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Prevalence of Atopic Dermatitis Among Primary School Children and Its Impact on Quality of Life in Kuching, Sarawak

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Abstract

Background

Atopic dermatitis (AD) is a common chronic inflammatory skin disorder that significantly burdens both children and caregivers' quality of life. This study aimed to investigate the prevalence and socio-demography of AD and determine its impact on the quality of life among AD children and their families in Sarawak.

Methods

This was a cross-sectional, observational population-based epidemiological study of primary school children in Kuching. The U.K. Working Party's Diagnostic (UKWPD) criteria was utilized to diagnose atopic dermatitis. Disease impact on quality of life was assessed via standardized questionnaires. Skin examination was performed.

Results

A total of 968 children aged 7 to 12 years were recruited. The prevalence of AD was 7.0%. Malays were the commonest affected ethnic group. Most of the AD children had other associated atopies. Majority of children with AD had mild to moderate severity based on IGA with mean EASI score (standard deviation) of 1.50 (2.0). The mean Children's Dermatology Quality Life Index (CDQLI) and Dermatitis Family Impact (DFI) were 7.26 (5.53) and 7.74 (6.12), respectively. "Symptoms of itch, sore or pain" was the most affected domain in children, whereas "Treatment impact" most affected in families. There was significant association between disease severity and children's quality of life.

Conclusion

Atopic Dermatitis is common in Kuching school children. Children with AD and their families had a significant impact on quality of life, although most were mild diseases.

Key words: *Atopic dermatitis, Eczema, Epidemiology, Quality of life, School children*

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Introduction

Atopic dermatitis (AD) is a complex, chronic, and recurrent inflammatory itchy skin disorder that often develops in early childhood and may persist into adulthood.[1] It is characterized by poorly demarcated erythema with oedema, vesicles, and weeping in the acute stage. Recurrent episodes of flares eventually lead to lichenification.[2,3] To date, AD remains a clinical diagnosis. Hanifin and Rajka criteria, the first validated diagnostic tool for

AD comprised of 4 major and 23 minor features.[4] The United Kingdom Working Party (UKWPD) refined and proposed new criteria in the '90s to improve practical applicability.[5] This has become a major advantage as its simplicity is favoured among researchers, particularly in population-based epidemiology studies.[5,6]

The prevalence of AD among children was reported between 5 to 25%. The International Study of Asthma and Allergies in Childhood (ISAAC) revealed that the prevalence of AD among Malaysian children in 2003 was 9.9% to 12.6%.7 The impact on the quality of life among affected children and families was significant with the increase in AD. While the existing local literature on AD was West Malaysia based,[7-14] lesser was known about the disease burden and sociodemography in East Malaysia. The prevalence of AD in the East could differ from the West Malaysia due to the distinctive racial diversity, cultural background and urbanisation. Our study aimed to establish and analyze the epidemiological background, risk factors, and treatment modalities of AD and its impact on the quality of life among the affected children and their families in Kuching, Sarawak.

Materials and Methods

This was a cross-sectional and observational population-based study of primary school children in Kuching, the capital city of Sarawak. Four out of 61 public national primary schools were selected by simple random selection to fulfil the calculated sample size of 954 students at 95% confidence interval. The 4 schools were SK Jalan Ong Tiang Swee, SK Batu Lintang, SK James Quop, and SK Chung Hua Pangkalan Baru. All Malaysian children attending the selected schools, from standard one to six, aged between 7 to 12 years were included.

The data collection commenced from January to December 2020 upon approval from the medical ethics committee. Questionnaire was utilized as research investigation tool and printed in multi-lingual hard copy format (Bahasa, English and Chinese). Written consent was obtained from parents. The respondents were the parents or guardians, and the children.

Clinical skin examination and collection of questionnaires were then conducted at the school premises 2 weeks later. Questionnaires were checked to ensure completeness. Parents or guardians were contacted for incomplete questionnaires. Students who were absent or unconsented during the day were given another date for examination.

Data analysis was done using IBM SPSS Statistics Version 22.0. Descriptive statistics such as mean with standard deviation or frequency with percentage were used to determine the characteristic of the students and the prevalence of AD. Univariate analysis Pearson's Chi-square test was applied to determine the association of the risk factors towards AD and the factors affecting AD children's quality of life. Logistic regression was used in multivariate analysis. $P \leq 0.05$ was considered significant.

