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Correlation Between Dietary Intake of Fiber, Fat, Animal Protein, and Simple Sugar, and SCORAD Index in Toddlers with Atopic Dermatitis

Nice Fenobileri[1,2], Rusdi[1,2], Finny Fitry Yani[1,2], Rinang Mariko[1,2], Anggia Perdana Harmen[1,2], Rahmi Lestari[1,2]

[1]Department of Child Health, Faculty of Medicine – Universitas Andalas, Padang, West Sumatera, Indonesia
[2]Department of Child Health, Dr. M. Djamil Hospital, Padang, West Sumatera, Indonesia

Corresponding Author: Dr. Nice Fenobileri

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ABSTRACT

Background: Atopic dermatitis (AD) is a chronic inflammatory skin disease with a global prevalence of up to 20% in children, predominantly affecting those under 5 years of age. Diet and nutrition are believed to play a significant role in AD severity; however, clinical evidence in toddlers remains limited. This study aimed to determine the correlation between average dietary intake of fiber, total fat, animal protein, and simple sugar with SCORAD values in toddlers with AD.

Methods: An observational cross-sectional study involving 45 toddlers aged 6 months to 5 years diagnosed with AD based on Williams criteria, conducted at 13 primary health centers in Padang (March 2025–March 2026). Disease severity was assessed using the SCORAD index. Dietary intake was evaluated using a 3-day food recall (2 weekdays and 1 weekend day). Spearman's correlation test was used with SPSS version 31.

Results: Median age was 2 years 3 months, with 53.30% female. Median SCORAD was 20.50, with majority classified as mild AD (57.80%). Mean fat intake was 30.43 ± 15.03 g/day and animal protein intake was 23.93 ± 13.53 g/day. Median fiber intake was 2.41 g/day and simple sugar intake was 6.22 g/day. No significant correlation was found between fat intake ($r = -0.041$; $p = 0.78$), fiber ($r = -0.048$; $p = 0.75$), animal protein ($r = 0.146$; $p = 0.33$), and simple sugar ($r = -0.046$; $p = 0.76$) with SCORAD values.

Conclusion: No significant correlation was found between average dietary intake of fiber, fat, animal protein, and simple sugar with AD severity in toddlers. Dietary restriction without clear clinical indication is not recommended in the management of AD in children.

Keywords: atopic dermatitis, SCORAD, dietary fiber, fat intake, animal protein, simple sugar, toddler

INTRODUCTION

Atopic dermatitis (AD) is a chronic inflammatory skin disease with a global prevalence of up to 20% in children, predominantly affecting those under 5 years of age.[1,2] In Indonesia, prevalence among preschool children has been reported at 19.5%.[3] The disease significantly impacts quality of life for patients and their families, with an economic burden proportional to disease severity.[4,5,6] Disease severity is assessed using the SCORAD index (score 0–103; mild <25, moderate 25–50, severe >50), the most widely used instrument in clinical research.[7,8] Topical steroids as the primary treatment have limited efficacy and long-

term side effects, necessitating non-pharmacological approaches including dietary modification.[9,10] Diet and nutrition are believed to play a key role in AD pathogenesis through gut and skin microbiota interactions and inflammatory modulation pathways. Dietary fiber has been reported as protective via production of anti-inflammatory short chain fatty acids (SCFA), while high-fat, high animal protein, and high simple sugar diets may worsen AD through dysbiosis and systemic inflammation.[11,12,13,14,15,16,17] Despite extensive mechanistic research, clinical evidence linking specific macronutrient intake to AD severity in toddlers remains limited and inconsistent. This study aimed to determine the correlation between average dietary intake of fiber, fat, animal protein, and simple sugar with SCORAD values in toddlers with AD in Padang.

METHODS

Study Design and Setting

This was an observational cross-sectional study conducted from March 2025 to March 2026 at 13 primary health centers in Padang, West Sumatera, Indonesia. Ethical approval was obtained from the Health Research Ethics Committee of Dr. M. Djamil Hospital, Padang.

Subjects

Subjects were toddlers aged 6 months to 5 years diagnosed with AD based on Williams criteria (major criterion plus at least 3 minor criteria), recruited by consecutive sampling. Exclusion criteria: diabetes mellitus type I or II, fever or illness within the past 14 days, and diarrhea. Minimum sample size of 37 was calculated using the correlation formula ($r = 0.47$[18]; $Z\alpha = 1.96$; $Z\beta = 0.84$) with 10% drop-out adjustment. Of 47 eligible subjects, 2 declined participation, yielding a final sample of 45 children.

