JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

A Comparative study of heights of Girl Students (13-15y) in Schools with and without Playground

Sara Ilyas[1], Uzma Fatima[2]
[1] Royale Degree College for women, Charminar, Hyderabad, Telangana, India
[2] Royale Degree College for women, Charminar, Hyderabad, Telangana, India,

ABSTRACT

Vitamin D is known as anti-ricketic factor or sunshine vitamin. The uniqueness of Vitamin D is that it can be synthesized by the body and it functions as a hormone. Apart from various other metabolic functions, it plays a pivotal role in calcium homeostasis and bone mineral metabolism, which effects the longitudinal growth in children. The comparative study was carried out to determine the possibility of a relationship between the presence of Playgrounds in schools and impact on the heights of the female students of age 13-15 years, in Hyderabad.

10 schools were selected (5 each with and without Playground) for a cross-sectional study. A total of 300 participants were assessed for height and interviewed regarding various Sun-Exposure factors. The data collected was compared with IAP standards using Height for Age Charts

The Average heights of students observed in schools with and without Playground facilities were recorded as 152 ± 9 cm and 146 ± 13 cm for the 13 year old, 154 ± 7 cm and 149 ± 14 cm for 14 year olds, 156 ±8 cm and 152 ± 12 cm for 15 year olds respectively.

Ample Sunlight availability in India should have helped to meet the Vitamin D requirement especially among growing children. Lack of awareness, social restrictions, traditional practices, indifferent attitude towards outdoor activity in schools and home, gender bias play a significant role in decreasing Sunlight exposure in Indian female adolescents.

KEY WORDS

Sun light, Schools, Vitamin D, Calcium, Bones

INTRODUCTION

Skeletal growth is a complex process that commences in the foetal stage and continues after birth till adolescence. Based on the skeletal extension, people may be classified as short, normal and tall, which exist irrespective of age and social groups. Bone is a living tissue composed mainly of protein, calcium, phosphorus and water (1). Bones are constantly remodelled with the resorption and deposition of Calcium. Calcium cannot be produced in the body nor is the digestive system very efficient in absorption of Calcium. The absorption of Calcium from the diet in the absence of Vitamin D is as less as 15-20% (2). Therefore, Vitamin D works dominantly in growth and development of bones and is one of the key vitamins for ideal health (3). For instance, it commands the cells present in the gut to absorb calcium and phosphorus — two chief minerals that are essential for maintaining strong and healthy bones (4). 90% of vitamin D gets utilized from sunlight exposure through skin and only 10% of it available from diet. (5)

Undoubtedly Genetics perform a crucial role in deciding peak bone mass. Elements like environment, sufficient nutrition and physical activity, especially in late childhood and early puberty act as effective modulators in determining an individual's genetic potential, peculiarly in countries where malnutrition is widespread. (6,7)

Besides dietary sources, when your skin is exposed to sunlight, it makes vitamin D from cholesterol. The sun's ultraviolet B (UVB) rays hit cholesterol in the skin cells, providing the energy for vitamin D synthesis to occur. Without vitamin D, only 10–15% of dietary calcium and about 60% of phosphorus are absorbed. Vitamin D sufficiency enhances calcium and phosphorus absorption by 30–40% and 80%, respectively (8). It is necessary to know that the sun's UVB rays cannot creep in through windows. Therefore, people who work next to sunny windows are still prone to vitamin D deficiency. (9)

However, traditional practices, high melanin percentage, a diet low in calcium and high in phytates and oxalates which depletes vitamin D, absence of food fortified with vitamin D, genetic factors such as escalated 25(OH)D-24-hydroxylase, which degrades 25(OH)D to inactive metabolites, topographical location of various places in the country (India extends from 8 to 38 degrees north latitude) and environmental pollution are some reasons proposed behind vitamin D deficiency in Indian children. Routine screening of healthy children for vitamin D deficiency is not recommended (10)

Since epidermal exposure is a prime factor to determine an individual's stature, this study was carried out to document the relationship between sun exposure with lateral growth school students. This prevalence study targeted school going girls of various schools both with and without a playground in Hyderabad between the ages of 13 to 15 years. About 300 healthy subjects willingly participated in a collection of anthropometric measurements. The results from tabulation of data were compared with the standards given by IAP 2015. (11)