Questionnaire

The questionnaire was composed of 3 sections and translated in 3 languages (English, Malay and Chinese). The questionnaire was completed by the parents, or guardians together with their children (except question 6 of section 2 was filled by research team). Section 1 assessed the basic socioeconomic background of the children and their families. Age, sex, ethnicity, number of siblings, order in family, anthropometric measurement, parents' education and occupation, family history of atopy (based on doctor's diagnosis), aggravating factor, treatments used and choice of medical advice were collected.

Section 2 was for the diagnosis of AD through a validated UKWPD criteria.[5] (1) A child must have an itchy skin condition, plus 3 or more of: (2) history of involvement of the skin creases such as folds of elbows, behind the knees, fronts of ankles or around the neck; (3) onset under the age of 2 (4) a personal history of asthma or allergic rhinitis; (5) a history of general dry skin in the last year; (6) visible flexural eczema noted by the research team.

Section 3 measured the quality of life in AD children and their family using validated questionnaires, Children's Dermatology Quality Life Index (CDLQI) and Dermatitis Family Impact (DFI).[15,16] CDLQI consisted of 10 subjects and 7 domains related to the week before assessment. The domains are Symptoms (Itchy, sore or pain); Emotion (Embarrassment, sadness, or self-conscious); Leisure (Clothing, going out and play, or hobbies, swimming or other sports); Personal relationships

(Friendships, bully or teasing); School or holidays; Sleep; and Treatment problem. DFI consisted of 10 subjects to measure how much having a child with AD affected the quality of life of the other (adult) members of the family in a one week recall period. For both questionnaires, each question is given a score based on the choice of the respondent, 0 points for "not at all", 1 point for "a little", 2 points for "a lot" and 3 points for "very much". The sum of all 10 questions gives a total score range of 0 to 30.

Clinical Examination

All the consented children were examined at the selected school by the clinical team, consisting of the investigator, medical officers, medical assistant, and staff nurses from Sarawak General Hospital's dermatology clinic. Clinical features of AD and its severity were determined during the examination. Two standardised AD severity scores were used-Eczema Area and Severity Index (EASI) and Investigator Global Assessment (IGA) scale.[17,18]

EASI score is a tool to measure the extent and severity of AD. The assessment is based on 4 body regions-head & neck, trunk, upper and lower extremities. Extent and severity of eczema signs are evaluated for each body region. The extent is based on percentage of skin affected by eczema and charted on a score from 0 to 6. The severity of eczema signs, including erythema, oedema or papulation, excoriation, and lichenification are charted as none (0 points), mild (1 point), moderate (2 points) or severe (3 points). The final score is the sum of the 4 region scores, which ranges from 0 to 72. A higher score denotes greater AD severity. The 5-point IGA scale categorises the AD severity as clear, almost clear, mild, moderate and severe. The gradings are based on inflammatory signs like the degree of erythema, population or induration, lichenification, and oozing or crusting.

Results

Primary School Children's Demography

A total of 968 from 1133 school children were enrolled in the study, giving a response rate of 85.4%. SK Jalan Ong Tiang Swee contributed 491 students to the study (97.8% response rate). This was followed by 194 students from SK Batu Lintang (60.6%), 159 students from SK James Quop (88.8%), and 124 students from SK Chung Hua Pangkalan Baru (93.9%). Of the 165 students who were not included, they were either absent during the clinical examination or given no consent. Refer to Table 1 for the overall school children's sociodemography.

Children with Atopic Dermatitis

The prevalence of atopic dermatitis in school children was 7.0%. There were 68 students with atopic dermatitis, 38 were girls and 30 were boys, giving a slight predilection for girls with a M:F ratio of 1:1.27. Most of the children with AD were 7 to 9 years old (54.4%).

In this study, AD was more common among Malays (29.4%) and Chinese (25.0%) when compared to the Dayaks [Bidayuh (17.6%) and Iban (20.6%)]. Other ethnicities accounted for 7.3%. The finding was relatively similar to Kuching's racial distribution. The 10 Indians in this study had no atopic dermatitis. The Malay children were mostly in the elder age group, especially 12 years old (35.0%). On the other hand, Dayak children with AD were younger, between 7 to 9 years (61.5%).

