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Effect of Vitamin D on children with allergic bronchitis

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Abstract:

Back ground: *This study was done to detect the level of vitamin D in children infected with allergic bronchitis.*

Aim: *The aim of this study is to evaluate the relation between allergic bronchitis in children with low level of vitamin D.*

Study Design: *Case-control study.*

Patient study: *This study was performed in Mosul city from January 2019 to June 2019. The total number of children in this study was 200 (152 patients and 48 control) were recruited from the emergency department, outpatients clinics of Ibn al-Atheer teaching hospital for children, pediatric private clinic and from primary schools of children in Mosul city. The sample size was 152 patients with allergic bronchitis (109 males and 43 females) whose age between 1-15 years, while the control group who were matched to the patients, included 48 children (38 males and 10 females), all of them were healthy children (no sign and symptoms of allergic bronchitis), they were not received any medication, with no history of allergic bronchitis or acute illness.*

Methods: *10 ml of blood were collected by vein puncture using dispossible syringe from each patients and control enrolled in this study for determination of vitamin D levels using enzyme linked immune-sorbent assay (ELISA technique), also throat swab samples were taken from both patients and controls and placed in a screw caped tube containing a transport media, after that the swab cultured on blood, MacConkey, and chocolate agar for (18-24) hours at 37˚C to see and detect the causative agents of bronchitis in children.*

Result: *Vitamin D levels was significantly lower in allergic bronchitis patients and even in control cases.*

Conclusion: *There is an important association between children allergic bronchitis and vitamin D deficiency or even insufficiency in both patients and control cases.*

Key words: *Allergic bronchitis, Vitamin D deficiency, throat swab.*

I. INTRODUCTION

Allergic bronchitis is the common chronic inflammatory disorder of the airways in childhood. The prevalence of this disease is increasing about 300 million people and 3% to 38% is children [(1)]. This is one of the

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causes of morbidity in children [2]. It characterized by wheezing, dyspnea, feeling of tightness in the chest and cough, especially at night or early in the morning, and this is due to increased airway inflammation, airway hyper-responsiveness and airflow obstruction in response to specific triggers [3,4]. The etiological factors are including atmospheric pollution, dietary changes, allergens and life style changes which may be responsible for the rising prevalence of disease [3]. Industrialized countries such as Australia, New Zealand and the United Kingdom are said to have the highest prevalence of allergic bronchitis [5].

Bronchitis is an inflammation of the lining of the bronchial tubes [6,7,8,9,10], the airways that connect the trachea to the lung [9]. This delicate, mucus-producing lining covers and protects the respiratory system, bronchitis may be either acute or chronic [6,7,8,9,10]. Most people have acute bronchitis at some point of their lives [9]. Acute bronchitis, also known as a chest cold, is short term inflammation of the bronchi of the lung [11,12], the most causes of acute bronchitis are viruses that can infect the respiratory tract and attack the bronchial tubes, while certain bacteria can also cause acute bronchitis [9]. Chronic bronchitis are more susceptible to bacterial infections of the airway and lungs, like pneumonia [9]. There are many types of bacteria which cause bronchitis such as *Mycoplasma pneumoniae* , *Chlamydia pneumoniae* **,** *Streptococcus pneumoniae*, *Moraxella catarrhalis, Haemophilus influenzae*, *Bordetella pertussis* and others [11,13].

(Vitamin D and bronchial asthma): Vitamin D, or the "sunshine vitamin" is a fat-soluble nutrient and a secosteroid hormone which is widely recognized as a modulator of calcium absorption and bone health and further regulates neuromuscular function, cellular differentiation, insulin secretion and blood pressure [14,15]. Vitamin D insufficiency is increasingly recognized in the general population, and has been largely attributed to dietary, lifestyle and behavioral changes [16,17]. Vitamin D has been shown to have a role in both innate and adaptive immunity by promoting phagocytosis and modulating the effects of Th_1, Th_2 and regulatory T cells [18,19]. Further evidence suggests that vitamin D alters human airway smooth muscle expression of chemokines and inhibits the expression of a steroid resistant gene [20].

II. MATERIALS & METHODS:

This study was performed in Mosul city from January 2019 to June 2019. The patients with allergic bronchitis were recruited from the emergency department, outpatients clinics of Ibn al-Atheer Teaching Hospital for children, Mosul general Hospital, pediatric private clinic and from primary schools of children in Mosul city.

