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Prevalence of Bronchial Asthma among Primary School Children

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ABSTRACT

Background: Asthma the most common chronic condition among children is operationally defined as "recurrent wheezing and or persistent coughing in a setting where asthma is likely and other rare condition have been excluded. Bronchial asthma is prevalent worldwide, especially in developed countries where its prevalence is increasing to epidemic proportions.

Objectives: This study aimed to assess the prevalence of bronchial asthma among primary school children.

Patients and Methods: This study was carried out on 2763 children that consisted of a representative sample of children attending eight primary schools in El Menoufiya Governorate. Four schools of them are located inside Shebin El Koum city the capital of the governorate. The other four schools are located in villages around the capital. Children were screened for chest symptoms by a questionnaire. **Results:** Clinical presentation of asthmatic children as cough, wheezes, dyspnea and chest tightness were the most common presenting symptoms. Also, rhinitis was the most common allergic condition that was associated with asthmatic children. Viral upper respiratory tract infection and environmental changes were the most common exacerbating factors while drugs and emotion were the least ones.

Conclusion: This work highlighted on the prevalence of childhood bronchial asthma among primary school children in El-Menoufia governorate, with overall point prevalence of 6.5 %, which showed significant increase during the last 20 years as by comparing the result of our study to the result of same study in 20 years ago, which reported that the prevalence of bronchial asthma in primary school children in Menoufiya governorate was 2.2 % , as the prevalence increased by 4.3 % (Triple times) during this period. This explain the magnitude of the problem of bronchial asthma in our community.

Keywords: Bronchial asthma, Primary school children, Wheezing, Persistent coughing.

INTRODUCTION

The word asthma originates from an ancient Greek word meaning panting. Essentially, asthma is an inability to breathe properly [1]. Asthma, the most common chronic condition among children is operationally defined as "recurrent wheezing and or persistent coughing in a setting where asthma is likely and other rare condition have been excluded [2]. Bronchial asthma is prevalent worldwide, especially in developed countries where its prevalence is increased to epidemic proportions [3]. There have been few studies on the epidemiology of asthma in Egypt, but none in Damietta governorate. Therefore, the present study has been carried out to determine the prevalence of bronchial asthma and to investigate its impact on the cognitive functions and academic achievement among preparatory school children in Damietta Governorate. In Egypt, the bronchial asthma is a significant health problem among school children, and the prevalence was 7.7% [4].Asthma is a complex respiratory disease characterized by inflammation and reversible obstruction of the airways that can lead to diverse symptoms such as wheeze, breathlessness, chest tightness, and cough. Asthma affects approximately 350 million people from all age groups worldwide and causes around 350,000 deaths per year. Although asthma is a lifelong disease, it is considered the most common chronic condition in children, where symptoms are usually more severe [5]. In Egypt, the prevalence of asthma among school children in the Nile Delta region is about 7.7%. 2 Asthma is relatively common in Egypt, and probably under diagnosed and under treated, particularly among children from less wealthy families [6].

In Egypt, it was reported that asthma prevalence was 4.8% in Egyptian infants and children aged less than 4 years, from five governorates [7]. Studies from Egypt reported that prevalence of asthma is 9.4% in 11–15-year-old school in Cairo and 8.2% was reported in another study of children with age of 3–15 years [8]. As few studies evaluated asthma prevalence in Egypt, so this study was conducted on El-Menoufia governorate including both urban and rural areas. This study was planned to determine the prevalence of bronchial asthma among school children aged 6-12 years old in El-Menoufia governorate and to identify the risk factors associated with childhood asthma [9].

Asthma is sometimes diagnosed based on the history and physical examination as recurrent episodes of coughing or wheezing, especially if they follow exposure to asthma triggers and respond to asthma medication. Pulmonary function testing can confirm the diagnosis if necessary [5]. The treatment of pediatric asthma requires balancing the efficacy and safety of various asthma medication, facilitating patient and family education, and developing a supportive treatment network to allow the affected child and his family to have life style as normal as possible [10]. So, the aim of the work was to assess the prevalence of bronchial asthma among primary school children.

PATIENTS AND METHODS

As an epidemiological study this work was carried out on eight primary school children in El-Menoufia

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governorate as a representative sample of children for our study. The schools were divided into two (2) groups according to the locality of each group, first group include schools, which are located inside Shebin El Koum city (urban locality) and the second group included schools that are located in villages around the capital (rural locality).

Urban schools: Shebin El Koum city was divided into 4 quarters and only one school was selected from each quarter randomly to represent all primary schools inside the capital, and then we selected from each school only one class in each age group for our study. The total number of pupils for our study from urban schools was 1383 pupils.

