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# **ORIGINAL ARTICLE**

# RISK FACTORS FOR CHILDHOOD ASTHMA: WHICH CAN BE AVOIDED? A CASE-CONTROL STUDY

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Introduction: Bronchial Asthma is one of the most common illnesses in children. Much is known about the risk factors for the disease—some factors can be avoided and others cannot. The aim is to study the associated risk factors for asthma in children and to determine which factors can be avoided.

Methods: All asthmatic patients(230), aged 7-18 years, who were undergoing regular checkups in chest outpatient clinic in Assiut school health insurance, were included in this study compared with 272 matched non asthmatic patients. Modified international study for asthma and allergy in childhood questionnaire (ISAAC) was used.

Results: mean ages were 11.4±2.8 years. Asthma was more common in boys (62.2%) and in children lived in rural areas (62.2%). In the first decade, asthma affected both boys and girls equally, boys were more affected in age 11-15 years while affected more females above age 15. Non avoidable risk factors for asthma were: gender, common in boys (OR1.01, CI 0.7 to1.043), having allergic rhinitis (OR2.8, CI2.6 to5.6), atopic dermatitis or allergic conjunctivitis, having a family history of asthma.

Some indoor and outdoor home environmental factors had a significantly increased risk of having asthma but can be avoided: as exposure to passive smoking(OR3.6, CI 2.6 to 5.6), contact to birds as pigeon, or animals like cats, insects as cockroaches, exposures to wood smoke or exhaust.

Conclusions: Some risk factors of asthma can be avoided as exposure to passive cigarette smoke, dust, wood smoke, cockroaches and contact to birds or animals. Reducing exposures can minimize the risk of asthma.

Keywords: Childhood asthma, risk factors, passive smoking, dust, animals, family allergies.

# INTRODUCTION

Globally, bronchial asthma is a major health problem especially among children, due to the increasing prevalence and associated increase in its morbidity and mortality. It has dramatically increased worldwide over the last few decades, in both developed and developing countries.  $^{\left( 1\right) }$ 

Although genetic predisposition is clearly evident, gene environment interaction probably explains much of the international variation in prevalence rates for allergy and asthma. Environmental factors such as infections and exposure to endotoxins may be protective or may act as risk factors, depending in part on the timing of exposure in infancy and childhood.<sup>(2)</sup> Research suggests that some genetic variants may only cause asthma when they are combined with specific environmental exposures, and otherwise may not be risk factors for asthma.<sup>(3)</sup>

Asthma comprises a range of heterogeneous phenotypes that differ in presentation, etiology and pathophysiology. The risk factors for each recognized phenotype of asthma include genetic, environmental and host factors. Although a family history of asthma is common, it is neither sufficient nor necessary for the development of asthma.<sup>(4)</sup>

The airways of asthmatics are hypersensitive to certain triggers, also known as stimuli such as environmental stimulant allergen, tobacco smoke, cold or warm air, perfume, pet dander, moist air, exercise, exertion and emotional stress. In response to exposure to these triggers, the bronchi contract into spasm "an asthma attack". Inflammation soon follows, leading to a further narrowing of the airways and excessive mucus production; which leads to coughing and other breathing difficulties.<sup>(5)</sup>

In children, the most common triggers of asthma are viral illnesses such as those that cause common cold.<sup>(6)</sup>

Many factors may have contributed to the rise of the problem of bronchial asthma. Increasing air pollution, fast modernization, and widespread construction work are some of the reasons for asthma to thrive. The situation is complicated by poor access to medical services, high price of effective drugs, and poor health education among the affected population.<sup>(7)</sup>

*Aim of the work:* is to assess the Risk factors associated with bronchial asthma in school children and to determine which factors can be avoided.

# PATIENTS AND METHODS

**Study Design:** A case-control study of 230 asthmatic children were included as a study group. Assiut is considered as large governorate located in the south of upper Egypt. Most of the population live in its rural areas with low incomes.

The children included in the study were those with a history of bronchial asthma and who exhibited symptoms such as coughing and slight wheezing or dyspnea between attacks, requiring the use of bronchodilating agents in the last 12 months.