III. RESULTS:

The patients were subdivided according to their age into five groups, the ages in both patients and control ranged between 1 to 15 years (mean ± SD = 8.99 ± 3.43), while in control (mean ± SD = 11.02 ± 1.28). Most patients with allergic bronchitis and control cases were commonly seen among the age groups of 10 to 12 years was 61 (40.1%) and 26 (54.2%) in patient and control respectively, then followed by the ages of 7 to 9 years was 42 (27.7%) and 5 (10.4%) in patient and control respectively, then followed by the ages of 4 to 6 years was 21 (13.8%) and 6 (12.5%) in patient and control respectively. As shown in Table (1).

Table 1 : Distribution of study sample according to age

Age group (yr.)	Patients		Control		χ^2 , df , p* value
	No.	%	No.	%	
1 – 3	12	7.9	4	8.3	1 , 0.999 NS**
4 – 6	21	13.8	6	12.5	0.054 , 1 , 0.816 NS
7 – 9	42	27.7	5	10.4	6.014 , 1 , 0.014 S
10 – 12	61	40.1	26	54.2	2.924 , 1 , 0.087 NS
13 – 15	16	10.5	7	14.6	0.590 , 1 , 0.442 NS
Total	**152**	**100.0**	**48**	**100 .0**	**6.830 , 4 , 0.145 NS**
min - max **Mean ± SD**	**1 – 16** **8.99 ± 3.43**		**9 – 14** **11.02 ± 1.28**		-----

*Chi-Square test was used ** Fisher Exact test was used

NS = Non Significant S = Significant

The present study demonstrated the distribution of patients with allergic bronchitis according to gender in which the males affected more than females in both patients and control as (M = 71.7%), F = 28.3%), while in control was (M = 79.2%, F = 20.8%). As showing in Table (2).

Table 2 : patients with allergic bronchitis according to gender

Gender	Patients		Control		χ^2 , df , p* value	OR	95% C.I (OR)
	No.	%	No.	%			
Male	109	71.7	38	79.2	1.041 , 1 , 0.308 NS	0.67	0.31-1.44
Female	43	28.3	10	20.8			
Total	**152**	**100 .0**	**48**	**100.0**			

* Chi-Square test was used OR= Odds Ratio NS = Non-Significant

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In this present study there were higher frequency in urban area 140 (92.1%) case than rural area 12 (7.9%) case, and the same thing was in control, in urban area was 40 (83.3%) case, while in rural area was 8 (16.7%). As shown in Table (3).

Table 3 : The frequency of patients with allergic bronchitis according to residence

Residence	Patients		Control		χ^2 , df , p* value	OR	95% C.I (OR)
	No.	%	No.	%			
Urban	140	92.1	40	83.3	3.119 , 1 , 0.077 NS	2.33	0.92-5.97
Rural	12	7.9	8	16.7			
Total	**152**	**100 .0**	**48**	**100.0**			

*Chi-Square test was used OR= Odds Ratio NS = Non-Significant

The most important bacteria that appeared from culture was *Streptococcus pneumonia* 25 cases (16.4%) just in patients, *Staphylococcus aureus* 18 cases (11.8%) in patients, in control 6 cases (12.5%), *Escherichia coli* 17 cases (11.2%) in patients, in control 10 cases (20.8%), *Streptococcus pyogenes* 16 cases (10.5%) in patients, in control 3 cases (6.3%), *Moraxella catarrhalis* 13 cases (8.5%) just in patients, *Neisseria meningitides* 4 cases (2.6%) just in patients, *Heamophilus influenza* 3 cases (2%) just in patients, *Pseudomonas aeruginosa* 1 case (0.7%) just in patients, *Burkholderia cepacia* 2 cases (1.3%) just in patients, *Corynebacterium diphtheroides* 7 cases (4.6%) in patients, in control 4 cases (8.4%), *Streptococcus viridance* 11 cases (7.2%) in patients, in control 7 cases (14.6%), *Streptococcus agalactiae* 7 cases (4.6%) in patients, in control 4 cases (8.3%), *Klebseilla pneumoniae* 8 cases (5.3%) in patients, in control 4 cases (8.3%), *Staphylococcus epidermidis* 9 cases (6%) in patients, in control 5 cases (10.4%), *Staphylococcus saprophticus* 8 cases (5.3%) in patients, in control 5 cases (10.4%), Mixed growth 3 cases (2%) just in patients. Some other throat culture giving no result (no growth) especially in Patients sample that might be considered as a viral infection. As shown in Figure (1).