Heredity and skeletal growth

The biological process of bone growth and mineral accrual is the principal step towards a healthy and strong skeleton system. The bone genotype is identified as a multifactorial trait with a strong genetic background. In vertebrates, the Three-D apparent bone density increases by 15% during pubertal growth spurt. The genetic ability of bone development may get affected by irregular puberty calendar, improper intake or absorption of calcium and decreased physical activity (12)

The major and minor growth genes are responsible for human length. It is observed that genetic factors contribute 80-90% with improved environmental factors (13)

Sun exposure and skeletal growth

Vitamin D from sun exposure is a fundamental source to meet its requirement among the majority of the population. Exposure of human skin to solar UVB radiation (wavelengths 290-315mm) leads to the conversion of 7-dehydrocholesterol to provitamin D in the skin, provitamin D_3 is then rapidly converted to Vitamin D_3 (cholecalciferol) by temp and membrane dependant processes. (14)

In India, despite the ample sunlight availability, vitamin D deficiency is a major health concern. The need for exposure of an individual's bare skin to sunlight for vitamin D synthesis is grossly understood. High melanin acts as natural sunscreen in dark skin individual's and also suppresses their vitamin D production. Therefore, these people require greater sun exposure (15,16,17).

For the Indian skin tone "direct sun exposure" is required daily for more than 45 min with bare face, arms, legs (18). The sunny days of India cause great discomfort to most Indians also, the desire of the community to attain lighter skin tone and cultural taboos, restricting females indoors prevent them from sufficient sun exposure. These factors overpower the importance of sun exposure for Vitamin D synthesis especially in the female population. Exposure of an adult with a bathing suit to a minimal erythemal dose of UV radiation brings a slight pinkness to the skin after 24 hrs. This produces vitamin D equivalent to consuming 10,000 - 25,000 IU (19). A typical exhibition of skin to sunlight between 1000 h and 1500 h in the spring, summer, and fall is the best source of vitamin D for most humans (20).

Calcium rich foods and skeletal growth

Calcium is known to be a major component in mineralization of the bony process. It is copiously available, of which 99% is found in bones. It plays a key role in skeletal mineralization and is required for normal growth, development and bone strength (21). From 1-18 years, 400 IU and 600 IU vitamin D/day and 250-500 mg/day and 600-800 mg/day of calcium respectively, are recommended (22). Absorption of Calcium takes place in the

proximal small intestine, through active Vitamin D dependent pathway (when Calcium intake is low) and Vitamin D independent pathway (when the calcium intake is high). Only 35% of the dietary intake is absorbed at an intake of 400mg per day. This percentage falls as the intake increases. Absorption of Calcium depends on various factors like phosphates, phytate, etc, age group and physiological state. Mean intake of calcium, proportion of Calcium from dairy sources were found to be lower while phytate content was found to be higher in children suffering from rickets. (23)

MATERIALS AND METHODS

A Questionnaire was administered to the students of various schools of random areas of the city of Hyderabad through face-to-face interview. The schools were classified accordingly, based on the presence and absence of the playground. The questionnaire form included details about age, gender, Sun Exposure with respect to outdoor games/modes of transport, sports uniform, physical activity records of the students. Anthropometric measurements of students' height, weight were recorded, from which the Body Mass Index (BMI-kg/m2) were calculated.

Height

Height was measured using a stadiometer. It was mandatory for participants to remove shoes and headscarf and undo their hairstyle and hairstyle accessories (where applicable) before stepping on a stadiometer placed on a flat floor along the wall. The pupils were instructed to keep their feet together, flat on the stepping board of the stadiometer. They were advised to inhale deeply, hold the breath, and maintain an erect stable posture. The head was positioned in such a way that the angle of the eye and the opening of the external auditory meatus were in a horizontal line. Height measurement was then carefully read to the nearest 0.1 cm.

Weight

Weight was determined using a digital weighing scale. Measurements were taken with each pupil compulsorily in light fabric and without shoes and socks. Weight was carefully read only after the point readings stabilized and was recorded to the nearest 0.1 kg

Children with BMI within the 5th percentile or below were classified underweight; those with BMI above the 5th but below the 85th percentiles were classified as normal/healthy, while overweight was those between the 85th and 95th percentiles were and the ones above the 95th percentile were classified as obese (24). Therefore, the height and weight measurements were essential integrants used to compute for the children's BMI which were then translated into weight status using the World Health Organization age and sex specific percentile ranks.