*Ethical Aspects;* The Institutional Ethical Committee, faculty of medicine Assiut University, approved the protocol of the study. Each patient, or one of his relative, gave an informed consent to participate in the study.

**Methods:** All asthmatic patients, aged 7-18 years, who were undergoing regular checkups in chest outpatient clinic in school health insurance during 12 months, were included in this study. Another 272 non asthmatic patients attended at the same period in anther out clinics, were also included as control group. Consent forms were taken.

**Data collection:** Data will be collected by a valid well designed structural questionnaire using modified international study for asthma and allergy in childhood questionnaire (ISAAC) phase three.<sup>(8,10)</sup> A questionnaire was used for each patient to identify the personal history as, age, sex, education and residence, symptoms of asthma and other associated allergic diseases such as allergic rhinitis, eczema or conjunctivitis. Risk factors for asthma as, passive smoking, exposure to allergens, indoors and out door air pollution, exercise, household size, family history of asthma and other allergies were also included.

The answers of questions were collected under supervision and Data collections through personal interviews with the patient and/or their parents were carried out. Each patient was then submitted to a physical examination.

Asthmatic children were medically treated according to the GINA guidelines (2009 update) by a single pulmonologist.

**Statistical analysis of data:** Data will be entered and verified then cleaned using software SPSS version 16 for windows. Descriptive statistics,  $\chi^2$  test, t-test, regression analysis, estimation of odd's ratio and other relevant tests will be done. A probability of less than 0.05 will be used as cut off point for all significant tests.

# RESULTS

Much is known about the risk factors for bronchial asthma, some factors can be avoided and others cannot. Non avoidable risk factors were shown in Tables 1-5.

Asthma was more common in boys than girls (62.2 % and 37.8% respectively) and in children lived in rural areas (62.2%) more than urban (37.8%). Table 1.

#### Table 1. General Characteristics of the studied group.

		Ca N=	Cases N=230		ntrols =272	P-value	Odd's 95%CI
			%	N٥	%		
Sex	Male	143	62.2%	168	61.8%		1.01
	Female	87	37.8%	104	38.2%	0.9	(0.7- 1.04)
residence	Urban	87	37.8%	106	39%	0.7	0.9
	Rural	143	62.2%	166	61%	0.7	(0.6- 1.3)

 $\chi^2$  Test was used.

The mean age was  $11.4\pm2.8$  for cases and  $11.8\pm3.4$  for controls. In the first decade, asthma affected both boys and girls equally, boys were more affected in age 11-15 years while affected more females above age 15.

Among females, asthma was common in age less than 10 years (43.7%), while in males it was common between 11-15 years; the difference is statistically significant. Table 2.

#### Table 2. Age distribution of asthmatic patient.

	Age	Asthma	-	
Group	(years)	No	%	p-value
Males	≤10	62	43.4%	
	11-15	74	51.7%	
	> 15	7	4.9%	0.02
Females	≤10	38	43.7%	
	11-15	36	41.4%	
	> 15	13	14.9%	

Genetic predisposition as having allergic rhinitis, atopic dermatitis or allergic conjunctivitis were also considered as non-avoidable risk factors for bronchial asthma. Other allergies were highly significant associated with asthmatic patients compared to control group. Sixty percent of subjects with asthma suffered from rhinitis, 29.1% and 15.7% associated with allergic conjunctivitis and allergic dermatitis respectively. Table 3.

There were statistically significant associations occurred between the symptoms of asthma and rhinitis (OR = 2.8; 95% CI = 2.6 to 5.6; p<0.001), asthma and eczema (OR = 2.1; 95% CI = 1.2 to 3.7; p<0.001) and asthma and Conjunctivitis (OR = 2.9; 95% CI = 1.8 to 4.7; p<0.001).

