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Research Article

Cross-Sectional Study to Estimate the Prevalence of AD and Identify the Risk Factors Associated with its Development in the Rural Community of India

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ABSTRACT

Introduction: Atopic Dermatitis (AD) is a chronic, inflammatory, relapsing dermatological disorder with onset at an early age.

Objective: This study was done to estimate the prevalence of AD in a rural community setting in North Indian population using UK Working Party criteria for AD and to assess the association of risk factors with AD by comparing with a non-AD subgroup in the study population.

Materials and methods: Consecutive patients with a diagnosis of AD (as assessed using Hanifin and Rajka criteria) were pooled out from 495 participating children from the Fatehgarh district of Punjab (30.6435°N, 76.3970°E). Various clinical and epidemiological features were considered and the significantly associated risk factors were evaluated by comparing the AD and non-AD subgroups.

Results: Out of 495 participants, seventeen participants (3.4%) were diagnosed with atopic dermatitis. Sixteen (3.2%), participants were in the age group ≤ 1 year, 118(23.8%) between 1 to 5 years and 361(72.9%) were >5 years of age respectively. Male to female ratio in these age groups was 1:1.06 in less than 1 year age group, 0.8: 1 in 1 to 5 year age groups and 1.06:1 in the 6 to 18 years age group. In our study, various risk factors were assessed with respect to their association with AD using univariable and multi variable regression analysis. The regression coefficient was significant for daycare centers, early use of antibiotics and tendency for cutaneous infection, in both univariable and multivariable analysis while use of curd during first two years of life was protective in the univarible regression analysis.

Conclusion: There are only a few studies from India on the prevalence of AD but none from a community setting. We observed a lower prevalence of AD in the rural community. An early exposure to antibiotics and attendance at day care centers (Anganwaris) was seen to be associated with the development of AD. More epidemiological studies on childhood and adulthood AD in different areas of the country are needed to see the real burden of disease.

Keywords: Atopic eczema; Epidemiology; Community-setting

INTRODUCTION

Atopic Dermatitis (AD; synonym eczema) is an inflammatory skin condition which affects mainly children, and to a lesser extent adults. More than 80% of children develop AD before the age of 5 years, and most of them grow out of the disease or have very mild disease in adulthood. Over the last two to three decade, the prevalence of AD has increased 2 to 3 fold [1]. It's higher in urban area than rural area and in higher socio-economic status [2].

There is a scarcity of studies that estimate the prevalence of AD in a developing nation like India. As per the ISAAC (International Study of Asthma and Allergies in Childhood) Phase 3 study conducted between 2001 to 2003, the global variation of AD prevalence ranged from as low as 0.9% (in India) to as high as 22.5% (in Ecuador) in the 6-7 years age group. The same study showed the prevalence of current eczema to be less than 5% at most centers in North India. In ISAAC Phase 3 study, there were 21 centers chosen all over India. Most centers were urban and included both private and public hospitals and colleges of large cities like Chandigarh, Ludhiana, Delhi, Jaipur and Mumbai etc [3,4].

No study has been conducted in the community and rural setting in

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India. Hence, this study was conducted to study the epidemiology and clinical presentation of AD in the rural community of North India, and to assess the risk factors for development of AD.

MATERIALS AND METHODS

A questionnaire based cross-sectional study was conducted in Fatehgarh Sahib District in Punjab (a rural community). We recruited children from birth to 18 years of age beginning from January 1, 2019 to December 31, 2019 after obtaining approval from the Institutional Ethics Committee. A written informed consent/assent/parental consent, was taken wherever applicable. All individuals in the study were selected by a simple randomized method and then segregated according to their age into three groups: Group A (<1 year)-infant and children below 1 year, Group B (1-5 years)-preschool children and Group C (6-18 years)-school going children.

Patients who fulfilled the UK working party criteria were diagnosed with AD. All study participants and/or their parents/guardians were enquired for potential risk factors of atopic dermatitis through the ISAAC questionnaire. The questionnaire included demographic variables: (age, gender, place of residence) socioeconomic variables maternal risk factor variables (presence of atopic dermatitis, asthma or atopy in mother, high fish intake during pregnancy) and child dependent variables (birth weight, mode of delivery, prematurity (term/preterm), birth order, vaccination, visits to day care center, use of antibiotics in the first 2 years of life, and consumption of homemade Indian curd (taken here as a probiotic). The diagnosis of AD was based on clinical assessment in the field by a dermatology resident (PK) who had a training of one year before initiation of this study. Cases diagnosed with AD were provided with appropriate advice and adequate treatment and if severe disease was present, he/she were referred to the nearby Government hospital to seek opinion from a dermatologist [5-7].