Children with AD also had concomitant bronchial asthma (36.8%) or allergic rhinitis (61.2%). One-quarter of the children had AD only (25.0%). Sixteen children (23.5%) had all the 3 diseases. Asthma was more common among Ibans and Bidayuh (56.0%), while more Malays and Chinese (51.4%) had allergic rhinitis. Around 80% of the children with AD had at least one first degree family member with atopy. Those affected family members were either one or both parents (50.0%), especially mother. The remaining half was a combination of siblings and parents. Mother was the most common family member to have atopic dermatitis (46.3%), asthma (48.2%) and allergic rhinitis (72.4%). There were 14 AD children with no family history of atopy. In contrast, family history of atopy was significantly less in children without AD, accounted for 29.6%. Most of the children had less than 4 siblings (73.5%). Thirty- seven were the firstborn in the family, either the only child (37.8%) or eldest among siblings (62.2%).

The two most common aggravating factors were dust and hot weather. Most seek professional medical help as their first choice (85.3%). Those parents who seek consultation from a doctor preferred private

practitioners or dermatologists (71.8%) over public polyclinic practitioners (23.5%). Neither ethnicity nor the parents' education level had influenced the choice of consultation. We found that 67.6% of AD children used moisturisers as part of the treatment. Half of them took antihistamines and applied topical corticosteroids (Table 2).

Although Pearson Chi-Square showed seven variables (only child, order in family, concurrent atopy and family history of atopy) were associated with AD (Table 1), a subsequent binary logistic regression revealed 4 variables remained statistically significant ($p<0.05$). Eldest in the family was 2.6 times (95% CI 1.4, 4.6) more likely to have AD than non-firstborn. The risk of having AD tripled in children with existing allergic rhinitis (95% CI 2.0, 6.9) and doubled in asthma (95% CI 1.3, 5.1). Meanwhile, children with family history of eczema were 7 times (95% CI 3.9, 13.6) more likely to have AD than non-family history. Refer Table 3.

UKWPD Criteria and Atopic Dermatitis Severity (EASI and IGA)

Pruritus is a mandatory feature for diagnosis of AD. Thirty-eight (55.9%) school children fulfilled 4 criteria, 16 (23.5%) met 5 criteria, 7 (10.3%) met 6 criteria, and 7 (10.3%) had all 7 criteria. Half of them had dry skin (51.5%). Majority of the parents reported that the disease affected skin creases (89.7%) in the past, and approximately 80% of the children with AD had visible flexural dermatitis during clinical examination. For the AD children with onset below the age of two, 52.9% had asthma, 58.8% had allergic rhinitis and one third had all the 3 atopic diseases. (Table 2).

Overall, school children with AD were mild with a mean EASI score (SD) of 1.50 (2.0). Majority of the AD children (98.5%) had EASI score less than 7. Scores were higher on limbs compared to head, neck and trunk. Similarly, IGA based assessment showed that more than half (54.4%) of the school children had almost clear to clear disease, 35.3% had mild disease, and 10.3% had moderate disease. None of the children had severe or very severe disease. Children with IGA-based moderate disease had a mean EASI score (SD) of 5.1 (3.75); whereas mean EASI score (SD) for children with IGA-based mild disease was 1.5 (0.76) and IGA-based almost-clear to clear disease was 0.56 (0.61). (Table 4).

CDQLI and DFI in Quality of Life

In our series, CDLQI revealed that 90% of school children's quality of life was affected by AD to varying degrees; more than half (52.9%) experienced moderate to large effect on daily living. We had 19 (27.9%) children whose AD significantly affected their quality of life with CDLQI score of more than 10. Two out of them (2.9%) had scored the highest 19 points. (Table 5) The most affected domain was "Symptoms" [1.35 (0.69)], followed by "School or holiday" [0.97 (1.41)], "Embarrassment" [0.96 (0.89)], "Treatment problem" [0.76 (0.85)] and "Go out & Play" [0.75 (0.82)]. Girls were slightly more affected than boys in all the domains. Looking into the those 19 children's family aspect, 13 families were severely affected with DFI score more than 10 (68.4%). The families of two children who scored highest in CLDQI also had higher DFI scores, 14 and 29. The other 6 families (31.6%) were moderately affected, and the scores were in the range of 6 to 10. The affected domains in DFI were treatment impact [0.97 (1.17)], household expenditures [0.87 (0.91)], and housework [0.74 (0.84)]. Parents had to take more effort and time to prepare the children's meals [0.62 (0.79)]. (Table 6).