#### Table 3. Association between asthma and other allergies.

Other allergies		Cases N=230		Controls N=272		- Davida	
		No	%	No	%	P-value	Odd's 95%C1
Eczema (allergic dermatitis)	yes	36	15.7%	22	8.1%	0.000	21(1227)
	No	194	84.3%	250	91.9%	0.000	2.1 (1.2-3.7)
Conjunctivitis(Allergic Conjunctivitis)	yes	67	29.1%	3	1.1%	0.000	2 9 (1 8-4 7)
	No	136	70.9%	269	98.9%	0.000	2.7 (1.0-4.7)
Rhinitis (allergic rhinitis)	yes	139	60.4%	77	28.3%	0.000	
	No	91	39.6%	195	81.7%	0.000	2.8 (2.0-5.0)

 $\chi^2$  Test was used (Odds ratio is odds ratio between two variables (dichotomous variable in other word yes and no among cases and controls).

Having a family history of asthma (OR 4.2, 95% CI 2.3 to 8.2) or family history of other allergy (5.5, 95% CI 4.1 to 12.7), were considered as non-avoidable risk factors for asthma in children. Significantly, 50.9% of patients with asthma had a family history of bronchial asthma too. On the other hand, allergic rhinitis and Eczema were the most

common associated allergies affected families of the asthmatic patients, (36.4% and 22.7% respectively). Asthmatic Mothers were the most common family member that carried the risk of asthma to their children (26.3%), while other allergies were commonly affected brothers and sisters in 45.5% of cases. Table 4.

#### Table 4. Family history of asthma and other allergies of Asthmatic children.

		Ca	ses	Cor	ntrols		
Risk factors	<u>N=230</u>		230	N=	272	P-value	
		No	%	No	%		
Family history of asthma	Yes	117	50.9%	29	10.7%	0.000	
	No	113	49.1%	143	90.3%	0.000	
Member of family affected	Father	29	24.6%	5	33.8%		
	Mother	31	26.3%	5	23.8%	0.2	
	Brother or sister	26	22%	8	38.1%	0.2	
	Others	32	27.1%	3	14.3%		
Family history of other allergies	allergic rhinitis	24	36.4%	7	30.4%		
	Eczema	15	22.7%	6	26.2%	0.5	
	Food allergy	15	22.7%	5	21.7%	0.5	
	Eye allergy	12	18.2%	5	21.7%		
member of Family affected	Father	7	10.6%	5	21.8%		
	mother	23	34.8%	7	30.4%		
	Brother or sister	30	45.5%	7	30.4%	0.2	
	Others	6	9.1%	4	17.4%		

 $\chi 2$  Test was used.

Multivariate logistic regression model was used to ascertain variables predicting asthma symptoms in those children. Family history of asthma, Food allergy, allergic rhinitis, allergic conjunctivitis and Presence of eczema seems to be non-avoidable risk factors for asthma. Table 5.

Non-avoidable		01-	F (D)	95% C.I.		
Risk factors	В	SIG.	Exb (B)	Lower	Upper	
Family history of asthma	2.284	.000	9.812	4.921	19.563	
Family history of other allergies	2.193	.000	8.723	4.1	12.7	
Food allergy	1.684	.000	5.388	2.198	13.205	
Allergic rhinitis	1.166	.000	3.209	1.856	5.548	
Allergic conjunctivitis	.552	.119	1.737	.868	3.477	
Presence of eczema	.225	.625	1.252	.508	3.087	

B means the correlation(r) or association between the risk factor and the disease.

Exp (B) (exponential of B) means adjusted odds ratio of one variable or factor among group of factors. It is used in regression analysis to predict the risk factors of the disease.

Many indoor and outdoor home environmental factors had a significantly increased risk of having asthma but can be avoided. Tables 6-9.

The most common avoidable risk factor was passive smoking, it is significantly reported in 64.3% of asthmatic children. Exposure to dust, fumes or certain strong smell

were also significantly affected patients' asthma attacks. Recurrent infections, either bacterial or viral; were reported in a majority of cases (68.3% and 50.9% respectively). Reflux esophagitis; although it is difficult to be oriented by younger children, it was reported in the questionnaire as a risk factor in 29.1% of patients. Table 6.

