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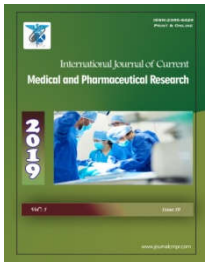

Research Article

ASSESSMENT OF VITAMIN D STATUS IN OBESE/OVERWEIGHT BANGLADESHI CHILDREN

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ABSTRACT

Aims and objective: Childhood obesity and vitamin D deficiency both are emerging health issues. Vitamin D is essential for normal growth and development and frequently found low in obese and overweight children. The aim this study was to assess serum vitamin D level, calcium, inorganic phosphate, alkaline phosphatase and parathormone (PTH) in obese and overweight children.

Materials and methods: In this cross sectional study 50 obese/overweight and 20 non obese children diagnosed based on CDC age and sex specific BMI chart were assessed for serum vitamin D, calcium, inorganic phosphate, alkaline phosphatase, and parathormone. Endocrine society clinical practice guideline was used to define vitamin D status. Result found that all of the obese/overweight children had low vitamin D status - 82% deficiency and 18% insufficiency whereas non obese group had 20% vitamin D deficiency, 45% insufficiency and 35% sufficiency. The mean value of vitamin D level in obese/overweight children was significantly lower than control group 14.9±4.8 vs 27.5±7.9 (p value 0.00). However there was no significant difference in the mean value of serum calcium, inorganic phosphate (iPO4), alkaline phosphatase (ALP) and parathormone in obese/overweight group and non-obese group. Majority of the obese/overweight children lived in urban areas (64%) and most of them (84%) had family history of obesity.

Conclusion: This study demonstrated a high frequency of vitamin D deficiency and insufficiency obese/overweight children. So targeted screening and appropriate treatment of this population is needed.

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INTRODUCTION

Obesity in childhood is one of the most important health issues. The problem is worldwide and is affecting high, middle and low income countries. A systematic analysis of 1,769 reports representing 188 countries revealed that the worldwide prevalence of childhood overweight and obesity has risen by nearly 50% over a period of three decades [1]. The prevalence of obesity and overweight among Bangladeshi school children of 6 to 15 year olds was 3.5% and 9.5% respectively. The proportion of obese and overweight students were more among the students from urban schools (5.6%, 10.6%) compared to the students from rural schools (1.2%, 8.6%) [2]. According to revised CDC 2000 BMI percentile, childhood overweight defined as BMI percentile >85th to 94th centile and and obesity is defined as BMI ≥95th centile. Vitamin D, the sunshine vitamin, has a crucial role bone mineral homeostasis. The role of vitamin D in human health has expanded into areas beyond bone. Vitamin D has proven anti-proliferative, pro-differentiation, anti-bacterial, immune-modulatory and anti-inflammatory properties within the body [3]. Several study showed decreased level of vitamin D in obese and overweight children [4]. The effects of vitamin D deficiency in obese children have been related to the pathogenesis of some obesity related co-morbidity such as insulin resistance and type 2 diabetes [5], hypertension [6], dyslipidemia and metabolic syndrome in obese children [7]. This study had been designed to assess vitamin D and related biochemical parameters (serum calcium, inorganic phosphates, alkaline phosphatase, parathormone) in these population. So that we can detect the deficiency or insufficiency and can give appropriate supplementation of vitamin D & calcium.

MATERIALS AND METHODS

This cross sectional study was conducted at Pediatric Endocrinology clinic of department of Paediatrics of Bangabandhu Sheikh Mujib Medical University from the period of November 2016 to October 2018. To perform this study a group of 70 children aged 5.5 to 18 years including both sexes were selected. Children who were taking systemic steroid for any cause, suffering from genetic, endocrine or any neurological disease that might lead to overweight or obesity, who had known liver or renal disease and those were getting vitamin D and/or calcium supplementation were excluded from the study. Sample were obtained by selecting all available children after considering exclusion criteria,

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informed written consent was taken from all the participants or parents or guardians after explaining them the objective as well as the method of the study. Data were gathered regarding particulars, sociodemographic characteristics like age, sex, residence, family history of obesity. Physical examination and anthropometric indices like weight, height, BMI were taken. The weight was measured by using electronic weighing machine to a nearest 100g and height was recorded using locally made height board where two horizontal flat wooden boards, one for head-end another for foot-end, was attached with a long vertical scale to nearest 0.5cm. BMI was calculated dividing weight (kg) by height (meter) ². Patients were categorized into obese, overweight and non obese group according to CDC BMI chart for particular age and sex. Patients were categorized into the following groups according to the CDC BMI age and sex specific chart:

Non obese - BMI <85thcentile
Overweight - BMI 85th to < 95 th centile
Obese - BMI ≥ 95th centile.

Biochemical assessment

Serum vitamin D that is 25(OH) D3 and calcium, inorganic phosphate, alkaline Phosphatase & parathormone were estimated from venous blood of the study population in the Department of Biochemistry of the same university. 25(OH) D3 is used to measure the vitamin D level in the body as it is the major circulating form of vitamin D and has a half-life of approximately 2-3 weeks. Estimation of serum 25(OH) D was done by Chemiluminescencemicroparticle immune assay (CMIA) technique using the analyzer Architect Abott, Ci 4100, USA 2012. Vitamin D level was classified into 3 categories[8].

Vitamin D deficiency : < 20 ng/ml
Vitamin D Insufficiency: 20 –<30 ng/ml
Vitamin D sufficiency : 30-100 ng/ml

Statistical analysis of data

All statistical calculations were done using the appropriate statistical software SPSS 22.0. The Chi-square test, unpaired student t-tests were done. P-value less than 0.05 was considered as significant.

Ethical consideration

Ethical clearance was taken from Institutional Review Board of Bangabandhu Sheikh Mujib Medical University (BSMMU).

