

Prevalence and Characteristics of Atopic Dermatitis-related Symptoms among School Children in Al-Baha Province, Saudi Arabia: A School-based Cross-sectional Study

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ABSTRACT

Introduction: Atopic Dermatitis (AD) is a chronic, relapsing inflammatory skin disorder that can impair sleep, learning and family wellbeing. Epidemiological evidence from Al-Baha Province remains limited, despite marked climatic contrasts between the mountainous Al-Sarah and coastal Tihamah.

Aim: To estimate the prevalence of AD-related questionnaire indicators, describe symptom characteristics (age at onset, clearance and nocturnal waking), and explore differences in recurrent itchy rash and eczema according to demographic, educational and geographical characteristics.

Materials and Methods: The present school-based cross-sectional study included children aged 6-15 years attending primary and intermediate schools in Al-Baha Province, southwestern Saudi Arabia, between February 2023 and February 2024. Parents of pupils across educational levels and ecological zones completed an Arabic questionnaire incorporating the validated Arabic version of the International Study of Asthma and Allergies in Childhood (ISAAC) Phase I eczema module. AD symptoms were defined by a recurrent itchy rash for at least six months, occurrence of the same rash during the preceding 12 months, and previous involvement of a characteristic site. Lifetime history of eczema ('eczema ever') and parent-reported physician-diagnosed AD were assessed separately. Analyses used item-specific denominators, Wilson 95% Confidence Intervals (CIs) and chi-square or exact tests.

Results: The final analysis included 978 children with a mean age of 10.22±2.97 years; 514 (52.6%) were female. Recurrent itchy rash was reported by 312 children (31.9%; 95% CI: 29.1%-34.9%); 236 children (24.1%; 95% CI: 21.6%-26.9%) reported the same rash during the preceding 12 months. AD symptoms were reported in 213 children (21.8%; 95% CI: 19.3%-24.5%). Eczema ever was reported by 316 (32.3%), whereas parent-reported physician-diagnosed AD was reported by 330 (33.7%). Among children with follow-up data, rash onset before two years of age was reported in 147/236 (62.3%), complete clearance during the preceding year in 169/234 (72.2%), and nocturnal waking at least once per week in 54/230 (23.5%). Recurrent itchy rash was more common among females and intermediate-school pupils, whereas eczema ever was more common among intermediate-school pupils and Al-Sarah residents.

Conclusion: AD symptoms were reported in 213 (21.8%) children. Recurrent itchy rash was more frequent among females and intermediate-school pupils, whereas eczema ever was more frequent among intermediate-school pupils and among residents of higher-altitude Al-Sarah than among residents of coastal Tihamah. Among children with nocturnal-waking data, 23.5% were awakened by the rash at least once per week. These findings require cautious interpretation but support greater awareness within schools and appropriate clinical assessment, while also underscoring the need for rigorous probability-based surveys using weighted, cluster-adjusted analyses.

Keywords: Eczema, Epidemiologic studies, Parents, Pruritus, Surveys and questionnaires

INTRODUCTION

AD is a chronic inflammatory skin disease characterised by itch, xerosis, eczematous lesions and a relapsing course [1,2]. Its clinical expression varies with age and reflects interactions among epidermal barrier impairment, immune dysregulation, inherited susceptibility, microbial influences and environmental exposures [3,4].

In children, the fluctuating nature of AD may complicate diagnosis because symptoms can improve before recurring. Clinical presentation may vary with age, skin site, disease activity and previous treatment [5]. This is relevant to epidemiological research because a single examination may not capture intermittent disease [6]. Standardised questionnaires provide a method for identifying symptom patterns across school populations; however, questionnaire-defined outcomes remain distinct from clinically confirmed diagnoses [7,8].

The burden extends beyond visible disease. Scratching may cause excoriation, pain and secondary infection, while persistent itch can

interrupt sleep and impair concentration, attendance, activity and emotional wellbeing [9,10]. Caregivers may also experience sleep loss, treatment demands, anxiety and reduced quality of life [11]. Population estimates are needed to guide school support, clinical referral and service planning.