We used logistic regression to appraise the relationship between severity of AD to children and family's quality of life. The univariate analysis showed that both the IGA and EASI scores negatively impacted children's quality of life. IGA severity was statistically significant to the domains of CDQLI ($p=0.002$). This relationship remained significant ($p=0.002$) after controlled for selected covariates such as gender, ethnicity and BMI. Post-hoc analysis showed strong association between moderate disease vs clear ($p=0.012$), moderate disease vs almost clear ($p=0.004$) and moderate disease vs mild disease ($p<0.001$). Likewise, statistical significance was seen between EASI severity and CDQLI in one-way ANCOVA ($p=0.025$). Higher EASI scores were associated with a greater impact on children's quality of life. Univariate and multivariate analysis showed no statistical significance between the severity scores and DFI. (Table 7).

Table 1. Demography of primary school children in Kuching

Category		AD	No AD	Total	***p*-value**
		n (%)	n (%)	n (%)	
Sex	Male	30 (44.1)	482 (53.6)	512 (52.9)	0.133
	Female	38 (55.9)	418 (46.4)	456 (47.1)	
Age	7-8	23 (33.8)	307 (34.1)	330 (34.1)	0.863
	9-10	26 (38.2)	318 (35.3)	344 (35.5)	
	11-12	19 (27.9)	275 (30.6)	294 (30.4)	
Race	Iban	14 (20.6)	194 (21.6)	208 (21.5)	0.556
	Malay	20 (29.4)	223 (24.8)	243 (25.2)	
	Chinese	17 (25.0)	174 (19.4)	191 (19.8)	
	Bidayuh	12 (17.6)	214 (26.8)	253 (26.2)	
	Melanau	2 (2.9)	18 (2.0)	20 (2.1)	
	Indian		10 (1.1)	10 (1.0)	
	Others	3 (4.4)	38 (4.2)	41 (4.2)	
Order in family	Only child	14 (20.6)	91 (10.7)	105 (11.4)	0.014
	Siblings	54 (79.4)	759 (89.3)	813 (88.6)	
	Eldest	23 (42.6)	220 (29.1)	243 (30.0)	0.037
	Non-firstborn	31 (57.4)	536 (70.9)	567 (70.0)	
BMI	Normal	40 (58.8)	592 (65.9)	632 (65.4)	0.295
	Overweight	9 (13.2)	127 (14.1)	136 (14.1)	
	Obese	19 (27.9)	180 (20.0)	199 (20.6)	
Other atopic diseases	Asthma				<0.05
	Yes	25 (36.8)	67 (7.8)	92 (9.9)	
	No	43 (63.2)	791 (92.2)	834 (90.1)	
	Allergic rhinitis				<0.05
	Yes	42 (61.8)	153 (17.8)	195 (21.1)	
	No	26 (38.2)	705 (82.2)	731 (78.9)	
Family history	Atopy				<0.05
	Yes	54 (79.4)	266 (29.6)	320 (33.1)	
	No	14 (20.6)	634 (71.4)	648 (66.9)	
	Asthma				<0.05
	Yes	29 (42.6)	158 (17.6)	187 (19.3)	
	No	39 (57.4)	742 (82.4)	781 (80.7)	
	Allergic rhinitis				<0.05
	Yes	29 (42.6)	124 (13.8)	153 (15.8)	
	No	39 (57.4)	776 (86.2)	815 (84.2)	
	Eczema				<0.05
	Yes	41 (60.3)	113 (12.6)	154 (15.9)	
	No	27 (39.7)	787 (87.4)	814 (84.1)	
Parents education	None	3 (2.2)	13 (0.8)	16 (0.9)	0.017
	Primary	1 (0.8)	108 (6.9)	109 (6.4)	
	Secondary	53 (40.2)	879 (56.4)	932 (55.1)	
	University / College	75 (56.8)	558 (35.8)	633 (37.5)	
Household [mean (SD)]	Size	4.63 (1.40)	4.91 (1.28)	4.89 (1.29)	
	Birth order	1.76 (1.00)	2.14 (1.22)	2.11 (1.21)	
	Siblings no.	2.75 (1.31)	3.00 (1.28)	2.90 (1.28)	