Rural schools: They included the other four schools which were located in villages around the capital, 2 of them were from Shanawan village, which is located in the south of the capital and the other 2 schools from Kafer Tambedy village which is located in the north of the capital. The schools were selected from each village randomly and then we selected from each school only one class in each age group for our study. The total number of pupils for our study from rural schools was 1617 pupils.

Criteria of diagnosis of asthma: The diagnosis of asthma is based primarily on history and physical examination. The clinical features the patient exhibit, particularly the symptoms he complains of and the signs noted on physical examination are usually sufficient to make the diagnosis of asthma. Investigations are mainly used to confirm the diagnosis of asthma and to grade its severity. **Symptoms:** The characteristic symptoms of asthma are cough, wheezing, and dyspnea. Dyspnea is the most common symptoms of asthma.
Signs: physical examination of the respiratory system may reveal no apparently abnormality if the patient is not in asthmatic attack. Wheezing predominantly occurs on exhalation.

Laboratory evaluation: spirometry remains the best test in patients suspected of having asthma. Because asthma is an obstructive airway disease, a decrease in the absolute value and percent predicted of the forced expiratory volume in 1 second (FEV1) to less than 80% of predicted normal may be present. Detailed history taking including personal history, patient complaint, aggravating factors, drug administration, grade of asthma, absenteeism from school, family history and social data. Complete physical examination to detect clinical signs of bronchial asthma and other allergic conditions.
Chest –x –ray: Both postero-anterior and lateral views of the chest were done to exclude other pulmonary pathology such as T.B, foreign body inhalation etc.
Routine laboratory investigations: Included stool and urine examination, complete blood count (CBC), Hb % and total leucocytic and differential counts from a blood film were assessed then absolute eosinophilic count (AEC) was calculated.

Pulmonary function tests were assessed pre- and post-bronchodilator by using β2 agonist by inhalation route (using auto link spirometer Zen L.T.D, Germany).

Resting pulmonary function tests: Included slow vital capacity maneuver values (ERV, SVC, TV, IC,), forced vital capacity maneuver values (FVC, FEV1, FEV1/FVC, PEF, FEF25-75%, etc.) and maximum voluntary ventilations (MVV).

Post-bronchodilator pulmonary function tests: Every patient received two puffs equal to 0.2 mg salbutamol (β2 agonist by inhalation route) and pulmonary function test was done after 30-60 minutes. Inhalation of a single dose of a β2 -agonist results in clinically significant bronchodilation (defined as a 15% or greater increase in FEV1 above baseline after drug administration) within 5 minutes in most patients, peak bronchodilation 30 to 60 minutes after drug administration, and persistent bronchodilation for 3 to 6 hours after drug administration in many patients.

Ethical consideration:

An approval of the study was obtained from Menoufia University Academic and Ethical Committee. An informed written consent was obtained from all parents before getting them involved in the study. The steps of the study, the aim, and the benefits were explained in details to the involved parents. Confidentiality of all data was ensured. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical Analysis

Data collected throughout history, basic clinical examination, and outcome measures were coded, entered and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 25.0, Armonk, NY: IBM Corp, 2018). Descriptive statistics included Percentage (%), standard deviation (SD) and analytic statistics included chi-square test (χ^2) and Student's t-test. P value ≤ 0.05 was considered statistically significant.

RESULTS

The difference between asthmatic children and controls regarding age groups was not significant risk factor ($P > 0.05$). Sex differences between asthmatic children and controls were not significant risk factor ($P > 0.05$). Residence either urban or rural was not significant risk factor for development of asthma and asthma effect on growth of asthmatic children. As regards weight and height, there were significant delayed growth between asthmatic children ($P < 0.05$) (Table 1).

Table (1): Different age, sex and residence groups as a risk factor for asthmatic children and control and the effects of asthma on growth of asthmatic children as regards weight and height.

Variable	Studied groups				Total		χ^2	p- value
	Cases		Controls		No.	%		
	No.	%	No.	%				
Age groups								
6- < 8 years	67	37.1	34	34.0	101	35.9	0.27	> 0.05
> 8- < 10 years	58	32.0	33	33.0	91	32.4		
> 10- <12 years	56	30.9	33	33.0	89	31.7		
Total	181	100	100	100	281	100		
Sex								
Male	89	49.2	50	50	139	49.5	0.01	> 0.05
Female	92	50.8	50	50	142	50.5		
Total	181	100	100	100	281	100		
Residence								
Urban	91	50.3	50	50.0	141	50.2	0.01	> 0.05
Rural	90	49.7	50	50.0	140	49.8		
Total	181	100.0	100	100.0	281	100.0		
Weight/Kg (X ± SD)	30.0± 10.2		36.3± 9.8		t=2.7			< 0.05
Height/ cm (X±SD)	127.2± 35.6		131.7± 50.8		t=3.2			< 0.05

Clinical presentation of asthmatic children as cough, wheezes, dyspnea and chest tightness were the most common presenting symptoms. Also, rhinitis was the most common allergic condition that was associate with asthmatic children. Factors inducing exacerbation among asthmatic children as viral upper respiratory tract infections and environmental changes were the most common exacerbating factors while drugs and emotion were the least one (Table 2).

