

## Comparison of Asthma among Adolescents in Urban and Rural Areas of Kaduna State, Northwestern Nigeria

Ogunsina M,<sup>1</sup> Yusuf N,<sup>2</sup> Omisakin OO,<sup>2</sup> Ekweani C.<sup>3</sup>

<sup>1</sup>Department of Internal Medicine and <sup>2</sup>Department of Surgery, Barau Dikko Teaching Hospital, Kaduna State University, Kaduna, Nigeria.

<sup>3</sup>Kabala Hospital, Kaduna, Nigeria.

### Article Metrics

Date submitted: 05/04/2021  
Date Accepted: 26/05/2021  
Date Published: 30/07/2021



### ABSTRACT

**Background:** There has been rising prevalence of asthma worldwide. One of the causes noted for this is increase in urbanization and westernization of diet. This has therefore reflected on varying prevalence documented within the urban and rural settings even in the same geographical regions worldwide especially among children and few reports among adolescents.

**Methods:** Using stratified random sampling, 320 participants were selected from two areas designated urban and rural. A modified ISAAC study Asthma questionnaire was administered to them after which a physical examination and best of 3 attempts pre-exercise peak expiratory flow rate (PEFR) were done. They were subjected to 6-minutes run and post-exercise PEFR were done and a drop of 15% or more was considered as exercise induced bronchospasm. Statistical analysis was done using EPI INFO 2002.

**Results:** Prevalence of current asthma symptoms or wheezing in the past 12 months was 10.6% and 6.3% in the urban and rural population respectively with an overall prevalence of 8.5% and a positive history of atopy in the participants and their families was seen to be a risk factor for asthma in the participants in both the urban [RR=2.47 (1.0-6.05)] and rural [RR=4.48 (2.35-8.54)] areas. Using EIB, the prevalence of asthma was 15% and 5.6% in the urban and rural population respectively ( $p < 0.000$ ) with an overall prevalence of 10.3%.

**Conclusion:** There was significant increase in the prevalence of asthma as compared to earlier reported and a significant difference between the urban and rural adolescents in this region.

**Keywords:** Asthma, Peak expiratory flow rate, Exercise induced bronchospasm.

### INTRODUCTION

Asthma, one of the major noncommunicable diseases, is a chronic inflammatory disorder of the airways whose prevalence is rising

worldwide.<sup>[1,2]</sup> It was estimated that more than 339 million people had asthma globally in 2016.<sup>[3]</sup> It causes huge economic losses from lost productivity

\*Correspondence: Dr. MA Ogunsina,

Email: [arinolaprecious@yahoo.com](mailto:arinolaprecious@yahoo.com) Tel: +234-8037876822

#### Access to the article



website: <http://www.jmbsr.com.ng>

doi: <https://doi.org/10.46912/jmbsr.56>

Find our articles on Google Scholar, fully indexed

#### How to cite this article:

Ogunsina M, Yusuf N, Omisakin OO, Ekweani C. Comparison of Asthma among Adolescents in Urban and Rural Areas of Kaduna State, Northwestern Nigeria. J Med Bas Sci Res 2021;2(1):99-106.

following absenteeism from work and school. It also imposes a huge burden on health care resources due to the frequent use of asthma therapies, hospitalization and emergency visits.<sup>[4],[5]</sup>

The problem of sub-optimal management of the disease due to the lack of adherence to WHO recommended guidelines particularly in African countries has also compounded the situation, thereby leading to rising morbidity and mortality.

The International Study of Asthma and Allergies in Childhood (ISAAC) noted that the prevalence of recent wheeze varied widely between countries and between centers within countries with the highest prevalence (20%) observed in English speaking countries like Australasia and parts of Latin America and lowest prevalence (<5%) in the countries like India.<sup>[6]</sup> There have been varying prevalence rates documented in the African continent. In the ISAAC study, Kenya had a prevalence rate of 17%, South Africa had 16%.<sup>[5]</sup> The result of EIB study in Ghanaian children by Addo-Yobo *et al* showed an overall prevalence of 3.1%.<sup>[7]</sup> In 1974, Warrell *et al* in Zaria, Nigeria noted that of the 106 asthmatic patients seen in the medical out-patient (paediatric and adult combined), childhood asthma was rare and asthma started after the age of 19 years.<sup>[8]</sup> In 1998, Falade in Ibadan, working with 3,058 children aged between 13-14 years found a prevalence of physician diagnosed asthma to be 18.4%.<sup>[9]</sup> Onazi, working with children aged 5-14 years, using EIB, had a prevalence of 6.0%.<sup>[10]</sup> Several reasons contributed to these variations which include genetic factors, lifestyle, environmental factors and so on.

