Self-Reported Risk Factors of Asthma in a Nigerian Adult Population

Nijerya Erişkin Populasyonda Olgular Tarafından Tanımlanan Astım Risk Faktörleri

Olufemi O. Desalu, Alakija K. Salami, Patrick O. Oluboyo

University of Ilorin Teaching Hospital, Department of Medicine, Ilorin, Nigeria

ABSTRACT

Introduction: The aim of the study was to establish the risk factors of bronchial asthma in a Nigerian adult population.

Materials and Methods: We conducted a cross-sectional study in Ilorin, Kwara State, Nigeria and selected 805 subjects from the study area by multi-stage cluster sampling. The European Community Respiratory Health Services (ECRHS) asthma-screening questionnaire was administered by trained assistants to collect demographic information, asthma symptoms in the preceding 12 months (Current asthma) and risk factors of asthma. The body weight (kg) and height (metre) were measured and the body mass index (BMI) was calculated. Odd ratio was calculated to determine the association between current asthma and risk factor of asthma.

Results: Current asthma in this study was 12.8%. Family history of asthma was the strongest risk factor of asthma in this study (OR=5.32), followed by allergic rhinitis (OR=5.29), outdoor pollutants (OR=3.51), tobacco smoking (OR=3.47), and indoor pollutants (OR=3.32), as well as a family history of allergic diseases (OR=2.38) and obesity (OR=1.87). Age, sex, educational achievement, home and socioeconomic status were not strong determinants of asthma (p>0.05). The majority of these identified factors were environmental factors with the exception of family history of allergy and asthma.

Conclusion: We identified family history of asthma, allergic rhinitis, outdoor pollutants and indoor pollutants, tobacco smoking and obesity as the risk factors of asthma. There is an urgent need to increase the awareness of the risk factors and promote preventive strategies to control the diseases.

(Tur Toraks Der 2009;10:56-62)

Key words: Asthma, risk factor, Nigerian

Received: 21. 08. 2008 Accepted: 17. 11. 2008

ÖZET

Giriş: Bu çalışmada Nijerya erişkin populasyonunda astım için risk faktörlerinin belirlenmesi amaçlandı.

Gereç ve Yöntemler: Çalışma Nijerya'nın Kwara eyaleti Ilorin bölgesinde kesitsel yöntemle yapıldı. 805 olgu çok basamaklı kesitsel yöntemle örneklendi. Avrupa Bölgesel Solunum Sağlığı Servisi (ECRHS) tarafından düzenlenen astım değerlendirme anketi; astım için risk faktörlerinin belirlenmesi, son 12 ay içerisinde görülen astım semptomlarının tanımlanması ve demografik özelliklerin toplanması için, konusunda deneyimli asistanlar tarafından uygulandı. Vücut ağırlığı (kg) ve boy (metre) ölçüldü, vücut kitle indeksi (VKI) hesaplandı. Astımla ilişkili risk faktörlerinin belirlenmesi için "odds ratio" hesaplama yöntemi kullanıldı.

Bulgular: Bu çalışmada astım %12.8 oranındaydı. Aile öyküsü astım için en önemli risk faktörüyken (OR=5.32) allerjik rinit (OR=5.29), çevresel hava kirliliği (OR=3.51), tütün kullanımı (OR=3.47), ev içi risk faktörleri (OR=3.32) ve obezite (OR=1.87) diğer önemli risk faktörleri arasında yer alıyordu. Yaş, cinsiyet, eğitim, çevre ve sosyoekonomik koşullar astım için belirleyici değildi (p>0.005). Astım için tanımlanan aile öyküsü dışında kalan risk faktörlerinin büyük kısmını çevresel faktörler oluşturmaktadır.

Sonuç: Bu çalışmadan aile öyküsünün, alerjik rinitin, çevresel hava kirliliğinin, ev içi risk faktörlerinin, tütün kullanımının ve obezitenin astım için önemli risk faktörleri olduğu görüldü. Astımla ilgili risk faktörlerinin farkındalığının artırılması ve hastalık kontrolü için koruyucu önlemlerin alınması acil ve önemli bir gerekliliktir.

