

Nutritional Rickets among Children Admitted with Wheezy Chest at Al-Bieda Medical Center –Libya

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Abstract

Nutritional rickets caused mostly due to Vitamin D deficiency. It has been declared a public health problem for both adults and children worldwide. Wheezy chest and related allergic diseases are the leading causes of morbidity in children. The objective of this study was to investigate the potential relation of vitamin D deficiency and wheezy chest in children. Case series study was conducted during the period from January to March 2021. 50 children aged 3 months to 24 months were selected randomly from children admitted to department of pediatric in Al-bieda medical center. Out of the total 56% were males, 70% were exclusively breastfed in their first 6 months of life. 68% have positive family history of chest allergy. (64%) developed first attack of wheezy chest before 6 months and recurrent attack were observed in (52 %). Vitamin D deficiency was observed in 62% of the wheezy patients with 56% of cases had minimum sun exposure. Early onset was more common in males. Late onset wheezy chest was more common in children lives in houses with bad ventilation in compare to those who lives in better conditions in conclusion, vitamin D deficiency was common finding among children included in our study. It was associated with minimum sun exposure and early weaning. However, larger follow up studies are required to elucidate the effect of vitamin D supplementation on different parameters of asthma severity, its potential therapeutic benefit on children suffered recurrent wheezy chest attacks

Key words: Wheezy chest, Vitamin D deficiency, Nutritional Rickets, Children.

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INTRODUCTION

Wheezing is a very common respiratory symptom during childhood. Epidemiological studies have reported that almost one-third of all children wheeze at least once in the first three years of life, with nearly 50% of all children having at least one wheezing episode by the age of 6 years [1-3]. However, early childhood wheezing is a heterogeneous condition, which has several phenotypic expressions and a complex relationship with the development of asthma later in life [4]. Wheeze is defined as continuous high pitched sound with musical quality emitting from the chest during expiration which lasts for more than 250 m second [5].

The human body produces vitamin D through two independent pathways: the photochemical action of solar UVB light (295 to 320 nm) in the skin and some limited dietary sources [6]. Rickets is failure of mineralization of osteoid tissue or growing bones

caused by vitamin D deficiency [7]. Nutritional rickets is caused by vitamin D deficiency due to inadequate dietary intake and cutaneous synthesis [8]. Vitamin D deficiency results in growth retardation, muscle weakness, skeletal deformities, hypocalcaemia, tetany and seizures [9]. Low serum 25-hydroxy vitamin D levels have been associated with increased risk of lower respiratory tract infections in young children as has been shown by various epidemiologic studies [10, 11]. Adding on, evidence is there suggesting enhanced risk of childhood wheezing associated with low levels of maternal intake of vitamin D during pregnancy and umbilical cord blood 25(OH)D [10, 12]. Various interventional trials support these associations by establishing lowered respiratory tract infections in children having vitamin D supplementation [13, 14]. Although there are many risk factors for development of recurrent wheezing [15, 16], an emerging risk factor of particular interests is Vitamin D status [17]. The evidence for the possible link between vitamin D and respiratory disease comes from multiple studies [18-

21]. Role of maternal vitamin D uptake and its relation to wheezing in early childhood also has been probed [22] those with low baseline 25(OH) Vitamin D levels (< 75nmol/L) were more likely to have a severe asthma exacerbation over a 4 months period [23]. Vitamin D has role in gene mediated expression of Bronchial smooth muscle cell following $1\alpha, 25$ (OH) $_2$ D stimulation also has been probed [24]. Studies have shown the role of Vitamin D in genetic related cell movement important for airway remodeling. Its other form $1\alpha, 25$ (OH) $_2$ D $_3$ induces genes in Ca $^{+}$ related pathways leading to bronchial smooth muscle contraction [25, 26].

Our study was done to evaluate the clinicoepidimological data of studied patients and to assess the prevalence of nutritional rickets due to vitamin D deficiency in wheezy infant.