RESULTS

Demographic details of the study area

Fatehgarh Sahib District is one of the twenty-two districts of the state of Punjab, India. There are about 170 villages in Fatehgarh Sahib Block, of which we studied 5 villages (Badiamikai, Chunni, Selampur, Khera and Nariangarh) for our study.

Demographic and socio-economic details of study participants

A total of 495 study subjects were interviewed for the study. The median (IQR) of age (years) were 9.00 (9.00; range: 0.3-18). Of 495 participants, 254(51.3%) were boys and 241(48.7%) were girls. Sixteen (3.2%) children were infants, 118(23.8%) were in 1-5 years, and 361(72.9%) were >5 years of age. The mean number of family members was 5 ± (2).

Majority of the participants in the study belonged to the upper class (8.3%), the upper middle-class families (32%) and the middle class (55.7%) and the rest were from the poor strata (5.6%). Eighty-one (16.4%) participants were attending day care/Anganwari centers. Thirty-two (6.5%) participants had been administered antibiotics at an early age (<2 years). Four hundred and sixty-nine (94.7%) participants had been administered albendazole during early childhood. Four hundred and seventy-three (95.6%) participants consumed homemade Indian curd on a daily/regular basis. Food allergy was present in 2 atopic children (0.4%), with patients complaining of itching and appearance of wheals on taking nuts and dry fruits. Passive smoking was present in 59(11.9%) participants. Nearly all (99.8%) the children were completely vaccinated as per the universal immunization program.

Tables 1 and 2 summarizes the demographic/socio-economic and clinical characteristics of the study population.

Table 1: Clinical characteristics of study population.

All parameters	Mean ± SD/median (IQR)/min-max/frequency (%) (n=495)
Weight (Kg)	31.08 ± 16.00/28.00 (28.00)/4.00-70.00
Height (cm)	129.29 ± 27.87/130.00 (48.00)/48.00-175.00
Itching (present)	44 (8.9%)
Atopy (present)	37 (7.5%)
Xerosis (Present)	63 (12.7%)
Visible flexural dermatitis (present)	9 (1.8%)
Dennie morgan lines (present)	22 (4.4%)
White dermographism (present)	24 (4.8%)
Cheilitis (present)	22 (4.4%)
Conjunctivitis (present)	37 (7.5%)
Keratoconus (present)	0 (0.0%)
Anterior subcapsular cataract (present)	0 (0.0%)
Keratosis pilaris (present)	29 (5.9%)
Anterior neck fold (present)	21 (4.2%)
Orbital darkening (present)	26 (5.3%)
Pruritus when sweating (present)	46 (9.3%)
Intolerance to wool (present)	81 (16.4%)
Cradle cap (present)	29 (5.9%)
Non-specific eczema (present)	59 (11.9%)
Tendency for infection (present)	24 (4.8%)

Table 2: Socio-economic and other demographic characteristics of the study population.

Parameter	Frequency (n=495)
History of breastfeeding (present)	491 (99.2%)
Attending day care/anganwadi (present)	81 (16.4%)
Completed vaccination (present)	494 (99.8%)
Early use of oral antibiotics (present)	32 (6.5%)
Probiotic use (present)	473 (95.6%)
Milk consumption (present)	385 (77.8%)
Fresh fruit consumption (present)	403 (81.4%)
History of albendazole use (present)	469 (94.7%)
History of food intolerance (present)	2 (0.4%)
History of passive smoking (present)	59 (11.9%)
Number of family members	Median 5.00
IQR 2.00	24 (4.8%)
Range 3.00-9.00	24 (4.8%)
History of wheeze/dry cough (present)	14 (2.8%)
Rhinitis (present)	16 (3.2%)
Socioeconomic status	
Upper class	41 (8.3%)
Upper middle class	155 (31.3%)

Middle class	272 (54.9%)
Lower middle class	27 (5.5%)
Livestock/pets (present)	137 (27.7%)
Primary fuel for cooking	
Liquified petroleum gas	312 (63.0%)
Wood	2 (0.4%)
Liquified petroleum gas and wood	156 (31.5%)
Wood and coal	1 (0.2%)
LPG, wood and coal	24 (4.8%)

Prevalence of AD in the study population

Out of 495 study participants, 17 participants fulfilled the UK working party criteria for atopic dermatitis. The overall prevalence of pediatric AD in Fatehgarh district of Punjab, assessed by UK Working Party's criteria, was found to be 3.4% with female predominance (male to female ratio of 0.7:1). We studied children between the age of 3 months to 18 years and found that mean age of diagnosis with AD was 3.3 ± 2.1 years (range; 1.1-5.4 years). Infants constituted 23% and children between the ages of 1 to 5 years constituted 58% of AD patients.