Clinical diagnosis requires compatible morphology, distribution, pruritus and chronicity, whereas population surveys use standardised symptom-related questions. Estimates vary with age, respondent, sampling, recall interval and case definition. The International Study of Asthma and Allergies in Childhood (ISAAC) eczema module assesses an itchy rash that comes and goes for at least six months, the same rash in the last 12 months, characteristic sites, clearance, nocturnal waking and lifetime history of eczema ('eczema ever') [7]. Reported estimates of AD and eczema-related symptoms in Saudi Arabia vary substantially by region and study design. Temperature, humidity, ultraviolet exposure, vegetation and aeroallergens may influence barrier function [12], while co-existing atopic disorders

may affect diagnosis and healthcare use [13]. Al-Baha Province contains mountainous Al-Sarah and coastal Tihamah, which differ in altitude and climate.

Geographical differences may reflect variations in environmental conditions, age distribution, questionnaire administration, access to healthcare, parental awareness or terminology. Although Al-Baha's mountainous and coastal communities permit comparison, ecological zone is only a residential proxy and does not directly measure climate or allergen exposure.

Previous Saudi studies have reported widely varying estimates of eczema and AD-related outcomes in Jazan, Madinah, Hail, Tabuk, Najran, Jeddah and Taif, as well as in national surveys [14-21]. These studies differed substantially in age groups, recruitment methods, respondents, questionnaires and outcome definitions, thereby limiting direct comparison across regions. The published evidence cited here does not include a school-based estimate specific to Al-Baha Province, despite its distinctive geographical setting. Al-Baha comprises the mountainous Al-Sarah and coastal Tihamah zones, which differ markedly in altitude and climate. Studying schoolchildren from both zones within a single survey framework therefore provides locally relevant epidemiological data and permits a descriptive comparison of AD-related questionnaire indicators across these contrasting ecological settings. The present study addresses a regional evidence gap and provides baseline data for future probability-based, clinically validated and environmentally informed studies.

The present study estimated the prevalence of AD-related questionnaire indicators, described symptom characteristics (age at onset, clearance and nocturnal waking), and explored differences in recurrent itchy rash and lifetime history of eczema according to demographic, educational and geographical characteristics.

MATERIALS AND METHODS

The present school-based cross-sectional study was conducted from February 2023 to February 2024 in Al-Baha Province, southwestern Saudi Arabia. The study area comprised two ecological zones: the mountainous Al-Sarah zone, including Al-Baha City, Baljurashi, Al-Mandaq, Bani Hassan, Al-Aqiq and Al Qara, and the coastal Tihamah zone, including Al Makhwah, Qilwah, Ghamed Al-Zenad and Al Hajrah. Geographic areas were grouped according to these ecological zones. The study protocol was approved by the Scientific Research and Ethics Committee, Faculty of Medicine, Al-Baha University (REC/MED/BU-FM/2022/31). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. The electronic information page explained the purpose of the study, the voluntary nature of participation, confidentiality of the information provided and the right to decline participation. Electronic informed consent was obtained from a parent or guardian before commencement of the questionnaire.

Inclusion and Exclusion criteria: Children aged 6-15 years who were attending primary or intermediate schools in either Al-Sarah or Tihamah were eligible for inclusion. Children whose parent or guardian did not provide electronic informed consent were excluded.

Sample size calculation: The target sample size was estimated using Cochran's single-population-proportion formula, $n_0 = Z^2 p(1-p) / d^2$. A prevalence estimate of 11.43%, based on a comparable Saudi study [14], was used with a 95% confidence level ($Z=1.96$) and a margin of error of 3% ($d=0.03$). The initial calculated sample size was 432.12. To account for the sampling structure, an assumed design effect of 2.0 was applied, increasing the required sample to 864.24. A further allowance of 10% was made for incomplete submissions, resulting in a required sample of 960.27, which was rounded to 961 participants.

Study Procedure

A non probability voluntary-response sampling approach was used across the Al-Sarah and Tihamah ecological zones. Parents or guardians of eligible pupils were invited to participate through WhatsApp groups routinely used to communicate with pupils' families. An electronic link to the questionnaire was disseminated through these groups, and participation was voluntary.

Parents completed a validated Arabic version of the International Study of Asthma and Allergies in Childhood (ISAAC) Phase I eczema module [7,15]. Permission to use the Arabic version was obtained from the author who translated the questionnaire into Arabic. The questionnaire incorporated the core ISAAC eczema symptom questions and response categories, as presented in the ISAAC Phase I Manual [7]. Parents were initially asked whether their child had ever experienced an itchy rash that had been coming and going for at least six months. Those responding positively were subsequently asked whether the same rash had occurred during the preceding 12 months and whether it had ever affected characteristic sites, including the folds of the elbows, behind the knees, in front of the ankles, under the buttocks, or around the neck, ears or eyes. Questionnaire-defined AD symptoms were identified by positive responses to all three sequential items [7,22]. The three-item sequence used for this questionnaire-based definition was derived from the ISAAC Phase I Manual [7]. Each questionnaire was required to refer to a single eligible child and to be completed by that child's parent or guardian. Questionnaires were excluded if eligibility could not be confirmed, duplicate or internally inconsistent responses were identified, or the principal eczema items required to determine the main questionnaire-defined outcomes were incomplete.