(Tur Toraks Der 2009;10:56-62)

Anahtar sözcükler: Astım, risk faktörleri, Nijerya

Geliş Tarihi: 21. 08. 2008 Kabul Tarihi: 17. 11. 2008

INTRODUCTION

Asthma is currently one of the world's most common long-term conditions; the disease may affect as many as 300 million people worldwide, a number that could increase further by another 100 million by the year 2025 [1]. The increasing prevalence of asthma, frequency of hospital admission and asthma related mortality have led to a great concern about the medical and social costs of this disease [1]. The prevalence and incidence of asthma throughout Africa have increased remarkably in recent

Address for Correspondence / Yazışma Adresi: Olufemi O. Desalu, University of Ilorin Teaching Hospital, Department of Medicine, Ilorin, Nigeria
Phone: +23408035025771 E-mail: femuy1967@yahoo.co.uk

years, although the condition was previously uncommon over most parts of the continent [1].

Asthma is a heterogeneous disease that results from genetic and environmental causes, and although genetics is an important determinant of asthma, environmental causes undoubtedly contribute to its expression [1,2]. The common denominator underlying the pathogenesis of asthma is bronchial hyperresponsiveness and atopy is the commonest risk factor for asthma development; others are air pollution, respiratory infection, obesity, family size, occupation, as well as tobacco smoking and drugs [1,2]. There is no agreed consensus on defining asthma and the method of diagnosing asthma in a population study and this often makes comparison of data from different countries impossible [3]. The clinical and epidemiological diagnosis of asthma sometimes involves the use of immunological methods such as IgE measurement and skin test, which might be expensive and impossible in a field survey in the low-income countries. Simple and cost-effective tool like a questionnaire which is not cumbersome for a trained fieldworker to administer; can still be enough for getting information on the epidemiology of asthma. A good knowledge of asthma may help to draw up suitable environmental preventive measures in an individual and in the community. Most of the studies on risk factors of asthma in Africa and elsewhere were carried out in children [4-7]. Although the majority of the asthmatics develop the illness in childhood, there are some differences in their clinical presentation from adult asthma [8]. There are few studies on the risk factors of asthma in adults in sub-Saharan Africa. The aim of this study was to establish self-reported risk factors of bronchial asthma in the Nigerian adult population.

MATERIALS AND METHODS

This was a descriptive cross-sectional study of the individuals between the ages of 18 to 65 years in the communities that make up Ilorin local councils in Kwara State Nigeria from January 2006 to April 2006. The University of Ilorin Teaching Hospital ethics and research committee approved the study. The participating subjects gave verbal consent to take part in the study. The calculated minimum sample size was =384, which was increased to have a true representation of the study population. We divided the study area into clusters, which have the same degree of urbanization and are socio culturally homogeneous, based on equality and homogeneity of the clusters, and a multi stage- cluster sampling method was adopted for sample selection in this study. Subjects in selected households who met the inclusion criteria: ages 18 to 65 years, lived in the study area for the preceding 12 months and gave their consent were enrolled to the study.

The designated trained assistants interviewed the subjects and administered the modified European Community Respiratory Health Survey (ECRHS) questionnaire face to face, to obtain demographic information, asthma symptoms and medications, and risk factors of asthma.

Definitions

Asthma in this study was defined as two or more asthma symptoms in the preceding 12 months (current asthma).

Statistical analysis

The data were analysed using SSPS Version 14 computer statistical software. Descriptive and frequency statistics were produced to examine the characteristics of the representative sample of this study population. Chi-square test was used to test the statistical significance. P value of 0.05 or less was taken as statistically significant. Odd ratio was used to determine the association between the risk factors and asthma in the study population. Bar chart was used for illustration

RESULTS

Demographic characteristics of the study population

Eight hundred and five subjects participated in the study, of whom 498 (61.9%) were males and 307(38.1%) were females. The demographic characteristic of the study population is shown in Table 1. The mean age of the study population was 32.98±9.78years.

Respiratory symptoms reported by the study population

Table 2 shows that nasal allergy was the commonest reported respiratory symptom 250 (31.1%), while nocturnal cough 217 (27.0%) was the commonest asthma symptom among the subjects, followed by wheezing 136 (16.9), chest tightness 127 (15.8%); and breathlessness, 69 (8.9%). The use of asthma medication such as inhalers and oral tablets was reported in 34 (4.2%) of the subjects in the study.