#### Table 6. Avoidable risk factors predisposed to asthmatic attacks in studied group.

		Cases	Cases N=230		Controls N=272		
RISK factors		No	%	No	%	P-value	Odd's 95%C1
Passive smoking	Yes	148	64.3%	86	31.6%	0.000	3.6
	No	82	35.7%	186	68.4%	0.000	(2.6-5.6)
Exposure to dust	yes	172	74.8%	127	46.7%	0.000	3.4
	no	58	25.2%	145	53.3%	0.000	(2.3-4.9)
Exposure to fumes	yes	163	70.9%	125	46%	0.000	2.8
	no	67	29.1%	147	54%	0.000	(1.9-4.1)
Exposure to certain strong smell (perfumes, smoke)	yes	72	31.3%	43	15.8%		2.4
	no	150	68.7%	220	84.2%	0.000	2.4
		100		229			(1.5-3.7)
Bronchitis (recurrent bronchitis)	yes	157	68.3%	80	47.2%		5.1
	no	73	31.7%	192	52.8%	0.000	(3.5-7.5)
Exposure to common colds(Flu)	yes	117	50.9%	58	21.3%		3.8
	no	113	49.1%	214	78.7%	0.000	(2.6-5.6)
Reflux esophagitis	yes	67	29.1%	36	13.2%		2.7
	no	163	70.9%	236	86.8%	0.000	(1.7-4.2)

Exposure to cockroach, pigeons or cats were significantly reported as risk factors for bronchial asthma in studied

group. Table 7.

		Ca	ses	Cor	ntrols		
Risk factors	-	N=	230	N=	272	P-value	Odd's 95%CI
		No	%	No	%		
Fundation to continue to		14/	(2 50/	07	25.7		3.1
	yes	146	63.5%	97	35.7	0.000	(2.1-4.5)
	no	84	36.5%	175	64.3		
Exposure to Digeons	VAS	1/10	64.8%	153	56.3%		1.4
	yes	147	04.070	155	50.576	0.05	(0.9-2)
	no	81	35.2%	119	43.8%		
Exposure to Cats	Ves	31	13 5%	9	3 3%		4.5
	900	01	10.070	,	0.070	0.000	(2.1-9.7)
	no	199	86.5%	263	96.7%		
Exposure to Dogs	ves	16	7%	14	5.1%		1.3
	5					0.3	(0.6-2.8)
	no	214	93%	258	94.9%		
Exposure to Cattle	ves	78	33.6	78	31.1%		1.2
	5					0.2	(0.8-1.8)
	no	152	66.1	194	68.9%		
Exposure to Cheeps	yes	76	33%	72	26.5%		1.3
	2					0.1	(0.9-2)
	no	154	67%	200	73.5%		

#### Table 7. Exposure to household animals, birds and insects among studied group.

Multivariate logistic regression model showed some avoidable risk factors predicting asthma symptoms in studied children. Table 8 Passive smoking, Pollution exposure, recurrent bronchitis, Common colds, exposure to cockroach and exposure to pigeon were strongly affected asthma attacks.

#### Table 8. Multiple logistic regression analysis for avoidable risk factors.

Avoidable	P	Sia	Even (D)	95% C.I.	
Risk factors	D		Ехр (В)	Lower	Upper
Passive smoking	.779	.005	2.179	1.258	3.776
Pollution exposure	.438	.124	1.550	.886	2.711
Recurrent bronchitis	1.221	.000	3.390	1.945	5.910
Common colds	.862	.003	2.369	1.344	4.176
Exposure to cockroach	.331	.235	1.392	.806	2.403
Exposure of pigeon	.035	.905	1.036	.585	1.833

Other risk factors affected asthma attacks in studied group were shown in Table 9. Physical exercise and exposure to cold air induced asthma in 53% and 56.1% of cases respectively. Psychological stress and lake of sun exposure caused exacerbation of asthmatic attack in 43.9% and 65.7% of cases. The difference between two groups was highly significant.

#### Table 9. Other risk factors affected asthma attacks in studied group.

		Cases		Co	ntrols		
Risk factors	-	N=230		Ν	=272	P-value	Odd's 95%CI
		No	%	No	%		
	yes	122	53%	70	25.7%	0.000	2.3
Physical exercise	no	108	47%	202	74.3%	0.000	(2.2-4.7)
For some to cold also	yes	129	56.1%	78	28.7%	0.000	3.1
Exposure to cold air	no	101	43.9%	194	71.3%	0.000	(2.2-4.5)
	yes	101	43.9%	54	19.9%	0.000	3.1
Exposure to stress (emotion)	no	129	56.1%	218	80.1%	0.000	(2.1-4.6)
-	yes	151	65.7%	256	94.1%		4.3
Sun exposure	no	79	34.3%	16	5.9%	0.000	(2.7-7.8)

# DISCUSSION

Asthma is a major public health problem in developed countries, especially in children. Ultimately the goal is to prevent asthma, not just to relieve its symptoms.