Large standardized international and national studies of previous prevalence studies of asthma in both children and adults have utilized written questionnaires<sup>[4]</sup> based on an important symptom of wheezing especially for epidemiological studies.<sup>[11],[12]</sup> Therefore, current asthma symptom has

been defined as wheezing occurring at any time within the previous 12 months.<sup>[10]</sup> The core question used in both the ISAAC study and the European Community Respiratory Health Survey (ECRHS) showed that responses to questions about self – reported wheezing in the previous 12 months have good specificity and sensitivity for both bronchial hyper responsiveness (BHR) and a diagnosis of asthma in both children and adults.<sup>[4]</sup>

There is also a paucity of data on the urban/ rural prevalence of asthma in adolescents in Nigeria and a few in Africa. There is therefore a need to generate more data on its prevalence in Nigeria as well as the urban/rural differences which this study was designed to observe. This will not only permit meaningful comparisons in asthma prevalence rates between Nigeria and other parts of the world but also provide data for the planning of health care measures and programs in both urban and rural areas.

## MATERIALS AND METHODS

The research work was conducted between May and July 2007 with participants from urban and rural areas. Kaduna metropolis represented the urban sample area because it is characterized by the presence of a big oil refinery, numerous textile and other factories as well as thousands of automobiles all of which emit huge amounts of gases like sulphur dioxide and nitrogen dioxide into the atmosphere. The town is also inhabited to a large extent by relatively affluent persons with increasing westernized lifestyle. The rural sample was drawn from Kasuwan Magani, a small town located about 60 kilometers south ward of Kaduna and inhabited mostly by farmers with a traditional lifestyle. There are no factories there and fewer number of automobiles. There is therefore relatively little air pollution.

A stratified random sampling method was used to select 320 students between 15-20 years from four

secondary schools from each town using the list of schools in the area obtained from the Ministry of Education. In each school, at least forty students were selected randomly from the list of students provided by the Principal. Any student with severe musculoskeletal abnormalities, cardiopulmonary diseases and poor effort at exercising was excluded.

A modified ISAAC study Asthma questionnaire was administered to the participants after each of the questions and items was explained in both English and Hausa (Hausa language is quite common and widely spoken in Kaduna). Their responses to the questionnaire were subsequently collected. They were physically examined, ages, weights and heights were recorded and the pre – exercise Peak Expiratory Flow Rates (PEFR) were measured with a mini – Wright's Peak flow meter. The PEFR was taken as the best of 3 attempts following the demonstration of the procedure by 3 trained aides and after 3 practice attempts. The participants were then made to run round a field as hard and as fast as possible for 6 minutes in groups of 4 participants at a time. At the end of the exercise, the PEFR was again measured.

A post exercise decrease in PEFR of 15% or more was considered significant and this was referred to as Exercise induced bronchospasm (EIB)

Six of the participants in the urban area and only one in the rural had bronchospasm severe enough to warrant the use of salbutamol inhaler and none had any need of further treatment. There were no injuries sustained during the exercise.

### Ethical Issues

Approvals were obtained from the Ethical committee the Kaduna State Ministry of Education and the Principals of the secondary schools concerned. Written consents were also obtained from the parents/guardians of the participants. Adequate arrangements were made to treat any minor injuries

like bruises or abrasions that resulted from falls. Salbutamol inhalers were available to treat cases of acute asthmatic attacks.

The results were disclosed only to the participants at the conclusion of the exercise. The participants were motivated to participate in the exercise with gifts like exercise books and biro pens.

### Statistical Analysis

Data were subjected to statistical analysis using the computer software EPI INFO 2002. The student's "t" test was used in comparative data analysis. The Chi-square test and Fisher's test were used to evaluate the significance of any difference in the asthma prevalence rates in the two populations of participants. The level of statistical significance was set at  $p < 0.05$ .