Table 1. Demographic characteristics of the study population

Characteristics	Frequency	Percentage (%)
Sex		
Male	498	61.9
Female	307	38.1
Age (distribution in years)		
<20	35	4.3
20-29	283	35.2
30-39	278	34.5
40-49	157	19.5
50-59	36	4.5
60+	16	2.0
Education		
None/Arabic/Primary education	233	28.9
Secondary	346	43.0
Undergraduate	95	11.8
Graduate/postgraduate	131	16.3
Occupation		
Housewife/unskilled/Unemployed	430	53.4
Professional	109	13.5
Intermediate	107	13.3
Skilled non manual	74	9.2
Skilled manual	85	10.6

N=805

Self-reported prevalence of current asthma

In this study, current asthma is the presence of two or more symptoms of asthma in the preceding 12 months and 103 had two or more symptoms of asthma (where N= 805). Therefore current asthma in this study was 12.8%. Figure 1 shows the age distribution of current asthma in the Nigerian adult population. The majority of the asthmatics 37 (35.9%) were in the age range of 20-29 years, 29 (28.2%) were between 30-39 years, 25 (24.3%) between 40-49 years while 2 (1.9%) were in age 60-65 years.

Prevalence of risk factors for asthma

Table 3 shows the prevalence of risk factors of asthma in the study population. One hundred and forty subjects (17.9%) reported to have smoked tobacco in their lifetime, 250 (31.1%) had a history suggestive of atopy (nasal allergies), 59 (7.3%) had a family history of asthma, 71 (8.8%) had a family history of allergic disease and 79 (9.8%) had obesity.

The multivariate analysis revealed that family history of asthma and allergic diseases, history of allergic rhinitis (atopic disease), tobacco smoking, recurrent (≥3 per week) exposure to outdoor pollutants, indoor pollutants and house dust were strongly correlated with current asthma. Obesity was also associated with the development of current asthma, as shown in Table 4.

DISCUSSION

This is a pioneer study on the risk factors of asthma in an adult population of Nigeria, Nigeria is a poor resource country and the most populous black nation in the world. The family history of asthma was the strongest risk factor of current asthma in this study, and subjects with a family history of asthma were five times (OR=5.32) more likely to have asthma than those without a family history of asthma. Our findings confirms the observation of other studies in Poland, China, Finland and south Bavaria as well several other countries [6-10], where the family history of asthma was the strongest risk factor of asthma. The geographical variation in asthma risk may be due to different case definitions of asthma and risk factors adopted, as well as the age groups of

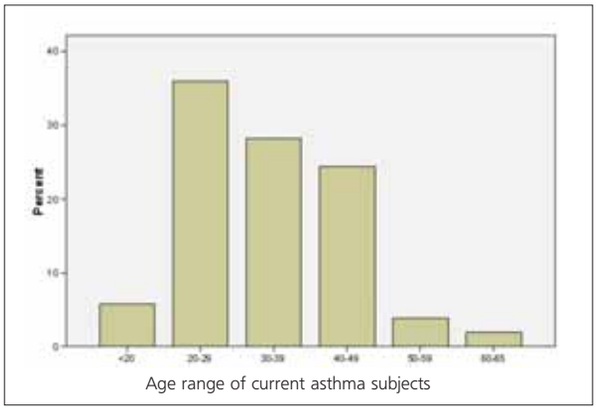

Figure 1. Age range distribution of current asthma

Table 2. Reported respiratory symptoms and medications in the study population

Respiratory symptoms	Frequency	Percentage
Nasal allergy/rhinitis	250	31.1
Nocturnal cough	217	27.0
Wheezing	136	16.9
Chesttightnees	127	15.8
Breathlessnees	69	8.9
Medications	34	4.2

Table 3. Reported risk factors of asthma in the study population

Asthma risk factor	Frequency	prevalence
Family history of asthma	59	7.3
Family history of allergic disease	71	8.8
Tobacco smoking	144	17.9
Allergic rhitinis	250	31.3
Obesty	79	9.8