Measurements

AD severity (dependent variable) was assessed using the SCORAD index by a trained general practitioner. Dietary intake (independent variables) was assessed using a 3-day food recall (2 weekdays and 1 weekend day) conducted by trained dietitians using food photo guides and food models. Food quantities were converted to grams using the Indonesian Food Composition Table (TKPI) 2017.[19]

Statistical Analysis

Univariate analysis was reported as frequencies/percentages for categorical data and mean ± SD or median (min–max) for continuous data. Normality was assessed using the Kolmogorov-Smirnov test. Bivariate analysis used Spearman's correlation due to non-normal distribution of SCORAD data. A p-value <0.05 was considered statistically significant. Analyses were performed using SPSS version 31.

RESULTS

Demographic Characteristics

The study included 45 toddlers with AD from 13 primary health centers in Padang. Demographic characteristics are presented in Table 1. The median age was 2 years 3 months, with a slightly higher proportion of females (53.30%). The majority of fathers and mothers had moderate education (73.30%), and the largest proportion of families were in the low socioeconomic category (44.40%).

Table 1. Demographic Characteristics of Subjects

Characteristic	**n (%)**
Age, median (min–max)	2 years 3 months (6 months–5 years)
Sex	
Male n, (%)	21 (46.70)
Female n, (%)	24 (53.30)
Father's Education Level	
Low n, (%)	2 (4.40)
Moderate n, (%)	33 (73.30)

High n, (%)	10 (22.20)
Mother's Education Level	
Low n, (%)	0
Moderate n, (%)	33 (73.30)
High n, (%)	12 (26.70)
Socioeconomic Status	
Low n, (%)	20 (44.40)
Moderate n, (%)	14 (31.10)
High n, (%)	11 (24.40)

Clinical Characteristics and Nutritional Intake

Clinical characteristics and nutritional intake are presented in Tables 2 and 3. Most subjects had normal nutritional status (73.30%) and a history of exclusive breastfeeding (64.40%). Cigarette smoke exposure was noted in 80.00% of subjects. The majority received no AD treatment (53.30%), while 35.60% used topical steroids. The median SCORAD was 20.50 (0–84.5), with mild AD in 57.80%, moderate in 24.40%, and severe in 17.80%. Energy, fat, and fiber intake were all in the severe deficit category based on the Recommended Dietary Allowance (RDA).

Table 2. Clinical Characteristics of Subjects

Characteristic	Value
Nutritional Status	
Severe malnutrition n, (%)	0
Undernutrition n, (%)	11 (24.40)
Normal n, (%)	33 (73.30)
Overweight n, (%)	0
Obesity n, (%)	1 (2.20)
History of Exclusive Breastfeeding	
Yes n, (%)	29 (64.40)
No n, (%)	16 (35.60)
Use of Formula Milk	
Standard formula n, (%)	24 (53.30)
Extensively hydrolyzed formula n, (%)	0
Amino acid-based formula n, (%)	0
None n, (%)	21 (46.70)
Antibiotic Use	
Yes n, (%)	3 (6,70)
No n, (%)	42 (93.30)
Cigarette Smoke Exposure	
Yes n, (%)	36 (80.00)
No n, (%)	9 (20.00)
AD Treatment	
Emollient n, (%)	5 (11.10)
Topical Steroid n, (%)	16 (35.60)
Oral Steroid n, (%)	0
Immunosuppresant n, (%)	0
Untreated n, (%)	24 (53.30)
SCORAD Index, median (min–max)	20.50 (0–84.5)
Atopic Dermatitis Severity Based on SCORAD Value	
Mild f, (%)	26 (57.80)
Moderate f, (%)	11 (24.40)
Severe f, (%)	8 (17.80)
Fat intake (g/day) Mean, SD	30.43 (15.03)
Fat intake (g/kgBW/day) Mean, SD	2.77 (1.3)
Percentage of fat intake/RNI (%) Mean, SD	67.54 (32.67)
Fiber intake (g/day) Median, min–max	2.41 (0.08–6.50)