## RESULTS

Socio-demographic description of study participants  
The distribution of the participants by age, sex, weight, height and location are shown in table 1. The

**Table 1. Socio-demographic and household characteristics of urban and rural adolescent participants in Kaduna**

Variable, N (%)	Urban	Rural	P-value
Age, mean±sd (Years)	15.7 ±0.81	17.5 ±1.41	< 0.05
<b>Sex</b>			
Female	70 (44)	69 (43)	
Male	90 (56)	91 (57)	
<b>Weight</b> mean±sd (Kg)	58.3±11.78	52.7±7.04	<0.032
<b>Height</b> mean±sd (cm)	166.7±8.9	157.3±10.8cm	<0.018

**Table 2. Comparison of asthma symptoms and allergic disorder in urban and rural adolescents in Kaduna**

Symptom	Urban	Rural
Chest tightness	29 (18.1)	26 (16.3)
Wheezing on exposure to dust	59 (36.9)	30 (18.8)
Nocturnal awakening	17 (10.6)	10 (6.3)
Wheezing in past 12 months	17 (10.6)	10 (6.3)
Seasonal wheezing	23 (14.4)	16 (10)
Wheezing after exercise	80 (50)	72 (45)

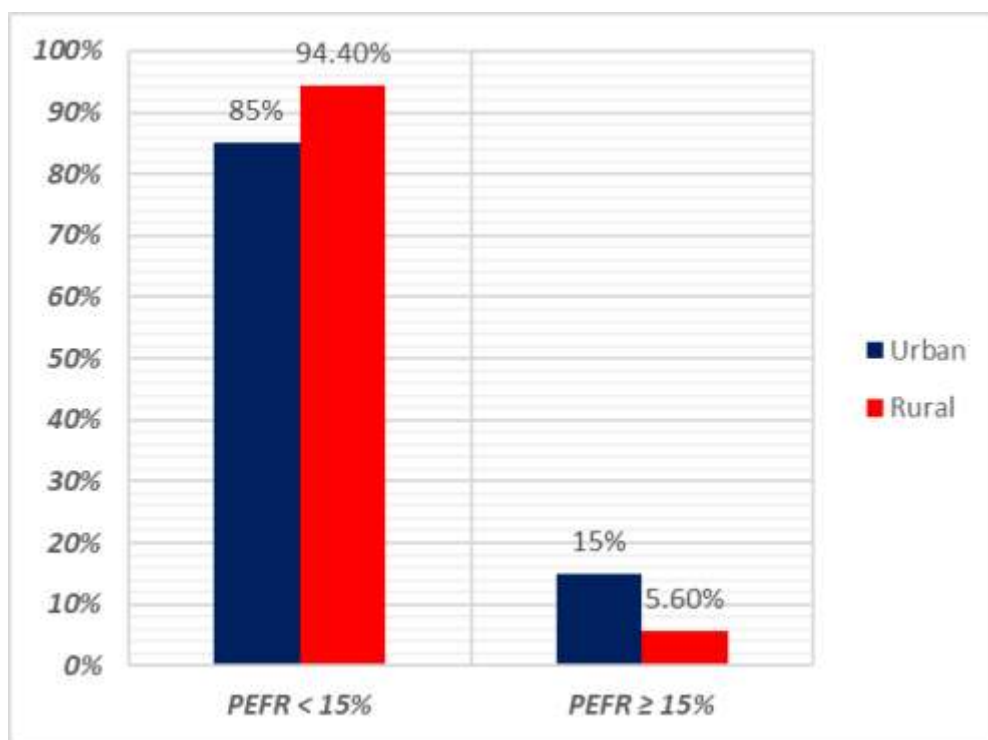


Fig 1: Change in lung function test in urban and rural adolescents in Kaduna

Table 3: Allergic disorders and asthma diagnosis in urban and rural adolescents

	Urban No (%)	Rural No (%)
<b>Type of allergic disorder</b>		
Allergic conjunctivitis	11 (6.9)	6 (3.8)
Dermatitis	9 (5.6)	4 (2.5)
Rhinitis	11 (6.9)	2 (1.3)
Allergy in family	27 (16.9)	24 (15.0)
Prevalence of physician diagnosed asthmatics	13 (7.5)	4 (2.5)
Asthmatic attacks in physician diagnosed asthmatics in the past 12 months	13 (100)	3 (75.0)
Medication use in physician diagnosed asthmatics in the past 12 months	3 (23.0)	1 (25.0)
Knowledge of asthma and allergy		
Excellent	2(1)	0
Very good	18(11)	0
Good	72(45)	11(7)
Poor	38(24)	13(8)
None	30(19)	136(85)

**Table 4. Lung function test findings in urban and rural participants in Kaduna**

Variable	Urban	Rural	P-value
Post-exercise change in PEFR			
<15%	136 (85.0)	151 (94.4)	
~	24 (15.0)	9 (5.6)	<0.000
% Change in PEFR mean±sd (Liters/Minute)	29.6±12.61	19.8±6.66	

mean ages of the urban and rural participants were 15.68 ±0.81 and 17.53 ±1.41 years respectively (p<0.04). The male/ female ratio for the urban and rural were 1.25:1 and 1.31:1 respectively. Their mean weights were 58.25 ± 11.78 kg and 52.7 ± 7.04 kg (p<0.032), and mean heights were 166.7±8.9cm and 157.3±10.8cm respectively (p<0.018).

