



Serum Vitamin D, ALK Phosphatase, Calcium and Phosphate in Children Suffering from Growing Pain in Bangladesh

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DOI: 10.31080/ASPE.2022.05.0567

Received: September 22, 2022

Published: October 17, 2022

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Abstract

Vitamin D deficiency or insufficiency among the children have been widely observed by different researches. There is evidence of a relationship in human bodies between Vitamin D, Alkaline Phosphatase, Calcium, and Phosphate. A community based cross sectional study conducted among 274 primary school children of 5-14 years age group complaining growing pain during March 2018 to February 2019 to determine the relationship of vitamin D with calcium, phosphorus and alkaline phosphate among the children with growing pain. As required, 3 ml of venous blood samples were collected from the study subjects with every precaution by experienced phlebotomists after obtaining written consent from the care givers and transported to the laboratory. Sample serum were tested by the Enzyme-Linked Immunosorbent Assay (ELISA). The collected data was analyzed with Windows SPSS. The chi-square test and binary logistic regression were performed to find out the relationship among vitamin D, Alkaline Phosphatase, calcium and phosphate. Among the subjects, 85.8% were found suffering from growing pain, among them 50.2% were male and 74.0% were within the age group of 10 years (8.82 ± 2.058 years). Prevalence of growing pain was more among the subject with Vitamin D, Alkaline Phosphatase and phosphate deficiency. less than 4.5mg/dl. No statistically correlation of Vitamin D with calcium and phosphate but negative correlation with Alkaline Phosphatase were observed among the subjects with growing pain. Wide range biochemical study among the children with growing pain is highly recommended to establish the findings of the current study for appropriate management regime.

Keywords: Growing Pain; Serum Vitamin D; Alkaline Phosphatase; Calcium and Phosphate

Introduction

Growing pain is a sort of persistent, nonspecific lower limb ache that most typically affects youngsters. Growing pains are the most common reason for pediatric outpatient visits. Growing pains impact 49.4% of children globally, with 3 to 37% of children suffering from them [1,2]. In a community-based study conducted in Bangladesh, 75.4% children were diagnosed as Growing Pain [3].

Vitamin D deficiency has been widely observed among persons suffering from chronic pain, raising the question of whether there is a link between the two [4-8]. Scientists had discovered a substantial likelihood of persistent and nonspecific musculoskeletal pain related to an undiagnosed and untreated chronic Vitamin D deficiency [9]. In recent studies, it was discovered that, like elsewhere, vitamin D insufficiency is common in Bangladesh [10,11].

The main function of vitamin D is to maintain calcium and phosphorus balance in the body by promoting calcium and phosphorus absorption from the intestines and kidneys [12]. In vitamin D deficiency, only 10%-15% of calcium and 50%-60% of phosphorus can be absorbed from ingested foods [13].

There is evidence of a relationship in human bodies between Vitamin D, Alkaline Phosphatase, Calcium, and Phosphate. Serum calcium and phosphate also had an impact on 1,25(OH)₂D production, parathyroid hormone is the most important regulator. Vitamin D plays a crucial role in the maintenance of blood calcium and phosphorus levels and in normal skeletal mineralization [14].

Vitamin D elevates plasma calcium and phosphate by increasing absorption in the intestine, calcium mobilization in bone and calcium reabsorption in the kidney [15,16]. Vitamin D deficiency is associated with impaired intestinal calcium absorption resulting in compensatory hyperparathyroidism, increased bone resorption, and decreased bone integrity. Serum alkaline phosphatase is also elevated during bone turnover. These biochemical parameters of bone turnover are indirect indices of skeletal metabolism.

The main objective of this article is to share with academicians and researchers, the relationship between vitamin D and calcium, phosphorus and alkaline phosphate among the children with growing pain.

Methodology

This was a part of a community based cross sectional study conducted among 274 primary school children of 5-14 years age group complaining growing pain during March 2018 to February 2019. Two primary schools were selected purposively (one from Dhaka city and one from Gazipur district). Permission was obtained from the respective school authorities. Students were asked to attend the school on the day of data collection. Parents/guardians of the students were also invited earlier to had a meeting explaining the objectives and procedure of the data collection, so that they can think whether they will permit the researcher to go through the procedure. Written informed consent was also obtained from the guardians of the participants. Following the enrollment, the subjects were asked to provide a blood sample. As per requirement, 3 ml of venous blood samples were collected with every precaution by experienced phlebotomists and transported to the laboratory. In the laboratory, sample serum was tested for vitamin D, Alkaline Phosphatase, calcium and phosphate by the Enzyme-Linked Immunosorbent Assay (ELISA). The collected data was analyzed with Windows SPSS. For descriptive analysis, the frequency was calculated as a percentage, mean, and standard deviation. The chi-square test was used to investigate the relationship between and status of vitamin D, Alkaline Phosphatase, calcium and phosphate. A binary logistic regression was performed to find out the relationship among vitamin D, Alkaline Phosphatase, calcium and phosphate. Ethical approval of the study was obtained from the Bangladesh University of Professionals (BUP).

Results

In the sample population, male and female ratios were equal. The participants in the study are on average 8.82 ± 2.058 and years (having growing pain) and 9.13 ± 1.894 years (without growing pain) old.

Growing pain was reported to be more common in individuals with Vitamin D levels less than 20 ng/ml (97.5 percent), with Alk Phosphatase levels less than 20 U/L (97.8 percent), calcium less than 9.5 mg/dl (89.4 percent) and with phosphate levels less than 2.5 - 4.5 mg/dl (98.1 percent). These findings indicate statistically significant ($p < 0.05$).