Table 2. AD diagnosis, aggravating factors, choice of consultation and treatment pattern

	Parents / Guardian's Response, n (%)	
	Yes	No
UKWPD Questions for AD diagnosis		
Q1 - Itchy	68 (100.0)	0
Q2 - Age onset		
Under 2	34 (50.0)	
2 to 5	15 (22.1)	
5 to 10	16 (23.5)	
Over 10	3 (4.4)	
Q3 - Skin creases	61 (89.7)	7 (10.3)
Q4a - Asthma	25 (36.8)	43 (63.2)
Q4b - Allergic rhinitis	42 (61.8)	26 (38.2)
Q5 - Dry skin	35 (51.5)	33 (48.5)
Q6 - Visible flexural dermatitis	55 (80.9)	13 (19.1)
Aggravating factors		
Dust	50 (73.5)	18 (26.5)
Hot weather	47 (69.1)	21 (30.9)
Food	28 (41.2)	40 (58.8)
Grass intolerance	24 (35.3)	44 (64.7)
Furry pets	23 (33.8)	45 (66.2)
Physical exercise	16 (23.5)	52 (67.5)
School stress	7 (10.3)	61 (89.7)
Preferred healthcare provider		
Doctor	58 (85.3)	10 (14.7)
Private general practitioner	31 (36.5)	
Dermatologist	30 (35.3)	
Public polyclinic doctor	20 (23.5)	
Emergency department	4 (4.7)	
Pharmacist	40 (58.8)	28 (41.2)
Family or friends	10 (14.7)	58 (85.3)
Traditional healer / Alternative medicine	8 (11.8)	60 (88.2)
Treatment modalities		
Moisturisers or Emollients	46 (67.6)	22 (32.4)
Antihistamines	36 (52.9)	32 (47.1)
Steroids		
Oral	6 (8.8)	62 (91.2)
Topical	34 (50.0)	34 (50.0)
Antibiotics	19 (27.9)	49 (72.1)
Traditional herbs	9 (13.2)	59 (86.8)

Table 3. The risk factors of atopic dermatitis

Factors	OR	95% CI		*p*-value
Eldest among siblings	2.57	1.43	4.62	0.002
Concomitant asthma	2.54	1.28	5.06	0.008
Concomitant allergic rhinitis	3.75	2.05	6.87	0.000
Family history of asthma	1.23	0.65	2.29	0.526
Family history of allergic rhinitis	1.24	0.64	2.41	0.528
Family history of atopic dermatitis	7.24	3.86	13.58	0.000

Table 4. Severity of AD by EASI and IGA

EASI (Total scores)#	n (%)	IGA	n (%)
Clear (0)	10 (14.7)	Clear	11 (16.2)
Almost clear (0.1-1.0)	28 (41.2)	Almost clear	26 (38.2)
Mild (1.1-7.0)	28 (41.2)	Mild disease	24 (35.3)
Moderate (7.1-21.0)	2 (2.9)	Moderate diseases	7 (10.3)
Severe (21.1-50.0)	0	Severe diseases	0
Very severe (50.1-72.0)	0	Very severe diseases	0

#Mean total EASI score (SD)=1.50 (2.0). Mean EASI score (SD) for each section-head & neck 0.03 (0.14); trunk 0.20 (0.44); upper limb 0.44 (0.53); and lower limb 0.83 (1.11)

Table 5. The scores for CDQLI and DFI

	n (%)				
Scores*	0 to 1	2 to 5	6 to 10	11 to 20	21 to 30
CDLQI	10 (14.7)	22 (32.4)	17 (25.0)	19 (27.9)	0
DFI	17 (25.0)	25 (36.8)	11 (16.2)	14 (20.6)	1 (1.5)

**Scores interpretation: 0-1=no effect; 2-6=small effect; 7-12=moderate effect; 13-18=very large effect; 19-30=extremely large effect*