PATIENTS AND METHODS

Study Design, Setting and patients

Case series study was conducted in the pediatric department at Albiada Medical Center. 50 children aged 3 months to 24 months were selected randomly from children admitted to pediatric department at Albiada medical center during January to

March 2021. A special data collection sheet was design for our study which includes information on the age, sex, mode of delivery ,maturity , birth at weight ,breast feeding , time of weaning , mode of feeding , family history , sun exposure and time recurrence attach of wheezy chest. Clinical signs of rickets were also recorded, including rosary beads, craniotabes, wide anterior fontanel, delayed dentition, widening of epiphysis, bowing of the legs, and double malleolus. Blood sample was collected for calcium, phosphorus, alkaline phosphatase, and serum 25 - OH Vitamin D (using ELISA method). Children with history of chronic illness were excluded.

STATISTICAL ANALYSIS

The data was be analyzed by SPSS program. All results were expressed as mean \pm SD. Chi-square, Fisher Exact and "t" tests were used to find the significance association.

RESULTS

The demographic and base line characters of the patients are summarized in table 1. We've found that 70% of the patients were on exclusive breastfeeding in their first 6 months of life and, early weaning was observed in 74% of patients (table 1).

Table-1: Demographic characters of the patients and type of feeding during early 6 months of life and age of weaning

	No.	%
Age		
<12 months	38	76
\geq 12 months	12	24
Sex		
Male	28	56
Female	22	44
Mode of delivery		
Normal vaginal delivery	35	70
Caesarian section	15	30
Family history of atopy		
present	34	68
absent	16	32
Type of feeding during first 6 months of life		
Exclusive breastfeeding	35	70
Breastfeeding & bottle feeding	15	30
Age at weaning		
< 6 months	37	74
\geq 6 months	13	26

Thirty two patients (64%) developed their first attack of wheezy chest before 6 months, while eighteen

patients (36%) developed their first attack after age of 6 months (Mean \pm SD =5.73 \pm 3.69) (Table 2) .

Table-2: Distribution of cases according to the age at first attack of wheezy chest

	No.	%
1st attack		
Early (<6)	32	64.0
Late (≥6)	18	36.0
Total	50	

Vitamin D level was normal in 38% of the patients, less than normal level in 62% of the patients (table 3).

Table-3: Vitamin D level

	No	%
Vit D level		
Normal	19	38.0
Decreased	31	62.0

Most of Children with history of early onset of wheezing (25%) found to have abnormal low level of vitamin D. while most children with history of late

onset of wheezing (61%) found to have normal level of vitamin D.(p-value=0.012)(table 4).

Table-4: Relation between age of children at first wheezing attack and vit D level

Vit D level	1 st attack				p-value
	Early (<6) (n = 32)		Late (≥6) (n = 18)		
	No.	%	No.	%	
Normal	8	25.0	11	61.1	0.012*
Low	24	75.0	7	39.9	
Min. – Max.	6.0 – 27.8		11.7 – 41.6		0.031*

Children who have family (positive) history of atopy were more likely to have early onset wheezing

(87.5%) compared to children with no family (negative) history of atopy (33.3%). (P- Value <0.001).

Table-5: Summarize the factors affecting the age at which children suffered first wheezy chest attack

		Age at First attack				P-value
		Early (<6) (n =32)		Late (≥6) (n =18)		
		No.	%	No.	%	
Family history of atopy	Present	4	12.5	12	66.7	0.001*
	absent	28	87.5	6	33.3	
Exclusive breastfeeding in first 6 months of life.	Yes	14	43.8	1	5.6	0.005*
	no	18	56.3	17	94.4	
Early weaning	Yes	8	25	12	66.7	0.004*
	no	24	75	6	33.3	
Housing	House	19	59.4	2	11.1	<0.001
	Apartment	8	25	15	83.3	
	Farm house	5	15.6	1	5.6	

94.4% of children with history of late attack of wheezing were exclusively breastfed during their early life, compared to 56.3% of children with history of early attack of wheezing.(p-value=0.005^{*}). 75% of children who had a history of early attack of wheezing were weaned early, compared to 33% of children with history of late onset wheezing attack(P- value = 0.004)

(Table5). 59.4% of children with early onset wheezy chest living in houses, most of children with late attack of wheezy chest > 6months (total No.=18),15 (83.3%) were living in apartments(statistically significances P-value <0.001(Table 5). Most of children (74%) who have abnormal low level of vitamin D had a history of minimum exposure to sunlight.