N=805

the studied population. The association of family history with asthma was said to be partly due to genetic causes, similar lifestyles and environmental exposure in family members [9,11]. Asthma is one of the inheritable condition in which the pathogenesis and treatment outcome involved several genes, of which chromosomes 5q and 11 are the most important. Unfortunately, the search for a specific gene (or genes) involved in the susceptibility to atopy or asthma from many studies so far have been inconsistent [12,13]. The prevalence of allergic rhinitis, which is an atopic condition, was 31.3%. This prevalence was similar to 31.4% reported in Kenya in East Africa [14] and 31.5% in Turkey [15]. In this study, atopic subjects (allergic rhinitis) were five times (OR=5.29) more likely to develop asthma symptoms than non-atopic subjects. The risk of developing asthma in subjects having allergic rhinitis in our study was similar to findings reported among adults in the USA (OR=5.45), and Melbourne, Australia (OR=5.9), and was also a more than four fold risk reported in Turkey (OR=3.45), however less than ten fold in Spain (OR=10.2) and (OR=12.3) in India [15-19]. Allergic rhinitis (AR) was second to family history of asthma as a risk factor of asthma in this study, unlike in several childhood and adolescent studies, where an atopic condition like (AR) was the strongest risk factor of asthma. The predominance of family history of asthma over allergic rhinitis (AR) may be attributed to the fact that the atopic condition primarily affects children and young adults, peaks during the teenage years and decreases thereafter. We also determined the association of outdoor pollutantz (traffic related smokes and black smokes) with the development of asthma. There was enough evidence to suggest that air pollutants such as ozone and particulate matters decrease lung function, trigger exacerbations of asthma and increase rates of hospitalization for asthma (20). Our study shows that

Table 4. Multivariate logistic analysis of risk factors associated with asthma

Risk factors	N	Asthmatics	OR	C.I	P value
Age range					
<40	657	83	1.00		
>40	149	20	1.08	0.64-1.83	0.77
Sex					
Male	498	68	1.00		
Female	307	35	0.81	0.53-1.20	0.35
Education attainments					
Lower	579	80	1.00		
Higter	226	23	0.71	0.43-1.16	0.17
Socioeconomic status					
Lower	646	64	1.00		
Higter	159	24	1.28	0.78-2.09	0.33
Residence					
Single room	553	76	1.00		
Apartment	227	27	0.75	0.47-1.20	0.23
Ever smoked					
No	661	64	1.00		
Yes	144	39	3.47	2.21-5.43	<0.01
Family history of asthma					
No	746	80	1.00		
Yes	59	23	5.32	3.00-9.43	<0.01
Family history of asthma					
No	743	86	1.00		
Yes	71	17	2.38	1.32-4.28	<0.01
Nasal allergy					
No	555	36	1.00		
Yes	250	75	5.29	3.40-8.20	<0.01
İndoor pollutants					
No	751	87	1.00		
Yes	54	16	3.22	1.73-6.02	<0.01
Outdoor pollutants					
No	793	99	1.00		
Yes	12	4	3.51	1.04-11.86	<0.01
Obesty					
No	79	16	1.00		
Yes	726	87	1.87	1.03-3.38	<0.04

N=Total number of respondetns (=805)
OR=Odd ratio,C.I=Confidence invertal
Referenced OR=1.00

the frequent exposure (> 3 times/ week) to outdoor pollutants were four times more closely associated with the development of asthma (OR=3.52). A few studies have shown that living close (50-100metres) to a motorway was associated with the development of wheezing in children, but not bronchial hyper-responsiveness [21-23]. Our results revealed a significant relationship between exposure to air pollution and increased risk of asthma, agreeing with reports of studies done elsewhere [8, 24, 25]. Attempts made to study the contributions of air pollution level to asthma development in France and in Germany after the reunification of West and East Germany, found no significant contribution towards increase prevalence of asthma [26, 27]. The role of air pollution in early pathogenesis and development of asthma is weak and remains controversial [28]. Apart from outdoor pollutants, there was a strong association between asthma and frequent exposure (>3times/ week) to indoor pollutants from cooking gases, emission from stoves ,biomass gases (firewood), cooking oil and insecticides aerosol (OR=3.22). The risk of developing asthma in those exposed to indoor pollutants in our