Prevalence of atopic eczema in the various age groups of less than 1 year, 1 to 5 years and 6 to 18 years was 25% (4 out of 16), 8.5% (10 out of 118) and 0.8% (3 out of 361), respectively. In the 6-7 years age group, only 2 out of 61 children were diagnosed with AD (3.2% prevalence); but none in the 13-14 years age group in comparison to the ISAAC study.

Clinical features of atopic dermatitis

Itching was a major symptom in our study participants (44 of 495 participants) but only 17(3.4%) patients fulfilled the UK working party criteria. A personal or family history of atopy was present in 14(83%) participants with AD and 23(4.8%) participants without AD. Most of the children (64.8%) in our study had 'pure AD' which means dermatitis without concomitant respiratory allergies. Only 3(17.6%) of children had recurrent wheeze and three (17.6%) had rhinitis. In our study, 64.7% AD children had onset of disease before 2 years of age. Visible flexural involvement was present in 52% AD children (most commonly popliteal fossae were involved followed by cubical fossa, ankle and neck), 17.6% had facial involvement, 11.8% had extensor involvement and 23.1% had mixed involvement. Among children up to 5 years of age, flexures were most affected followed by face and extensors. In older children also, flexures were the most involved site. Dry skin was present in 63 out of 497 participants (12.6%) but was more common in atopic group (80%) than in non-atopic group (11%).

Minor features of Hanifin and Rajka criteria were commonly found in the study group (Table 3) [8].

Table 3: Comparison of frequency of minor features and socioeconomic status between AD and Non-AD participants.

Parameters	AD	Non-AD	P-value
Dennie morgan lines (present)	7 (41.2%)	15 (3.1%)	<0.001[2]
White demographism (present)	8 (47.1%)	16 (3.3%)	<0.001[2]
Chelitis (present)	8 (47.1%)	14 (2.9%)	<0.001[2]
Eye involvement (present)	10 (58.8%)	27 (5.6%)	<0.001[2]
Keratosis pilaris (present)	13 (76.5%)	16 (3.3%)	<0.001[2]
Anterior neck fold (present)	4 (23.5%)	17 (3.6%)	0.004[2]
Orbital darkening (present)	7 (41.2%)	19 (4.0%)	<0.001[2]
Pruritus when sweating (present)	11 (64.7%)	35 (7.3%)	<0.001[2]
Intolerance to wool (present)	13 (76.5%)	68 (14.2%)	<0.001[2]
Cradle cap (present)	10 (58.8%)	19 (4.0%)	<0.001[2]
Non- specific eczema (present)	5 (29.4%)	54 (11.3%)	0.041[2]
Food intolerance (present)	2 (11.8%)	0 (0.0%)	0.001[2]
Tendency for infection (present)	13 (76.5%)	11 (2.3%)	<0.001[2]
Day care/anganwadi (present)	10 (58.8%)	71 (14.9%)	<0.001[2]
Vaccination up to date for age (present)	16 (94.1%)	478 (100.0%)	0.034[2]
Early use of oral antibiotics (present)	13 (76.5%)	19 (4.0%)	<0.001[2]
Probiotic use (present)	13 (76.5%)	460 (96.2%)	0.005[2]
Milk consumption (present)	17 (100.0%)	368 (77.0%)	0.018[2]
Frequent Fresh fruit consumption (>3 times/week) (present)	13 (76.5 %)	386 (80.8%)	0.052[2]
Albendazole use in children above I year (present)	13 (76.5%)	456 (95.4%)	0.009[2]
Passive smoking (present)	8 (47.1%)	51 (10.7%)	<0.001[2]
Number of family members	4.76 ± 0.83	4.88 ± 1.47	0.945[2]
Wheeze/dry cough (present)	3 (17.6%)	11 (2.3%)	0.010[2]
Rhinitis (present)	3 (17.6%)	13 (2.7%)	0.014[2]
Socioeconomic Status			0.742[2]
Upper class	2 (11.8%)	39 (8.2%)	
Upper middle class	6 (35.3%)	149 (31.2%)	
Middle class	8 (47.1%)	264 (55.2%)	
Lower middle class	1 (5.9%)	26 (5.4%)	
Livestock/Pets (present)	4 (23.5%)	133 (27.8%)	1.000[2]

1. Wilcoxon test.
2. Fisher's exact test.

Risk factor assessment

Various risk factors were assessed with respect to their association with AD using univariable and multi variable regression analysis in Table 4. The model was based on an alpha of 0.05. The overall model was significant, $\chi^2(8)=121.60$, $p<0.001$, suggesting that tendency for infection, mode of delivery, day care/anganwari attendance, early use of antibiotics and curd/probiotic use had a significant effect on the odds of observing AD. The McFadden R-squared value was 0.82 for this model.

