# The importance of post exercise peak expiratory flow rate & plasma IgE as a diagnostic tests for asthma among adult normal subjects & asthmatic patients.

*Mossa M. Marbut*,*
*Jawad Ali Salih*,*
*Abdul- Ghani M. Al-Samarai**.*
** Department of physiology, College of Medicine- Tikrit University.*
*** Department of medicine, College of Medicine- Tikrit University.*

## Abstract

Asthma can be classify as early onset or extrinsic asthma, which usually occur in atopic children and resolves in 80 %, and late onset or idiopathic non-atopic adult asthma, which is chronic in the majority of cases. Asthma also may develop because of exposure to dusts, organic materials, fumes and chemical substances in the working environment. The aim of this study is to identify the prevalence and risk factors of bronchial asthma among adult age groups. 1384 individuals were included in this cross section study. And also we took a control group (100 cases) from normal population and those without any respiratory diseases. Data collected was carried out during the period from September 18th 2002 to December 3rd 2002 in Al-Hijaj village in Bajii. The age range of study population was from 18 to 45 years. A cross sectional study that include total number of population equal to 1384. 760 (54.9%) were male and 624 (45.1%) were female. Asthma was diagnosed clinically in 104 cases (7.5 %) before or were newly diagnosed as a case of asthma. The asthmatic cases were common in male (66.3%) as compared to female (33.7%), this difference was statistically significant ($P< 0.05$). Measurement of mean of PEFR in asthmatic cases before exercise is 199.9 ± 51.2 while after exercise is 182.7 ± 49.7. This difference was statistically significant ($P< 0.05$). Measurement of mean of PEFR in risk group before exercise is 353.56 ± 33.62. While after exercise was 271.4 ± 34.36. This difference was highly statistically significant ($P< 0.01$). Moreover, in normal cases the mean of PEFR before exercise is 324.1 ± 41.3 while after exercise is 313.4 ± 45.76. This difference was not significant ($P> 0.05$). The reading of IgE measurement in asthmatic cases (104 cases). The mean is 343.81 ± 282.17 I.U. Also, the reading of IgE measurement in the risk group cases (125 cases) and the mean is 426.87 ± 293.6 I.U. This difference was statistically significant ($P<0.05$).

**Key words :** Asthma, exercise PEFR, risk factors, serum IgE.

## Introduction

Asthma is defined as recurrent episodes of wheezing or dyspnea characterized by a significant increase in resistance to airflow, spontaneously or following treatment, periods of complete or almost complete freedom of symptoms occur accompanied by a substantial decrease in resistance to airflow (1).

A person shall be said to have asthma when the following criteria are met: -

*a*-Recurrent episodes of wheezing or dyspnea.

*b*-Objective evidence by pulmonary function test of significantly increased resistance to airflow during episodes and of improvement when the patient is symptom free, spontaneously or under optimum treatment (2,3).

Asthma can be classify as early onset or extrinsic asthma, which usually occur in atopic children and resolves in 80 %, and late onset or idiopathic non-atopic adult asthma, which is chronic in the majority of cases (4,5,6).

Allergens can trigger episodes of asthma in atopic patients but asthma is more often aggravated by non specific factors such as cold air, tobacco smoke, dust and acid fumes, respiratory viral infection and emotional stress. In children and young adults asthma almost invariably follows strenuous exertion (exercise induced asthma) or exposure to cold air (7,8).

The aim of this study is to identify the prevalence and risk factors of bronchial asthma among adult age groups.

## Patients & methods

A cross sectional study was done in Al-Hijaj Village in Bajii among adults, 1384 samples (individuals) were included in this cross section study. After explaining the nature of the study to each individual, patients who have been diagnosed clinically before or were newly as a case of asthma, and other cases which to considered as a risk factor for asthma were interviewed. These risk factors include the cases, which are complain from atopic diseases (like conjunctivitis, rhinitis, sinusitis, and eczema). Also, a 100 subjects as control group was taken from normal population and those without any respiratory diseases.

Data collected was carried out during the period from September 18th 2002 to December 3rd 2002 in Al-Hijaj village in Bajii. The age range of study population was from 18 to 45 years. The total number of population were 1384, of them 760 (54.9%) were male and 624 (45.1%) were female. All data were presented as mean & standard deviation (SD). Student T test was used to compare between different groups.

## Results

The study involved examinations of 1384 subjects, 760 male and 624 female. Asthma was diagnosed clinically in 104 cases (7.5 %). The asthmatic cases were common in male (66.3%) as compared to female (33.7%), this difference was statistically significant ($P< 0.05$).