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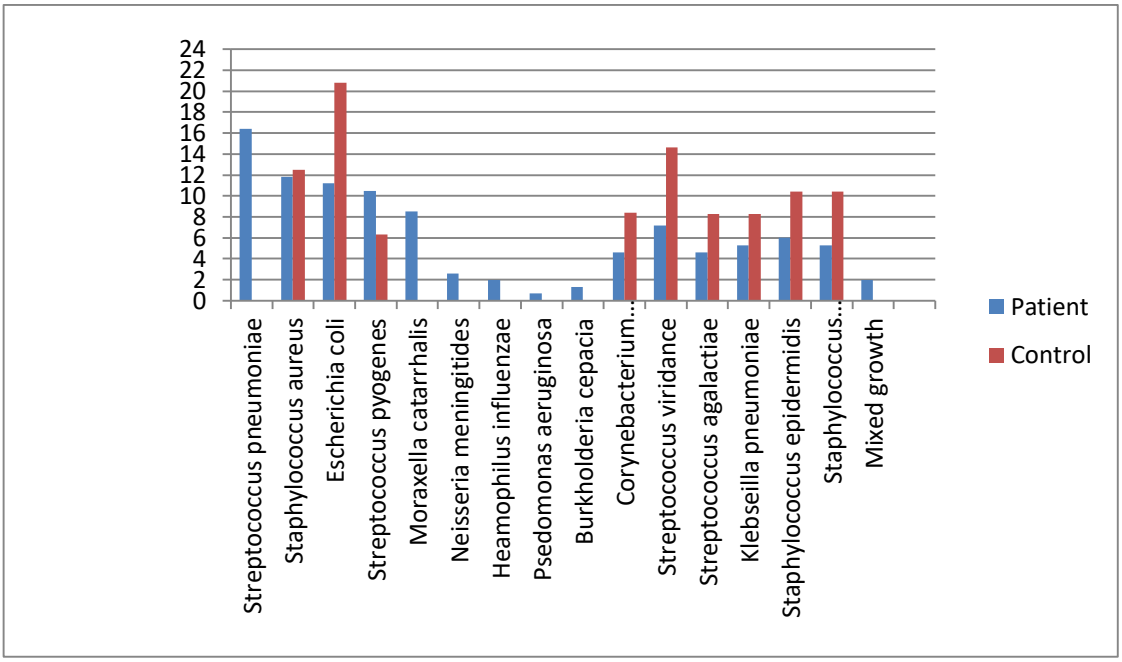

Figure 1 : Types of bacteria that found in the deep throat of patients with allergic bronchitis

In this present study we found that the higher percentage of severe vitamin D deficiency in both patients and control was found to be 55 cases (36.2%) in patients and 13 cases (27%) in control, while the lower percentage of excess vitamin D level (but not toxic) in both patients and control was found to be 6 cases (3.9%) in patients and 2 cases (4.2%) in control. As shown in table (4).

Table 4 : Frequency of Vitamin D level in patients with allergic bronchitis

Vitamin D level (ng/ml)	Patient		Control		χ^2 , df , p*value	OR	95% C.I (OR)
	No.	%	No.	%			
V.s.v.D.d	25	16.4	6	12.5	1, 0.045**S	4.17	1.14 – 15.24
S.v.D.d	55	36.2	13	27.0	1, 0.021**S	4.23	1.38 – 13.07
V.D.d	24	15.8	9	18.7	2.457,1, 0.117 NS	2.67	0.79 – 9.05
Suboptimal vitamin D provision	22	14.5	8	16.7	2.504,1, 0.114 NS	2.75	0.79 – 9.58
Optimal vitamin D ***Level	8	5.3	8	16.7	-----	-----	-----

Upper normal level	12	7.9	2	4.2	1, 0.050** S	6.00	1.09 – 31.37
Over dose, but not toxic	6	3.9	2	4.2	1, 0.388**NS	3.00	0.50 – 16.93
Total	**152**	**100 .0**	**48**	**100 .0**	**8.225 , 6, 0.222 NS**	-----	-----

