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Seasonal and gender differences in Vitamin D status among the obese adolescents: A prospective study

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Abstract
Introduction: Sunlight is the only major source of vitamin D. Inspite of abundant sunlight, darker skin pigmentation, pollution and inadequate sun exposure contributes to the deficiency of this vital nutrient. Obesity among college students is another risk factor for vitamin D deficiency.
Objective: The primary objective of the study was to find out the prevalence of vitamin D deficiency among overweight and obese college going adolescents in summer and winter seasons.
Methods: Survey was conducted with a pre-tested self-administered questionnaire to find out the socio-economic background, health profile and physical activity behavior among the college students (n=750) between 17 and 19 years of age studying in Government Arts and Science Colleges in Puducherry. For the biochemical analysis of vitamin D, a subsample of 60 willing obese adolescents was selected.
Results: Mean weight of obese girls was lower (77%) than boys (81%) whereas waist circumference of girls was higher (85cm) than that of boys (79%). Percentage of bone mass was higher in males (3%) than in females (2%). Only 10% of girls and 40% of boys had normal level of vitamin D in summer. In winter season both obese girls and boys were categorized in the groups if either deficiency (87%) or insufficiency (77%). Sunlight exposure, regular exercise and physical activity were found to be very low in vitamin D deficient adolescent girls than in boys.
Conclusion: Unhealthy food habits, physical inactivity, inadequate sunlight exposure were the primary factors which contributed to vitamin D deficiency in obese adolescents more in winter than in summer.

Keywords: Vitamin D deficiency, obesity, sunlight exposure, college going adolescents, physical activity

1. Introduction
Vitamin D, a fat soluble vitamin is also considered as an endocrine hormone, because this unique nutrient can be synthesized endogenously (Skin). Its synthesis in the body depends on several factors such as latitude, atmospheric pollution, clothing, skin pigmentation, duration and time of exposure to sunlight (Holick M E et al, 2008 and Holick A F, 2006) [1, 2]. It is also known anti rickety factor or sunshine vitamin (WHO, 2004) [3]. Vitamin D is required to maintain the normal blood levels of calcium and phosphate, normal mineralization of bone, muscle contractions and general cellular functions in all cells of the body (Ritu G and Gupta,2014) [4].
Vitamin D status has been estimated such that 1 billion people in worldwide are found to be either deficient or insufficient (Bruney TS, 2011) [5]. Vitamin D deficiency is highly prevalent among children and adolescent worldwide and in entire Indian subcontinent prevalence ranging from 70% to 100% (Hypponen E et al, 2001) [6]. Vitamin D deficiency has been identified as a worldwide public health problem which is also associated with chronic disorders such as Type 1 Diabetes mellitus, Type 2 Diabetes mellitus, asthma, overweight, cardio vascular diseases, malignancy (Al-Musharaf S et al, 2012) [7], autoimmune disease (McCarron D et al, 1984) [8], multiple sclerosis and schizophrenia (Rabbani A et al, 2009) [9]. Vitamin D deficiency among female students was about five times more than the male students (Gordon CM, 2008) [10].
Endocrine Society of America defines Vitamin D deficiency as levels below 20 ng/ml and vitamin D insufficiency as D levels of 21-29 ng/ml (Hoilck MF, 2013) [11]. It is estimated that for every 100 IU of vitamin D ingested, blood level of vitamin D increases by 1 ng/ml and hence to achieve a blood level of above 30 ng/ml, one require to ingest 3000 IU of vitamin D a day.

Obesity and insulin resistance are found to be associated with low serum levels of 25-hydroxy vitamin D. Being a fat soluble vitamin, vitamin D is sequestrated into the fat cells of obese people and serum levels may be low. In addition, the limited mobility as well as sun exposure seen in obese people can also contribute to low vitamin D levels. Recently association has been identified between vitamin D and obesity and also with insulin resistance. Very low level of Vitamin D in serum or combined with inadequate calcium intake has been associated with cardio metabolic risk factors such as hypertension, obesity, metabolic syndrome and Type 2 DM.

In the present study, vitamin D status among obese adolescents was assessed in summer and winter seasons in Puducherry, South Indian population.

1.1 Aim of the study

The overall aim of this study was to find the prevalence of vitamin D deficiency among the adolescent population and to study their relationship with different obesity indices.

