

# The Clinico-Epidemiological Profile and the Risk Factors Associated with the Severity of Atopic Dermatitis (AD) in Eastern Indian Children

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## ABSTRACT

**Objective:** To study the clinical features and the various epidemiological risk factors and their correlation with the severity of atopic dermatitis in eastern Indian children (Bihar).

**Design:** A prospective hospital based study.

**Settings:** The Paediatrics OPD and the Dermatology OPD of a tertiary care teaching hospital which was located in the Rohtas district of Bihar, India. The study was carried out over a period of 2 years from January 2010 to December 2011.

**Participants:** One hundred and thirty two children of the ages of zero months to 15 years, who were diagnosed with atopic dermatitis.

**Main Outcome:** The demographic profile, the common clinical features and the various risk factors and their correlation with the severity of atopic dermatitis in eastern Indian children.

**Results:** Out of a total of 1829 paediatric patients of the ages of zero months to 15 years with paediatric dermatoses, 132 (7.21 %) had atopic dermatitis. Of the 132 patients, 57 (43.2%) were boys and 75 (56.8%) were girls, with a male to female ratio of 1: 1.3. Among these, 29 were infants and 103 were children. Two (62.1%) patients belonged to rural areas, while 50 (37.9%) belonged to urban areas. A personal history, a family history (up to the third degree relatives) and both a personal and a family history of atopy were present in 43.18 %, 33.34 % and 12.1 % of the patients respectively. Forty (30.3 %) patients had been exclusively breast fed during the first six months of their lives. A majority (89.4 %) of the patients had the onset of the disease before they were five years of age. In infantile AD, the mean age  $\pm$  SD at onset was  $5.2 \pm 3.01$  months. In the infantile group, 8

(27.6 %) patients had mild, 14 (48.3 %) had moderate and 7 (24.1 %) had severe atopic dermatitis. Infantile AD had a statistically significant higher SCORAD (SCORing Atopic Dermatitis) index score in all the three grade of severity of the disease. One hundred and three patients had childhood AD, out of which 40 (38.8 %) were boys and 63 (61.2 %) were girls, with a male to female ratio of 1: 1.57. In childhood AD, the mean age  $\pm$  SD at the onset of the disease was  $3.47 \text{ years} \pm 3.02$ . . Sixty three (61.1 %) patients belonged to the rural areas, while 40 (38.9 %) were from urban areas. In the first six months of their lives, 31 (30 %) children had been exclusive breast fed, 64 (62.23 %) had been mixed fed and 8 (7.77 %) had been exclusively bottle fed. One hundred and thirty (98 %) patients presented with itching. The exclusively breast fed children were more likely to have mild AD. The mixed fed and the bottle fed children had a higher risk for developing moderate and severe AD, with an odds ratio of 2.24 (95 % CI 0.58-8.3) and 2.741 (95% CI 0.397- 18.9) respectively. In winter season, statistically significant risk to had moderate and severe form atopic dermatitis than other seasons (rainy and summer).

**Conclusion:** Although the prevalence of AD has been considered to be increasing, it still remains low in comparison to that in the developed countries. In Indian children, the disease is relatively milder than in the children of the developed countries. This study identified the winter season, bottle feeding during the first six months of life and infantile AD as the risk factors for moderate and severe AD. Exclusive breast feeding during the first six months of life seemed to protect against moderate and severe AD.

**Key Words:** Atopic dermatitis, Risk factors, Eastern India, Children

## INTRODUCTION

Atopic Dermatitis (AD) is a chronic or a chronically relapsing, eczematous skin disease that is also called as atopic eczema and it is characterized by itching, dry, inflamed and easily irritated skin which is accompanied by a cutaneous functional dysfunction. There is no laboratory "gold standard" for the diagnosis of AD. The diagnosis of AD is based on a constellation of signs and symptoms [1]. It arises as the result of a complex interplay between various genetic, immunological and environmental factors. Atopic dermatitis has a strong familial basis. Twin studies have shown that monozygotic twins had about an 86% risk to develop

AD if the twin partner had the disease, whereas there was only a 21% disease risk in dizygotic twins [2]. The prevalence of AD has been increasing over the past 30 years. Changes in the environmental pollutants and the breast feeding pattern and increased awareness and urbanization are some of the reasons which have been cited for this change [3]. There is lot of published research on the natural history, epidemiology, aetiopathogenesis, clinical patterns and the management of AD in the world literature, but there are only very few large Indian studies which have been on this topic. There is only one published study which had been done in Eastern Indian Children, which has analyzed the clinico-

epidemiological profile of AD in Indian children. In this study, we studied the clinical and the epidemiological profile of AD and we tried to identify the various risk factors which were associated with the severity of atopic dermatitis in the eastern Indian children.

