are fortified foods such as cereal, cheese, and milk. These diets are difficult to be afforded by people of low socio economic statuses (LSE).

Despite of ample amount of sunshine in India, vitamin D deficiency is present in a sizeable share of general population which in itself seems to be a paradox (2). India receives a plenty of sunshine all year round and thus people in India should not lack vitamin D. On the contrary, epidemiologic studies from different parts in India reported higher than 70% prevalence of vitamin D deficiency in all age groups, including toddlers, school children, pregnant women and their neonates and adult males (3). Leading more of an indoor life due to urbanisation underlies one of the causes of such deficiency in children brought up in well off families.

Assessment of vitamin D is based on measurement of serum 25(OH)D. Vitamin D deficiency is typically defined as circulating 25 (OH)D concentrations less than 20 ng/mL (50 nM) (4). In this state, the subsequently low ionized calcium concentration stimulates PTH secretion, which eventually leads to increased 1,25 (OH)D synthesis (5). An insufficient exposure to sunlight is a major cause of vitamin D deficiency. Other causes are sunscreen sun protection. (6), dark skin, body mass index (BMI) greater than 30 (7), malabsorptive conditions, and use of a wide variety of medications including antiretroviral drugs. Geographic latitude, time of the day for sunlight exposure, seasonal fluctuations and age also determine the vitamin D levels. Generally, biweekly exposure of arms and legs for 5 to 30 min (depending on time of day, season, latitude, and skin pigmentation) between 10 AM and 3 PM is often enough (8). Asians have skin type 4 or 5 as compared to Caucasians (mostly skin type2 or 3). Dark-skin individuals require greater duration of exposure than their light-skinned counterparts to synthesise equivalent amount of vitamin D_3 (9).

However except for a few studies, inadequate data exists on the association of hypovitaminosis D in children aged 6 months to 5 years with socioeconomic (household income, number of family members, and parents' education level) and demographic factors. Looking at the magnitude of problem, the following study was conceptualized.

MATERIAL AND METHODS

The present study was a hospital based cross sectional study conducted on 80 children from 6 months to 5 years of age attending OPD in department of Pediatrics, JLN Medical College, Ajmer from April 2013 to March 2014 and diagnosed of hypovitaminosis D. 80 children, who met the inclusion criteria, were included in the study by random sampling. Patients with serious illness and other skeletal diseases were excluded from the study. Institutional ethical clearance was obtained for the study protocol. Written consent was taken from parents/guardian of children before they were subjected to full medical history (from parents) and clinical examination. Socio demographic profile, mother's education, feeding history, immunization history, sun exposure, drug history was taken using standardized questionnaire. After obtaining written informed consent from the parents, blood samples were obtained from the children and Vitamin D was estimated using commercially available kit (Siemens Advia Centaur) by chemiluminiscence technique (CLIA).

Serum 25 (OH) vitamin D reference range was taken as per US endocrine society classification (10).

Deficiency	**<20 ng /ml**
Insufficiency	>21-29 ng /ml
Sufficient	>30 ng /ml
Risk of toxicity	>150 ng /ml

For categorisation of the population into rural or urban, the following Criterion was used as proposed by department of census (2011), Government of India.The definition of an urban unit at the 2011 Census:

a) All places with a municipality, corporation, cantonment board or notified town area committee etc.
b) All other places which satisfied the following criteria:

i. A minimum population of 5,000;
ii. At least 75 per cent of the male working population engaged in non-agricultural pursuits; and
iii. A density of population of at least 400 per sq. km.

All areas which are not categorized as urban area or revenue villages governed by Gram Panchayat are considered as Rural Area.

For categorization of socio demographic profile of cases and control, modified BG Prasad classification (2013) (11) based on the per capita monthly income was used.

Assessment of SES by modified BG Prasad classification (2013)

Socio-economic status Class	Modified BG Prasad's ssification (2013)
1	Rs 5156 and above
2	Rs 2578-5155
3	Rs 1547-2577
4	Rs 773-1546
5	Rs below 773

Statistical analysis

Data were recorded in a computerized database and analyzed using statistical software SPSS (Version 20.0; SPSS Inc., USA). Standard descriptive statistics were presented as percentages or mean ± SD. The results were considered significant with $p<0.05$ or $p<0.01$.