Statistical Analysis

300 female students were interviewed and their anthropometric parameters mean and standard deviation was calculated using Microsoft Excel 2016. A regression analysis was carried out to understand the association between the Sun Exposure and determinants like mode of transport, uniform, outdoor and weekend activity levels, usage of break in schools etc. A p-value of less than 0.05 was considered statistically significant.

Result and Discussion

The students were selected randomly from the classes 8-10 and shortlisted on the basis of age (13-15). The students were divided based on age and the presence/absence of a playground in the school. Factors that increased Sun-light exposure were assessed and compared across the groups.

Anthropometric Measurements

The heights of the students from both the groups were recorded and classified according to the IAP 2015 age and sex specific percentile ranks. Around 50% of the students with Playground facilities were found to have heights close to the 50th percentile which was significantly higher when compared to the other group of students (38%). (Fig. 1).

Their parents' heights were also recorded and compared using the standards, Average Indian height for men – 5.8 feet (177cm) and women 5.3 feet (162cm) set by NIN (29). The mothers and fathers' height of students without playground was found to be 67%, 27%, 6% and 41%, 5%, 54% categorised as normal, short, tall respectively whereas it 77%, 10%, 13% of mothers and 35%, 5%, 60% of fathers grouped as normal, short, tall respectively.

A majority of mothers (27%) of students without playground were found to have height below Indian standards which may be responsible for child's short stature. However, only 5% of fathers were found to be short. Among the students with playground, only 10% and 5% of mothers and fathers were noticed to be short.

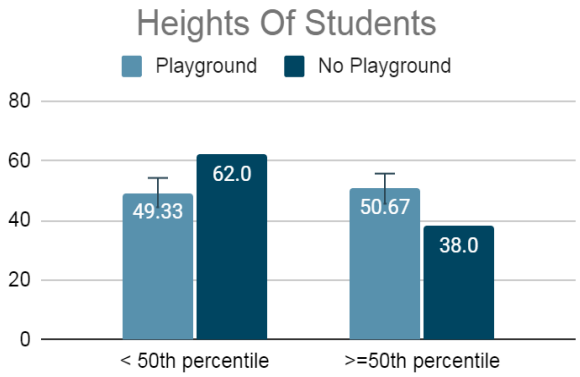

Fig. 1 **Height Comparison at 50th Percentile**

Table 1: **Sun Exposure Determinants**

	Playground (%)	No Playground (%)	p Value
Mode Of School Transport			
By Walk	19	24	
2-Wheeler	36	33	0.420628
Others	45	43	
Recess			
Inside Class	58.7	79.5	0.073445
In Ground	41.3	20.5	
Outdoor Games			
Never	27.7	12.67	
Daily	18.92	3.33	
Twice a week	13.51	29.33	0.212958
Once a week	39.86	54.67	
Sports Uniform			
Uniform	57.3	22.7	
Hands Exposed	22	20	
Legs Exposed	0	0	0.097893
Both Exposed	35.3	2.7	
Weekend Sun Exposure (hrs)			
<1	45.3	70	
01-02	41.3	28	0.849068
>2-3	6	1.3	
>3	7.3	0.7	

Table 2: **Mean and Standard Deviation of Heights of the Students**

	Classification	Playground (n=150)		Without Playground (n=150)		Total (n=300)	p Value
Age		No.	Height (cm)	No.	Height (cm)		0.022
	13	50(33.3)	152 ± 9	50(33.3)	146 ± 13	100(33.3)	
	14	50(33.3)	154 ± 7	50(33.3)	149 ± 14	100(33.3)	
	15	50(33.3)	156 ± 8	50(33.3)	152 ± 12	100(33.3)	

According to the data of Heights collected as shown in Table 2, students of schools with Playground facilities were found to have heights closer to the reference values when compared to their counterparts. 13 years old students without Playground facility had maximum deviation from the reference values (146 ± 13). An observed difference was found to be statistically significant at 0.022

The Mode of transport of the students was assessed to find out if the sun exposure during the travel from school to home and vice versa plays a role in skeletal development. More students studying in schools with Playground Facility (24%) were found to be exposed to the Sun as they came by walk compared to the Non-Playground School counterparts (19%). Students traveling by 2 wheelers or other vehicles were found to be almost similar in both categories.