Additional symptom characteristics assessed included age at onset of the itchy rash, complete clearance during the preceding 12 months and nocturnal waking attributable to the rash. Lifetime history of eczema and parent-reported physician-diagnosed AD were assessed separately. Because the study included children aged 6-15 years and all questionnaires were completed by parents or guardians, age at onset was assessed across the full study age range. Parent-reported physician-diagnosed AD was treated as an additional study-specific indicator rather than as part of the core ISAAC symptom definition.

The principal study outcomes were recurrent itchy rash lasting for at least six months, occurrence of the same rash during the preceding 12 months, questionnaire-defined AD symptoms, lifetime history of eczema and parent-reported physician-diagnosed AD. Symptom characteristics included age at onset, complete clearance during the preceding 12 months and nocturnal waking. Demographic, educational and geographical parameters comprised age, sex, nationality, educational level, ecological zone and geographic area.

Outcome denominators and missing data: Overall prevalence estimates, including questionnaire-defined AD symptoms, were calculated using the full analytical sample as the denominator. The questionnaire followed a sequential branching structure. Age at onset, complete clearance and nocturnal waking were analysed using item-specific denominators based on the number of eligible respondents with available data. Missing values were not imputed. Questionnaires with missing responses to subsequent follow-up items (complete clearance or nocturnal waking) were retained because these items were not required to determine the principal questionnaire-defined outcomes; the affected analyses therefore used item-specific denominators.

STATISTICAL ANALYSIS

Statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) version 21.0. Continuous variables were summarised as mean±Standard Deviation (SD), whereas categorical variables were presented as frequencies and percentages, n (%). Wilson 95% CIs were calculated for prevalence estimates.

Exploratory unadjusted bivariate comparisons of recurrent itchy rash and lifetime history of eczema across demographic, educational and geographical characteristics were undertaken using Pearson's chi-square test, Fisher's exact test or the Monte Carlo exact test, as appropriate for the observed cell frequencies. In these analyses, the composite questionnaire-defined AD-symptom outcome was used for prevalence estimation and was not subjected to subgroup association testing. All statistical tests were two-sided, and a p-value <0.05 was considered statistically significant. Analyses were unweighted and did not account for school-level clustering, potential confounding or multiple testing.

RESULTS

Participant characteristics: Of the 1,011 parents or guardians invited to participate, 991 submitted a questionnaire, corresponding to a response rate of approximately 98%. Following screening, 13 (1.3%) questionnaires were excluded because they contained insufficient information to confirm eligibility or determine the principal

Characteristic	Category	n (%) or mean±SD
Age, years	Mean±SD	10.22±2.97
Gender	Male	464 (47.4)
	Female	514 (52.6)
Nationality	Saudi	961 (98.3)
	Non Saudi	17 (1.7)
Ecological zone	Mountainous Al-Sarah	615 (62.9)
	Coastal Tihamah	363 (37.1)
Geographic area	Al-Baha City	352 (36.0)
	Baljurashi	92 (9.4)
	Al-Mandaq	38 (3.9)
	Bani Hassan	29 (3.0)
	Al-Aqiq	53 (5.4)
	Al Qara	51 (5.2)
	Al Makhwah	200 (20.4)
	Qilwah	33 (3.4)
	Ghamed Al-Zenad	124 (12.7)
	Al Hajrah	6 (0.6)
Educational level	Primary school	669 (68.4)
	Intermediate school	309 (31.6)