Table (1) show the readings of PEFR by using peak flow meter before and after 3 minutes of cessation of exercise in asthmatic cases (104 cases), the risk group (125 cases) and the normal control subjects (100 cases) respectively.

Measurement of mean of PEFR in asthmatic cases before exercise is 199.9 ± 51.2 while after exercise is 182.7 ± 49.7. This difference was significant statistically ($P< 0.05$). Measurement of the mean of PEFR in risk group before exercise is 353.56 ± 33.62. While after exercise was 271.4 ± 34.36. This difference was highly statistically significant ($P< 0.01$). Moreover in normal cases the mean of PEFR before exercise is 324.1 ± 41.3 while after exercise is 313.4 ± 45.76. This difference was not significant ($P> 0.05$)

Table 2 shows the reading of plasma IgE concentration measurement in asthmatic cases (104 cases). The mean is 343.81 ± 282.17 I.U. Also, table 2 shows the reading of IgE measurement in the risk group cases (125 cases) and the mean is 426.87 ± 293.6 IU. This difference was significant statistically ($P<0.05$).

The prevalence rate of risk factors for bronchial asthma is 9.3%, rate was common in male (64%) as compared to female (36%), this difference was statistically significant ($P<0.05$). Frequency of other allergic diseases among asthmatic is 51% and these cases suffer from different types of allergic diseases: such as (62.9%) presented with rhinitis, (62.9%) with conjunctivitis and (59.2%) with sinusitis.

Regarding risk factors, there are 86.5 % of the cases with conjunctivitis, 78% with rhinitis and 70.5% with sinusitis. In asthmatic cases there is no evidence of skin diseases, while in the risk group cases, 15.5 % of the cases suffer from eczema.

Regarding food allergy, it is manifested in 27 % of asthmatic cases, this allergy mainly due to spices, eggplant, and eggs. The family history of food allergy was detected in 4 % of cases. In the risk group cases, 56 % of the cases allergic to different types of food such as eggplant, spices, and eggs. The family history of food allergy was detected in 20% of cases.

## Discussion

Examination of 1384 individuals in Al-Hijaj Village with ages range of 18-45 years, reveals that the prevalence of asthma was 7.5 % and this rate was higher in male (66.3%) than in female (33.7%), this difference was statistically significant ($P<0.05$). This rate was lower than that reported from Jeddah (12%) and Riyagh (12%) (3). Also the present rate varies with

the rate of 9.5% reported in AI-Khobar city, Saudi Arabia (4).

As for the risk factors for bronchial asthma, the prevalence rate was 9.3 % which is more in male (64%) than in female (36%). This difference was statistically significant (P< 0.05).

Regarding the development of disease, there are 37 % of the case show that the onset of attack starts from birth or from the first years of age, and other cases represent different groups of age. Broder and Colleagues collected data for the community of Tecumseh, Michigan, where almost 50% of all subjects had onset before the age of 10 years (5).

In asthmatic cases, prevalence of other allergic diseases such as rhinitis, conjunctivitis and sinusitis is about 51%. This finding agrees with the previous studies which found the prevalence of a topic diseases in asthmatic cases is 52% (6,7,8).

In risk group, 78% of the cases were with rhinitis, 70.5% with sinusitis and 86.5% with conjunctivitis. Some studies have suggested atopy appearance to be the strongest identifiable predisposing factor for asthma and this atopic diseases are sometimes associated with asthma (9,10). As for as the time of asthmatic attacks is concerned, 59.5% of asthmatic attacks occur in the spring and winter, 27% have attacks all-time and 8.5% in the winter. In other studies the pollen allergens associated with the development of asthma come mainly from grasses and weeds (11,12).

About the heating system, the study shows that 90.5% of the risk group cases use the kerosene type of heating system and the other group use electric type. Some data suggest that indoor pollutants (like carbon monoxide, carbon dioxide, nitric acid, nitrogen oxides which are produced by heating with gas, wood, coal, and kerosene units) may contribute to the development of asthma, yet further studies are needed (13).

Among the problems related to indoor pollution are: nose irritation, respiratory infection and bronchitis. The pulmonary function test response to exercise can help to establish a diagnosis of asthma. Peak flow metric test done for all the cases and it was done before and after exercise to find the difference between first and second reading of all cases involved (14, 15).