2. Methodology

2.1 Anthropometric Measurement

This study was approved by the ethical committee of Bharathidasan Govt. College for women, Puducherry. This study was conducted after obtaininga written consent and a pre-tested self-administered questionnaire and to find out the socioeconomic background, health profile, physical activity among the college going adolescents (N=750) in the age group between 17 and 19 years. This study was conducted in six Government and Government aided Arts and Science colleges in Pondicherry. Stadiometer and weighing machine was used to measure height and weight respectively. Body composition analyzer (Tanita) was used for predicting bone mass and body fat percent. Body mass index (BMI) is defined as the weight in kilograms divided by square of the height in meters. As per the guidelines of International Obesity Task Force (IOTF) obesity is defined as BMI ≥ 25 kg/m^2, and Overweight as BMI 23-24.9 kg/m^2 (Cole TJ et al, 2000)[13].

2.2 Biochemical Measurements

All blood samples were obtained between 8A.M. and 9A.M after overnight fasting. For biochemical analysis, a subsample of 60 eligible and willing obese adolescents (30-girls & 30-boys) was selected by purposive sampling method. Fasting blood samples (5ml) were collected and stored at -20celcius prior testing. Blood serum levels of 1, 25 OH vitamin D3, calcium and Alkaline Phosphatase were estimated by standard methods and all the participant samples were collected both in summer and winter, i.e. march-May 2015 and November-January 2015.

3. Results and Discussion

From Table 1, it is evident that mean BMI was almost identical in both obese boys and girls. Body fat percent was slightly higher in girls (31%) than boys (28%). Bone mass was found to be higher in boys (3%) than in girls (2%).

Table 1: Anthropometric and body composition parameters of obese adolescents

Anthropometric and body composition parameters	Girls (N=30) Mean ± SD	Boys (N=30) Mean ± SD
Weight (Kg)	76.95 ± 8.2	80.69 ± 7.82
Height (m)	1.6 ± 0.01	1.6 ± 0.05
BMI	30.57 ± 2.6	29.9 ± 2.6
Waist circumference (cm)	84.93 ± 5.46	79.2 ± 9.2
Body fat (%)	30.95 ± 5.94	28.17 ± 3.3
Bone mass	2.2 ± 0.21	3.01 ± 0.3

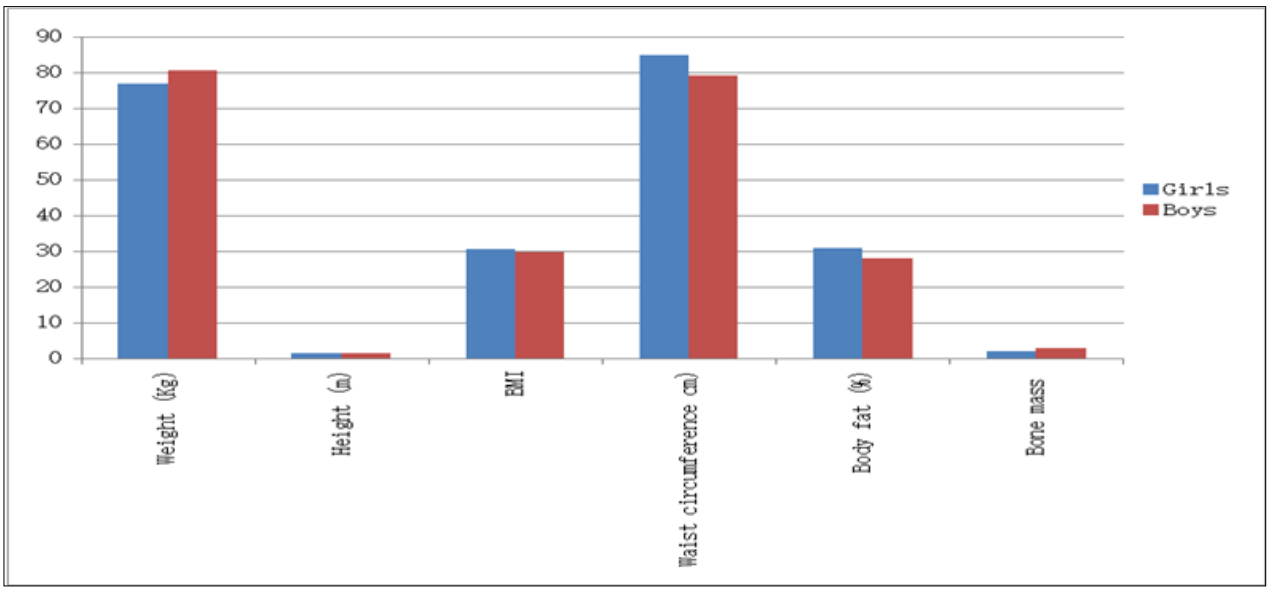

Fig 1: Anthropometric and body composition parameters of obese adolescents

Table 2: Vitamin D levels in summer and winter

Biochemical parameters	Sumer				Winter			
	Girls (n=15)		Boys (n=15)		Girls (n=15)		Boys (n=15)	
	Mean	Range	Mean	Range	Mean	Range	Mean	Range
Vitamin D (ng/ml)	31.9	18-48	33	15-49	17.87	6-26	21	6-36
Calcium (mg/ml)	9.3	8.1-10.3	9.3	7.9-10.6	9.2	8-9.8	8.6	7.5-9.8
Alkaline phosphatase (IU/L)	190	152-260	204.3	150-320	215	158-298	242.9	167-388