study was greater than the result reported for childhood asthma in Nigeria (OR=0.6), in India (OR=0.8-1.0) and Poland (OR=0.95) [8,19,29]. The use of biomass gas has been associated with the development of respiratory symptoms suggestive of obstructive airway disease in the females [30,31]. The majority of epidemiologic studies of asthma studies worldwide did not address all the indoor pollutants associated with asthma, hence there were insufficient data on the role of indoor pollutants in the prevalence of asthma. The role of other indoor co-variables like dampness and mouldy growth that were not evaluated in this study, need to be taken into consideration and given adequate attention in future studies. The prevalence of smoking at any time among the respondents was 17.9%, asthma symptoms were closely linked to tobacco smoking, subjects who had ever used tobacco were four times more likely to develop asthma (OR=3.47) compared to none smokers. Our results is consistent with other studies in the USA, Australia, Brazil, India and Europe [16,17,19,32,33], but some other reports found no relationship between asthma and smoking [34-37]. Globally, several studies found environmental tobacco smoking to be strongly associated with the development of childhood [4,29,38,39] and adult asthma [40,41]. An important problem of population studies on smoking and asthma in the developing countries is distinguishing asthma from chronic obstructive pulmonary diseases. We were able overcome this problem by excluding smokers who presented with asthma like symptoms after the age of 40 years and whose sputum consistency and character were similar to that of chronic bronchitis. In our study, subjects with a family history of allergic disease apart from asthma were twice as likely to develop current asthma (OR=2.38). This study also found that subjects who reported allergy to dust were two times (OR=2.12) more likely to have asthma than those who reported no allergy. Although we did not carry out a skin prick test, several studies carried out in our environment and high income countries documented allergy to house dust mites as a common form of atopic sensitization [17,42,43]. A few years ago, dust mite exposure and sensitization in the first three of years of life were associated with a risk of childhood asthma, and this sensitization often depends on the concentration of dust mites in each atmosphere and frequency of exposure [44,45]. A recent intervention study however failed to show any association between infant exposure to dust mite allergens and development of asthma [46]. Obesity is excessive fat accumulation in body and is diagnosed when the body mass index is ≥30kg/m^2 in our study. Subjects who were obese were twice as likely to have current asthma (OR=1.87) compared to the non-obese subjects. This result was agrees with the observation of some studies in adults, where the prevalence of asthma increased with the body mass index (BMI) [16,47,48]. Few theories have supported the obesity related asthma development, one of which is that certain mediators such as leptins may affect airway function and development and that gastroesophageal reflux from obesity increases the likelihood of asthma [49-51]. Furthermore, body weight reduction in obese persons has been associated with improvement in the lung function [51]. Our data revealed that asthma was more common in subjects aged <40years, males, lower socioeconomic class, lower educational attainment and not living in an apartment, however these risk factors were not significantly associated with asthma ($P > 0.05$). These poor associations might be partially due to the awareness of the disease, degree of literacy of the subjects and poor memory recall of asthma like symptoms which was adopted as a case definition of asthma. The presence of asthma was strongly determined by a family history of asthma, family history of allergic diseases, nasal allergy which was suggestive of atopy, tobacco smoking and obesity as well as indoor and outdoor pollutants. These were the risk factors of bronchial asthma in this study population.

These risk factors of asthma were mostly environmental factors and they can be modified. By modifying these environmental factors, the risk of developing asthma and frequent asthma exacerbations could significantly reduced. The environmental control agency and government needs to formulate a strategic plan aimed at reducing both indoor and outdoor pollutants in the study area. Furthermore, the health practitioner should increase the awareness of the risk factor of the disease and promote asthma preventive measures to control its morbidity in the Nigerian adult population.

Acknowledgement

We, the authors, express our deep gratitude to the trained assistants for their patience and diligence during data collection.

REFERENCES

1. Global initiative for asthma (GINA): Burden report. Available at http://www.ginasthma.com. Accessed May 30, 2008.
2. McFadden ER jr. Asthma. In; Braunwald, Fauci, Kasper, Hauser, Longo, Jameson, eds. Harrison's Principle of Internal Medicine. 15th edition. New York: McGraw-Hill Companies Inc, 2001;1456-62.
3. David Duffy. Evaluation of asthma and allergy. Available at www.qimr.ed.au/DavidD/asthma/htm. Accessed May 30, 2008.
4. Dagoye D, Bekele Z, Woldemichael K, ,et al. Domestic risk factors for wheeze in urban and rural Ethiopian children. QJM 2004;97:489-98.
5. Rehana Majeed, Uzma D.M. Rajar, Naheed Shaikh, Farrukh Majeed and Aijaz A. Arian. Risk Factors Associated with Childhood Asthma. Journal of the College of Physicians and Surgeons Pakistan 2008;18:299-302
6. Dai. L. An analysis of the risk factors of child bronchial asthma. Zhonghua Liu Xing Bing Xue Za Zhi 1993;14:131-5.
7. Kotaniemi JT, Lundbäck B, Nieminen MM, et al. Increase of asthma in adults in northern Finland?-a report from the FinEsS study. Allergy 2001;56:169-74.