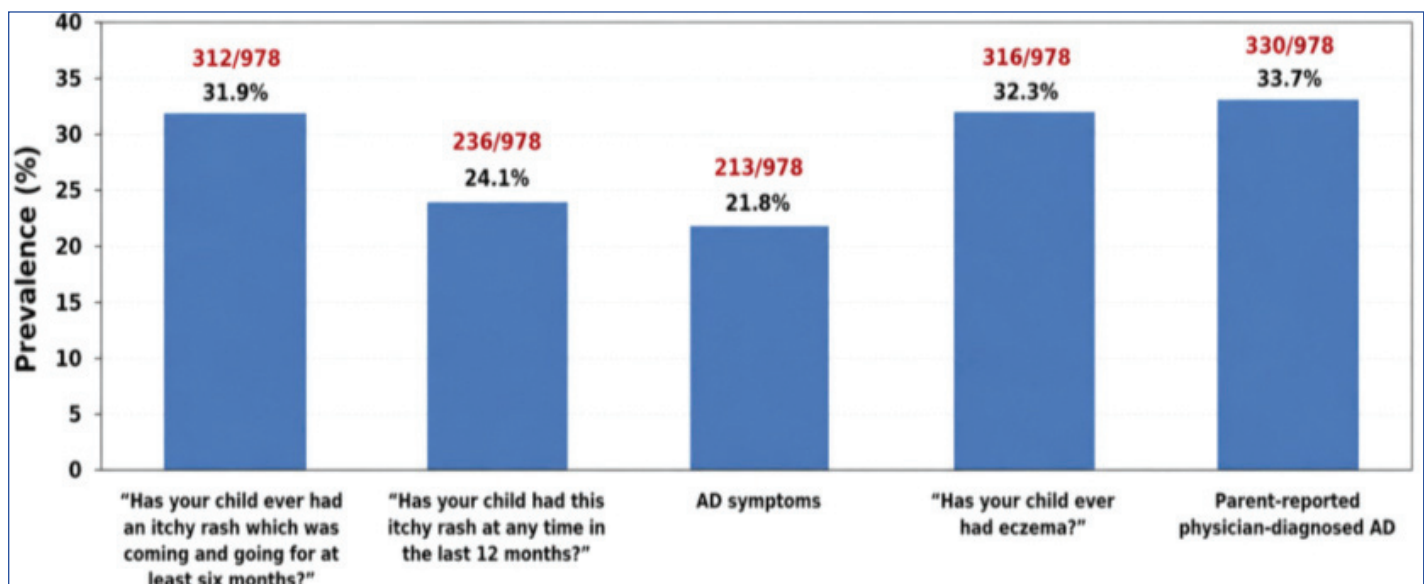
[Table/Fig-1]: Demographic, educational and geographic characteristics of participants (N=978).
SD: Standard deviation; AD: Atopic dermatitis

eczema outcomes. Consequently, 978 (98.7% of submitted questionnaires) questionnaires were included in the final analysis. The analytical sample comprised 978 children with a mean age of 10.22±2.97 years. The sample included 514 (52.6%) females, 961 (98.3%) Saudi nationals, 669 (68.4%) primary-school pupils and 615 (62.9%) Al-Sarah residents. Al-Baha City contributed 352 (36.0%) participants, followed by Al Makhwah with 200 (20.4%) and Ghamed Al-Zenad with 124 (12.7%) [Table/Fig-1].

Prevalence indicators: An itchy rash coming and going for at least six months was reported by 312 (31.9%) children (95% CI: 29.1%-34.9%). All 312 children completed the subsequent item; 236 reported an itchy rash during the previous 12 months, whereas 76 did not. The overall prevalence of 12-month recurrent itchy rash was 236/978 (24.1%) (95% CI: 21.6%-26.9%). Among the 236 children who proceeded to the characteristic-site item, 213 answered yes and 23 answered no. Thus, 213 (21.8%) of 978 children met the questionnaire criteria for AD symptoms (95% CI: 19.3%-24.5%). Eczema ever was reported for 316 (32.3%) children (95% CI: 29.5%-35.3%), and parent-reported physician-diagnosed AD was reported for 330 (33.7%) children (95% CI: 30.8%-36.8%) [Table/Fig-2].

Questionnaire-defined symptom characteristics: Data on age at onset were available for 236 children: 147 (62.3%) developed the rash before 2 years of age, 50 (21.2%) at two to four years and 39 (16.5%) at five years or later. Complete clearance during the preceding year was reported for 169 of 234 (72.2%). Among the 230 children with nocturnal-waking data, 80 (34.8%) were never awakened, 96 (41.7%) were awakened less than once per week, and 54 (23.5%) were awakened at least once per week [Table/Fig-3]. The stem-and-branch sequence used to derive the AD-symptom estimate is presented in [Table/Fig-4].