There is no cure for asthma, but it can be controlled with medication and proper management.<sup>(9,10)</sup> With the rates of

asthma steadily increasing each year, it is the leading cause of respiratory- related hospital admissions among children. It is also the leading cause of absenteeism from school.<sup>(11)</sup>

Controlling of many contributing risk factors is considered the main issue that may decrease asthmatic attacks. Asthma in children results from the complex interaction of

#### different factors.

In this study we followed the factors postulated to be risky for triggering or aggravating asthma. All asthmatics students attended outpatient chest clinic of school health insurance in Assiut governorate during the period of the study, were included. Patients aged 6-18 years; were compared by 272 matched controls.

Much is known about the risk factors for bronchial asthma. Different possible risk factors for asthma were reported in this work and divided into two main groups. Some factors could be changed (avoidable risk factors) and others could not (Non avoidable risk factors). Genetic predisposition to allergic reaction leaves children more susceptible to asthma.

#### Non avoidable risk factors:

➤ **Gender:** in current study, asthma was reported more common in boys than girls (62.2 % and 37.8% respectively). In the first decade, asthma affected both boys and girls equally, boys were more affected in age 11-15 years while affected more females above age 15.

Among females, asthma was common in age less than 10 years (43.7%), while in males it was common between 11-15 years; the difference was statistically significant.

This data was similar to Habbick et al, they found that the prevalence of asthma was higher among boys than among girls, although the prevalence of wheezing was the same among the older girls and boys.<sup>(12)</sup> Also, other studies, which usually showed a male: female ratio of about 1.5:1 for children younger than 15 years, with a female preponderance after this age.<sup>(13-15)</sup>

➤ **Residence:** Most of the Assiut population lived in its rural areas with low incomes. We reported that asthmatic patients lived in rural areas (62.2%) were more than urban (37.8%). It was suggested that the presence of many risk factors in Assiut rural areas beside poor health care may increase the prevalence of asthma among children. Our finding could be justified due to small the sample size and the study being facility based rather than population based, also this may be due to various different geographical, social and environmental factors.

Our results are consistent with Yawn who reported that, The rural environment has a rich mixture of allergens from seasonal crops, abundant wildflower and weed growth, dust and animal dander in barns and silos, air pollution (e.g., ozone, methane gas from manure), and noxious odors from landfills which are frequently located in rural areas.<sup>(16)</sup> Furthermore, Ernest and Cormier found that 5% of rural children in Canada who lived in farm environments had asthma.<sup>(17)</sup> These finding contrary to those Abd EI-Hai that stated that residence of urban areas accounted for more than (79%) of asthma cases, while those of rural residence accounted only (20.7%).<sup>(18)</sup> Also Aligen et alstated that all children living in urban setting regardless of race and income are at increased risk of asthma.<sup>(19)</sup>

However, Higgins et al reported that risk factors for asthma in nonurban children are similar to risk factors in urban children. Ethnicity is a risk factor for asthma regardless of socioeconomic status.<sup>(20)</sup>

➤ **Other allergic diseases:** Genetic predisposition as having allergic rhinitis, atopic dermatitis or Allergic Conjunctivitis were also considered as non-avoidable risk factors for bronchial asthma. Other allergies were highly significant associated with asthmatic patients compared to control group. Sixty percent of subjects with asthma suffered from rhinitis, 29.1% and 15.7% associated with allergic Conjunctivitis and allergic dermatitis respectively.