Table 6. Mean score and standard deviation of each domains in CDLQI and DFI

	Mean Score (SD)			
CDLQI (n=68)	**Total**	**Boys**	**Girls**	***p*-value**
Q1 - Itchy, Sore or Pain	1.35 (0.69)	1.40 (0.81)	1.32 (0.57)	0.633
Q2 - Embarrassed	0.96 (0.89)	0.90 (1.00)	1.00 (0.81)	0.156
Q3 - Friendship	0.26 (0.61)	0.27 (0.69)	0.26 (0.55)	0.788
Q4 - Clothes	0.65 (0.75)	0.83 (0.83)	0.50 (0.65)	0.350
Q5 - Go out & Play	0.75 (0.82)	0.67 (0.84)	0.82 (0.80)	0.812
Q6 - Swimming or Sports	0.63 (0.95)	0.57 (0.86)	0.68 (1.02)	0.270
Q7 - School or Holiday	0.97 (1.41)	0.70 (1.29)	1.18 (1.49)	0.162
Q8 - Bully	0.29 (0.69)	0.30 (0.65)	0.29 (0.73)	0.950
Q9 - Sleep	0.63 (0.85)	0.57 (0.86)	0.68 (0.84)	0.769
Q10 - Treatment problem	0.76 (0.85)	0.70 (0.88)	0.82 (0.83)	0.589
Total score	**7.26 (5.53)**	**6.90 (5.85)**	**7.55 (5.33)**	**0.931**
DFI (n=68)				
Q1 - Housework	0.74 (0.84)	0.60 (0.77)	0.84 (0.89)	0.791
Q2 - Feeding	0.62 (0.79)	0.57 (0.82)	0.66 (0.78)	0.830
Q3 - Sleep	0.56 (0.80)	0.50 (0.78)	0.61 (0.82)	0.728
Q4 - Family activity	0.44 (0.70)	0.27 (0.52)	0.58 (0.79)	0.055
Q5 - Shopping	0.34 (0.66)	0.23 (0.43)	0.42 (0.79)	0.218
Q6 - Expenditure	0.87 (0.91)	0.73 (0.91)	0.97 (0.92)	0.387
Q7 - Tiredness	0.47 (0.78)	0.47 (0.78)	0.47 (0.80)	0.785
Q8 - Emotion	0.49 (0.74)	0.40 (0.56)	0.55 (0.86)	0.052
Q9 - Relationship	0.25 (0.56)	0.20 (0.41)	0.29 ± 0.65	0.146
Q10 - Treatment impact	0.97 (1.17)	1.03 (1.27)	0.92 (1.10)	0.187
Total score	**5.74 (6.12)**	**5.00 (5.32)**	**6.32 (6.70)**	**0.241**

Table 7. Relationship between AD severity (by IGA or EASI) and Quality of life (by CDQLI or DFI)

	Univariate		Multivariate	
Factors	**CDLQI**	**DFI**	**CDLQI**	**DFI**
IGA	0.002[a]	0.242[a]	0.002+	nil
EASI	0.023[c]	0.248[c]	0.025[b]	nil

The p-value for multivariate analysis were derived after controlled for gender, ethnicity and BMI category.
[a]p-value was derived from one-way ANOVA; [b]p-value was derived from ANCOVA; [c]p-value was derived from linear regression

Discussions

Prevalence and Risk Factors

AD is one of the most common skin disorders affecting up to 20% of children in some countries.[7] Approximately 28% of the Malaysian population are children.[19] The ISAAC study published our national prevalence of AD as 11.0% (6-7 years old) and 9.3% (13-14 years old) in 2008, based on population study in cities of West Malaysia (WM).[7,20] The urbanization of Malaysia's cities over the decades has led to the rise of AD prevalence by nearly 4 folds.[7]

This is the first population-based study of AD among school children in Kuching, in the age group of 7 to 12. Based on the UKWPD criteria questionnaire and clinical examination, the overall prevalence of AD was 7% and girls (8.3%) were more prevalent than boys (5.9%). This was comparable to the 7.6% of AD prevalence among secondary school children in Kota Kinabalu, the capital city in another state in East Malaysia, Sabah.[21]

