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"Childhood Asthma in Bangladeshi Children: A Study in a Tertiary Care Level Hospital, Dhaka, Bangladesh"

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Abstract:
Background: *Asthma is the most common chronic disease in children and is the leading cause childhood morbidity. The risk for asthma is associated with exposure to several environmental & genetic factors.*
Aim and objective*: Aim of the study was to determine the risk factors of childhood asthma*
Methods and Materials*: This descriptive case control study was conducted in the Department of Pediatric Respiratory Medicine (Pulmonology), Dhaka Shishu (Children) Hospital, Dhaka, Bangladesh.During the period from January 2018 to December 2018, which included 350 children where 175 was cases and 175 was controls Group. This study was carried out among 350 subjects, out of which 175 were cases and 175 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 were175 hospitalized children suffering from diseases other than asthma.Each control was matched to each case by gender, age and residential area (urban or rural). For each study subject, parents were interviewed by means of a semi structured questionnaire included items concerning several risk factors.*
Results: *Family history of asthma (mother- OR= 46.2, 95%CI 32.37-68.63; sibling/ relative- OR= 28.42, 95% CI 1.99-50.29), bronchiolitis in early life (OR= 113.92, 95%CI 47.25-184.45), exposure to food like hilsa fish, beef, egg, brinjal, prawn (OR= 47.84, 95%CI 10.18-110.81) and dust both indoor (house dust mites) and outdoor (OR= 149.34, 95% CI 11.44-201.35) and presence of atopic condition like allergic rhinitis (OR= 40.35, 95% CI 1.82-69.09) were significant risk factors in logistic regression analysis. Besides, household 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 generalpopulation.*
Key word*: Asthma, Risk factors, Family history, Bronchiolitis, Allergic rhinitis.*

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I. Introduction

Childhood asthma is the most common 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 asthmaworldwide.[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 usuallyassociated 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.

II. Objectives

General objective:

- To determine the possible risk factors associated with Childhood Asthma in Bangladesh.

Specific Objectives:

- To assess the types of Childhood Asthma among patients in Bangladesh.
- To identify the possible risk factors associated with Childhood Asthma in Bangladesh.

III. Methodology and Materials

This descriptive study was conducted in the Department of Pediatric Respiratory Medicine (Pulmonology), Dhaka Shishu (Children) Hospital, Dhaka, Bangladesh during the period from January 2018 to December 2018, which included 350 children where 175 were cases and 175 were controls Group. So, finally total 175 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 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 140 cases age above 8 years. However, it could not be performed in 35 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 randomallocation.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.

IV. Results

Socio-demographic characteristics of 175cases and 175 controls are shown in Table I. 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 bothgroups.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 siblingcorrelatives (P= 0.001, OR= 5.52, 95%CI 2.08-14.96),household crowding (P= 0.027, OR= 2.47, 95%CI1.02-6.03), 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%CI0.95-7.87),Allergytofood(P=0.001,OR=17.38,95%CI3.52-116.06)anddust(P= 0.001, OR= 42.67,95% CI 8.55-287.76) weresignificant 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% CI1.55-17.54) and allergic rhinitis (P= 0.001, OR= 6.77, 95% CI 2.24-21.44) were also found as risk factors (TableIV)In logistic regression analysis maternal asthma (OR=46.2,95%CI32.37–68.63),asthmainsiblingand relatives (OR= 28.42, 95% CI 1.99-50.29), food allergy (OR=47.84, 95% CI 10.18-110.81), dust allergy (OR= 149.34, 95% CI 11.44-201.35), H/Obronchiolitis(OR=113.92 , 95% CI 47.25-184.45), allergic rhinitis(OR=4.35, 95% CI 1.82- 69.09) were significantly associated with asthma (Table-V).