Comparisons: Recurrent itchy rash was more frequent among females than among males (36.2% versus 27.2%; p=0.002) and among intermediate-school pupils than among primary-school pupils (36.6% versus 29.7%; p=0.033) [Table/Fig-5]. Eczema ever was more frequent among intermediate-school pupils (37.5% versus 29.9%; p=0.017) and Al-Sarah residents (35.0% versus 27.8%; p=0.021); frequencies also differed across geographic areas (Monte Carlo p=0.030) [Table/Fig-6]. Small subgroup sizes within individual geographic areas precluded reliable comparisons among areas. These exploratory comparisons concerned recurrent itchy rash and eczema ever as separate questionnaire indicators and should not be interpreted as associations with the composite questionnaire-defined AD-symptom outcome.



[Table/Fig-2]: Overall prevalence of Atopic Dermatitis (AD)-related questionnaire indicators (N=978).
AD: Atopic dermatitis

Questionnaire item	Category	n/N (%)
Has your child had this itchy rash at any time in the last 12 months?	Yes	236/312 (75.6)
	No	76/312 (24.4)
Has this itchy rash at any time affected any of the following places? (The folds of the elbows, behind the knees, in front of the ankles, under the buttocks, or around the neck, ears or eyes)	Yes	213/236 (90.3)
	No	23/236 (9.7)
At what age did this itchy rash first occur?	Younger than 2 years	147/236 (62.3)
	2-4 years	50/236 (21.2)
	5 years or older	39/236 (16.5)
Has this rash cleared completely at any time during the last 12 months?	Yes	169/234 (72.2)
	No	65/234 (27.8)
In the last 12 months, how often, on average, has your child been kept awake at night by this itchy rash?	Never in the last 12 months	80/230 (34.8)
	Less than one night per week	96/230 (41.7)
	One or more nights per week	54/230 (23.5)

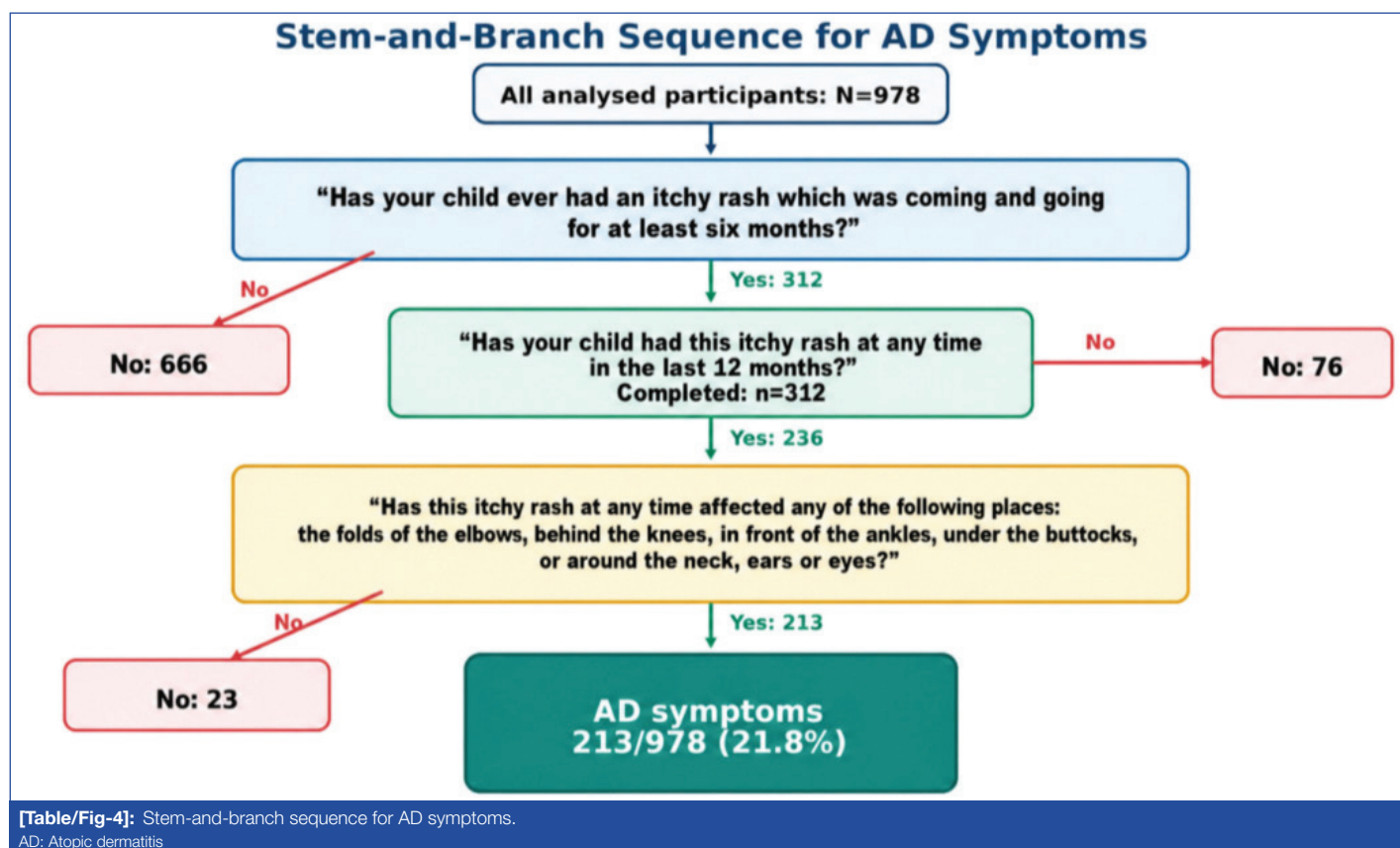
[Table/Fig-3]: Parent-completed questionnaire items and follow-up responses using item-specific denominators.

