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EVALUATION OF RISK FACTORS OF CHILDHOOD ASTHMA IN A TERTIARY CARE HOSPITAL OF BANGLADESH

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ABSTRACT

Background: *Asthma is the most common chronic disease in children and is the leading cause of childhood morbidity. The risk for asthma is associated with exposure to several environmental & genetic factors.*

Objective: *To determine the risk factors of childhood asthma.*

Study design: *Case control study.*

Place of the study and study period*: Pediatric Asthma Centre, Department of Pediatrics, Bangabandhu Sheikh Mujib Medical University (BSMMU), from Jan'09 to Dec'09.*

Materials: *This study was carried out among 100 subjects, out of which 50 were cases and 50 were controls, age ranging from 5 to 15 years. Cases were diagnosed asthmatic children as determined by a pediatric pulmonologist on the basis of history, physical examination and spirometry. Controls were 50 hospitalized children suffering from diseases other than asthma.*

Methods: *Each control was matched to each case by gender, age and residential area (urban or rural). For each study subjects, parents were interviewed by means of a semi structured questionnaire included items concerning several risk factors.*

Results: *Family history of asthma (mother- OR= 13.2, 95%CI 9.25-19.61; sibling/ relative- OR= 8.12, 95% CI 0.57-14.37), bronchiolitis in early life (OR= 32.55, 95%CI 13.5-52.7), exposure to food like hilsa fish, beef, egg, brinjal, prawn (OR= 13.67, 95%CI 2.91-31.66) and dust both indoor (house dust mites) and outdoor (OR= 42.67, 95% CI 3.27-57.53) and presence of atopic condition like allergic rhinitis (OR= 11.53, 95% CI 0.52-19.74) were significant risk factors in logistic regression analysis. Besides, household crowding (P= 0.027, OR= 2.47,95% CI 1.02-6.03), house dampness (P= 0.047, OR= 2.45, 95% CI 0.92-6.65), exposure to paternal smoking (P= 0.037, OR= 2.70, 95% CI 0.95-7.87) and atopic dermatitis (P= 0.002, OR= 5.06, 95% CI (1.55-17.54) were significantly associated with asthma (p<0.05) in univariate analysis in this study.*

Conclusion: In this study, family history of asthma, H/O bronchiolitis in early life, presence of atopic dermatitis and allergic rhinitis, dust and food allergy, household crowding, house dampness, and exposure to paternal smoking were found as risk factors of childhood asthma. Asthma in children can be prevented by raising awareness against these risk factors among general population.

KEY WORDS*: Asthma, Risk factors, Family history, Bronchiolitis, Allergic rhinitis.*

INTRODUCTION

Asthma is the commonest chronic childhood respiratory disease.[1] It is a chronic inflammatory disorder of the lower airways resulting in episodic airflow limitation and one of the leading causes of childhood morbidity.[2]A community-based study in a coastal area of Bangladesh on the prevalence of asthma showed high prevalence of childhood asthma (11.8%).[3] Another study revealed that the prevalence of asthma in children (5-14 years) was higher (7.3%) than in adults (5.3%). Around 7 million people including 4 million children suffer from asthma related symptoms in Bangladesh.[4] Over recent decades 42% reduction in asthma death rates worldwide between 1990 and 2013 because of the improved assessment and management of asthma by public health.[5] However, there is no therapeutic regimen that can cure asthma. Hence, it is necessary to gain a better understanding of the risk factors of asthma, and to develop alternative public health and pharmacological primary preventive measures that can effectively reduce the prevalence of asthma worldwide.[6]

Hereditary atopy, early exposure to protein antigens such as cow's milk or egg white, recurrent respiratory tract infections, indoor and outdoor environmental factors have significant association for the development of asthma.[7] The history of (H/O) pneumonia in early life is strongly associated with bronchial asthma.[8] Acute lower respiratory infections caused by respiratory syncytial virus (RSV) is associated with increased risk of subsequent allergic sensitization.[9] Asthma in rural areas is usually associated with some specific predisposing factors, such as agricultural dust, damp housing, emission of smoke during cooking, allergens from mammals, chicken, birds and arthropods, agricultural pesticides and insecticides .[10] There are very few studies in Bangladesh that attempted to explore the risk factors of childhood asthma. The identification of risk factors is essential for adaptation of preventive measures and sensitizing people in the community. Therefore, the aim of the study was to identify the risk factors of childhood asthma in a tertiary hospital in Dhaka, Bangladesh.