Table- I: Socio-demographic status of case and control groups.(n=350)

Variables	Case (n=175)N (%)	Control (n=175)N (%)
Age (years)		
5 -10	119 (68)	119 (68)
11-15	56(32)	56 (32)
Mean±SD	8.4±3.3	8.4±3.3
Range	(5-15)	(5-15)
Sex		
Male	123 (70)	123 (70)
Female	52 (30)	52 (30)
Residential area		
Urban	175 (50)	175 (50)
Rural	175 (50)	175 (50)
Monthly income		
<5000	46 (26)	77 (44)
5000-15000	128 (72)	98 (56)
>15000	01 (02)	0 (0)
Birth History		
Preterm	18 (10)	21 (12)
Term	157 (90)	154 (88)
Birth Weight		
2500 gm	126 (72)	147 (84)
<2500 gm	49(28)	28 (16)
Birth Order		
1-2	126 (72)	105 (60)
3-5	49 (28)	70 (40)
Birth Spacing		
24 months	119 (68)	254(88)
<24 months	56 (32)	21 (12)

Table-II: Classification of asthma in the cases (n=175)

Classification	Number of Subject (%)
Mild persistent asthma	81(46)
Intermittent asthma	70 (40)
Acute exacerbation of bronchial asthma	11 (06)
Severe persistent asthma	7 (04)
Moderate persistent asthma	4 (02)
Cough variant asthma	2 (02)

Table- IV: Comparison of the variables associated with asthma among case and control subjects.(n=350)

Variables	Case (n=175) N (%)	Control (n=175) N (%)	P value	OR (95%CI)
H/O bronchiolitis	67 (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-III: Comparison of the variables associated with asthma among case and control subjects.(n=350)

Variables	Case (n=175) N (%)	Control (n=175) N (%)	P value	OR (95% CI)
H/ O asthma				
Mother	56 (26)	14 (8)	0.016	4.04 (1.10-16.17)
Father	14 (8)	7 (4)	0.399	2.09 (0.31-17.36)
Sibling or relatives	102 (58)	35 (20)	0.001	5.52 (2.08-14.96)
Parental education (more than high school)				
Father	91 (52)	88(50)	0.841	1.08(0.46-2.56)
Mother	91 (52)	81 (46)	0.548	1.27(0.54-3.01)
Household crowding (people/room)				
Present	98(56)	60 (34)	0.027	2.47(1.02-6.03)
House dampness	67 (38)	35 (20)	0.047	2.45(0.92-6.65)
Passive smoking				
Father	60 (34)	28 (16)	0.037	2.70 (0.95-7.87)
Others member	18 (10)	42 (24)	0.062	0.35 (0.10-1.21)
Maternal smoking during pregnancy	14 (8)	04 (2)	0.168	4.26(0.42-103.95)
Exclusive breast feeding (6 months)	105 (60)	112 (64)	0.680	0.84 (0.35-2.05)
Allergy to				
Food	74(42)	07 (4)	0.001	17.38 (3.52-116.06)
Dust	112 (64)	07 (4)	0.001	42.67 (8.55-287.76)

Table- V: Risk factors analysis for asthma (multiple logistic regression models). (n=350)

	B	S. E	Df	Sig	OR	95% CI for OR	
H/O asthma						**Lower**	Upper
Mother	9.03	6.47	1	0.056	46.2	32.37	68.63
Father	-27.93	24.01	1	2.226	0.00	0.0	58.59
Family H/O asthma (sibling/relatives)	7.31	4.69	1	0.042	28.42	1.99	50.29
Allergy							
Food	9.13	3.92	1	0.073	47.84	10.18	110.81
Dust	13.12	2.73	1	0.003	149.34	11.44	201.35
H/O bronchiolitis	12.18	3.46	1	0.003	113.92	47.25	184.45
H/O atopic dermatitis	-8.19	8.50	1	1.176	0.336	5.77	9.10
H/O conjunctivitis	-71.71	1.47	1	0.489	0.00	5.25	43.29
H/O allergic rhinitis	8.54	2.24	1	0.035	40.35	1.82	69.09

V. 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. 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 allergytest. 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 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 I n 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. 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 negativeassociationhasbeenidentifiedwithrisk 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.Present study also reflected the similar finding. Waheed et al. mentioned 36.5% asthmatic had exposure to cigarette smoke.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 age8.4+/-3.3.Several other studies revealed that pre-term(<37 weeks), low birth weight (<2·5 kg) and high infant weight gain (>600 g/month) are associated with subsequent development 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.However, we did not evaluate these factors in ourstudy.

Limitations of the study

This cross-sectional study was conducted in a single community with a small sized sample. So, the results and findings may not reflect the actual scenario of the whole country.

VI. Conclusion and recommendations

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 riskfactors.

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