#### Comparison of asthma symptoms and allergic disorder in urban and rural adolescents

The proportions of the participants in the two populations showing a positive questionnaire response regarding symptoms suggestive of asthma are displayed in Table 2 and shows statistically significant higher percentages in the urban sample. Prevalence of current asthma symptoms or wheezing in the past 12 months was 10.6% and 6.3% in the urban and rural population respectively with an overall prevalence of 8.5%. Table 3 showed that symptoms suggestive of allergy like conjunctivitis, atopic dermatitis, rhinitis and family history of atopy were more frequent in the urban population (p < 0.05). Positive history of atopy in the participants and their families was seen to be a risk factor for asthma in the participants in both the urban [RR=2.47 (1.0-6.05)] and rural [RR=4.48 (2.35-8.54)] areas. Thirteen (7.5%) participants in the urban had been previously diagnosed asthmatics and 4 (2.5%) in the rural but almost 100% of all participants reported attacks in the past 12 months and just about 25% of them were on regular medication. 93% of the rural participants had poor knowledge of asthma.

#### Lung function test findings in urban and rural adolescents

Fig 1 shows the results of PEFR measurements pre- and post-exercise. A significantly higher percentage of the urban participants (15%) showed a decrease in post – exercise PEFR of 15% or more than the rural participants (5.6%) and a mean percentage change in PEFR of 29.6±12.61 and 19.8±6.66L/min respectively (p<0.000) as shown in Table 4.

#### DISCUSSION

The mean weight of the urban participants was found to be significantly higher than that of the rural participants. This is most probably a reflection of a superior socioeconomic status on the part of the urban participants. Increase in the body mass index and obesity have been said to be risk factors for asthma in “at risk individuals” and also for worsening asthma symptoms in known asthmatics<sup>11</sup>.

The responses to the questionnaire used in this study showed a prevalence of current asthma symptoms or wheezing in the past 12 months of 10.6% and 6.3% in the urban and rural population, respectively and an overall prevalence of 8.5% in both population which is lower than that documented by Falade et al in the ISAAC study done in Ibadan in the South Western region of Nigeria.<sup>18</sup> This difference may be due to the different age groups involved in the studies. It is also much lower than the 14.2% noted in Anambra by Ele et al.<sup>14</sup> This might also be due to the understanding of the participants of what wheezing means. The overall prevalence found in this study is like that recorded in Nairobi, Kenya and Cape Town, South Africa under the ISAAC study,<sup>15</sup> but was significantly higher in the urban children than in the rural children (P < 0.05) as also shown in Ghana.<sup>16</sup>

There are significantly higher levels of allergic diseases like conjunctivitis, dermatitis and rhinitis in

the urban children. This was in accord with findings in other studies<sup>[15]</sup> This observation as well as the finding of a higher prevalence rate for asthma in the urban sample might probably be due to a combination of factors which include: westernized lifestyle and diet on the part of the urban participants which has been postulated to be associated with a greater tendency to asthma and allergy.<sup>[16]</sup> Probable additional protective reason among the rural children might be the longer periods of breastfeeding that had been noted to confer protection against asthma.<sup>[17]</sup>

An additional positive history of allergy or asthma in the family especially in the mothers or more still, both parents increase the risk of developing asthma.<sup>[18]</sup> Several workers have reported that T-lymphocytes isolated from cord blood of babies born to atopic mothers were already able to respond to allergen.<sup>[19]</sup> This finding suggests that low amounts of allergen taken in by the mother can be passed on to her offspring via the placenta. The fact that the urban participants were domiciled in Kaduna town where the atmosphere is highly polluted by emissions from numerous factories, automobiles and an oil refinery, could also be responsible for the observed higher prevalence rate for asthma symptoms in the urban sample.<sup>[20]</sup> Pollution from factories has been shown to be associated with an increase in respiratory morbidity in Nigeria.<sup>[21]</sup> The prevalence of physician diagnosed participants was lower than that noted by asthma symptoms as also noted by other authors.<sup>[22],[23]</sup>