However, the age-specific prevalence of AD in our study was lower than that in WM. The discrepancy might have been attributed to many studies done in WM that were either clinic or hospital-based.[8,9,10,11] There were two population-based studies from WM that reported a higher prevalence, 13.7% (5 to 7 years old) and 13.5% (Preschool age, less than 6 years old).[12-14] This could be due the difference in ethnic mix of children, age and environmental factors. It was also well recognised that AD prevalence varied between rural and urban areas. WM developed at a pace greater than EM due to geographical and logistic differences. Several studies reported a higher prevalence in specific races.[20,22,23] ISAAC study showed a significant difference in the prevalence of both within countries and between geographical areas.[5,20] Scandinavia, Western Europe, Australasia, and urban areas in Africa have a higher prevalence rate than China, the Middle East, Central Asia and Eastern Europe.[24] Children in our cohort were of diversified racial background while other studies from WM were predominantly Malays (80-90%) and Chinese. The prevalence of AD in Iban (6.7%) and Bidayuh (4.7%) children were slightly lower when compared to Malays (8.2%) or Chinese (8.9%). Nonetheless, these data showed that AD is common among school children in Malaysia.

The prevalence of AD is known to decrease with age;[25] however, we found no difference in the prevalence of AD between 7 to 12 years old. A stable trend was noticed at a range of 6.4% to 8.0%. Prevalence was highest in 12 years old (8.4%) and lowest in 11 years old (4.6%).

AD is a known disease of infancy and childhood, in which more than 80% had onset before the age of 7 years.[26] Half of children with AD in our series had onset before the age of 2 years. Only 3 of the children had onset after the age of 10 (4.4%). The finding corresponded to a study in preschool children in Kuala Lumpur, 70% of children had AD onset less than 2 years old.[14] A population-based study in Singapore also recorded similar results.[27] A clinic-based study at the paediatric institute reported early onset of disease with a median age of diagnosis of 22 months.[28] Late-onset of AD is otherwise not uncommon. A study from the National University of Malaysia showed that 22.6% of patients had late onset of AD between 11 to 30 years old.[10] Another cohort also reported that 32.2% of children had disease onset after the age of 7 years.[29]

AD was more common in girls, despite there being more boys in this study. The M:F ratio was the most apparent amongst 12-year-olds (1:2). One population-based study in Australia also found higher prevalence in girls, either by clinical examination (17.7%) or UKWPD criteria (12.3%) than boys, 14.8% and 9.2% respectively.[30] The female preponderance is similar to the ISAAC study and another clinic-based local study.[5,11] On the other hand, other local studies showed more males affected with M:F ratio of 1.7:1.[10,14,28] A Korean review article mentioned that boys were more likely to develop AD than girls during infancy, but there was a girls predominance in adolescence.[31]

Family history of atopy was the single most

critical risk factor for atopy among children.[32] We found similar association in our cohort with a sevenfold increase risk of getting AD. Children with concomitant asthma or allergic rhinitis had doubled to a tripled risk of developing AD. Approximately three-quarter of the school children in this series had at least one concomitant atopic disease. A study in Taiwan also showed increased risk of AD development by two folds among atopy children.[33] The local study had shown significant association between AD and concomitant atopic diseases.14 Our study also showed that the eldest in the family had tripled AD development risk. Studies on siblings suggested a diminished risk of atopy in younger siblings due to the protective effect of early-life viral infections.[34]

Quality of Life among AD Children

AD's chronic and recurrent nature incurred significant negative impact on both affected children and their families.[35] In our study, AD had influenced the children's quality of life in various aspects, even though most had mild course of disease. This was also true in a factor analysis study done in Hong Kong.[36] The most affected domains were "Symptoms", "Emotions" and "School or holiday". Literature had shown consistent results in many studies worldwide.[28,36-41] Constant itch, sore or pain was the most significantly affected psychosocial domains among children with AD. The biggest challenge in AD is the management of itch. Itch had disturbed half of the children's sleep and 50% of them responded "very much" and "quite a lot". Sleep deprivation would affect a child's behavioural development and school performance in longterm.[35,42]

Feeling of embarrassment, self-conscious, upset and sad among the AD children, particularly girls, had indirectly taken a toll on school work and holiday enjoyment. Children with AD often shy away from their peers due to chronic and visible skin lesions.[43] It also affected the domain "Go out & play and swimming or sports". The stigmatization and negative changes of self-perception would gradually drain the children emotionally to mental distress. Although the disease did not affect the domain "friendship' and "bully", careful attention must be emphasized to keep the social stigma of AD at minimal level in schools. The social relations with peers in this age group grow significantly.[44]