Fiber intake (g/kgBW/day) Mean, SD	0.23 (0.14)
Percentage of fiber intake/RNI (%) Mean, SD	13.86 (8.15)
Animal protein intake (g/day) Mean, SD	23.93 (13.53)
Animal protein intake (g/kgBW/day) Mean, SD	2.13 (1.22)
Simple sugar intake (g/day) Median, min–max	6.22 (0.40–48.71)
Simple sugar intake (g/kgBW/day) Median, min–max	0.54 (0.06–3.59)
Simple sugar intake as percentage of total energy (%) Median, min–max	3.2 (0.37–17.06)

RNI = Recommended Nutrient Intake, based on Indonesian Nutritional Adequacy Figures (Angka Kecukupan Gizi/AKG), Indonesian Ministry of Health, 2019

Table 2 presents the median SCORAD index was 20.50 (range 0–84.5), with severity distribution of 57.80% mild, 24.40% moderate, and 17.80% severe. Mean fat intake was 30.43 ± 15.03 g/day or 2.77 g/kgBW/day, with a percentage of RNI of 67.54 ± 32.67%, classified as severely deficient. Median fiber intake was 2.41 g/day (0.08–6.50) or 0.23 ± 0.14 g/kgBW/day, with a percentage of RNI of only 13.86 ± 8.15%, also classified as severely deficient. Mean animal protein intake was 23.93 ± 13.53 g/day or 2.13 g/kgBW/day. Median simple sugar intake was 6.22 g/day (0.40–48.71) or 0.54 g/kgBW/day (0.06–3.59), with a median percentage of total energy of 3.2% (0.37–17.06%), indicating that the majority of subjects remained within the WHO recommendation of less than 10% of total energy.

Table 3. Macronutrient Intake Characteristics

Variable	Value
Total Energy (kcal/day), Mean ± SD	891.66 (±335.49)
Percentage of total energy/RNI (%), Mean, SD	68.16 (±23.09)
Total carbohydrate (g), Median, min–max	117 (24.50–301.64)
Percentage of carbohydrate/total energy (%), Median, min–max	53.08 (38.6–85.9)
Percentage of carbohydrate/RNI (%), Mean, SD	68.16 (23.09)
Total fat (g), Mean, SD	30.43 (15.03)
Percentage of fat/total energy (%), Median, min–max	30.11 (10.37–60.92)
Percentage of fat intake/RNI (%), Mean, SD	67.54 (32.67)
Total protein (g), Mean, SD	23.93 (13.53)
Percentage of total protein/total energy (%), Mean, SD	17.64 (2.43)
Percentage of total protein/RNI (%), Mean, SD	147.64 (54.74)

RNI = Recommended Nutrient Intake, based on Indonesian Nutritional Adequacy Figures (Angka Kecukupan Gizi/AKG), Indonesian Ministry of Health, 2019

Table 3 presents the macronutrient intake profile of 45 toddler subjects with atopic dermatitis. Mean total energy intake was 891.66 ± 335.49 kcal/day, with a percentage of RNI of 68.16 ± 23.09%, classified as severely deficient. Median total carbohydrate intake was 117 g/day (24.50–301.64), with a median percentage of total energy of 53.08% (38.6–85.9%) and a percentage of RNI of 68.16 ± 23.09%, also classified as severely deficient. Mean total fat intake was 30.43 ± 15.03 g/day, with a median percentage of total energy of 30.11% (10.37–60.92%) and a percentage of RNI of 67.54 ± 32.67%, likewise classified as severely deficient. In contrast, mean total protein intake was 23.93 ± 13.53 g/day, with a mean percentage of total energy of 17.64 ± 2.43% and a percentage of RNI of 147.64 ± 54.74%, classified as excessive. Energy, carbohydrate, and fat intakes were in the severely deficient category, while protein intake exceeded the recommended RNI; however, in terms of macronutrient composition, the dietary intake of subjects in this study met the criteria for a balanced diet.

Correlation of Dietary Intake with SCORAD Value

Results of Spearman's correlation test between each macronutrient intake and SCORAD values are presented in Table 4.

No statistically significant correlation was found between fat, fiber, animal protein, or simple sugar intake and SCORAD values, both in the overall sample and after controlling for confounding variables (age, sex, nutritional status, AD treatment, parental atopy history).