All 312 eligible respondents completed the 12-month item, and all 236 respondents who proceeded to the characteristic-site item completed it. Subsequent denominators reflect the number of eligible respondents with available data. For the clearance item, 234 of 236 eligible respondents provided a response; two responses were missing. For the nocturnal-waking item, 230 of 236 eligible respondents provided a response; six responses were missing.

intermediate-school pupils in Jazan, Saudi Arabia [14]. In Madinah, Saudi Arabia, a survey recorded chronic rash in 10.4% of the sample, recent rash in 8.8% and physician-diagnosed eczema in 14.0% [15]. The present AD-symptom estimate also exceeded national Global Asthma Network estimates of 4.5% and 5.1% in standard age groups [16]. Comparisons are limited by differences in age groups, respondents, sampling, weighting and cluster adjustment [Table/Fig-7] [14-21].

Other Saudi studies [17-21] reported widely varying estimates based on caregiver-reported diagnoses, physician-diagnosed disease, study-specific classifications and symptoms derived from non-ISAAC questionnaires. Differences may also reflect age, recruitment, administration, healthcare access, recall and denominator selection. The 21.8% estimate is therefore most appropriately compared with estimates from studies using the same three-question sequence.

Recurrent itchy rash and eczema ever were more frequently reported among intermediate-school pupils. The higher frequency among intermediate-school pupils should be interpreted cautiously because educational level closely tracks age in this sample; the cross-sectional design does not permit independent assessment of the effects of age, exposure or diagnostic history. Recurrent rash was reported more frequently among females, although eczema ever did not differ by sex. Sex-related patterns in paediatric AD vary by age and outcome [23], and potential mechanisms were not assessed. The subgroup findings therefore relate to the individual questionnaire indicators analysed rather than to the composite questionnaire-defined AD-symptom outcome.



[Table/Fig-4]: Stem-and-branch sequence for AD symptoms.
AD: Atopic dermatitis

DISCUSSION

AD symptoms were reported in 21.8% of participating schoolchildren. Recurrent itchy rash was reported in 31.9%, including 24.1% during the preceding 12 months. Eczema ever and parent-reported physician-diagnosed AD each approached one-third. The AD-symptom estimate was questionnaire-based and did not represent clinically confirmed disease. The third question captures a history of flexural involvement that may predate the preceding 12 months.

The recurrent-rash prevalence estimates in the present study exceeded the 10.0% and 12.3% reported for elementary- and

Although eczema ever was more frequent in Al-Sarah, recurrent itchy rash did not differ significantly by ecological zone. Al-Baha has a marked altitudinal gradient [24], and temperature and humidity may influence skin hydration and dermatitis activity [25,26]. However, ecological zone was a residential proxy; data on indoor climate, allergens, pollution, housing, socioeconomic conditions, healthcare access and individual exposures were unavailable.