Mean Calcium level was 9.3 mg/dl in the study group in summer but in winter it was reduced to 8.6mg/dl in boys while it was 9.2mg/dl in girls. The consumption of calcium rich foods such as milk and milk products, green leafy vegetables and millets like ragi among girls than boys was the reason for constant calcium levels in girls. Boys exhibited the habit of drinking carbonated beverages frequently than girls which might decrease their calcium intake in their daily diet. Increase in mean alkaline phosphatase level was noticed in winter (215IU/L & 242IU/L) than in summer (190IU/L & 204IU/L) in both girls and boys respectively corresponding to the simultaneous decrease in serum Vitamin D levels.

Table 3: Status of vitamin D in summer and winter

Status of vitamin D	Summer		Winter	
	Girls (n=30)	Boys (n=30)	Girls (n=30)	Boys (n=30)
Group I- Severe deficiency (<10 ng/ml)	-	-	6(20)	5(16.66)
Group II- Deficiency (10-20 ng/ml)	9(30)	5(16.7)	14(46.7)	12(40)
Group III- Insufficiency (20-30 ng/ml)	18(60)	13(43.3)	10(33.3)	13(43.33)
Group IV- Sufficiency (>30 ng/ml)	3(10)	12(40)	-	-

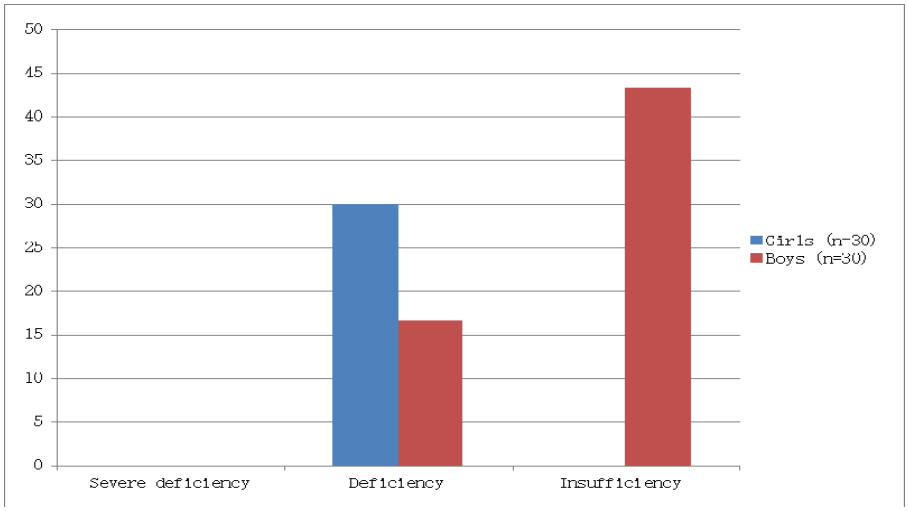

Fig 2: Status of Vitamin D in summer

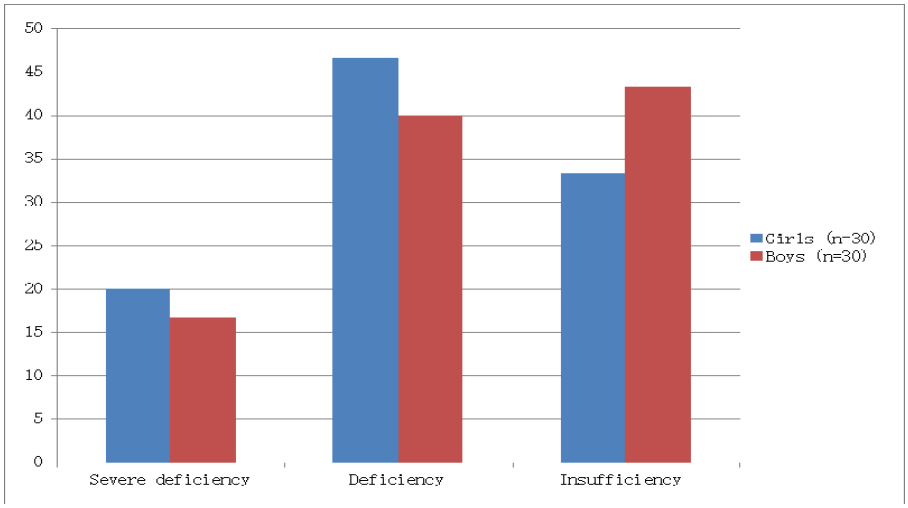

Fig 3: Status of Vitamin D in winter

Low levels of vitamin D were observed in about 30 percentage of girls and 17% of boys in summer. Only 10% of girls and 40% of boys had normal level of vitamin D in summer. In winter season both obese girls and boys were categorized in the groups if either deficiency (87%) or insufficiency (77%). Serum vitamin D levels of less than 20ng/dL has shown to be significantly associated obesity in both adults and adolescents.