MATERIALS AND METHODOLOGY

The study was designed as a case-control study, performed during the period of jan'09 to Dec'09 in Pediatric Asthma Center, BSMMU, Dhaka, Bangladesh. Initially 70 cases were enrolled for this study. However, parents of 10 cases did not want to be included and we excluded another 10 cases for incomplete information as they came with distant relatives. So, finally total 50 eligible children (cases) were undertaken for this study. Cases were previously diagnosed patients of asthma as determined by a pediatric pulmonologist, aged 5- 15 years according to the "National Guidelines : Asthma , Bronchiolitis , COPD[11] on the basis of following criteria, clinical criteria : paroxysmal respiratory distress , recurrent cough (particularly night cough, night awaking cough, cough induced vomiting) , recurrent wheeze (3 or more episodes) ; laboratory criteria- pulmonary function test(PFT) : Spirometry showing obstructive defect and positive reversibility test . Child having

forced expiratory volume in the first second (FEV_1) < 80% of predictive value and FEV_1/ forced vital capacity (FVC) ratio <70%, with an improvement of FEV_1 by 12% and 200 ml over prebronchodilator level, 10 minutes after inhalation of 200µg of salbutamol diagnosed to have bronchial asthma. When spirometry could not be performed, in addition to clinical criteria, family history or concomitant atopic illness, exclusion of other differential diagnoses and finally, improvement on therapeutic trial were considered for diagnosis. Spirometry was done in 30 cases age above 8 years. However, it could not be performed in 20 cases in following situations- children below 8 years, parents did not give consent and for financial constraint. Children presented with wheeze due to other causes (Cystic fibrosis, TB, etc.) were excluded. Each control was matched to each case who was admitted in paediatric ward immediately after selection of index case suffering from disease other than asthma. Inclusion criteria for controls were having same age, sex and residential area. Controls were not previously diagnosed as asthma, no history of atopic diseases, no asthma symptoms such as wheezing, cough, etc. Purposive, non- probability sampling was done for convenience. Samples were selected without any random allocation.

Once the parents gave consent for participation in the study, they were interviewed by means of a structured questionnaire. Information were also collected from the previous medical records that were available to the parents. A member of the research team completed the data sheet. Questionnaire included both open and closed. Name, age, sex, address, presenting complaints, diagnosis (type of asthma), age of diagnosis and date of history taking were included in open questionnaire. Closed questionnaire included items concerning residential area, monthly income, birth history(term, 37 completed weeks/ preterm< 37 weeks), birth weight(normal>2500 gm/ low birth weight<2500 gm) , birth order, parental asthma, family history of asthma (sibling or relative), parental education (more than high school), house dampness, household crowding, exclusive breast feeding (up to 6 months), passive smoking (either father or mother or other family members who live in same house, used to smoke within the room and household environment), allergy to food (commonly hilsa fish, beef, egg, brinjal, prawn) and dust (indoor or outdoor), H/O bronchiolitis, atopic dermatitis, allergic rhinitis & conjunctivitis.

OPERATIONAL DEFINITIONS [11]

Intermittent asthma: Two or less than two nocturnal symptoms in a month. Between the episodes, patient is symptom free and PFT is normal.

Mild persistent asthma: Nocturnal attack of dyspnea more than 2 times per month and baseline PEFR or FEV_1 is usually <80% to 65% of predicted value.

Moderate persistent asthma: Almost daily attack of dyspnea and baseline PEFR or FEV_1 <65% to 50% of predicted value.

Severe persistent asthma: Dyspnea to some extent continuously for 6 months or more and baseline PEFR or FEV1 is < 50% of predicted value.