Among 230 children with nocturnal-waking data, 54 (23.5%) were kept awake at least once per week, whereas 96 (41.7%) were kept awake less than once per week. Persistent itch, extensive disease,

Variables	Category	No recurrent itchy rash, n (%)	Recurrent itchy rash, n (%)	p-value
Gender	Male	338 (72.8)	126 (27.2)	0.002*
	Female	328 (63.8)	186 (36.2)	
Nationality	Saudi	655 (68.2)	306 (31.8)	0.795
	Non Saudi	11 (64.7)	6 (35.3)	
Ecological zone	Mountainous Al-Sarah	407 (66.2)	208 (33.8)	0.094
	Coastal Tihamah	259 (71.3)	104 (28.7)	
Geographic area	Al-Baha City	226 (64.2)	126 (35.8)	0.101
	Baljurashi	66 (71.7)	26 (28.3)	
	Al-Mandaq	25 (65.8)	13 (34.2)	
	Bani Hassan	23 (79.3)	6 (20.7)	
	Al-Aqiq	33 (62.3)	20 (37.7)	
	Al Qara	34 (66.7)	17 (33.3)	
	Al Makhwah	133 (66.5)	67 (33.5)	
	Qilwah	23 (69.7)	10 (30.3)	
	Ghamed Al-Zenad	97 (78.2)	27 (21.8)	
Educational level	Primary school	470 (70.3)	199 (29.7)	0.033*
	Intermediate school	196 (63.4)	113 (36.6)	

[Table/Fig-5]: Association between recurrent itchy rash coming and going for at least six months and sociodemographic characteristics.
*p <0.05; Pearson's Chi-square test was used where appropriate; Fisher's exact test was used for nationality, and the Monte Carlo exact test was used for geographic area.

Variables	Category	No eczema ever, n (%)	Eczema ever, n (%)	p-value
Gender	Male	323 (69.6)	141 (30.4)	0.222
	Female	339 (66.0)	175 (34.0)	
Nationality	Saudi	652 (67.8)	309 (32.2)	0.440
	Non Saudi	10 (58.8)	7 (41.2)	
Ecological zone	Mountainous Al-Sarah	400 (65.0)	215 (35.0)	0.021*
	Coastal Tihamah	262 (72.2)	101 (27.8)	
Geographic area	Al-Baha City	227 (64.5)	125 (35.5)	0.030*
	Baljurashi	61 (66.3)	31 (33.7)	
	Al-Mandaq	23 (60.5)	15 (39.5)	
	Bani Hassan	23 (79.3)	6 (20.7)	
	Al-Aqiq	33 (62.3)	20 (37.7)	
	Al Qara	33 (64.7)	18 (35.3)	
	Al Makhwah	132 (66.0)	68 (34.0)	
	Qilwah	23 (69.7)	10 (30.3)	
	Ghamed Al-Zenad	102 (82.3)	22 (17.7)	
Educational level	Primary school	469 (70.1)	200 (29.9)	0.017*
	Intermediate school	193 (62.5)	116 (37.5)	

[Table/Fig-6]: Association between eczema ever and sociodemographic characteristics.
*p<0.05; Pearson's chi-square test was used where appropriate; Fisher's exact test was used for nationality, and the Monte Carlo exact test was applied for geographic area.

suspected infection or functional impairment should prompt clinical assessment in accordance with diagnostic guidance [27], rather than reliance on questionnaire-based classification alone. Sleep disturbance in paediatric AD is associated with poorer sleep and daytime functioning [28].

The higher prevalence of parent-reported physician-diagnosed AD than of questionnaire-defined AD symptoms suggests that these measures capture different constructs. Because the timing and clinical verification of previous diagnoses were unavailable, the reason for this difference cannot be determined from the present study.