8. Liebhart J, Malolepszy J, Wojtyniak B, et al. Prevalence and risk factors for asthma in Poland: Results from the PMSEAD Study. J Investig Allergol Clin Immunol 2007;17:367-74.
9. Von Mutius E, Nicolai T. Familial aggregation of asthma in a South Bavarian population. Am J Respir Crit Care Med 1996;153:1266-72.
10. Burke W, Fesinmeyer M, Reed K, et al. Family history as a predictor of asthma risk. Am J Prev Med 2003;24:160-9.
11. Koppleman GH, Los H, Postma DS. Genetic and environmental in asthma: the answer of twin studies. Eur Respir J 1999;13:2-4.
12. Holloway JW, Beghe B, Holgate ST. The genetic basis of atopic asthma. Clin Exp Allergy 1999;29:1023-32.
13. Wiesch DG, Meyers DA, Bleecker ER. Genetics of asthma. J Allergy Clin Immunol 1999;104:895-901.
14. Esamai F, Anabwani GM. Prevalence of allergies, rhinitis and dermatitis in primary school in Uasin Gishu district Kenya. East Afr Med J 1996;73:474-8.
15. Yuksel H, Dinc G, Sakar A, et al. Prevalence and co-morbidity of allergic egzema, rhinitis, and asthma in a city in western Turkey. J Investig Allergol Clin Immunol 2008;18:31-5.
16. Arif AA, Delclos GL, Lee ES, et al. Prevalence and risk factors of asthma and wheezing among US adults: an analysis of the NHANES III data. Eur Respir J 2003;21:827-33.
17. Abramson M, Kutin JJ, Raven J, et al. Risk factors for asthma among young adults in Melbourne, Australia. Respirology 1996;1:291-7.
18. Sunyer J, Antó JM, Kogevinas M, et al. Risk factors for asthma in young adults. Spanish Group of the European Community Respiratory Health Survey. Eur Respir J 1997;10:2490-4.
19. Aggarwal AN, Chaudhry K, Chhabra SK, et al. Prevalence and risk factors for bronchial asthma in Indian adults: a multicentre study. Indian J Chest Dis Allied Sci 2006;48:13-22.
20. Tatum AJ, Shapiro GG. The effects of outdoor air pollution and tobacco smoke on asthma. Immunol Allergy Clin North Am 2005;25:15-30.
21. Van Vliet P, Knape M, de Hartog J, et al. Motor vehicle exhaust and chronic respiratory symptoms in children living near freeways. Environ Res 1997;74:122-32.
22. Venn AJ, Lewis SA, Cooper M, et al. Living near a main road and the risk of wheezing illness in children. Am J Respir Crit Care Med 2001;164:2177-80.
23. Nicolai T, Carr D, Weiland SK, et al. Urban traffic and pollutant exposure related to respiratory outcomes and atopy in large sample of children. Eur Respir J 2003;21:956-63.
24. Shima M, Nitta Y, Adachi M. Traffic-related air pollution and respiratory symptoms in children living along trunk roads in Chiba Prefecture, Japan. J Epidemiol 2003;13:108-19.
25. Guo YL, Lin YC, Sung FC, et al. Climate, traffic-related air pollutants, and asthma prevalence in middle-school children in Taiwan. Environ Health Perspect 1999;107:1001-6.
26. Von Mutius E, Martinez FD, Fritzsch C, et al. Prevalence of asthma and atopy in two areas of West and East Germany. Am J Respir Crit Care Med 1994;149:358-64.
27. Baldi I, Tessier JF, Kauffmann F, et al. Prevalence of asthma and mean levels of air pollution: results from the French PAARC survey. Pollution Atmospherique et Affections Respiratoires Chroniques. Eur Respir J 1999;14:132-8.
28. Effect of air pollution? Official statement of the American Thoracic Society. Am J Respir Crit Care Med 2000;161:665-7.
29. Fagbule D, Ekanem EE. Some environmental risk factors for childhood asthma: a case-control study. Ann Trop Paediatr 1994;14:15-9.