## MATERIALS AND METHODS

This hospital based, prospective study was carried out in the Outpatients Department (OPD), of the Department of Pediatrics and the Department of Dermatology, at Narayan Medical College and Hospital, Jamuhar, Rohtas, Bihar, India, for a period of two years from January 2010 to December 2011. The institute's ethical committee approved the study protocol. After taking an informed written consent from the parents of the every patient, all the patients were enrolled on a pre structured proforma. This proforma included the data on the present age, the age at onset of the disease, the area of residence, the personal and the family history of the atopy, the seasonal variation, the religion of the patient, the development of milestones, the socioeconomic status of the parents, the history of relapse and the status of breast feeding (exclusive breast feeding/no breast feeding (top feeding)/mixed feeding).

A thorough clinical examination was done, which included the measurement of height, weight, distribution of the lesion, severity of the skin lesion and the type of the skin lesion. In every patient, the diagnosis of AD was confirmed after a consultation with the dermatologist. The eczema was categorized after a thorough clinical examination of the lesions. The atopic dermatitis was classified as acute, sub acute and chronic, according to the stage of the disease. Erythema, oedema, vesiculation and oozing were a part of the "acute AD", while the "sub acute AD" was defined as patches with minimal oozing, crusting and scaling. Dry, rough lichenified plaques with or without scaling denoted the "chronic AD". The severity of the disease was assessed by the SCORAD index [4]. The SCORAD index is a clinical tool which is used to assess the extent and the severity of eczema (SCORing Atopic Dermatitis). The SCORAD index consists of the interpretation of the extent of the disorder, that is, the intensity, which is composed of six items (erythema, oedema/ papules, the effect of scratching, oozing/crust formation, lichenification, and dryness), and two subjective symptoms (itch and sleeplessness). The maximum score is 103 points.

**Inclusion Criteria:** Children of ages of zero months to 15 years who were diagnosed with Atopic dermatitis.

**Exclusion Criteria:** The patients of AD with any associated congenital skin disorders immunodeficiency disorders or drug rashes.

## STATISTICAL ANALYSIS

The mean age of the patients was expressed in mean  $\pm$  SD. The data were analyzed by using the Open Epi statistical software, version 2.3.1. The mean, standard deviation, odds ratio and the relative risk were calculated by using appropriate statistical methods. A P value of  $< 0.05$  was considered as statistically significant for any given measures.

## RESULTS

Out of a total of 1829 paediatric patients of ages of zero months to 15 years, who were seen in the Outpatients Department (OPD) of the Department of Paediatrics and the Department of Dermatology from January 2010 to December 2011, 132 children were found to have atopic dermatitis. In this study, the prevalence of atopic

dermatitis was 7.21% of all the paediatrics dermatoses in this age group. Among these 132 patients, 57 (43.2%) were boys and 75 (56.8%) were girls, with a male to female ratio of 1: 1.3. Eighty two (62.1%) patients belonged to rural areas, while 50 (37.9%) patients belonged to urban areas. Among the rural area patients, 30 (36.6%) were boys and 52 were girls with a male to female ratio of 1: 1.7, whereas among the urban area patients, 27 (54%) were boys and 23 (46%) were girls with male to female ratio of 1: 1.2. Of the 132 patients, 98 (74.2%) were Hindus, 30 (22.7%) were Muslims and 4 (3.1) were of other religions. Socioeconomically, 34(25.8%) were from higher socio-economic groups, 61 (46.2%) were from the middle class and 37 (28%) were from the lower socio-economic strata. The personal history, family history (up to the third degree relatives) and both the personal and the family history of atopy was present in 42.18 %, 31.34 % and 11.1 % patients respectively. One hundred and eight (81.8 %) patients had a history of relapse. One hundred and eighteen (89.4 %) patients had the onset of atopy before they were five years of age. The distribution of the patients according to the age of onset of atopy has been shown in [Table/Fig-1].

Of the 132 patients, 29 were infants (up to 1 year of age) among

Age (In Year)	Number of Patients (N=132)	Percentage
0-1	38	28.8
1-2	40	30.3
2-3	26	19.7
3-4	10	7.6
4-5	4	3
5-15	14	10.6

[Table/Fig-1]: Age at onset of Disease

Severity of AD	SCORAD Index Mean $\pm$ SD		P Value
	Infantile AD (< 1 year)	Childhood AD (1-15 Year)	
Mild	17.8 $\pm$ 4.29	12.3 $\pm$ 5.1	0.0065
Moderate	38.35 $\pm$ 8.28	33.3 $\pm$ 7.5	0.032
Severe	88.42 $\pm$ 14.24	64.9 $\pm$ 11.89	0.002

[Table/Fig-2]: SCORAD Index score (Mean  $\pm$  SD) among Infantile AD and childhood AD.