Both boys and girls were found to be either deficient or insufficient in winter. The reasons for low vitamin D low levels (Mean =19.5ng/dl) in obese adolescent could be attributed to low sunlight exposure in winter in addition to excess body fat.

Our study found that there was high prevalence of vitamin D deficiency in obese adolescent group. Among 60 obese adolescents, only fourteen came under the group II deficiency (10-20ng/dL). But in winter, twenty six obese girls and boys were found to be deficient of this vitamin. Girls were more (47%) deficient than boys (40%) in winter. Inadequate sunlight and/or exposure along with low dietary calcium intake in winter than in summer might aggravate the deficiency of vitamin D. A study done by Catherine M Gorden *et al* (2008)[10] supports the finding that girls were more deficient of vitamin D than boys. Recently in 2014, a study done by Sivakumar R and Shanthi R in Chennai, India also found 33% of girls had Vitamin D deficiency when compared to 17% in boys. Both studies showed that vitamin D deficiency was more among girls than boys. Also in the present study girls were more deficient/insufficient of Vitamin D (90%) than boys (60%) in summer. In winter none had vitamin D levels more than 30ng/mL.

4. Conclusion

Sub clinical Vitamin D deficiency is common in India across all age groups which is also seen in the present study in obese college going adolescents. Mass vitamin D fortification in commonly consumed food articles such as milk and oil may be the need of hour to address this major public health issue. Dietary supplements, mandatory physical exercise during college hours, outdoor game activities with adequate sunlight exposure are essential to maintain a healthy weight and for avoiding vitamin D deficiency in adolescent groups.

5. References

1. Holick ME, Chen TC. Vitamin D Deficiency: a worldwide problem with health consequences. American journals of Clinical Nutrition. 87(4):1080-2008.
2. Holick AF. Resurrection of vitamin D deficiency and rickets. Journal of Clinical Investigation, 2006; 116(8):2062-2072. 2.1
3. Report of joint FAO/WHO expert consultation on vitamin and mineral requirement in human nutrietion: Bangkok 1998. Second Edition FAO Rome, 2004. Avilable at http://whqlibdoc.who.int/publications/2004 9241546123.pdf
4. Ritu G. Gupta vitamin D deficiency in India: prevalence causalities and interventions.Nutrientns.2014;6(2):729-75
5. Bruney TS. Childhood obesity: effects of micronutrients, supplements, genetics, and oxidative stress. J Nurse Pract. 2011, 647-53.
6. Hypponen E, Laara E, Reunanen A, Jarvelin MR, Virtanen SM. Intake of vitamin D and risk of type 1 diabetes a birth-cohort study. Lancet. 2001; 358:1500-1503.
7. Al-Musharaf S, Al-Othman A, Al-Daghri NM, Krishnaswamy S, Yusuf DS, Alkharfy KM *et al*. Vitamin D deficiency and calciumin take in reference to increased body mass index in children and adolescents. Eur J Pediatr. 2012; 171:1081-6
8. McCarron D, Morris CD, Henry HJ, Stanton JL. Blood pressure and nutrient intake in the United States. Science. 1984; 29:1392-8.
9. Rabbani A, Alivian SM, Motlagh ME *et al*. vitamin D insufficiency among children and adolescents living in Tehran, Iran J trop pediatr 2009; 55:91
10. Gordon CM, Feldman HA, Sinclair L *et al*. Arch Paediatr Adolesc Med. 2008; 162; 505-51211.
11. Sivakumar Ramukalanjiam, Shanthi Ramesh. Vitamin D Status in Children of South Chennai, Tamil Nadu, India. Research Journal of Pharmaceutical, Biological and Chemical Sciences November - December RJPBCS 2014; 5(6):579. ISSN: 0975-8585.
12. Holick MF, Vitamin D Treatment Guidelines, Chapter 136, Section 18. http://apiindia.org/medicine_update_2013/chap136.pdf
13. Cole TJ, Bellizzi MC , Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: International survey. BMJ. 2000; 320:1240-3.