Almost a quarter of the AD children also felt that "Treatment" had bothered them at certain extend. A Thai study reported that taking oral medications, especially number of medications could significantly affect quality of life of the children and caretakers.[37] Parental admonitions may further stigmatize the AD children to additional isolation.[43] In our study, children between 10 to 12 years were more affected than juniors (7 to 9 years) in most domains, particularly physical symptoms, school work or holiday enjoyment and emotions. Pre-adolescent children are more self-aware and have a better cognitive, psychosocial and emotional development.[45] They are in transition between childhood and adulthood to gain independence and establish a secure identity. This group of children's self-expression and concern on AD, including emotion and treatment, must be addressed during clinic consultation.

Quality of Life among Families of AD Children

AD affects the social and emotional aspects of families of AD children. A study showed that restrictions of everyday family life and limitations with stringent treatment regimes have led to parental exhaustion, hopelessness, guilt, anger and depression.46 Caring for a child with AD requires adjustments to family lifestyles and incurs financial costs.[47]

Domains that were affected were "Treatment impact", "Expenditure", "Housework", and "Feeding". About a quarter of the family felt "A lot" and "Very much" affected by the "Treatment impact". The family of children with clear to mild disease responded to "Treatment impact" with a mean score (SD) of 0.84 (1.07), compared to those with a moderate disease which was significantly higher, 2.57 (1.13). This was in accordance with other studies.[28,37,48] Parents had spent more time and effort helping the children deal with the disease and its treatment, in addition to the chores in the house, especially to keep the linens clean and environment dust-free. Some of the parents believed that certain foods could aggravate the disease and were meticulous with meal preparation for the family. Consequently, adaptations to family lifestyles have expectedly increased the overall household expenses. The treatment of AD could be costly if parents self-purchased medications, seek consultation from private clinics and alternative

treatment practitioners.

Co-sleeping is a common habit in Malaysia. The mean score (SD) of domain "Sleep" in family members was 0.56 (0.80). There were 16% of them responded to sleep disturbances as "A lot" and "Very much", of which half of the children had mild to moderate disease. This negative effect on parental sleep pattern was also reported in a Thai study.[37]
In our study, majority of the primary caregivers were working parents. Twenty AD children's mothers were housewives. Nevertheless, the domains like "Relationship", "Emotion" and "Tiredness" were less affected. Less than 10% of families regarded those as "very much" or "A lot". This could be explained by the fact that approximately one-third of mothers had atopy. Their personal experience helped in coping and understanding the disease. Mothers were able to cope with emotional distress and exhaustion despite feeling more occupied with childcare. Our cohort of school children was predominantly mild in disease severity. Literature showed that parents of children with more severe AD had more impact on emotional distress.48 We found that those families that responded with profound impact on "Relationship", "Emotion" and "Tiredness" were in the younger age group (7 to 9 years), about 10% had moderate disease. More than 90% had no family history of atopy.

Intervention in AD School Children

The clinical assessment had given the study a great advantage to understand the AD disease burden among school children. We noticed that 33% of children with AD were not using moisturizers, which is the main therapy that improves skin barrier and reduces pruritus.[49] Emollient therapy has proven to enhance topical corticosteroids' efficacy, thus reducing its steroid usage and dependency.[50] The research findings enable our team to plan and organize educational programs for the children and parents, which encompasses disease knowledge, prevention of triggers, practical skincare, treatment and wholesome AD's management. School children with moderate disease or frequent flares were given appointment to be managed and followed up at Sarawak General Hospital's dermatology clinic.

Conclusion

Atopic dermatitis is common among school children in Kuching. This study gave insight into AD in school children and acknowledged that AD had a significant physical, emotional and social impact on the affected children and their families, although the majority were mild in severity. The association between AD and other atopic diseases vis-à-vis asthma, allergic rhinitis is demonstrated, as is the association with genetic tendencies of AD's development. Clinicians should incorporate measurement of quality of life to accurately assess AD severity to improve long term management of AD.

Conflict of Interest Declaration

The authors have no conflict of interest to declare.

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