Clinical Feature	No of Patients (N= 132)	Percentage
Pruritus / Itching	130	98
Chronic relapsing eczema	108	82
Family History of atopy	91	68.9
Excoriation of Skin	86	65.1
Dryness of the skin	82	62.1
Flexural Lichenification	64	48.5
Ichthyosis	46	34.9
Recurrent conjunctivitis	22	16.7

[Table/Fig-3]: Common clinical presentation of atopic dermatitis

Severity of AD	SCORAD Index Mean $\pm$ SD		P Value
	EBF children (n= 40)	Mixed fed children (n= 81)	
Mild	(22) 10.23 $\pm$ 6.5	(30) 11.8 $\pm$ 7.05	0.461
Moderate	(15) 31.26 $\pm$ 6.31	(39) 36.19 $\pm$ 8.15	0.022
Severe	(3) 72.66 $\pm$ 14.24	(12) 89.84 $\pm$ 12.41	0.038

[Table/Fig-4]: SCORAD Index score (Mean  $\pm$  SD) among exclusively breast fed (EBF) and mixed fed (Breast milk and bottle fed) children with AD.

Severity of AD	SCORAD Index Mean $\pm$ SD			P Value
	Summer (n=55)	Winter (n=55)	Rainy (n=24)	
Mild	(32)9.43 $\pm$ 5.91	(14)14.42 $\pm$ 6.9	(10)9.8 $\pm$ 7.33	0.546
Moderate	(19)31.52 $\pm$ 7.29	(29)36.48 $\pm$ 7.67	(11)31.81 $\pm$ 5.52	0.0438
Severe	(4)59.78 $\pm$ 11.77	(10)81.96 $\pm$ 14.62	(3)60.67 $\pm$ 11.53	0.0344

**[Table/Fig-5]:** Seasonal variation and severity of AD.

whom 17(58.6%) were boys and 12(41.4%) were girls, with a male to female ratio of 1.4: 1. The mean age (Standard deviation- SD) at onset was 5.2 ( $\pm$ 3.01) months. Nineteen (65.5 %) belonged to the rural areas, while 10 (34.5 %) were from urban areas. Nine (31 %) had been exclusively fed on breast milk for the initial 6 months of their lives, while 17 (58.7 %) had been fed on mixed feed (breast milk and cow / buffalo milk/ formula milk powder) and 3 (10.3 %) had been exclusively bottle fed (cow or buffalo milk or formula milk powder). In the infantile group, 8 (27.6 %) had mild, 14 (48.3 %) moderate and 7 (24.1 %) had severe atopic dermatitis. Infantile AD had a statistically significant higher SCORAD Index score in all the three grades of severity of the disease, as has been shown in [Table/Fig-2].

One hundred and three patients were in the childhood group (1-15 year), among which 40 (38.8 %) were boys and 63 (61.2 %) were girls, with a male to female ratio of 1: 1.57. The mean age  $\pm$  SD at onset of the disease was 3.47 years  $\pm$  3.02. Sixty three (61.1 %) patients belonged to the rural areas, while 40 (38.9 %) were from urban areas. In the first six months of life, 31 (30 %) children had been exclusively breast fed, 64 (62.23 %) had been mixed fed (breast milk and cow / buffalo milk/ formula milk powder) and 8 (7.77 %) had been bottle fed (cow or buffalo milk or formula milk powder). Childhood AD had a statistically significant lower SCORAD Index score in all the three grades of severity of the disease. One hundred and thirty (98 %) patients presented with the complaint of itching or pruritus, as has been shown in [Table/Fig-3].

The exclusively breast fed children were more likely to have mild AD as compared to the mixed fed children or the bottle fed children. The mixed fed and the bottle fed children had a higher risk of developing moderate and severe AD, with an odd ratios of 2.24 (95% CI 0.58-8.3) and 2.741 (95% CI 0.397- 18.9) respectively. On comparing the SCORAD Index score between the exclusively breast fed children and the mixed fed children, the mixed fed children were found to have a statistically significant higher score in moderate and severe AD, as has been documented in [Table/Fig-4]. It was found that in the winter season, there was a statistically significant risk of developing the moderate and the severe forms of atopic dermatitis, as has been shown in [Table/Fig-5].