The difference in Modes of Transport was mostly dependent on the socio-economic status and distance of the residence from school. Students of the schools with Playground facilities were found to be more of walkers than their counterparts. This may help the students to significantly increase their exposure to sunlight and improve the physical health of the students.

A regular school day is 6 hours long with two recess breaks of 10 and 20 minutes each (25). This time provides for good sunlight exposure along with serving the purpose of increasing physical activity and de-stressing the student. However, it was observed that students who had the Playground Facility spent most of their time in the class (58%) during the recess, while most of their counterparts, in schools without Playground facility (79%), would spend their time outside the class in the corridors etc.

Students who had access to the Playground did not show much interest in going out to play as their counterparts did. This was due to laziness, lack of time to return to class after the bell, fear of tanning and slow eating habits.

Exposure to sunlight is hindered by an increase in the indoor lifestyle. Though this is mostly seen in the urban population (26), children in urban areas can also spend some time in the sun over the weekend, a larger section of candidates from schools without playground facilities (70%) spent below an hour in the sun over the weekend. A significant percentage of students from Schools with Playground facility (41%) spent their time in the sun for almost 1-2 hours, while only (28%) of their comparative group spent 1-2 hours in the sun.

Since the study dealt with only female students, they did not show much outdoor activity even on the weekend due to society restrictions. A smaller section, however, did manage to play few sports outside like badminton, cycling, etc post breakfast and in the early evenings.

Students' involvement in school outdoor activities were categorized as Never, Once a week, twice a week and daily. Despite the availability of a playground in schools, a large population (27%) (40%) and (14%) preferred to stay indoors, move out in the sun once a week and twice a week respectively which did not vary much when compared with students without a playground facility.

Schools should make it compulsory for students to participate in outdoor games at the school level and make necessary arrangements for the same. These activities help attain physical strength, bone mineralization and develop team spirit.

Institutionalized students had no specific sports uniform and exposure (77%) declining their cutaneous synthesis of Vitamin D, whereas the sports attire worn by their mates from schools with a playground (58%) had both their hands and legs exposed to sun. This direct exposure of skin to sunlight helps in the absorption of Vitamin D and improve skeletal health. (27)

Schools without Playground facilities did not lay emphasis on maintaining any particular sports uniform as the Schools with Playground did. However, due to gender-based traditional restrictions, these uniforms did not benefit the students with sun exposure.

CONCLUSION

Schools can play an important role in the physical growth of the students by encouraging physical activity especially for female students who have limitations and restrictions outside schools. Since 40-50% of total skeletal mass is accumulated during childhood and adolescence, it is crucial that female students get ample Sun exposure for Vitamin D synthesis. Hypovitaminosis of vitamin D and decreased exposure to sunlight not only has an effect on the height of the child but may lead to increased risk of chronic diseases including cancer, chronic inflammatory or autoimmune diseases and other metabolic disorders. (28)

The mean heights of the two comparison groups indicated a clear difference when compared at 50th percentile. This may imply that a good sun exposure may have a notable effect on the lateral growth of School children.

The students with playground facility had their mean heights closer to the reference height while the other group did not meet the standards. Sun exposure factors were found to have a significant effect on skeletal development.

ACKNOWLWDGEMENT

We thank the management, staff members and students of all the schools (All Saints' High School, St. Joseph High School, St. Marks Boys Town High School, Focus High School, Hyderabad International School, Javid Mission School, Maaz High School, Krishnaveni Talent School, Springfield School and Royal Mission High School) associated for their willingness and assistance required in data collection.

An immense gratitude to Ms. Monika Surya, for her support and guidance throughout.