RESULTS

Of the 80 children investigated, a significantly higher percentage of hypovitaminosis was seen in female child as compared to the male child.

In our study 91% mothers were educated and only 9% were illiterate. It was observed that majority (55%) of mothers of children having vitamin D sufficiency were educated above secondary level. 91% of the mothers in vitamin D sufficiency group were educated up to secondary level or higher.
Significant difference was seen in illiterate Vs above secondary or up to secondary education level group in vitamin D deficient & sufficient children.

Most of the subjects (60%) belonged to class II & III socioeconomic status. Among the vitamin D deficient children 57% were from class II+ class III. The deficient and insufficient vit D status was found in lesser percentage of children belonging to class IV and V.

In vitamin D insufficient children, statistically significant difference was seen in Class II+III Vs class IV+V socioeconomic status whereas no significant difference was seen in other socioeconomic classes and vitamin D level.

No significant difference was seen in rural or urban children regarding vitamin D status.

TABLE 1- AGE DISTRIBUTION OF CASES AND CONTROLS

Age Group	Cases (n=40)	Control (n=40)	Total (n=80)
>6m- 1yr	10 (25%)	10 (25%)	20 (25%)
>1yr -2 yr	22 (55%)	20 (50%)	42(52.5%)
>2yr -5 yr	8 (20%)	10 (25%)	18(22.5%)
Total	40	40	80