## DISCUSSION

Atopic dermatitis (AD) is a chronic or a chronically relapsing eczematous skin disease that is also called as atopic eczema and it is characterized by itching, dry, inflamed and easily irritated skin which is accompanied by a cutaneous functional dysfunction. Eczema literally means to boil out (Ec-out, Zema- boil) and the terms, 'eczema' and 'dermatitis' are often used synonymously.

Atopic dermatitis has three phases [1]. The infantile phase (upto 2 years of age) primarily involves the face, scalp, neck and the extensor surface of the extremities, with erythematous oozing papulo-vesicular lesions [2]. In the childhood phase (between 2 years- 10 years of age), the lesions are sub acute, more scat-

tered and often localized in the flexor folds of the neck, elbows, wrist and the knees [3]. In the adolescent and the adult phases (more than 10 years of age), the lesions are primarily dry, lichenified and hyperpigmented plaques in the flexor areas.

The prevalence of AD has been increasing over the past 4 decades in the developed countries and also in India [3,5]. Our study was hospital based rather than population based and so the exact incidence of AD in the community could not be estimated. But these patients comprised of 7.21% of all the paediatric dermatoses cases in the study age group. A four decades old study from Bihar reported an incidence of 0.38% among the total number of outpatient attendees [6]. In contrast to the findings of our study, a north Indian hospital based study reported 28.46 % [7] and 29.9 % patients of AD among the total numbers of paediatric dermatology patients. The "Hygiene Hypothesis" can explain the relatively lower occurrence of AD in our study as compared to that in the north Indian children. The overall hygiene was poor and various infections in childhood were rampant in this part of the country because of the poor socio-economic status. However, the prevalence in Bihar also had increased over the past four decades [6]. The reasons for this increase has not been known but they are probably the increased environmental pollution, the exposure to agricultural chemicals, the decline in breast feeding, earlier weaning, urbanization, increased awareness, better case detection techniques and the improved quality of life which can explain the increasing trend in the occurrence of AD.

In the previous studies which were done, there was a contrasted view regarding the gender ratio, though most of the studies had reported a male predominance with a male to female ratio of 2.13 :1 for infants and 1.09:1 for children (among males) 7 and of 2.25:1 for infants and 1.6:1 for children (among females) [8]. In contrary, our study found that girls outnumbered the boys, with a female to male ratio of 1.3: 1. However, in the infantile group, boys outnumbered the girls, with a male to female ratio of 1.4: 1. In the childhood group, the female to male ratio was 1.57:1. Our study results were comparable to those of a study which was done by Rajka G et al., who found a female predominance with a female to male ratio of 1.5:1 [9].

Todd G et al., [10] and Poysh L et al., [11] found a higher prevalence of AD in the urban areas than in the rural areas. In contrast to these findings, our study found a higher prevalence in the rural areas, with a rural to urban ratio of 1.64:1. This finding can be explained by the fact that our hospital caters predominantly to the rural population. Our findings on the basis of religion were proportionate to the percentage populations of the different religions in eastern India.

William HC found that the prevalence of AD increased with an improvement in the socio-economic condition [3]. A similar finding was reported by Spergel et al., They found that the prevalence of AD had increased by 2 to 3 folds during the past three decades in the industrialized countries due to the improvement in the socio-economic conditions and the improved life style [12]. In contrast, in our study, 46.2 % patients had hailed from the middle class, 28 % from the lower socio-economic class and only 25.8% from the upper socio-economic class, which was comparable to the findings of an Indian study which was done by Sarkar and Kanwar, in which they had found that a majority of the patients belonged to middle class families (53.8 % for up to 1 year and 57.57 %

onwards), while a minority of the patients were from the lower strata of the society (15.5 % for up to 1 year and 23.23 % for above one year) [8].

In our study, the mean age ( $\pm$ Standard deviation SD) at the onset of the disease was 5.2 ( $\pm$ 3.01) months for infantile AD and it was 3.47 years  $\pm$  3.02 for childhood AD. This was comparable to the findings of other Indian studies in which the mean age at onset was 4.2 months for infantile AD and 4.5 years for childhood AD [7] and 4.5 months for infantile AD and 4 years for childhood AD [8]. In the present study, 28.8 % of the children developed the disease by the age of one year and 89.4 % developed it by the age of five years. Only 10.6 % developed it after five years of age. In a study which was done by Rajka J, it was found that 60% of the patients had the onset of the disease in the first year of life and that 85 % had it by five years of age [13]. In a north Indian study, it was found 55.2 % patients had developed the disease by one year of age and only 5.6 % had developed the disease after 6 years of age [8]. In our study, the late presentation can be explained by the fact that in the rural areas, the milder disease is often ignored, especially during infancy, in the lower socio-economic strata of the society.