This study, using EIB, shows prevalence of 15% and 5.6% in the urban and rural population respectively ( $p < 0.000$ ) with and overall prevalence of 10.3%. It was noticed to be higher in females than males in this study (M: F ratio 1: 1.2). This is different from what was noticed by Abubakar who had a male preponderance.<sup>[24]</sup> This might be due to the age group he worked with where the majority was less than 15 years, Sunyer *et al* and de Marco *et al* have shown that

females have a higher risk of asthma than males after the age of 15.<sup>[25],[26]</sup> The ratio of male to female rates for asthma varies across the human life span. Prevalence rates are higher in boys than in girls in childhood whereas from adolescence and during the reproductive period of a woman's life, the rates in women exceed those of men but revert after the menopause though this may be modified by hormone replacement therapy.<sup>[27]</sup> These differences are attributed to the effect of sex hormones associated with menstruation, pregnancy, lactation and the menopause on the airway function in women.

The questionnaire showed a prevalence of asthma to be 8.5% while that of EIB was 10.3%. This was probably due to the those that were positive with the EIB may not have had wheezes after exercise or at any other times or probably did not recognize it if it was not severe but with the objective measurement of changes in PEFR before and after exercise, they were actually recognized. Several studies have shown various correlations between asthma symptoms and EIB. Thole *et al* noted a poor correlation between EIB and those that responded to asthma symptoms on questionnaire.<sup>[28]</sup> This result is higher than earlier studies from same area.<sup>[25],[29]</sup> This might show the increasing prevalence has shown worldwide<sup>[3],[4],[13]</sup> and significant difference between the urban and rural areas might also be a reflection on urbanization since report by Abubakar of 4.1% is from Zaria, comparable to the rural prevalence of 5.6% in this study since Zaria does not have as many industries as Kaduna metropolis used for the urban study.

## CONCLUSION

The prevalence of asthma is higher among urban adolescents than rural adolescents in Kaduna likely



due to urbanization, a westernized lifestyle, air pollution from factories and automobiles unlike the more traditional lifestyle and purer atmosphere in the rural area. There was significant increase in asthma prevalence as compared to earlier documented in the same region. The ISAAC questionnaire appeared to have been a good screening tool for asthma and can be further enhanced by other test like the EIB.

**Conflict of interest:** We declare no conflict of interest.

**Acknowledgement:** Nil

## REFERENCES

1. Anderson HR, Butland BK, Strachan DP. Trends in prevalence and severity of childhood asthma. *BMJ* 1994; 308:1600-1604.
2. WHO. <https://www.who.int/news-room/fact-sheets/detail/asthma> (Accessed 30/3/21)
3. Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet* 2017; 390: 1211–59.
4. Guy M, Neil P, David S, Innes A. Global Burden of Disease due to Asthma. The Global Burden of Asthma Report - 2014. [http://www.globalasthmareport.org/resources/Global\\_Asthma\\_Report\\_2014.pdf](http://www.globalasthmareport.org/resources/Global_Asthma_Report_2014.pdf)
5. Pearce N, Sunyer J, Cheng S. Comparison of asthma prevalence in the ISAAC and ECRHS. ISAAC steering committee and the European Respiratory Health Survey. *Eur. Respir. J.* 2000; 16: 420–426.
6. Guy M, Neil P, David S, Innes A, Philippa E. The global asthma report 2018 [http://www.globalasthmareport.org/resources/Global\\_Asthma\\_Report\\_2014.pdf](http://www.globalasthmareport.org/resources/Global_Asthma_Report_2014.pdf) Accessed (02/04/2021)
7. Addo – Yobo E, Custovic A, Taggart S. Exercise induced bronchospasm in Ghana: differences in prevalence between urban and rural subjects. *Thorax* 1997; 52; 161 – 165.
8. Warrel DA, Fawcette IW, Harrison DW, Agamah AJ. Bronchial asthma in the Nigerian Savannah region. *Quart. J. Med.* 1975; 174: 125 – 147.
9. Falade AG; Olawuyi F, Osinusi K, Onadeko BO. Prevalence and severity of symptoms of asthma, allergic rhino – conjunctivitis and atopic eczema in secondary participants in Ibadan, Nigeria. *East Africa. Med. Journal* 1998. Dec, 75 (12) 695 – 698.
10. Onazi SO, Orogade AA, Yakubu AM. Exercise-Induced Bronchospasm among School Children in Gusau, Nigeria. *West African Journal of Medicine* Vol. 31, No. 2 April–June 2012.
11. Matthew Masoli, Denise Fabian, Shaun Holt, Richard Beasley. The global burden of asthma: executive summary of the GINA Dissemination Committee Report. Global Initiative for Asthma (GINA) Program. *Allergy*. Volume 59, Issue 5 Pages: 469-559 May 2004. <https://doi.org/10.1111/j.1398-9995.2004.00526.x>
12. Gergen PJ, Mullally DI, Evans R: National survey of prevalence of asthma among children in the United States, 1976 to 1980. *Pediatrics*. 1988, 81 (1): 1-7.
13. Gennuso J, Epstein LH. The relationship between asthma and obesity in urban minority children and adolescents. *Arch. Pediatr. Adolesc. Med.* 1998;152; 1197-1200.
14. Ele PU, Ibeh CC. Prevalence of bronchial