Acute exacerbation: Loss of control of any class or variant of asthma, which may cause mild to life threatening attack.

Cough variant asthma: Chronic cough frequently occurs at night and sputum eosinophilia, but without the abnormalities of airway function seen in asthma.

Bronchiolitis: Child below 2 years, respiratory distress associated with wheeze preceded by runny nose.

Allergic rhinitis: It is characterized by nasal irritation, sneezing, rhinorrhea and nasal blockage due to exposure to an inhaled allergen.

Atopic dermatitis: It is characterized by dryness of skin, intense itching and thickening or lichenification with excoriation, persists at least 6 months or more with wax and wane.

Allergic conjunctivitis: It is characterized by sudden lacrimation with itchy, red eyes, after exposure to pollen or allergen, usually associated with rhinitis.

Measurement of house dampness in this study relied on self- reporting and therefore, was subjective. Dampness was assessed by house age, foundation type, cladding type, shading of house, frequency of ventilation through open windows, presence of air conditioners, fans, water intrusion, condensation, visible mold growth and less exposure to sunlight.[12]

Finally, data were expressed as mean ± standard deviation for continuous variables. Proportions where compared, using Chi-square test for contingency tables. A logistic regression analysis of risk factors for disease was performed, using SPSS, version 16.0. $P<0.05$ was consider statistically significant.

RESULT

Socio-demographic characteristics of 50 cases and 50 controls are shown in Table- 1. A control was matched to each case by age, gender & residential area. Mean age was 8.4±3.3 years and 70% were male in both case and control group. In cases, 72% and in controls, 56% had monthly income between 5000 to 15,000 Tk. Most of the subjects were born at term with normal birth weight in both groups.

Table-II depicted distribution of cases according to classification of asthma. Mild persistent asthma (46.0%) was most common followed by intermittent asthma (40.0%), acute exacerbation of bronchial asthma (6%), severe persistent asthma (4%), moderate persistent and cough variant asthma 1% each.

Maternal asthma (P= 0.016, odds ratio OR= 4.04, 95% CI 1.10- 16.17), asthma in sibling or relatives (P= 0.001, OR= 5.52, 95% CI 2.08-14.96), household crowding (P= 0.027, OR= 2.47, 95% CI 1.02-6.03), house dampness (P= 0.047, OR= 2.45, 95% CI 0.92-6.65), exposure to paternal smoking (P= 0.037, OR= 2.70,95% CI 0.95-7.87), Allergy to food (P= 0.001, OR= 17.38, 95% CI 3.52-116.06) and dust

(P= 0.001, OR= 42.67,95% CI 8.55-287.76) were significant risk factor in our study (Table- III).

H/O bronchiolitis in early life (P= 0.001, OR= 14.71, 95%CI 2.97 – 98.56), presence of atopy like atopic dermatitis (P= 0.002, OR= 5.06 ,95% CI 1.55-17.54) and allergic rhinitis (P= 0.001, OR= 6.77, 95% CI 2.24-21.44) were also found as risk factors (Table-IV)

In logistic regression analysis maternal asthma (OR= 13.2, 95% CI 9.25 – 19.61), asthma in sibling and relatives (OR= 8.12, 95% CI 0.57-14.37), food allergy (OR=13.67, 95% CI 2.91-31.66), dust allergy (OR= 42.67, 95% CI 3.27-57.53), H/O bronchiolitis (OR= 32.55, 95% CI 13.5-52.7), allergic rhinitis (OR= 11.53, 95% CI 0.52- 19.74) were significantly associated with asthma (Table- V).