Table 4. Correlation Between Nutrient Intake with SCORAD Value

Nutrient Intake	Total SCORAD Value	
	Correlation (r)	p Value
Fat (gram)	−0.041	0.78
Fat (g/kgBW)	0.003	0.986
Fiber (gram)	−0.048	0.75
Fiber (g/kgBW)	−0.121	0.42
Animal Protein (gram)	0.146	0.33
Animal Protein (g/kgBW)	0.198	0.19
Simple Sugar (gram)	−0.046	0.76
Simple Sugar (g/kgBW)	0.365	0.14

Table 4 presents the results of Spearman's correlation test between each dietary intake variable and total SCORAD values in 45 toddlers with atopic dermatitis. No statistically significant correlation was found between any of the nutrient intake variables and SCORAD values. Fat intake showed a very weak negative correlation with SCORAD, both in absolute terms ($r = -0.041$; $p = 0.78$) and when adjusted for body weight ($r = 0.003$; $p = 0.986$). Similarly, fiber intake demonstrated a weak negative correlation in absolute terms ($r = -0.048$; $p = 0.75$) and per kilogram body weight ($r = -0.121$; $p = 0.42$), neither of which reached statistical significance. Animal protein intake showed a weak positive correlation with SCORAD ($r = 0.146$; $p = 0.33$ and $r = 0.198$; $p = 0.19$ per kilogram body weight), but this was also not statistically significant. Simple sugar intake likewise demonstrated no significant association with SCORAD values, with $r = -0.046$ ($p = 0.76$) for absolute intake and $r = 0.365$ ($p = 0.14$) per kilogram body weight. Overall, none of the dietary variables fat, fiber, animal protein, or simple sugar intake demonstrated a statistically significant correlation with AD severity as measured by the SCORAD index (all $p > 0.05$).

DISCUSSION

Demographic Characteristics of Subjects

This study enrolled 45 toddlers diagnosed with atopic dermatitis (AD) from 13 primary health centers in Padang. The median age was 2 years 3 months, with subjects ranging from 6 months to 5 years of age. This distribution is consistent with Nissen et al. (2013), who reported that the highest incidence of AD occurs during the first 18 months of life, and with global data showing that approximately 60% of AD cases emerge in the first year and 90% within the first five years of life.[20,21,22] The sex distribution showed a slightly higher proportion of female subjects (53.30%) compared to male subjects (46.70%), which is consistent with global AD epidemiology reporting marginally higher prevalence in females across all age groups.[22]

Given the toddler age range of this study, a proportion of subjects may have already passed the peak manifestation phase of AD and are transitioning toward subsequent atopic conditions — a sequential progression known as the atopic march, whereby AD and food allergy in infancy are followed by asthma and allergic rhinitis in childhood.[23,24] However, this study did not evaluate the presence of concurrent atopic comorbidities.

The socioeconomic distribution showed the largest group in the low-income category (44.40%), followed by moderate (31.10%) and high (24.40%). Low socioeconomic status may negatively impact access to nutritious foods, healthcare services, and long-term adherence to AD management. This has implications for the interpretation of

dietary intake data, as economic constraints may limit dietary variety and quality.[25]

Clinical Characteristics of Subjects

The majority of subjects (73.30%) had normal nutritional status, while 24.40% were undernourished and 2.20% were obese, with no cases of severe malnutrition or overweight identified. These findings are consistent with Nkuingoua et al., who conducted a study on 259 children aged 0–18 years with AD in Kinshasa and found no significant correlation between nutritional status and AD severity ($p = 0.985$).[26]

A striking finding was the high prevalence of cigarette smoke exposure among subjects (80.00%), far exceeding the proportion without exposure (20.00%). While passive smoke exposure has been proposed as a trigger for AD, Al-Alusi et al. (2025) reported no significant increase in AD severity associated with passive or active smoke exposure.[27]

AD severity, assessed using the SCORAD index, showed a median of 20.50 (range 0–84.5), with the majority of subjects classified as mild (57.80%), followed by moderate (24.40%) and severe (17.80%). This distribution is consistent with findings by Galli et al. (2020), who reported 64% mild, 25% moderate, and 11% severe AD, and with Silverberg et al. (2021), who found 54.2% mild, 34.3% moderate, and 10.8% severe.[28,20]

Regarding dietary intake within the clinical context, mean fat intake was 30.43 ± 15.03 g/day (67.54 ± 32.67% RNI), classified as severely deficient.[29,30] The preponderance of subjects demonstrated a narrow and homogeneous range of dietary intake, yielding insufficient inter-individual variability to identify a statistically significant correlation with SCORAD values. These findings are consistent with those of Bachelli et al. (2026), who reported no significant association between dietary intake and SCORAD scores in children with atopic dermatitis in the context of uniform dietary restriction across the study population.[31]