*Chi-Square test was used OR= Odds Ratio S = Significant

** Fisher Exact test was used NS = Non-Significant

*** Reference group

IV. DISCUSSION:

In this current study, allergic bronchitis was identified over a wide range of age (1-15) years old (mean ± SD = 8.99 ± 3.43) (P = 0.145 NS), and there was no significant association between allergic bronchitis and children in most age groups, and there was no significant association between allergic bronchitis and children in most age groups. In agreement with this result of Fahad Aleem et al [21], Ihab Hafez El Sawy et al [22], which they demonstrated that there was no significant association between allergic bronchitis in children and age groups. Although the present study was in disagreement with Zainab A. Razak Al- Sharifi [23], Seung Jin Lee et al [24], and this may be due to geographical, environmental and immunological differences between children. Analysis of the gender for children with allergic bronchitis showed that the incidence was more common in male (71.7%) than females (28.3%) approximately (3:1), and there was no significant association between gender and allergic bronchitis in children. This result was in agreement with Fehmida Najmuddin and Keya Lahiri [25], Bahaa El Din Mohamed Hassanein et al [26], on the other hand the present study was in disagreement with Nasrin Esfandiar et al [27], Ourania Kolokotroni et al [28], which they demonstrated that the prevalence of asthma was similar in both sexes. One of the most important reason for the infection with allergic bronchitis in males than females was explained by Malik G et al [29] which demonstrated that the high incidence of allergic bronchitis in males compared to females may be attributed to presence of two X chromosomes which provide greater genetic diversity to the female immunological defenses. The analysis of residence for children with allergic bronchitis showed that the incidence was more in urban area (92.1%) than rural area (7.9%), and there was no significant association between allergic bronchitis in children and residence, this result was in agreement with Dr. Yashowanth Rao Alladi et al [30], Hala G Elnady et al [31], this result may be due to crowded population in urban area than rural area and also exposure to passive smoking and environmental triggers such as cars, air conditioners, and carpets were more increased using in urban than rural area, moreover, the green area and trees that can be seen in urban area were very little when it is comparable with rural area, but in contrast the present study was disagreement with Bahaa El Din Mohamed Hassanein et al [26], M. Lama et al [32], which they demonstrated that there was association between residence and allergic bronchitis in children which was related to low socioeconomic status of families lived in rural areas. In our current study we found that the most causative agents of allergic bronchitis in children was the gram positive bacteria, also gram negative bacteria

were found but less than gram positive bacteria, the most important pathogenic types of bacteria that had been isolated from patients throat swabs and cause allergic bronchitis in children were *Streptococcus pneumoniae* (16.4%), *Staphylococcus aureus* (11.8%), *Escherichia coli* (11.2%), *Streptococcus pyogens* (10.5%), *Moraxella catarrahlis* (8.5%), *Nesseria meningitides* (2.6%), *Heamophilus influenza* (2%), *Pseudomonase aerogenosa* (0.7%) and others respectively. This result was in agreement with Dieng Assane et al [(33)] which demonstrated that the most common bacterial cause of acute respiratory infections among children under 5 years were *Streptococcus pneumoniae* (17.9%) followed by *Moraxella catarrahlis* (15.43%) and *Heamophilus influenza* (8%), But in contrast this result was in disagreement with Dr. Nawal S Faris [(34)] which demonstrated that the most common bacterial cause of upper respiratory tract infection that had been isolated from patients throat swabs was group A beta-hemolytic *Streptococci* (8.7%), while *Streptococcus pneumoniae* (3%), followed by *Pseudomonas* species, *Enterobacter* species and *Acinetobacter* species. The analysis of vitamin D in this study revealed a significant association between vitamin D deficiency and allergic bronchitis in children, this result was in agreement with Fahad Aleem et al [(21)], Dr. Ghada Mohamed Farouk El Deriny [(22)], which demonstrated a high significant association between vitamin D deficiency and allergic bronchitis in children and this result might be due to different reasons like exclusively breast feed infants which give the infant very little amount of daily vitamin D needed (just 10 IU/day) while the exact needed about 100 IU/day in the first 2 years, also obesity increase the risk of vitamin D deficiency because of thick adipose tissue which prevent the sun light to penetrate the skin, moreover, use of sunscreen as a protective factor inhibits more than 95% of vitamin D in the skin from the sun [(30)], in addition to some behavior factors result in vitamin D deficiency in healthy people such as excessive clothing coverage especially in the winter season, increase time spent indoors and intrinsic factors such as the skin melanin content and increased cutaneous destruction of vitamin D_3 and decreased dietary food intake [(35)], also less outdoor exercise with decreased exposure to sunlight [(36)], But in contrast this result was in disagreement with Hussein Dabbah et al [(37)], Karen S Leis [(38)] which they demonstrated that no significant association between vitamin D and asthma or allergic bronchitis in children.

V. CONCLUSIONS:

Allergic bronchitis was more prevalent among children from 10 to 12 years old group, also it was found that its more frequent in males than females and most patients were from Urban area, while the most important pathogenic bacteria that had been isolated from patients throat swabs cultures was *Streptococcus pneumonia*, moreover, we found that most infected children have an vitamin D deficiency in their bodies, and even in control cases.

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