Table- I: Socio-demographic status of case and control groups

Variables	Case (n=50) N (%)	Control (n=50) N (%)
Age (years)		
5 -10	34 (68)	34 (68)
11-15	16 (32)	16 (32)
Mean±SD	8.4±3.3	8.4±3.3
Range	(5-15)	(5-15)
Sex		
Male	35 (70)	35 (70)
Female	15 (30)	15 (30)
Residential area		
Urban	25 (50)	25 (50)
Rural	25 (50)	25 (50)
Monthly income		
<5000	13 (26)	22 (44)
5000-15000	36 (72)	28 (56)
>15000	01 (02)	0 (0)
Birth History		
Preterm	05 (10)	6 (12)
Term	45 (90)	44 (88)
Birth Weight		
≥2500 gm	36 (72)	42 (84)
<2500 gm	14 (28)	08 (16)
Birth Order		
1-2	36 (72)	30 (60)
3-5	14 (28)	20 (40)
Birth Spacing		
≥24 months	34 (68)	44 (88)
<24 months	16 (32)	06 (12)

Table- II: Classification of asthma in the cases (n=50)

Classification	Number of Subject (%)
Mild persistent asthma	23 (46)
Intermittent asthma	20 (40)
Acute exacerbation of bronchial asthma	03 (06)
Severe persistent asthma	02 (04)
Moderate persistent asthma	01 (02)
Cough variant asthma	01 (02)

Table- III: Comparison of the variables associated with asthma among case and control subjects

Variables	Case (n=50) N (%)	Control (n=50) N (%)	P value	OR (95% Cl)
H/ O asthma				
Mother	13 (26)	04 (8)	0.016	4.04 (1.10-16.17)
Father	04 (8)	02 (4%)	0.399	2.09 (0.31-17.36)
Sibling or relatives	29 (58)	10 (20)	0.001	5.52 (2.08-14.96)
Parental education (more than high school)				
Father	26 (52)	25 (50)	0.841	1.08(0.46-2.56)
Mother	26 (52)	23 (46)	0.548	1.27(0.54-3.01)
Household crowding (people/room)				
Present	28 (56)	17 (34)	0.027	2.47(1.02-6.03)
House dampness	19 (38)	10 (20)	0.047	2.45(0.92-6.65)
Passive smoking				
Father	17 (34)	08 (16)	0.037	2.70 (0.95-7.87)
Other member	05 (10)	12 (24)	0.062	0.35 (0.10-1.21)
Maternal smoking during pregnancy	04 (8)	01 (2)	0.168	4.26(0.42-103.95)
Exclusive breast feeding (6 months)	30 (60)	32 (64)	0.680	0.84 (0.35-2.05)
Allergy to				
Food	21(42)	02 (4)	0.001	17.38 (3.52-116.06)
Dust	32 (64)	02 (4)	0.001	42.67 (8.55-287.76)

Table- IV: Comparison of the variables associated with asthma among case and control subjects

Variables	Case (n=50) N (%)	Control (n=50) N (%)	P value	OR (95% Cl)
H/O bronchiolitis	19 (38)	02 (4)	0.001	14.71(2.97-98.56)
H/O atopic dermatitis	18 (36)	05 (10)	0.002	5.06 (1.55-17.54)
H/O conjunctivitis	23 (46)	10 (20)	0.005	3.41(1.29-9.16)
H/O allergic rhinitis	24 (48)	06 (12)	0.001	6.77 (2.24-21.44)

Table- V: Risk factors analysis for asthma (multiple logistic regression models) (n=100)

	B	S.E	Df	Sig	OR	95% CI for OR	
H/O asthma						**Lower**	**Upper**
Mother	2.58	1.85	1	0.016	13.2	9.25	19.61
Father	-7.98	6.86	1	0.636	0.00	0.0	16.74
Family H/O asthma (sibling/relatives)	2.09	1.34	1	0.012	8.12	0.57	14.37
Allergy							
Food	2.61	1.12	1	0.021	13.67	2.91	31.66
Dust	3.75	0.78	1	0.001	42.67	3.27	57.53
H/O bronchiolitis	3.48	0.99	1	0.001	32.55	13.5	52.7
H/O atopic dermatitis	-2.34	2.43	1	0.336	0.096	1.65	2.60
H/O conjunctivitis	-20.49	0.42	1	0.997	0.00	1.50	12.37
H/O allergic rhinitis	2.44	0.64	1	0.001	11.53	0.52	19.74