Table 4: Univariable and Multivariable analysis of the risk factors with significant p- value.

Dependent: Atopic dermatitis Uk criteria		Absent	Present	OR (univariable)	OR (multivariable)
Age	≤ 1 Years	12 (75.0)	4 (25.0)	-	-
	1-5 Years	108 (91.5)	10 (8.5)	0.28 (0.08-1.13, p=0.054)	0.00 (0.00-0.68, p=0.065)
	>5 Years	358 (99.2)	3 (0.8)	0.03 (0.00-0.13, p<0.001)	0.18 (0.01-5.44, p=0.284)
Tendency for infection	Absent	467 (99.2)	4 (0.8)	-	-
	Present	11 (45.8)	13 (54.2)	137.98 (41.89-557.53, p<0.001)	327.56 (22.59-27460.13, p=0.001)
Gestational maturity	Term	477 (97.1)	14 (2.9)	-	-
	Preterm	1 (33.3)	2 (66.7)	68.14 (6.19-1518.63, p=0.001)	-
	Post-term	-	1 (100.0)	196176909.59 (0.00-NA, p=0.990)	-
Mode of delivery	NVD	469 (97.3)	13 (2.7)	-	-
	LSCS	9 (69.2)	4 (30.8)	16.03 (3.95-56.72, p<0.001)	234.49 (10.94-22880.36, p=0.003)
Breastfeeding	Absent	1 (25.0)	3 (75.0)	-	-
	Present	477 (97.1)	14 (2.9)	0.01 (0.00-0.08, p<0.001)	-
Day care (Anganwari)	Absent	407 (98.3)	7 (1.7)	-	-
	Present	71 (87.7)	10 (12.3)	8.19 (3.05-23.23, p<0.001)	154.18 (3.04-79020.59, p=0.031)
Vaccination	Present	478 (96.8)	16 (3.2)	0.00 (NA-Inf.00, p=0.990)	-
	Absent		1 (100.0)	-	-
Early use of oral antibiotics	Absent	459 (99.1)	4 (0.9)	-	-
	Present	19 (59.4)	13 (40.6)	78.51 (25.24-300.36, p<0.001)	193.09 (17.09-8333.25, p<0.001)
Probiotic use	Absent	18 (81.8)	4 (18.2)	-	-
	Present	460 (97.3)	13 (2.7)	0.13 (0.04-0.49, p=0.001)	10.46 (0.45-571.10, p=0.170)
Milk consumption	Absent	110 (100.0)	-	-	-
	Present	368 (95.6)	17 (4.4)	14522343.07 (0.00-NA, p=0.987)	-
Fresh fruit consumption	Absent	92 (100.0)	-	-	-
	Present	386 (95.8)	17 (4.2)	13845135.36 (0.00-NA, p=0.988)	-
Albendazole use	Absent	22 (84.6)	4 (15.4)	-	-
	Present	456 (97.2)	13 (2.8)	0.16 (0.05-0.59, p=0.002)	0.08 (0.00-2.14, p=0.121)
Food intolerance	Absent	478 (97.0)	15 (3.0)	-	-
	Present	-	2 (100.0)	183482303.14 (0.00-NA, p=0.985)	-
Passive smoking	Absent	427 (97.9)	9 (2.1)	-	-
	Present	51 (86.4)	8 (13.6)	7.44 (2.69-20.32, p<0.001)	-
Socioeconomic status	Upper class	39 (95.1)	2 (4.9)	-	-
	Upper middle class	149 (96.1)	6 (3.9)	0.79 (0.17-5.50, p=0.772)	-
	Middle class	264 (97.1)	8 (2.9)	0.59 (0.14-4.01, p=0.515)	-
	Lower middle class	26 (96.3)	1 (3.7)	0.75 (0.03-8.22, p=0.818)	-
Livestock pets	Absent	345 (96.4)	13 (3.6)	-	-
	Present	133 (97.1)	4 (2.9)	3)	-

Model fit: $\chi^2(8)=121.6$; p=<0.001; Pseudo-$R^2=0.82$.
Number in data frame=495; Number in model=495; Missing=0.
AIC=44.4; C-statistic=0.965; H&L=Chi-sq (8)15.95 (p=0.6043).