While measuring the flow rates serially before and after exercise, a positive test would confirm the diagnosis while a negative one should alert the physician to search for another diagnosis. The ventilatory function test response to exercise can help to establish a diagnosis of asthma, a post exercise fall in PEFR of 20% or more is the diagnostic of asthma (15).

In the present study PEFR was done before and after exercise for asthmatic cases, risk group cases and for normal individuals. In asthmatic patients there are 12.5% of them show fall of 20% in PEFR value after exercise. 87.5% of the same cases show abnormal readings of PEFR before exercise (below normal value which is 300-500 liters), while after exercise there is 98% with abnormal reading.

The mean of PEFR in asthmatic cases before exercise is 199.9 ± 51.2, while after exercise is 182.7 ± 49.7, this difference was statistically significant (P <0.05). Physical exercise has two distinct and opposite effects on ventilatory function in asthmatics, depending upon the duration of exercise, exercise lasting about 6 minutes increases airway resistance and this lead to decrease the peak expiratory flow rate and FEV1 most often between 20 and 50%. For the day-to-day monitoring of pulmonary function use of peak flow meter which measures the PEFR provides longitudinal assessment of the diurnal degree of airway obstruction (15).

Patients with sever asthma will present a clear decrease in ventilatory capacity after exercise and most asthmatics with daily symptoms will present a moderate fall in PEFR after exercise, The mechanism by which exercise causes bronchial obstruction is unknown but a fall in the temperature and humidity of the airways is a critical initiating event leading to mast cell mediators release (16).

In risk group there are 46.4% of the cases show abnormal readings of PEFR after exercise, with a mean of 353.6 ± 33.6 before exercise and after exercise is 271.4 ± 34.36.

This difference was statistically significant ($P<0.01$). This finding is considered high if compared with the previous findings which suggest that 25% of suspected asthmatic patients show abnormal reading of PEFR (15, 16,17). However, both studies show the importance of exercise as a precipitating factor of asthma and show the importance of peak flow meter as a diagnostic test.

In the normal group the mean value of PEFR before exercise was $324.1 \pm 41.3$, and after exercise was $313.4 \pm 45.76$. This difference is statistically not significant ($P> 0.05$). Analysis of the non asthmatic individuals who presented with fall in PEFR after exercise shows that some of them have no family or personal history of allergic diseases while the other gave history of atopic diseases, this finding can be explained by an important fact that the airway hyper responsiveness which present universally in asthmatics and some subjects with allergic diseases is also seen in some of otherwise normal subjects (17).

Although total serum IgE levels are elevated in the majority of individuals with IgE mediated disease, this is not the case with all allergic patients and in addition to allergic diseases there are many non allergic diseases that may be associated with elevation in serum IgE including parasitic, infectious, neoplastic, immuno-deficiency and cutaneous diseases (18).

In a prospective study of adults attending an allergy clinic, previous results stated that elevation of serum IgE in only 76% of patients with IgE mediated asthma, in our study there is elevation of serum IgE in 85% of patients with asthma (the mean is 343.81 I.U). This elevation reaches a higher level in several cases and there is a variation in the level of IgE between these cases (17).

In the case of risk group, Previous findings stated that cystic fibrosis patients with atopy have higher IgE levels (the mean is 598 I.U) as compared with other patients with cystic fibrosis only (the mean is 281 I.U). In the present study the mean of IgE level is 426.87 I.U and there is a higher level of IgE in these cases (8, 18, 19).

In these cases of the risk group, the elevation of IgE level is seen in 95% of the cases and this means that the elevation of IgE level above the normal value is more in the risk group than in asthmatic cases.

This difference in the mean of IgE level between the asthmatic cases and the risk group cases is statistically significant ($P<0.05$).

In atopic diseases there are increase total or specific serum IgE, for example in rhinitis the total nasal secretion IgE may occasionally be higher than total serum IgE, although elevated levels of one generally correlate with elevated levels of the other. Moreover elevated levels of total serum or nasal IgE are usually associated with identifiable specific IgE in the skin or nose, and there is good correlation between high levels of circulating specific IgE and the presence of clinical symptoms (18, 19)

In cases of allergic conjunctivitis the increased levels of IgE can be detected in the tears of patients and the serum levels are significantly elevated, allergen specific IgE antibodies have been demonstrated in the tears and serum of patients. In general IgE is frequently in atopic diseases and the tendency of IgE to reach higher levels in more severe diseases and in diseases with more severe respiratory symptoms (18).

## References

1-Lichtenstein, L.M., Valentine, M.D., and Norman, P.S.: A pre-evaluation of Immuno - Therapy for asthma. Am. Rev. Respiratory Dis.; 1984:129:657.