This is in consistency with Hassan who found that the prevalence of allergic rhinitis, allergic conjunctivitis and atopic dermatitis in El-Sharkia governorate were (19.3), (12.1%) and (13.7%) respectively.<sup>(21)</sup> El-Shafey also study the prevalence of allergic rhinitis, allergic conjunctivitis and atopic dermatitis among school children in Cairo metropolitan and he found that the prevalence of these allergic diseases were (32.1), (21.4%) and (25%) respectively.<sup>(22)</sup> While, Slib et al reported that allergic rhinitis affecting 10%-25% of the world population.<sup>(23)</sup>

➤ A family history of asthma and other allergies: they were considered as non-avoidable risk factors for asthma in children. Significantly, 50.9% of patients with asthma had a family history of bronchial asthma too. On the other hand, allergic rhinitis and Eczema were the most common associated allergies affected families of the asthmatic patients, (36.4% and 22.7% respectively). Asthmatic Mothers were the most common family member that carried the risk of asthma to their children (26.3%), while other allergies were commonly affected brothers and sisters in 45.5% of cases.

The previous results are supported by Magdy et al, who stated that positive family history of asthma was risk factor for asthma.<sup>(24)</sup> Also Al -Mousawi et al found that, Sensitization to allergens, family history of asthma and history of whooping cough increased the risk of asthma.<sup>(25)</sup>

To some extent, asthma seems to run in families. Children whose brothers, sisters, or parents have asthma are more likely to develop the illness themselves. If both parents have asthma, the risk is greater than if only one parent has it. For some reason, the risk appears to be greater if the mother has asthma than if the father does.<sup>(26)</sup> Concerning food allergy, there were higher percentage of food allergy among the cases (23.5%) vs. (4.4%) of controls and the difference is statistically highly significant.

These results coincide with Dean et al who reported that Sensitization to eggs or milk at one year was a predictor for increased sensitization to peanut at 3 years. Sensitization to eggs at one year was associated with increased sensitization to aeroallergens at 3 years.<sup>(27)</sup>

Also, Ellwood et al., stated that, the world wide analysis of food intake and prevalence of asthma symptoms showed a negative association with the consumption of starch, cereals and vegetables, but not other major food groups.<sup>(28)</sup>

**Avoidable risk factors:** Many indoor and outdoor home environmental factors had a significantly increased risk of having asthma but can be avoided.

➤ **Passive smoking:** The most common risk factor was passive smoking, it is significantly reported in 64.3% of asthmatic children compared to (31.6%) of the controls (p-value < 0.001). This means that exposure to tobacco smoke is one of the strongest and most consistent risk factor in the development and exacerbation of asthma.

Several epidemiological studies have shown that exposure to environmental tobacco smoke (ETS) is associated with poor respiratory health in children, adversely affect lung function and may increase the risk of development of bronchial asthma. Similar to other particulate matter, postnatal exposure to ETS causes a proinflammatory lung irritant. In addition, ETS has been associated with elevate serum IgE antibodies, an indication of allergy development.<sup>(29,30)</sup>

These data go hand in hand with those of Vagras et al who found that environmental tobacco smoke exposure has been associated with the increased use of the emergency department (E.D) for acute asthma care.<sup>(31)</sup>

Furthermore, several explanations had suggested for the effects of ETS on asthmatic children, feleszko et al<sup>(32)</sup> reported that maternal smoking during pregnancy and child's environmental tobacco smoke exposure might cause asthma through increased bronchial hyper reactivity, alteration in circadian variation in pulmonary function, heighten sensitivity to allergen or an irritant effect. EI-Heneidy et al found that parentral smoking is an important risk factor for asthma compared to other air pollutants.<sup>(33)</sup>

**► Exposure to dust, fumes or certain strong smell**; were also significantly affected patients' asthma attacks in this study; (74.8%, 70.9% and 31.3% respectively).

Chen et al reported that, Outbreaks of asthma

exacerbations have been shown to occur in relationship to increased levels of indoor pollutants, such as, smoke and fumes from gas, molds, and cockroach infestations.<sup>(34)</sup>

Abdul and Mostafa reported that Exposure to incense smoke (bakhour) has been linked to several illnesses, including respiratory symptoms, asthma, elevated cord blood IgE levels, contact dermatitis and cancer. This study demonstrated that burning of Arabian incense (bakhour) is common practice in Omani households and is an important trigger of wheezing among children with asthma.<sup>(35)</sup>

➤ **Recurrent infections**; either bacterial or viral; were reported in a majority of cases (68.3% and 50.9% respectively) as a triggering factor for asthma attacks compared with control group and the difference was highly significant (p-value < 0.001).