DISCUSSION

There is scarcity of population based epidemiological studies on the prevalence of AD in our country. The prevalence of AD was estimated to be 3.4% in the present study. The lower overall prevalence in the study could be due to a predominantly rural study population, higher rates of infection leading to the development of immunity, and possibly lesser pollution due to mainly an agriculture-based economy with lack of industrialization. From the ISAAC study and other study data, it emerges that AD is most prevalent in the more westernized, developed countries and least prevalent in underdeveloped countries. The prevalence of 3.4% as seen by us is seemingly less than that reported in the ISAAC-3 study (less than 5% in India with a globe prevalence from 3 to 20.5%), yet it needs to be seen in the context of the prevalence in a rural setting in a developing country [9,10]. Subgroup analysis in the various age groups revealed a rising trend of AD prevalence in this community. In the age groups less than 1 year and 1 to 5 years the prevalence was 23.5% and 8.5% respectively which not only conforms to the notion that AD is a disease of young age but also highlights the high 1-year prevalence of AD in this age group. The prevalence decreased to 3.2% in the 6-7 years age group and was absent in the 13-14 years age group. We may thus infer from this that while the prevalence of AD has risen rapidly in less than 5-year age group, the disease is mild in severity, and possibly resolves spontaneously by the time of puberty/adolescence. However, this question can be best answered by a study with longitudinal follow up rather than the current cross-sectional design. Disease severity measured by SCORAD (scoring for AD) was found to be mild in majority of patients in our study with the mean of 12 ± 3.4, consistent with the findings.

Our overall prevalence of 3.4% was less than that reported in a study done in residential schools; 4.6% among 1943 children in the 6-16 years age group from South Chhattisgarh. We attribute this lower prevalence to several factors-smaller sample sizes in the present study, regional variations in the AD prevalence in the country, the population studied rural versus residential school children, and the study tool employed Hanifin and Rajka criteria, which is slightly more sensitive compared to the UK Working party criteria. We could not compare our data with any other study due to the lack of more community-based studies on AD in India [11].

In few studies, probiotics has been linked to reduce atopic dermatitis. On univariable analysis we found a protective effect of homemade Indian curd on atopic dermatitis children (CI 0.04-0.49, p=0.001) but no significant effect was observed on multivariable analysis (CI 0.45-571.10, p=0.170).

Breastfeeding is advocated as a way of preventing allergies, including AE. In the rural communities in India most mothers exclusively breastfeed their babies for at least 6 months; mostly for more than 2 years. This behaviour is tradition driven and also possibly influenced by increased promotion by Accredited Social Health Activist (ASHA) and multipurpose workers about the benefits of breastfeeding. In our study, we found a significant correlation between AD and breastfeeding in the atopic (84%) versus non-atopic group (99%). On univariable analysis breastfeeding was found to be a protective factor (CI 0.00-0.08, p<0.001); and may be the reason for an overall low prevalence in the rural community [12].

In India, we have Anganwari as day care centers (similar to a creche) predominantly in the rural communities. In these Anganwari's, children between the ages of 1 year to 5 years come from 10 am to 1 pm and also get a mid-day meal. These visits lead to high exposure of children to microorganisms. In our study, we found that the prevalence of AD was high among the children going to daycare centers. Found that early day care attendance had significant effect on increasing eczema risk while it flattened as children grew similar to what we observed [13].

More than three-fourth (76.5%) children who developed AD had taken medicines from the local practitioner in their early childhood which included antibiotics like amoxicillin, cephalosporins, antifungal ointments like terbinafine and azoles. The regression coefficient for early use of oral antibiotics was statistically significant (B=5.26, OR=193.09, p<0.001, 95% CI 25.24-300.36) in multivariable analysis.

Most of the mothers had a normal delivery and the children were term babies, with normal birth weight. We didn't find any significant difference in birth parameters of both atopic and non-atopic group except for LSCS which happened to be more (23.5%) in comparison to general population 1.9% (OR=234.49, p=0.003, CI-10.94-2280.8).

Most of our study subjects had mild "pure" atopic dermatitis, and we found significant decrease in mean weight and height in atopic dermatitis group in the age groups of 1 y to 5 y and 6 y to 18 y as compared to the non-atopic group. This is despite the fact that the disease was not severe unlike western studies. This altered growth deficit is difficult to explain but may reflect food fads and avoidance of certain food items due to the fear of exacerbating the eczema. Our study had several limitations like a cross-sectional design, and a small sample size.

CONCLUSION

Concluding, our observations show that the prevalence of AD is less in the Indian rural community and severity of illness was predominantly mild. Occurrence of AD was significantly associated with attendance at daycare centers, early use of antibiotics and, tendency for cutaneous infection.

SOURCES OF SUPPORT

Nil

CONFLICTING INTEREST

Nil

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