REFERENCE

1. **Skirven, Terri M., et al. Rehabilitation of the hand and upper extremity. Elsevier Health Sciences, 2020**
2. https://www.health.harvard.edu/womens-health/vitamin-d-and-calcium-supplements-take-them-or-leave-them
3. **Holick MF. Biological effects of sunlight, ultraviolet radiation, visible light, infrared radiation and vitamin D for health**. Anticancer research. 2016 Mar 1;36(3):1345-56.
4. https://ods.od.nih.gov/factsheets/VitaminD-HealthProfessional/
5. **Indian Council of Medical Research (ICMR), Nutrient Requirements and Recommended Dietary Allowances for Indians, a Report of the Expert Group of the Indian Council of Medical Research 2010. Hyderabad, India: National Institute of Nutrition; 2010**
6. **Greer FR, et al. Optimizing bone health and calcium intakes of infants, children, and adolescents**. Pediatrics. 2006 Feb;117(2):578-85.
7. **Gunter KB, et al. Physical activity in childhood may be the key to optimizing lifespan skeletal health.** Exercise and sport sciences reviews. 2012 Jan;40(1):13.
8. **Lips P, et al. The prevalence of vitamin D inadequacy amongst women with osteoporosis**: an international epidemiological investigation. Journal of internal medicine. 2006 Sep;260(3):245-54.
9. https://nutritiondata.self.com/facts/fats-and-oils/628/2
10. **Jones G, et al. 25-Hydroxyvitamin D-24-hydroxylase (CYP24A1): its important role in the degradation of vitamin D.** Archives of biochemistry and biophysics. 2012 Jul 1;523(1):9-18.
11. https://iapindia.org/pdf/IAP-Paediatrician-friendly-IAP-Growth-Charts-for-0-18-years-1-746x1024.jpg
12. **Parfitt AM. Genetic effects on bone mass and turnover-relevance to black/white differences**. Journal of the American College of Nutrition. 1997 Aug 1;16(4):325-33.
13. **Ogata T. Genetics of human growth**. Clinical Pediatric Endocrinology. 2006;15(2):45-53.
14. **Wacker M, Holick MF. Sunlight and Vitamin D: A global perspective for health.** Dermato-endocrinology. 2013 Jan 1;5(1):51-108.
15. **Lo CW, et al. Indian and Pakistani immigrants have the same capacity as Caucasians to produce vitamin D in response to ultraviolet irradiation.** The American journal of clinical nutrition. 1986 Nov 1;44(5):683-5.
16. **Clemens TL, et al. Increased skin pigment reduces the capacity of skin to synthesise vitamin D3**. The Lancet. 1982 Jan 9;319(8263):74-6.
17. **Matsuoka LY, et al. Racial pigmentation and the cutaneous synthesis of vitamin D.** Archives of dermatology. 1991 Apr 1;127(4):536-8.

18. **Ritu VD, Vitamin D. deficiency in India: prevalence, causalities and interventions**. 2014 Feb 21;6(2):729-775.
19. **Holick MF, Chen TC. Vitamin D deficiency: a worldwide problem with health consequences.** The American journal of clinical nutrition. 2008 Apr 1;87(4):1080S-6S.
20. **Nair R, Maseeh A. Vitamin D: The "sunshine" vitamin.** Journal of Pharmacology and Pharmacotherapeutics. 2012 Jun;3(2):118-26.
21. **Bonjour JP. Calcium and phosphate: a duet of ions playing for bone health.** Journal of the American College of Nutrition. 2011 Oct 1;30(sup5):438S-48S.
22. **Khadilkar A, et al. Prevention and treatment of vitamin D and calcium deficiency in children and adolescents**. Indian Academy of Pediatrics (IAP) guidelines. Indian pediatrics. 2017 Jul;54(7):567-73.
23. **Bhatia V. Dietary calcium intake-a critical reappraisal.** Indian Journal of Medical Research. 2008 Mar 1;127(3):269.
24. **Jan A, Weir CB. BMI Classification Percentile and Cut Off Points.** StatPearls: Treasure Island, FL, USA. 2021:1-4.
25. **Khan S, Kotharkar R. Through the eyes of the learner: A critical evaluation of an urban Indian school. ArchNet-IJAR**: International Journal of Architectural Research. 2012 Jul 1;6(2):79.
26. **Aparna P, et al. Vitamin D deficiency in India**. Journal of family medicine and primary care. 2018 Mar;7(2):324.
27. **Sizar O, et al. Vitamin D Deficiency**. InStatPearls [Internet] 2021 Jul 21. StatPearls Publishing.
28. **Puri S, et al. Vitamin D status of apparently healthy schoolgirls from two different socioeconomic strata in Delh**i. relation to nutrition and lifestyle. British Journal of Nutrition. 2008 Apr;99(4):876-82.
29. https://weather.com/en-IN/india/health/news/2020-09-29-national-institute-of-nutrition-changes-ideal-weight-height-for