Study	Location and sample	Instrument	Reported prevalence	Comparability
Alhazmi M et al., 2017 [14]	Jazan Region, Saudi Arabia; school pupils; N=1,032	ISAAC Phase I eczema module	Calculated recurrent rash: 10.0% and 12.3%	Educational-stage comparison.
Nahas M et al., 2012 [15]	Madinah City, Saudi Arabia; ages 6-8; N=5,188	Validated Arabic ISAAC questionnaire	Chronic itchy rash 10.4%; recent itchy rash 8.8%; physician-diagnosed eczema 14.0%	Younger cluster sample.
Al Nahas S et al., 2024 [16]	Saudi Arabia (national); ages 6-7 and 13-14; N=7,682	Global Asthma Network questionnaire	AD symptoms: 4.5% and 5.1%	Standard age bands and combined symptom criterion.
Alshammrie FF et al., 2022 [17]	Hail City, Saudi Arabia; preschool children; N=964	Online caregiver questionnaire	Diagnosed eczema 54.5%	Convenience recruitment.
Alatawi AM et al., 2023 [18]	Tabuk City, Saudi Arabia; ages 5-19; N=384	Arabic self-administered questionnaire	AD 30.2%	Broad age range.
Alqahtani JM 2016 [19]	Najran Region, Saudi Arabia; schoolchildren; N=1,700	ISAAC questionnaire and skin-prick testing	Physician-diagnosed AD 12.5%	Diagnostic-history outcome.
Alqadheeb AFA et al., 2015 [20]	Jeddah City, Saudi Arabia; ages 0-15; N=936	Study-specific questionnaire	AD or eczema symptoms: 202 of 936 (21.6%)	Case-classification details limited.
Sabry EY 2011 [21]	Taif City, Saudi Arabia; ages 3-65; N=854	Original Arabic allergy questionnaire	AD symptoms: 388/854 (45.4%)	Non ISAAC instrument and broad age range.
Present study	Al-Baha Province, Saudi Arabia; ages 6-15; N=978	Questionnaire incorporating the validated Arabic ISAAC Phase I eczema module	Recurrent itchy rash: 312 of 978 (31.9%); 12-month recurrent itchy rash: 236 of 978 (24.1%); AD symptoms: 213 of 978 (21.8%); eczema ever: 316 of 978 (32.3%); parent-reported physician-diagnosed AD: 330 of 978 (33.7%)	Parent-completed; unweighted and not cluster-adjusted.

[Table/Fig-7]: Selected prevalence studies from Saudi Arabia [14-21].
AD: Atopic dermatitis; ISAAC: International Study of Asthma and Allergies in Childhood

Study strengths include a sample size exceeding the target, inclusion of both educational levels and ecological zones, recruitment across Al-Baha City and nine governorates, and use of an established questionnaire. The analysis retained the stem-and-branch structure, confirmed 213 positive characteristic-site responses, used item-specific denominators and distinguished AD symptoms, eczema ever and physician diagnosis. The design effect was used for sample-size planning but did not substitute for cluster-adjusted estimation.

The observed nocturnal waking may warrant greater awareness of sleep-related and educational difficulties within schools, together with appropriate clinical referral; however, the present study did not evaluate school-based interventions. Future probability-based surveys should use designs that permit weighted, cluster-adjusted estimation, multivariable modelling and concordance assessment. Clinical examination, treatment history, family atopy, validated severity instruments and measured exposures would strengthen interpretation. Recent Global Asthma Network data demonstrate substantial international variation in eczema prevalence trends among children and adolescents [29].

Limitation(s)

The cross-sectional design supports descriptive rather than causal interpretation. Given the voluntary nature of participation, the use of unweighted and non cluster-adjusted analyses, and

the questionnaire-based definition of AD symptoms, the findings should be generalised cautiously. Future research should therefore use probability-based sampling with weighted, cluster-adjusted analyses and incorporate multivariable modelling, clinical validation and measured environmental exposures.

CONCLUSION(S)

AD symptoms were reported in 21.8% of participating schoolchildren in Al-Baha Province. Recurrent itchy rash was more frequent among females and intermediate-school pupils. Eczema ever was significantly more frequent among intermediate-school pupils than among primary-school pupils and among Al-Sarah residents than among Tihamah residents. Among 230 children with nocturnal-waking data, 23.5% were awakened by the rash at least once per week. These findings support greater awareness within schools and timely clinical assessment, while also highlighting the need for future probability-based surveys using appropriate sampling and weighted, cluster-adjusted analytical methods.

Authors' contribution: HSA: Contributed to the conceptualisation, study design, methodology, supervision, interpretation of the results, drafting of the original manuscript, and critical revision of the manuscript. NKMA: Contributed to participant recruitment, data collection, data curation, literature review, and critical revision of the manuscript. AMSA: Contributed to methodological input, data management, statistical analysis, interpretation of the findings, and critical revision of the manuscript. RASA: Contributed to participant recruitment, data collection, literature review, and critical revision of the manuscript. NAAA: Contributed to data collection, data curation, data verification, and critical revision of the manuscript. ASHA: Contributed to the literature review, interpretation of the findings, drafting of the manuscript, and critical revision of the manuscript. SAA: Contributed to participant recruitment, data collection, data verification, and critical revision of the manuscript. SRA: Contributed to data curation, literature review, interpretation of the findings, drafting of the manuscript, and critical revision of the manuscript. All authors reviewed and approved the final manuscript.

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