Table-6: Relation of time of sun exposure and vitamin D level.

Sun exposure	Vitamin D level				MC p
	normal (n =19)		low (n =31)		
	No.	%	No.	%	
No	5	26.3	23	74.2	0.001*
1 – 2 hours	5	26.3	6	19.4	
>2 hours	9	47.4	2	6.5	

DISCUSSION

Wheezing in infants affects children quality of life, it is also related to the development of childhood asthma (4). In the present study 56% of the studied children were males. The high prevalence of wheezy chest in males is in accordance with previous studies by Naglaa S.Osman *et al.*, 2019 [27], Turkeli *et al.*, 2016 [28] and Abd EL-Menem *et al.*, 2013 who found that 63% of the Egyptian asthmatic children were males [29].

In our study 62% of the participant children were found to have signs of rickets and low vitamin D level. However, in this study exclusive breastfed in first months of life was reported among 74% of the children. In a the United States, Weiseberg P *et al.* study shows that, 96% of children who developed rickets were exclusively breast fed during their early life [30]. Haider *et al.* Conclude that 85.3% feed exclusively breastfed [31]. Canadian and Pakistani studies accordingly show high prevalence of rickets among children exclusively fed by breastfeeding during their early months of life [32, 33].

Early weaning from breastfeeding is associated with the risk of wheezing and other allergic disease. In the present study, 74% of the children were weaned early. However, early weaned children were in high risk of having wheezy chest regardless of a history of asthma or atopy in the nuclear family [34]. Weaning was also associated with transient wheezing, although not with atopic disease as in the study conducted in Denmark by Linneberg *et al.* [35]. Early weaning is a risk factor for infection, which is in turn related to an increased risk of wheezing in infants, whereas early bacterial exposure could be a protective factor against the subsequent onset of allergic disease, such as asthma [36].

Minimum or no sun exposure was reported in 74.2% of the children in this study. However, Haider *et al.* was found that 98.3% of rachitic children had minimum or no exposure to sun light [32]. Comparable result reported by Robinson PD *et al.* [37]. Possible reasons could be living in multistoried apartments or indoor due to hot climate and wearing fully covered clothes with most of the women covering their head and few their faces as well.

Family history of asthma is a major criterion in asthma predictive index proposed by Costro- Rodriguez *et al.* [38]. In the present study, we found that 68% of the children have a positive family history of atopy. In accordance with previous researches [39-41].

In the current study children born by cesarean section were 30% compared with those born by vaginal delivery 70%, as other study. Mode of delivery is not associated with subsequent risk of developing childhood asthma or wheezing episodes [42].

Regarding the type of housing effect, This study found a high prevalence of asthma in public housing that characterized by small rooms, absence of adequate ventilation and backyards (42% in house, 46% in apartments) (p-value<0.001). A study held in Boston shows that associations between housing conditions and respiratory symptoms in the preceding month to the study were frequently positive and sometimes statistically significant. Home dampness and the individual mold and water variables were all significantly associated with increased symptoms [43].

Patients having rickets presented with respiratory tract infections is recommended to have proper anticipation, prevention, and early treatment of vitamin D deficiency rickets, not only to reform the skeletal system but also to avoid increased infection rate in such patients [44].

CONCLUSION

In conclusion, nutritional rickets associated with vitamin D deficiency are prevalent in infants who have history of recurrent wheezy chest. It is recommended that the serum vitamin D level should be tested in the routine workup in children with recurrent wheezy chest. Larger follow up studies are required to elucidate the effect of vitamin D supplementation on different parameters of asthma severity, and how it can therapeutically be beneficial in patients with recurrent wheezy chest.

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