- asthma in adolescents in Anambra state Nigeria. *Nig J. Int. Med* 2002 5(1/2): 23-26.
15. Addo- Yobo OD, Woolcock A et al. Exercise induced bronchospasm and atopy in Ghana. Two surveys 10 years apart. *PLOS Med.* Feb. 2007 4 (2), 0355 – 0360.
  16. Braun-Fahrlander C, Gassner M, Grize L, Neu U, Sennhauser FH, Varonier HS, et al. Prevalence of hay fever and allergic sensitization in farmer's children and their peers living in the same rural community. SCARPOL team. Swiss Study on Childhood. Allergy and Respiratory Symptoms with Respect to Air Pollution. *Clin Exp Allergy* 1999; 29:28-34.
  17. Busse WW, Lemanske RJ Jr. Epidemiology and pathogenesis of asthma. In. Parry E, Godfrey R, Mabey D, Gill. G (Eds) *Principles of Medicine in Africa*. Third Edition Cambridge University Press. 2004, pages 768 – 77.
  18. European Community Respiratory Health Survey. Genes for asthma? An analysis of the European Community Respiratory Health Survey. *Am J. Respir Crit Care Med* 1997; 156:1773-1780.
  19. Wardlaw A. J. Inflammation in asthma. In. Andrew PR, Terence B. (Eds). *Asthma*. 1st Edition, BIOS Scientific Publishers Limited, UK, 1993:107-129.
  20. Romieu I, Menese F., Ruiz S. Effects of air pollution on the respiratory health of asthmatic children living in Mexico City. *Am J. Respir Crit. Care Med.* 1996; 154:300-307.
  21. Dosumu EO. Effects of air and environmental pollution on the respiratory system: emphasis on the Nigerian situation. *Nig J. General Pract.* 1999; 3:26-30.
  22. Dales RE, Raizenne M, El-Saadanny S, Brook J, Burnett R: Prevalence of childhood asthma across Canada. *International Journal of Epidemiology.* 1994, 23: 775-81. 10.1093/ije/23.4.775.
  23. Pearce NE, Weiland S, Keil U, Langridge P, Anderson HR, Strachan D et al. Self-reported prevalence of asthma symptoms in children in Australia, England, Germany and New Zealand: An international comparison using the ISAAC written and video questionnaires. *European Respiratory Journal.* 1993, 6: 1455-61
  24. Abubakar A. Prevalence of asthma among primary school children in Zaria (dissertation) ,West African College of Physicians, Faculty of Paediatrics, April 2000.
  25. Sunyer J., Anto JM, et al. Risk factors for asthma in young adults. Spanish group of the European Community Respiratory Health survey. *Eur.Respir J* 1997; 10:2490-2494.
  26. de Marco R, Locatelli F, Sunyer J, Burney P and the European Community. Differences in incidence of reported asthma related to age in men and women. A retrospective analysis of the data of the European Community Respiratory Health survey. *Am J. Respir Crit Care Med* 2000; 162:68-74.
  27. Papageorgiou N, Gaga M, Marossis C, Reppas C, Avarlis P, Kyriakou M et al. Prevalence of asthma and asthma-like symptoms in Athens, Greece. *Respir Med* 1997; 91:83-88.
  28. Thole RT, Sallis RE, Rubin AL, Smith GN. Exercise-induced bronchospasm prevalence in collegiate cross-country runners. *Med Sci Sports Exerc* 2001;33(10):1641- 6. doi: 10.1097/00005768-200110000-00005.
  29. Abdurrahman MB, Taqi AM. Childhood bronchial asthma in Northern Nigeria. *Clin Allergy* 1982; 12: 379–38.