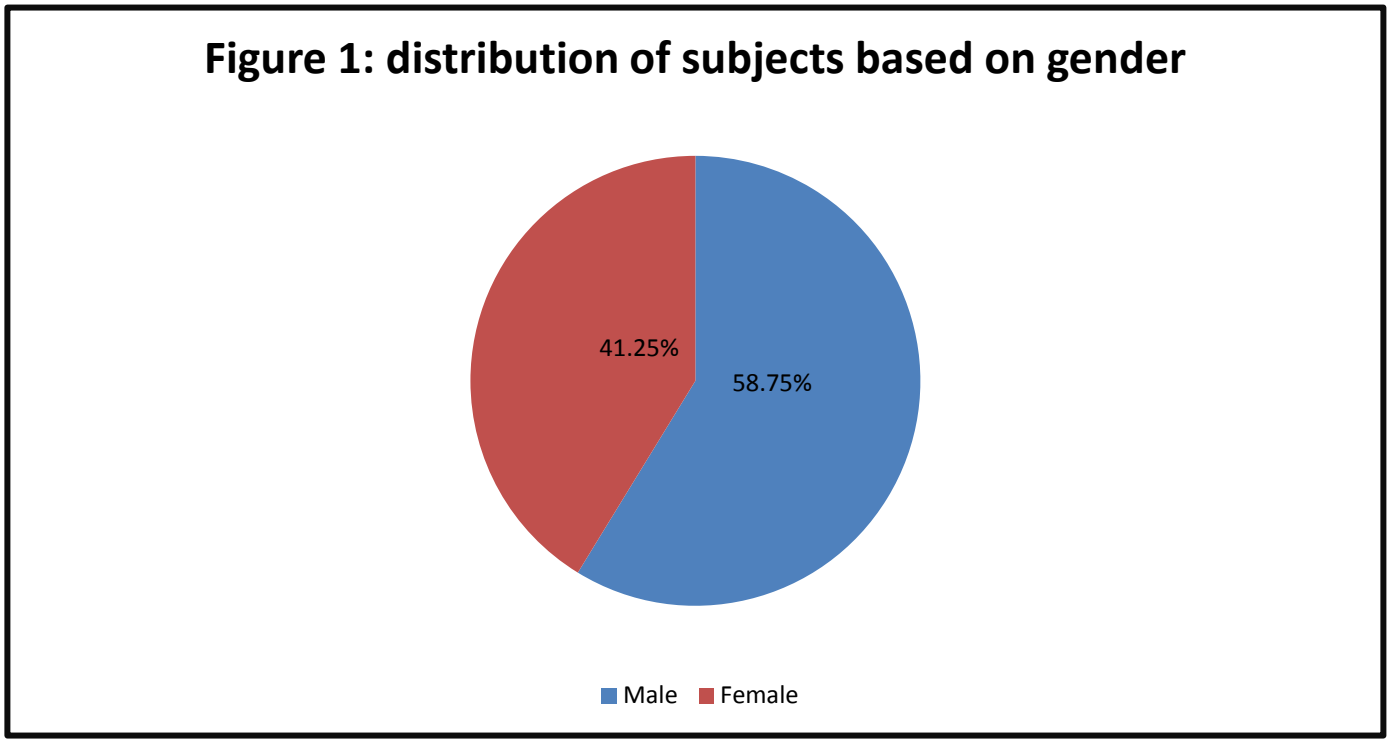


TABLE 2- EDUCATIONAL STATUS OF SUBJECTS' MOTHER IN RELATION TO VITAMIN D STATUS

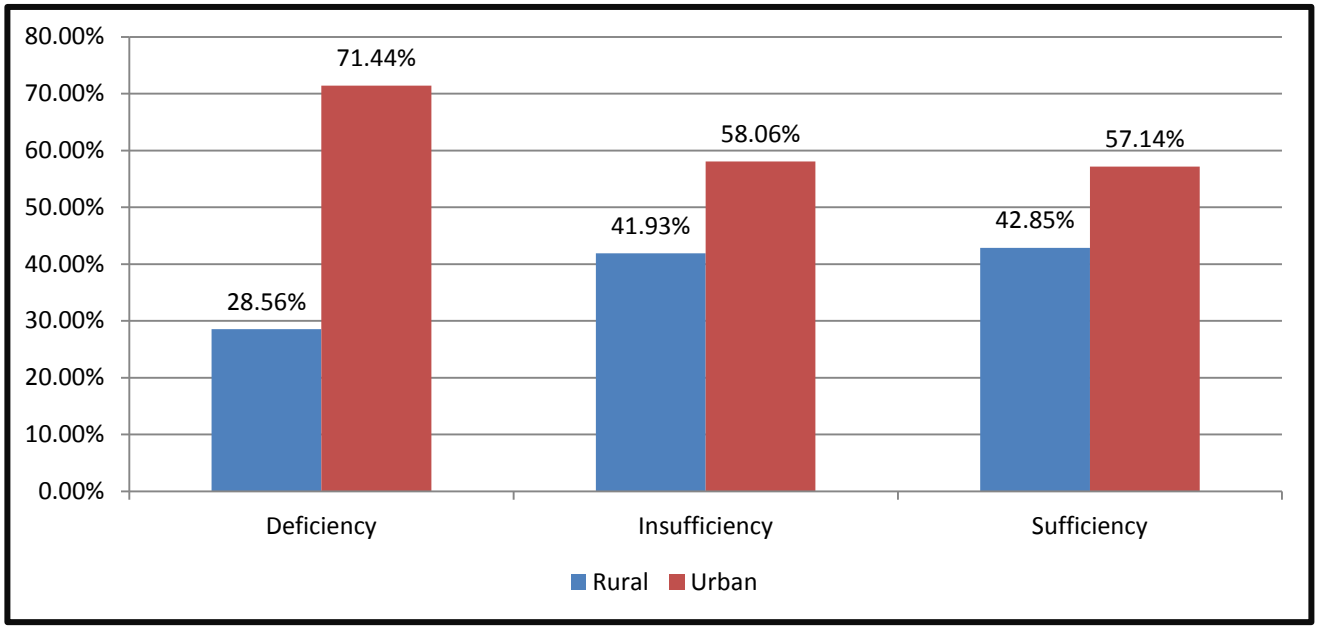
Educational status	**Deficiency (n=7)**		**Insufficiency (n=31)**		**Sufficient (n=42)**		**Total (n=80)**
Illiterate	3 (42.85%)		3(9.67%)		1 (7.14%)		7 (2.38%)
Up to secondary	2 (28.56%)		12 (38.70%)		20 (47.61%)		34 (42.5%)
Above secondary	4 (57.14%)		12 (38.70%)		23 (54.76%)		39 (48.75%)
Total	7		31		42		80
Educational status	Deficiency		Insufficiency		Sufficient		
	Z score	P value	Z score	P value	Z score	P value	
Illiterate Vs up to secondary	0.66	>0.05	1.13	>0.05	1.87	>0.05	
Up to secondary Vs above secondary	4.02	<0.05	1.03	>0.05	2.84	<0.05	
Illiterate Vs above secondary	3.65	<0.05	1.55	>0.05	5.51	<0.05	