2-Macleod J. Davidson's Principles and Practice of Medicine. 18th ed.–Churdill Living Stone London, 1999 : 328-334.

3-AL-Frayh A, Bener AB, AL-Jawadi TQ. Prevalence of asthma among Saudi children. Saudi Medical J. 1992; 13:521-524.

4-AL-Dawood K, Epidemiology of bronchial asthma among school boys in AL-Khobar city, Saudi Arabia. Saudi Medical J. 2001; 22(1):61-66.

5-Broder, I., et al. Epidemiology of asthma and allergic rhinitis in a total community: Tecumsch, Michigan: III.

Second survey of the community. G. Allergy Clin. Immunol. 1974; 53: 127.

6-Barbee, R.A., et al. Allergy skin test reactivity in a community population sample: correlation with age, histamine Skin reaction and total serum Immunoglobulin E.J Allergy Clin. Immunol. 1981; 68: 15.

7-Barbee, R.A. et al. Distribution of IgE in a community population sample: correlation's with age, sex And allergen - Skin test reactivity J. Allergy Clin. Immunol. 1981; 68: 106.

8-Barbee, R.A.et al. Immediate skin test reactivity in general population sample. Ann. Intern. Med. 1976; 84: 129.

9-Salman AA., Al-Janabi, BS., Marbut MM. Epidemiological characteristics of asthma in adults attending PHCC in Al-Dour city. TMJ. 2006; 12(1): 1-4.

10-Sears MR, et al. Relation Between Airway Responsiveness And Serum IgE in Children With Asthma and in Apparently Normal Children. N Engl. J.M. ed.1991; 325:1067-1071.

11-Sophioglu C, et al. Mechanism of Grass – Pollen – Induced Asthma. Lancet. 1992; 339: 569-72.

12-Pollart SM, et al. Epidemiology of emergency room asthma in Northern California: Association with IgE antibody to Ryegrass pollen. J. Allergy Clin. Immunol . 1988; 82:224-30 .

13-Samet JM, Marbury MC, Spengler JD. Health effects & sources of indoor air pollution part 1. AM. Rev. Respire. Dis. 1987; 136: 1486 – 1508.

14-Marbut MM., Al-Samarrai, AM. Prevalence of exercise induce asthma among Iraqi soccer premier club players. TMJ. 1997;3(2): 159-62.

15- Marbut MM., Jawad, MA., Al-Samarrai, AM. Exercise induced asthma in secondary school students & its therapeutic modulations. TMJ. 2004; 10(1): 17-23.

16- Pullan CR, Hey EN. Wheezing, asthma, & pulmonary dysfunction 10 years after infection with respiratory syncytial Virus in infancy . BMJ. 1982; 284:1665-1669.

17-Kaliner M., MD., Lemanske R.,M.D. Rhinitis and asthma, JAMA. 1992-vol 268:20-25.

18-Middleton , E,J Richarles E. Reed, M.D.,N. Franklim Adkinson, Jr, MP., John W. Yunginger. Allergy Principles and Practice , 1988 Vol.2.

19-Henderson, L.L Swedhund, H.A., Van Dellen RG. Evaluation of IgE test in an allergy practice, J. Allergy Clin. Immunol. 1971; 48: 361.

**Table (1):** The mean and standard deviation of peak expiratory flow rate (L/Sec) before and after exercise in asthmatic cases, risk group, and control group according sex.

| **Parameters** | **Before exercise in male** | **After exercise in male** | **Before exercise in female** | **After exercise in female** |
|---|---|---|---|---|
| Asthmatic patients (104) | 223.47 ± 44.9 | 207.5 ± 41.21 | 152 ± 20.53 | 135.14 ± 27.1 |
| Risk group subjects (125) | 377.75 ± 15.4 | 356.01 ± 19.09 | 315.11 ± 19.84 | 298.69 ± 27.2 |
| Control subjects (100) | 357.50 ± 32.1 | 347.29 ± 41.3 | 295.19 ± 20.23 | 281.34 ± 21.84 |

**Table (2):** The mean and standard deviation of IgE measurement (I.U/ML) in asthmatic cases (n=104), and risk group(125)

| **Parameters** | **IgE Measurement for Asthmatic Cases** | **IgE Measurement for Risk group Cases** |
|---|---|---|
| **Mean** | 343.81 | 426.87 |
| **S.D** | ± 282.17 | ± 293.60 |