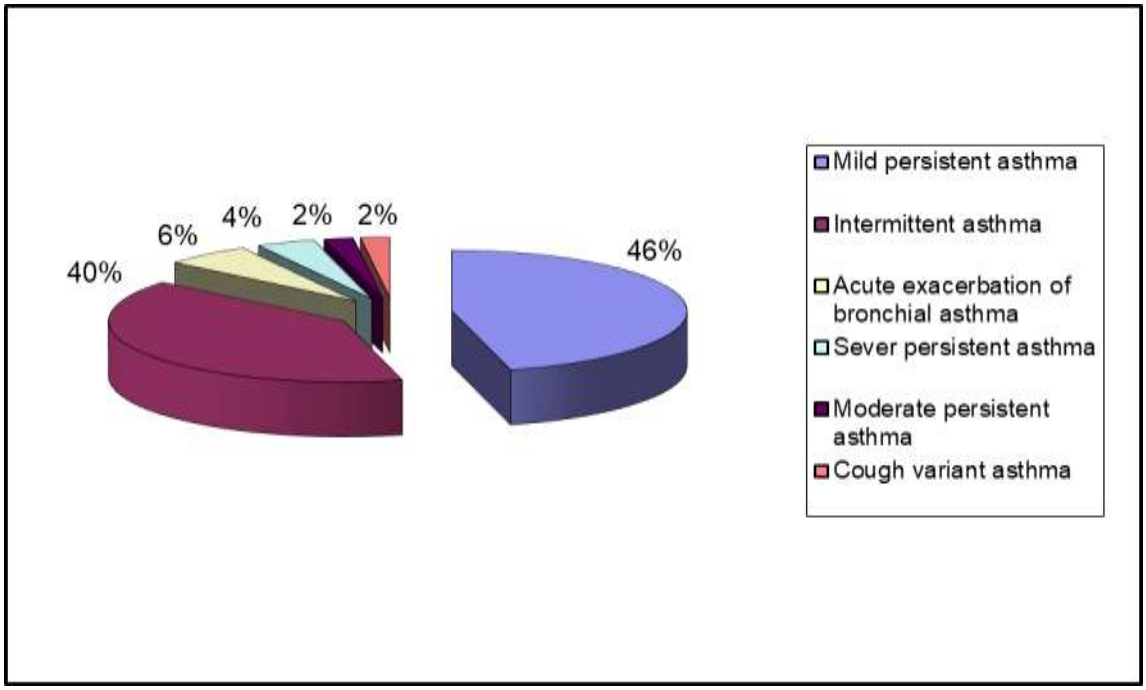

Figure1: Pie diagram showing types of asthma of the cases(n=50)

DISCUSSION

This case control study was conducted to evaluate the risk factors of childhood asthma, demonstrated that family H/O asthma, household crowding, house dampness, exposure to passive smoking, food and dust (indoor/outdoor) allergy, H/O bronchiolitis, allergic rhinitis and atopic dermatitis were the risk factors.

However, there were certain limitations of present study. It was a single center hospital-based study at a tertiary care hospital and the sample size was small to determine the significant association of certain factors. Evaluation of the risk factors in this study was completely based on history, face to face interview from parents and no laboratory evidence was utilized such as skin prick allergy test.

Genetic predisposition is an important component of asthma risk. Family history increases the risk of asthma to a child. Multiple loci across many chromosomes have been related with asthma.[13]The heterogeneity of asthmatic phenotypes make it difficult to fully define the disease at the genetic level.[14] The improved understanding of genetic and environmental interactions will provide opportunities for targeted therapy to reduce the risk of developing asthma.[15] Association between childhood asthma and parental asthma was found in several studies.[16] Maternal asthma and asthma in sibling or relatives had significant association with childhood asthma in this study. A study on asthma in rural Bangladeshi children done by Zaman et al also showed maternal and paternal asthma as risk factors.[17]Yahya et al, Sheikh et al, Waheed et al further revealed that 47%, 50% and 66% of asthmatic children having positive family history respectively. [18,19,20]