TABLE 3: VITAMIN D STATUS AND SOCIO ECONOMIC STATUS OF SUBJECTS

Socioeconomic status	**Deficiency (n=7)**	**Insufficiency (n=31)**	**Sufficient (n=42)**	**Total (n=80)**
Class I	0	0	0	0
Class II+III	4 (57.14%)	10 (32.25%)	18 (42.85%)	32 (40%)
Class IV+V	3 (42.85%)	21 (67.74%)	24 (57.14%)	48 (60%)
Total	7	31	42	80

	Z score	P value	Z score	P value	Z score	P value	
Class II+ Class III Vs Class IV+ Class V	0.54	>0.05	2.99	<0.05	1.32	>0.05	

FIGURE 2: SERUM VITAMIN D STATUS IN RELATION TO RURAL AND URBAN POPULATION



DISCUSSION

In the present study, significant difference was seen in LSE Class II+III Vs class IV+V with vitamin D insufficiency in USE i.e. Class II+III. These results are similar those of M Atiq et al (12) in Pakistan. Our study found that children from the higher socio economic group were at greater risk of hypovitaminosis D. This is contrary to the study by Marwah et al. (13). LInhares et al did not find any significant differences in the mean vitamin D concentration between the various socio economic groups (14). The higher levels observed in LSE infants could be on account of increased time spent outdoors with their mothers that gives them greater exposure to sunlight. Also, the children in low SES are comparatively poorly dressed possibly leading to more body area exposed to sun as compared to high SES. Mothers of infants of the USE class were mostly housewives, lived in flats and bungalows which confined their infants indoors. So, the time spent in outdoor activities was less. Moreover, sun protection behaviours like application of sunscreen before the exposure to sun also minimises the absorption of UVB. This gave children a lesser exposure to sunlight

probably leading to high prevalence of vitamin D deficiency amongst this group. This also infers that vitamin D level is more associated with direct contact with sunlight rather than personal diet which is any way better in the USE.

A significantly higher percentage of hypovitaminosis was seen in female child as compared to the male child in the present study. This again could be accounted to sparse clothing of male child to that of the female child which in turn effect the exposure to sunlight. Quite similar results were found in another study from India (15).

The present study showed a significant difference in illiterate and literate mothers of vitamin D deficient & sufficient children. We noted that the mean vitamin D levels were lower in children with uneducated or poorly educated mothers than in children with low and highly educated mothers. Parental education, specifically of a mother has a significant association with vitamin D deficiency in children. This was also noted in a study in Britain on children aged between 6 months and 5 years (16). This might be due to the fact that illiterate parents do not have sufficient knowledge about the importance of vitamin D supplementation in their children, which then manifests as hypovitaminosis D. This can be explained by their insufficient knowledge about the importance of vitamin D supplementation due to their poor educational level.

CONCLUSION

Vitamin D deficiency is more prevalent in infants and children (less than 5 yrs of age) of upper socio-economic strata in the Indian population, probably linked to lesser sunlight exposure. In view of this high prevalence of hypovitaminosis D, judicious sun exposure should be encouraged by active outdoor lifestyle in both school and home as well as promotion of dietary foods and supplements rich in vitamin D (which otherwise is a sunshine vitamin) to children older than 2 years. Further larger studies are needed to evaluate the role of vitamin D supplements as well as the role of sunlight exposure in this group of children.

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