	Growing Pain	
	Yes	No
	235 (85.8)	39(14.2)
Sex		
Male	118(50.2)	19(48.7)
Female	117(49.8)	20(51.3)
Age Group		
Up to 10 years	174(74.0)	28(71.8)
Over 10 years	61(26.0)	11(28.2)
Mean age	8.82 ± 2.058 years	9.13 ± 1.894

Table 1: Distribution of sex and age among school going children with growing pain.

Vitamin D has no correlation with calcium ($r = 0.024$; $p = 0.358$) and phosphate ($r = 0.004$; $p = 0.474$) but it has significant negative correlation with Alkaline Phosphate ($r = -0.659$; $p = 0.001$) among the subjects with growing pain. On the other hand, no correlation with phosphate ($r = 0.004$; $p = 0.474$) but significant negative correlation with calcium ($r = -0.530$; $p = 0.001$).

	Growing Pain		Test of significant
	Yes	No	
Vitamin D			
Below 20 ng/ml	78(97.5%)	2(2.5%)	$\chi^2 = 23.737$ $p = 0.000$
20 - 29 ng/ml	31(13.2)	0(0.0%)	
30 - 100 ng/ml	31(100.0%)	37(22.7%)	
Alk Phosphatase			
Less than 20 U/L	88 (97.8%)	2 (2.2%)	$\chi^2 = 63.152$ $p = 0.000$
Within 20 - 140 U/L	58(24.7)	35(89.7)	
More than 140 U/L	89 (97.8%)	2 (2.2%)	
Calcium			
Less than 9.5 mg/dl	84 (89.4%)	10 (10.6%)	$\chi^2 = 7.204$ $p = 0.027$
Within 9.6 - 10.6 mg/dl	130 (86.7%)	20 (13.3%)	
More than 10.6 mg/dl	21 (70.0%)	9 (30.0%)	
Phosphate			
Within 2.5 - 4.5 mg/dl	53 (98.1%)	1 (1.9%)	$\chi^2 = 8.446$ $p = 0.004$
More than 4.5 mg/dl	182(77.4)	38(97.4)	

Table 2: Serum Vitamin D, Alkaline Phosphatase and Calcium status of school going children.

	Vitamin D (ng/ml)	Respondent with growing pain (n = 235)			Respondent without growing pain (n = 39)			
		Calcium (mg/dl)	Alk Phosphatase (U/L)	Phosphate (mg/dl)	Vitamin D (ng/ml)	Calcium (mg/dl)	Alk Phosphatase (U/L)	
		r (p-value)			r (p-value)			
Vitamin D (ng/ml)	r (p-value)	1.000				1.000		
Calcium (mg/dl)		0.024 (0.358)	1.000			-0.530 (0.001)	1.000	
Alk Phosphatase (U/L)		-0.659 (0.001)	-0.295 (0.001)	1.000		0.185 (0.130)	-0.187 (0.127)	1.000
Phosphate (mg/dl)		0.004 (0.474)	.338 (0.001)	-0.319 (0.001)	1.000	0.033 (0.421)	-0.179 (0.138)	0.041 (0.403)

Table 3: Correlation matrix of Vitamin D, Calcium, Alkaline Phosphate and Phosphate among the subjects with and without growing pain.

Discussion

Children from both rural and urban primary schools participated in the study. A total of 274 young people participated in this study, with an equal ratio of male-female. Among the subjects, 85.8% were found suffering from growing pain, among them 50.2% were male and 74.0% were within the age group of 10 years (8.82 ± 2.058 years). According to Evans and Scutter's study, 36.9% of Australians experience growing pain [17].

This study indicates that prevalence of growing pain is more among those who had serum Vitamin D level less than 20 ng/ml, serum Alk Phosphatase level less than 20 U/L, serum calcium level less than 9.5 mg/dl and serum phosphate less than 4.5 mg/dl. The differences of level of vitamin D, Alkaline phosphatase, calcium and phosphate among subjects with growing pain and no growing pain was found statistically significant ($p > 0.05$). In a study conducted in Pakistan [18] found 95% of the study children had vitamin D insufficiency and normal alkaline phosphatase. Similar findings also reported from Indian [19] study. Normal vitamin D levels were 20.5% and those with normal calcium and phosphorus levels were 97.1% and 84.9% of the study population.

No statistically correlation of Vitamin D with calcium and phosphate but negative correlation with Alkaline Phosphatase were observed among the subjects with growing pain and on the other hand, no correlation with Alkaline Phosphatase and phosphate but negative correlation with calcium observed among the subjects having no growing pain ($p > 0.05$). Positive correlation was found between vitamin D levels and calcium in normal population in Turkish [20] and another Indian [21] study. But positive relationship between vitamin D level and calcium, inorganic phosphate and alkaline phosphatase reported in a Bangladeshi [22] study among the patients with juvenile idiopathic arthritis.

Conclusion

The high frequency of vitamin D deficiency and insufficiency and no statistically correlation of Vitamin D with calcium and phosphate but negative correlation with Alkaline Phosphatase observed in Bangladeshi schoolchildren with growing pain. Wide range biochemical study among the children with growing pain is highly recommended to establish the findings of the current study for appropriate management regime.

Acknowledgements

Researchers would like to thank subjects who participated in this study and their parents. We would also like to thank our paediatricians who facilitated the study.

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