Fiber intake was critically low (median 2.41 g/day, only 13.86 ± 8.15% RNI). It is important to note that fiber data in the Indonesian Food Composition Table (TKPI 2017) are largely based on crude fiber rather than total dietary fiber, likely underestimating actual fiber intake, although recorded values remain critically low.[19] The protective effect of dietary fiber against atopic dermatitis severity is likely to manifest only at sufficiently high or frequent intake levels; consequently, the critically low fiber intake observed in the present study was unlikely to generate an adequate biological response.[3233]

The mean animal protein intake in the present study was 23.93 ± 13.53 g/day (2.13 ± 1.22 g/kgBW/day), approaching or exceeding the recommended daily total protein intake. Animal protein represents the primary allergen source most frequently associated with disease exacerbation through IgE-mediated sensitization in toddlers with moderate-to-severe atopic dermatitis.[34] Accordingly, wholesale elimination of animal protein without a clear clinical indication is not recommended.[35]

Median simple sugar intake was 6.22 g/day (min–max: 0.40–48.71 g/day), representing 3.2% of total energy intake (min–max: 0.37–17.06%). This value remains well below the WHO recommended threshold for free sugar intake of less than 10% of total energy. However, the maximum simple sugar intake reached 48.71 g/day (17.06% of total energy), indicating that a subset of subjects consumed simple sugars in excess of the recommended threshold. The absence of a statistically significant correlation with SCORAD values in the present study is attributable to the overall intake levels remaining substantially below the pro-inflammatory threshold, thereby insufficient to elicit a measurable biological response.[31,36]

Macronutrient Intake Characteristics

Mean total energy intake was 891.66 ± 335.49 kcal/day, which falls below the Recommended Nutrient Intake (RNI) at

68.16 ± 23.09%, classified as severely deficient.[29] However, the RNI is established based on the nutritional needs of healthy children with normal physical activity, and its direct application as a reference for children with chronic diseases such as AD should be interpreted with caution.[29] The low energy intake in this cohort is more appropriately understood in the context of clinical factors including reduced appetite due to persistent pruritus, sleep disturbances, and parental dietary elimination practices carried out without medical guidance as an attempt to prevent AD exacerbation.[37]

Median total carbohydrate intake was 117 g/day (range 24.50–301.64 g/day), with a median contribution to total energy of 53.08% (range 38.6–85.9%). Despite the absolute deficit relative to RNI, the percentage contribution of carbohydrates to total energy remained within the Acceptable Macronutrient Distribution Range (AMDR) of 45–65% for children, although the very wide range reflects substantial inter-individual variability in dietary patterns.[38]

Mean total fat intake was 30.43 ± 15.03 g/day, with a median energy contribution of 30.11% (range 10.37–60.92%), which remains within the AMDR for fat in children aged 1–3 years (30–40%) and 4–5 years (25–35%). Despite the absolute deficiency relative to RNI, the macronutrient distribution was proportionally balanced. The very wide inter-individual range indicates considerable variability in fat consumption patterns across subjects.[38]

Mean total protein intake was 23.93 ± 13.53 g/day, with a mean energy contribution of 17.64 ± 2.43%. This slightly exceeds the AMDR for protein in children (10–15% of total energy), although the absolute gram intake varied widely across subjects.[38]

Correlation Between Fat Intake and SCORAD Value

Spearman's correlation analysis revealed no statistically significant correlation between fat intake and total SCORAD values, both in absolute terms ($r = -0.041$; $p = 0.78$) and when adjusted for body weight ($r = 0.003$; $p = 0.986$). This finding indicates that total fat intake does not have a linear relationship with AD severity in this toddler population, contrary to the initial hypothesis that high fat intake would worsen AD through gut dysbiosis and systemic inflammation.