This agrees with Jackson et al who stated that wheezing following Rhino viruses infection in infancy and early childhood is the most significant predictor for the subsequent development of asthma at 6 years of age.<sup>(36)</sup> Asthma has become the most common childhood illness after the common cold.<sup>(37)</sup>

➤ **Reflux oesophagitis:** although it is difficult to be oriented by younger children, it was noticed as a risk factor in 29.1% of patients. There was a highly statistical significant difference between Cases and controls group (p-value <0.001).

This agrees Sontag et al, who Showed that asthmatics had more frequent and more severe daytime as well as nighttime reflux symptoms and suffered from more reflux related nocturnal awakening from sleep. This association could be explained by the mechanism that when gastric content rise into the esophagus, triggering bronchospasm by stimulating the vagus nerve.<sup>(38)</sup>

**Exposure to Cockroach:** Exposure to cockroach was significantly reported as risk factors for bronchial asthma in studied group. The percentage of exposure among the cases (63.5%) while in control group it was (35.7) and the difference was statistically significant (p-value < 0.05).

This results consistent with El-sharif et al who stated that Cockroach exposure was shown to increase the probability of having wheezing by three folds among cases compared to the control group.<sup>(39)</sup> Furthermore El-Gamal showed that, Exposure to cockroach is associated with increased risk of asthma.<sup>(40)</sup> Cockroach allergen is often associated with asthma in low-income and minority children. In a study of urban asthmatic children, 85% of the bedrooms tested positive for cockroach allergens.<sup>(41)</sup>

dust mites may sensitize the airway, leading to inflammation. Exposure to different animals were significantly reported as risk factors for bronchial asthma in studied group. Cats, cheeps, dogs or cattle exposure inside the house had a significant relation with asthma, compared to controls. Cats, cheeps and dogs exposure reported in 13.5%, 33% and 33.6 % respectively of the cases.

This is in consistency with Lau et al (2005) they found that Cat allergen exposure is associated with the development of sensitivity and asthma.<sup>(42)</sup> On the other hand, Lewis et al reported that the combination of widespread exposure to pet allergens and high prevalence of allergic sensitization to these allergens suggests that a substantial proportion of patients with asthma are at risk for cat or dog allergen induced asthma symptoms.<sup>(43)</sup>

Moreover Sporik et al concluded that, allergic sensitization to furred pet allergens is quite common, and in some populations more than 60% of children with asthma are sensitized to cat or dog allergens.<sup>(44)</sup> El-Sharif reported that having furry animals (hamster, dogs, cats, cheeps, goats or rabbit) recently indoors increase the risk of wheezing and asthma.<sup>(39)</sup>

It was found that, common household allergens are cockroaches, and pet dander. Allergens in the lungs trigger bronchial hyperresponsiveness and airway inflammation.<sup>(45)</sup> Briefly, detection of the allergen by lymphocyte cells in the lung initiates the allergy induced asthma reaction. This triggers the production of proinflammatory products, which narrow the airway, and the release of specific IgE antibodies.<sup>(46)</sup>

Solution So

Hough<sup>(47)</sup> reported that EIA affects 12-15% of the population while other studies had demonstrated rates as high as 35% or even 50% in competitive-caliber figure skaters, ice hockey players, and cross-country skiers.<sup>(48)</sup>

>> Psychological stress caused exacerbation of asthmatic attack in 43.9% of cases. The difference between two groups was highly significant.

Development of psychological distress in children has been associated with asthma that is more difficult to manage, requiring higher doses of steroids,<sup>(49)</sup> more frequent and prolonged admissions to hospital,<sup>(50)</sup> and greater functional disability.<sup>(51)</sup>

# CONCLUSION

Factors such as cigarette smoke, respiratory infections, air pollutants and exposure to cockroaches or animals; may cause irritation of the bronchial trees and compound the effects of allergens. These factors are preventable, thus permitting a possible reduction of the prevalence of asthma in children.

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