RESULTS

The demographic characteristics of the enrolled participants are summarized in table 1.Most of the child of both group belonged to adolescent age group. There was significant difference in distribution of residence of the study population. It revealed that 60% children in the non obese group lived in rural areas where as 64% of overweight and obese children lived in urban areas p = 0.03). Family history of obesity was present in 84% of obese/overweight group which was statistically significant (p= 0.005). There was no statistical significant deference of age and sex distribution of the study populations.

Table 1 Demographic characteristics of the study subjects (n=70)

Characteristics	Obese/overweight (n= 50) N (%)	Non-obese (n= 20) N (%)	P value
Age group			
Childhood (<10yr)	18 (36)	8 (40)	0.4
Adolescent (10-18yr)	32 (64)	12(60)	
Sex			
Male	30 (60)	9(45)	0.2
Female	20 (40)	11(55.0)	
Residence			
Rural	18 (36)	12(60)	0.03
Urban	32 (64)	8(40)	
Family H/O of obesity			
Present	42 (84)	10(50)	0.005
Absent	8 (16)	10(50)	

Table 2 compared the mean anthropometric parameters of the study subjects which showed that mean height of obese/overweight were significantly higher (145.7±13cm) than the non obese (133.3±13.5 cm) group (p value -0.00) and the mean age of obese/overweight and non-obese group is similar. As expected, the body mass index was significantly higher in the obese group.

Table 2 Anthropometric parameters of the study subjects (n=70)

Characteristics	Obese/overweight(n=50)		Non -obese(n=20)		P value
	Mean±SD	Range	Mean±SD	Range	
Age (years)	10.7± 2.3	5.6 -16	10.1 ((±2.5)	5 -13	0.33
Height (cm)	145.7±13.1	115 -169	133.3±13.5	114 – 160	0.00
Weight (Kg)	60.3±18.8	30-116	28.7±7.9	19 -49	0.00
BMI (Kg/m²)	24.92± 7.6	14.1 -40	16.1±2.0	13.2 -21	0.00

All children in obese/overweight group had low vitamin D level (deficiency -82 % and insufficiency -18 %) and in non obese group 35% had sufficient level ofvitamin D , 65% of them had low vitamin D level (20 % deficiency and 45% insufficiency) (table 3). The mean value of vitamin D level was significantly lower in obese/overweight group than non-obese group (14.9±4.8 vs 27.5±7.9) p value 0.00. There was no significant difference in the mean value of level of serum calcium, inorganic phosphate, alkaline phosphatase and parathyroid hormone between obese/overweight and non-obese group (table 4).

Table 3 Vitamin D status in obese/overweight and non-obese group (n= 70)

Vitamin D status	Obese/overweight(n = 50) N (%)	Non-obese (n = 20) N (%)	P value
Deficiency	41(82)	4(20)	0.00
Insufficiency	9(18)	9(45)	0.02
Sufficiency	0(00)	7(35)	0.00

Table 4 Mean value of serum vitamin D (ng/ml), calcium, inorganic phosphate, alkaline phosphatase and parathormone in both group (n= 70)

Parameter	Obese/overweight (n=50) Mean± SD	Non obese (n=20) Mean± SD	p-value
Vitamin D	14.9±4.8	27.5±7.9	0.00
S. Calcium (mg/dl)	9.5±0.38	9.3 ±0.69	0.12
S. iPO_4 (mg/dl)	5.09±1.10	5.07±0.74	0.94
S.ALP (U/L)	259.3±94	216.3±51	0.06
S. PTH (pg/ml)	62.9±35.9	67.5±38	0.63

DISCUSSION

In this cross sectional study we assessed vitamin D status of 50 obese/overweight and 20 non obese children. Study revealed that low vitamin D was present in 100% of the obese/overweight children. Non obese had low vitamin D status in 65% and it was statistically significantly lower than obese/overweight group (p value- 0.00). Study had done in other countries have consistently shown the similar result of hypovitaminosis D in obese/overweight children. An Iranian study done in 45 obese and 45 non obese children showed that the frequency of hypovitaminosis D was 95.6% in obese and 667% in non obese children [9]. Study done in Indian children found that 80% of obese/overweight had hypovitaminosis D. We compared the mean value of vitamin D level of both groups which showed that the mean vitamin D level in obese/overweight were significantly lower than the non obese group 27.5±7.9 vs 14.7±4.8 (p value 0.00). The higher frequency of hypovitaminosis D in obese/overweight children is assumed to be due to sequestration of this fat-soluble vitamin within their plentiful adipose tissue [10]. Obese children has poor dietary habit and there by low dietary vitamin D intake. They usually lead sedentary lifestyle causing limited sun exposure which also has been cited as possible confounding factors [11], [12]. In this study no significant difference was found in the mean value of serum calcium, inorganic phosphate (iPO_4), alkaline phosphatase (ALP) and parathormone in obese/overweight group in comparison to non-obese group. Majority of the study done in obese children found normal level of serum calcium, inorganic phosphate (iPO_4), alkaline phosphatase (ALP) and no significant difference between obese and non obese group [9]. In this study we also found that majority (64%) of the obese/overweight children belonged to urban areas and most of them had family history of obesity. Studies showed that family history of obesity is a significant risk factor of overweight and /or obesity [13]. .The mean height obese /overweight group (145.7±13.1) was significantly higher than mean height of non obese group (133.3±13.5). Study showed that obese children are usually taller than their non-obese peers [14].

Limitations

This study has several limitations that are small sample size, single centered study, dietary intake of vitamin D and sun exposure was not assessed.

CONCLUSION

There is a high frequency of vitamin D deficiency in obese/overweight children. So targeted screening and appropriate treatment is needed.

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