Respiratory syncytial virus and rhinovirus infection causing wheeze related respiratory tract illnesses in infancy are associated with increased risk of subsequent childhood asthma.[21] Viral infection provokes wheezing in a susceptible infant with abnormal lung physiology and atopic sensitization.[22] Respiratory syncytial virus bronchiolitis is common in Bangladesh.[23]A study by Hassan et al. showed that early childhood lung infections like pneumonia, bronchiolitis were the risk factors in both metropolitan and coastal areas of Bangladesh.[24]Even similar positive association was reported between infections and asthma from Western Sydney.[25] Our result also found similar association between bronchiolitis and asthma. Recent study showed that pertussis infection has been positively linked to asthma development.[26] Atopic conditions like allergic rhinitis and atopic dermatitis were the risk factors in our study. Hassan et al. also found significant association of all three atopic conditions with asthma. [4] Other authors further reported that atopic dermatitis [27], allergic rhinitis and allergic conjunctivitis[28] to be associated with asthma.

Exposure to dust (indoor/outdoor) was significantly associated with asthma in present study. It was found that house dust mite had positive association with asthma in children.[29] Traffic exposure is also associated with asthma symptoms in childhood.[30] Outdoor air pollution might impair lung growth,[31] and thereby increases the risk of poor asthma control and exacerbation of symptoms.[32] Stephenjet et al[33] and Pragalatha et al[34] showed that 79% and 61% asthmatic children had dust exposure respectively. A complex relationship exists between various dietary factors and asthma risk. Mother-reported allergy to certain food items (commonly hilsa fish, beef, egg, brinjal, prawn) was observed in present study that was statistically significant. However, we did not perform any skin prick test for allergy. A negative association has been identified with

consumption of fruit and vegetables, and a positive association with fast foods, salt and trans fatty acid intake in previous study.[35,36] Asthma risk is associated with exposure to paternal smoking during childhood.[15] Present study also reflected the similar finding. Waheed et al. mentioned 36.5% asthmatic had exposure to cigarette smoke.[20]

In high income countries inverse association was found between family size and childhood asthma. However, there is a greater severity of asthma symptoms in larger families .[37] But our result is not consistent with this observation, contradicting "hygiene hypothesis". Previous study in Bangladesh showed that, children living in small families (three or less people) were more likely to suffer from asthma. An inverse relationship between sibship size and atopy formed the basis of "hygiene hypothesis". [38] Household crowding had positive association with childhood asthma in this study probably due to small sample size. High risk of asthma symptoms is seen in children exposed to dampness and visible mould in home environments.[39] House dampness was also a risk factor for asthma development in our study. Breastfeeding reduces the risk of asthma in young children, regardless of its duration.[40] A study in Australian children found that exclusive breast feeding for longer than 4 months was protective against asthma, wheezing and atopy.[41] Majeeb et al. showed that absence of exclusive breast feeding was associated with development of asthma.[42]But we did not find any positive association when compared with control group. Asthma is more prevalent in boys until the age of 13 years, after which it is more prevalent in girls. Complex biological mechanisms cause sex-associated differences in asthma prevalence .[43] In our study 70% cases were male with mean age 8.4+/-3.3.

Several other studies revealed that pre-term (<37 weeks), low birthweight (<2·5 kg) and high infant weight gain (>600 g/month) are associated with subsequent development of asthma in childhood.[44] Caesarean section is one of the important risk factors found to be associated with asthma.[45] Both pre-natal and post-natal maternal stress are associated with increased risk of childhood asthma probably by changing the course of healthy lung development.[46] Intake of antibiotics and paracetamol in last 12 months were observed to be the risk factors in both metropolitan and coastal area of Bangladesh by Hassan et al.[4] However, we did not evaluate these factors in our study.

CONCLUSION

In conclusion, family H/O asthma, H/O bronchiolitis, allergic rhinitis, atopic dermatitis, allergy to food and dust, household crowding, house dampness and exposure to paternal smoking were found as common risk factors for the development of childhood asthma. Preventive strategies should be based on public awareness, sensitizing people and proper education regarding these risk factors.

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