In the present study, 65.8 % children had a history of atopy, among which, 42.18 %, 31.34 % and 11.1 % of children had a personal history, a family history (up to the third degree relatives) and both a personal and a family history of atopy. Halbert et al., Found that approximately 70 % of the patients had a family history of atopy [14]. The family history was found to be varied in different studies. In an Indian study, a personal or a family history of atopy was observed in 54 % and 65 % of the patients respectively [15].

In the present study, infantile AD had a statistically significant higher SCORAD Index score in the mild, moderate and the severe forms of AD, with mean  $\pm$  SD scores of 17.8 $\pm$  4.29 vs. 12.3  $\pm$  5.1 ( $P=0.0065$ ), 38.35 $\pm$  8.28 vs. 33.3 $\pm$  7.5 ( $P=0.032$ ) and 88.42 $\pm$ 14.24 vs. 64.9 $\pm$  11.89 ( $P=0.002$ ) respectively. Sarkar R and Kanwar AJ, in a study which was done in north India, also reported that infantile AD was relatively more severe than childhood AD [8].

The role of breast-feeding in AD has been controversial. Gdálvich M et al., found that exclusive breast feeding of the high risk infants for at least 4 months prevented the development of AD [16]. Saarinen UM and Kajossari M, found that a prolonged breast feeding was associated with a reduced incidence of allergy or atopic dermatitis [17]. In this study, 30.3 % of the patients (31% with Infantile AD and 30 % with childhood AD) were exclusively breast fed during the initial 6 months of life, 61.4 % were mixed fed and only 7.6 % were exclusively bottle fed. Although in our study, mixed or bottle feeding didn't increase the risk of mild AD, the mixed fed and the bottle fed children had a higher risk of developing moderate and severe AD with odds ratios of 2.24 (95 % CI 0.58-8.3) and 2.741 (95% CI 0.397- 18.9) respectively. The mixed fed children also had a statistically significant higher score in moderate ( $p=0.022$ ) and severe AD ( $p=0.038$ ) than the exclusively breast fed children. Thus, exclusive breast feeding seemed to protect against the severe form of AD. In India, breast feeding is the custom and the AD is milder in India as compared to that in the west.

In this study, the most common (98 %) clinical presentation was

itching. The face was affected in 76.8 % patients with infantile AD and in 56.8% patients with childhood AD. Our findings were comparable to those of Dhar S and Kanwar AJ [7].

In our study, the disease severity was assessed by SCORAD and we found that 42.4 %, 44.7% and 12.9 % of the patients had mild, moderate and severe disease, which was almost comparable to the findings of another Indian study which was done by Dhar et al., [15]. In this study, we found that in winter, the AD was more severe than in the summer season. On ANOVA analysis, with respect to the effect of the season on the severity of the disease, the severity score (SCORAD Index score) was found to be significantly higher in winter than in summer (36.48 $\pm$ 7.67 vs. 31.52 $\pm$ 7.29,  $p=0.0438$  and 81.96 $\pm$ 14.62 vs. 59.78 $\pm$ 11.77,  $p=0.0344$ , for moderate and severe AD respectively). However, the severity score was not significantly different for mild AD. There was no significant difference in the severity scores in the summer and the rainy seasons. No earlier Indian study had compared the SCORAD severity score in different grades of the disease in different seasons. Atopic dermatitis is known to be severe and to exacerbate during the winter and to improve during summer, most likely, due to the seasonal variations in the skin moisturization [9]. In a study by Vocks et al., they found that itch intensity in patients with AD, inversely correlated with temperature but that there was a lesser effect of humidity, air pressure and hours of sunshine [18].

## CONCLUSION

The epidemiological data on atopic dermatitis in India is mainly hospital based, The data on the true point prevalence in the community is still scanty. Although the prevalence of AD has been considered to be increasing, it still remains low in comparison to that in the developed countries. In Indian children, the disease is relatively milder than in the children from the developed countries. This study identified the winter season, bottle feeding during the first six months of life and infantile AD as the risk factors for moderate and severe AD. This study also identified that the severity score (SCORAD Index) was inversely correlated with the temperature. Exclusive breast feeding during the first six months of life seemed to protect against moderate and severe AD. A better knowledge on its epidemiology in different climatic regions can help in a better management of the patients and in improving the quality of their lives. Our study has some limitations: (1) as this was a hospital based study, the true point prevalence in the community couldn't be extrapolated. (2) In the older children, the history was completely based on the recall of the parents. So, there was a possibility of a recall bias, especially in patients from the rural areas and from the lower socio-economic strata of the society.

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