Table (2): Clinical presentation and allergic association and factors inducing exacerbation among asthmatic children

Symptoms	Number		% +VE
	+ve No	-ve No	
Cough	167	14	92.2
Wheezes	159	22	87.8
Dyspnea	147	34	81.2
Chest tightness	135	46	74.5
Anorexia	15	166	9.0
Fever	12	169	7.2
Tachycardia	3	178	1.8
Allergic association	122	59	67.4
Rhinitis	75	106	41.4
Dermatitis	42	139	23.2
Conjunctivitis	5	176	2.7
Exacerbating Factors	**Number**	**%**	
Viral respiratory infection	90	49.7	
Environmental (weather changes)	70	38.6	
Allergen	33	18.2	
Exercise induced	39	21.5	
Food & food Additives	43	23.7	
Drugs	5	2.7	
Emotion	3	1.65	

Eosinophilia was significant finding in CBC of asthmatic children ($P < 0.0001$) as compared to CBC of the control (Table 3).

Table (3): Comparison of laboratory investigations between cases and controls.

Variable	Studied groups				Total		χ^2	p- value
	Cases		Controls					
	No.	%	No.	%	No.	%		
HB %:								> 0.05
≤ 12 g/ dl	55	30.3	28	28.0	83	29.5	0.08	
> 12 g/ dl	126	69.7	72	72.0	198	70.5		
WBCs:							0.09	> 0.05
≤ 12.000	168	7.1	98	98.0	166	90.5		
> 12.000	13	92.9	2	2.0	15	9.5		
Eosinophilia:							35.3	< 0.0001
Present	75	41.4	7	7.0	82	29.2		
Absent	106	58.6	93	93.0	199	70.8		
Parasitic infestation:							0.01	> 0.05
Present	62	34.2	33	33.0	95	33.8		
Absent	119	65.8	67	67.0	186	66.2		
Total	181	100.0	100	100.0	281	100.0	----	----

Concerning pulmonary function tests, most asthmatic children (104, 57.45%) showed normal pulmonary function tests, 55 (30.38%) had mild obstruction, 19 (10.5%) had moderate obstruction and only 3 (1.6 %) showed sever obstruction (Table 4).

Table (4): Pulmonary function tests of the asthmatic children.

	Normal	Mild Obstruction	Moderate obstruction	Severe obstruction
Mean FVC %	98.75	94.5	90.34	87.56
Mean FEV1 %	95.57	83.75	72.36	63.12
Mean FEV1/FVC %	87.63	75.64	67.45	56.43
Mean PEF %	76.95	70.54	65.93	58.72
Mean PEF 25-75 %	82.57	75.12	69.8	65.46
Total	104	55	19	3
%	57.45	30.38	10.5	1.6

All children who reported mild obstruction improved after inhalation of β2 agonist, but not all children who reported moderate obstruction improved after inhalation of β2 agonist as there were 3 children showed obstruction and this can be explained by associated bronchitis in this case. Also, the same occurred with children who reported severe obstruction as not all children improved after inhalation of β2 agonist. This can be explained by the process of remodeling, which happen in severe asthmatic cases (Table 5).

Table (5): pulmonary function tests before and after inhalation of β2 agonist

	Before inhalation of bronchodilator		After inhalation of bronchodilator	
	No.	%	No.	%
Mild obstruction	55	30.38	0	0
Moderate obstruction	19	10.5	3	15.4
Severe obstruction	3	1.6	1	33.3

The classification of the asthma severity according to GINA (2002) showed that 49.1% of asthmatic children were intermittent asthma, 30.93% were mild persistent, 14.9% were moderate persistent and only 5.5% were severe persistent asthma. The relationship between the grade of asthma severity and pulmonary function tests (PFTs) as100% of children with intermittent asthma had normal PFTs. In mild persistent asthma, 27.9% had normal PFTs and 72.72% had mild obstruction. In moderate persistent asthma, 44.4% of children had moderate obstruction and 55.5% had mild obstruction. In severe persistent asthma, 30% of children had severe obstruction in PFTs and 70% had moderate obstruction (Table 6).

Table (6): Classification of asthma severity according to GINA (2002) and relationship between grade of asthma severity and pulmonaryfunction tests.