30. Jarvis D, Chinn S, Sterne J, et al. The association of respiratory symptoms and lung function with the use of gas for cooking. European Community Respiratory Health Survey. Eur Respir J 1998;11:651-8.
31. Jarvis D, Chinn S, Luczynska C, Burney P. Association of respiratory symptoms and lung function in young adults with use of domestic gas appliances. Lancet 1996;17:426-31.
32. Janson C, Anto J, Burney P, et al. The European Community Respiratory Health Survey: what are the main results so far? Eur Respir J 2001;18:598-611.
33. Macedo SE, Menezes AM, Knorst M, et al. Risk factors for asthma in adults in Pelotas, Rio Grande do Sul State, Brazil. Cad Saude Publica 2007;23:863-74.
34. Vesterinen E, Kaprio J, Koskenvuo M. Prospective study of asthma in relation to smoking habits among 14,729 adults. Thorax 1988;43:534-9.
35. Gulsvik A. Prevalence and manifestations of obstructive lung disease in the city of Oslo. Scand J Respir Dis 1979;60:286-96.
36. Higgins MW, Keller JB, Metzner HL. Smoking, socioeconomic status, and chronic respiratory disease. Am Rev Respir Dis 1977;116:403-10.
37. Sunyer J, Anto JM, Kogevinas M, et al. Smoking and bronchial responsiveness in non atopic and atopic young adults. Spanish Group of the European Study of Asthma. Thorax 1997;52:235-8.
38. Jaakkola MS. Environmental tobacco smoke and respiratory diseases. Annesi-Maesano, I., Gulsvik, A., and Viegi, G. eds. Eur Respir Mon 2000;15:322-83.
39. Cook DG, Strachan DP. Health effects of passive smoking-10: Summary of effects of parental smoking on the respiratory health of children and implications for research. Thorax 1999;54:357-66.
40. Leuenberger P, Schwartz J, Ackermann-Liebrich U. Passive smoking exposure in adults and chronic respiratory symptoms (SPALDIA Study). Am J Respir Crit Care Med 1994;150:1222-8.
41. Ng TP, Hui KP, Tan WC. Respiratory symptoms and lung function effects of domestic exposure to tobacco smoke and cooking by gas in non-smoking women in Singapore. J Epidemiol Community Health 1993;47:454-9.
42. Onadeko BO, Sofowora EO. Skin sensitivity test in Nigerians with bronchial asthma. Trans Royal Soc. Trop.Med Hyg 1979;73:269-71.
43. Monteiro B. Gininafon M. Agbodjogve A. Epidemiological study of adult bronchial asthma in Benin hospital environment. Allerg immunol (Paris) 1989;21:103-6.
44. Wahn U, Lau S, Bergmann R, et al. Indoor allergen exposure is a risk factor for sensitization during the first three years of life. J Allergy Clin Immunol 1997;99:763-9.
45. Sporik R, Holgate ST, Platts-Mills TA, Cogswell JJ. Exposure to house-dust mite allergen (Der p I) and the development of asthma in childhood. A prospective study. N Engl J Med 1990;323:502-7.
46. Simpson A, Custovic A. Allergen avoidance in the primary prevention of asthma. Curr Opin Allergy Clin Immunol 2004;4:45-51.

47. Shaheen SO, Sterne JA, Montgomery SM, Azima H. Birth weight, body mass index and asthma in young adults. Thorax 1999;54:396-402.
48. Camargo CA Jr, Weiss ST, Zhang S, et al. Prospective study of body mass index, weight change, and risk of adult-onset asthma in women. Arch Intern Med 1999;159:2582-8.
49. Shore SA, Fredberg JJ. Obesity, smooth muscle, and airway hyperresponsiveness. J Allergy Clin Immunol 2005;115:925-7.
50. Beuther DA, Weiss ST, Sutherland ER. Obesity and asthma. Am J Respir Crit Care Med 2006;174:112-9.
51. Schaub B, von Mutius E. Obesity and asthma, what are the links? Curr Opin Allergy Clin Immunol 2005;5:185-93.