Severity / Age group(years)	Intermittent asthma		Mild Persistent		Moderate Persistent		Severe Persistent	
6 - ≤ 8	32		21		11		3	
8 - ≤ 10	29		19		7		3	
10 - ≤ 12	28		15		9		4	
Total	89		55		27		10	
%	49.1		30.38		14.9		5.5	
PFTS / **Severity**	**Normal**		**Mild obstruction**		**Moderate obstruction**		**Severe obstruction**	
	No.	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**
Intermittent	89	(100)	0	0	0	(0)	0	(0)
Asthma	15	(27.9)	40	40	40	(0)	0	(0)
Mild persistent asthma	0	(0)	15	15	15	(44.4)	0	(0)
Moderate persistent asthma	0	(0)	0	0	0	(70)	3	(30)

DISCUSSION

In this study, the overall point prevalence was found to be 6.5 % as the prevalence is higher in urban areas than rural areas. The prevalence was 7.1% in Shebin El Koum city and was 6.0% in villages around. Other studies tried to estimate the prevalence of asthma among children. **El Bayoumy and Saad** [11] found that the prevalence was 2.4 % among Heliopolis primary school children (Cairo) in the age group 6-12 years. However, **Mohamoud *et al.*** [12] reported a prevalence of 3.6% in Benha city in school children aged 5-15 years. **Abdel Latif** [13] studied the prevalence of asthma among 2321 secondary school students in Misr El Gedida, Shubra and Abbassia that was 5.6% and both genders were equal candidates to develop asthma. A study of the prevalence rate of bronchial asthma in school children aged 6-14 years in Alexandria reported 18% [14].

In the present study, the overall point prevalence of childhood asthma among 2763 primary school children aged 6-12 years was found to be 6.5 %. This suggests that bronchial asthma is a common condition in our school children in El-Menoufiya governorate and has increased in the last 30 years. But it is still lower than the international prevalence which is 10% worldwide [15]. This is in agreement with many authors, **Wickens *et al.*** [16] reported that asthma has increased in the last 30 years. The increase in the prevalence of pediatric asthma may be explained by exposure to exogenous factors as outdoor pollutants e.g. ozone, sulpher dioxide and cigarette smoke and reduction in host resistance or a combination of both [17].

In our study male to female ratio was 1: 1.03 respectively without sex predominance. This may be due to the age of our group study (6 – 12 years) as boys start growing up and girls start puberty. As it is known that childhood asthma is more prevalent in boys than girls. The increased risk for males in childhood is probably related to narrower airways, increased airway tone, and possibly higher serum IgE in boys [18]. More females than males develop asthma during puberty, and thereafter, probably due to effects of hormonal changes and greater prevalence of obesity in girls in prepubertal years and the increase in the thoracic size in males during puberty which increase airway diameter [19].

In the present study, asthmatic presenting symptoms in children were cough 167 (92.2 %), wheezy chest in 159 (87.8 %), dyspnea in 147 (80.2%), and chest tightness 135 (74.5 %). Similarly, **Chang *et al.*** [20] found that the commonest chest complaints in asthmatic children in order of frequency were cough, dyspnea, wheezy chest, nocturnal symptoms and chest infection.

As regards pulmonary function tests (PFTs) in our study, 104 children (57.45 %) showed normal tests, 55 (30.38 %) showed mild obstruction, 19 (10.5 %) showed moderate obstruction and only 3 (1.6%) showed sever obstruction. As we compared the result of PFTs to classification of asthma severity in our study, which showed that 89 children (49.1 %) were intermittent asthma, 55 (30.38 %) were mild persistent, 27 (14.9 %) were moderate persistent and 10 (5.5 %) were severe persistent asthma. We concluded that PFTs were good indicator for asthma severity. This is in agreement with National Heart Lung Institute (NHLBI) (2006) guidelines categorized asthma severity based on spirometry. The mean values for forced vital capacity (FVC), forced expired volume in 1 sec (FEV (1)), FEV (1)/FVC ratio, and forced expiratory flow (FEF) (25-75) were 92.7, 92.2, 85.3, and 78.0 percent predicted, respectively. Seventy-seven percent of FEV (1) values were >/= 80%, 18.6% were between 60-80%, and 3.1% were <60% of predicted. Similarly, **Fuhlbrigge *et al.*** [21] reported that spirometry is an important component of the National Asthma Education and Prevention Program guidelines for asthma. Compared to children with an FEV1% > or = 100%, children with FEV1% 80% to 99%, 60% to 79%, and < 60% were 1.3, 1.8, and 4.8,

respectively. FEV1 is an important component of asthma health status and asthma severity classification.

CONCLUSION

This work highlighted on the prevalence of childhood bronchial asthma among primary school children in El-Menoufia governorate, with overall point prevalence of 6.5 %, which showed significant increase during the last 20 years compared to the result of a similar study 20 years ago, which reported that the prevalence of bronchial asthma in primary school children in Menoufiya governorate was 2.2 % as the prevalence increased by 4.3 % (Triple time) during this period .This explain the magnitude of the problem of bronchial asthma in our community.

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