Bachelli et al. (2026) reported similar findings, with no significant association identified between dietary intake and SCORAD scores ($p>0.05$) in 104 children and adolescents with atopic dermatitis. These results suggest that the relationship between dietary intake and AD severity is more complex than previously anticipated, underscoring the importance of considering specific fatty acid composition rather than total fat intake alone when evaluating its influence on atopic dermatitis.[31]

Low et al. (2013), in a cross-sectional study of 150 toddlers aged 12–36 months with atopic dermatitis, found that children who underwent dietary fat restriction from dairy products, eggs, and meat did not demonstrate statistically significant improvement in SCORAD values compared to those without dietary restriction. These findings indicate that a global reduction in total fat intake, without consideration of specific fatty acid types, does not directly correlate with changes in SCORAD values in the toddler age group.[39]

These findings differ from those of Lim et al. (2023), who conducted a two-stage cross-sectional study involving 11,494 young Chinese adults in Singapore and Malaysia. Subjects with atopic dermatitis consumed significantly higher daily total fat compared to the control group (532.72 g/week vs. 484.78 g/week; $p = 2.82 \times 10^{-6}$). A high-fat dietary pattern was demonstrated to be significantly associated with an increased risk of atopic dermatitis after adjustment for age, sex, BMI, physical activity, and sedentary lifestyle (AOR: 1.278; 95% CI: 1.049–1.559; $p < 0.05$).[40]

The discrepancy between the present findings and those of Lim et al. (2023) can be attributed to several fundamental factors. First, there were differences in population characteristics. Subjects in the present study

were toddlers aged 6 months to 5 years, whereas subjects in Lim et al. were young adults with a mean age of 22.23 years. Second, the relatively narrow range of fat intake variability in the toddler population of the present study stands in contrast to Lim et al., which encompassed a considerably wider fat intake range, categorized as low (≤253.27 g/week), moderate, and high (≥641.32 g/week), across a large sample of 11,494 subjects.[40]

The composition of specific fatty acid types in the diet plays a more critical role than total fat intake in the pathogenesis and severity of atopic dermatitis.[41] Supplementation with a combination of omega-3 polyunsaturated fatty acids (PUFA), gamma-linolenic acid (GLA), and vitamin D in 52 children with atopic dermatitis demonstrated a significant reduction in SCORAD values from a median of 42 to 25 after 4 months ($p<0.001$), indicating that specific fatty acid types, rather than total fat intake, are the determining factor in atopic dermatitis severity.[41] Experimental studies have consistently demonstrated that mediators derived from eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) —both of which are PUFA — can attenuate Th2/Th17 inflammation, reduce IgE and histamine levels, and restore epidermal lipid balance, thereby improving skin barrier function.[42]

Correlation Between Fiber Intake and SCORAD Value

Spearman's correlation analysis showed a weak and non-significant negative correlation between fiber intake and SCORAD values, both in absolute terms ($r = -0.048$; $p = 0.75$) and when adjusted for body weight ($r = -0.121$; $p = 0.42$). This indicates that daily fiber intake in this population does not have a linear relationship with AD severity as measured by the SCORAD index. These findings are consistent with those of Bachelli et al. (2025), who employed a cross-sectional design. The study was conducted among 104 children and adolescents aged 1 to 17 years and 11 months with atopic dermatitis in Brazil, utilizing a food frequency questionnaire to assess dietary intake frequency. The results demonstrated no significant association between dietary intake, including fiber, and SCORAD values ($p>0.05$).[31]

Similar findings were reported by Lim et al. (2013), who studied 62 children aged 12 months to 13 years with SCORAD values ranging from 20 to 50, using a food frequency questionnaire over a three-month period. Subjects were divided into three groups based on the number of foods restricted, and SCORAD assessments were performed over four months to evaluate changes in disease severity. The study found that changes in SCORAD values did not directly correlate with the composition of specific nutrients, including fiber, but were more substantially influenced by the overall pattern of dietary restriction.[43]

Contrasting findings were reported by Lim et al. (2025), who demonstrated a potential protective effect of dietary fiber intake against atopic dermatitis. In a large-scale cross-sequential study involving 13,561 young Chinese adults from Singapore and Malaysia (mean age 22.51 ± 5.90 years), individuals with high fiber intake (mean ≈ 98 g/week) were found to have a significantly lower risk of developing atopic dermatitis by 17%, after adjustment for genetic predisposition, BMI, age, sex, and lifestyle factors. A fundamental methodological distinction between Lim et al. and the present study warrants emphasis: Lim et al. employed multivariate logistic regression with a categorical outcome defined as the presence or absence of atopic dermatitis in the preceding 12 months, rather than a correlation between fiber intake and continuous SCORAD values.[32]

Contrasting findings were also reported by Lim et al. (2023), who conducted a large-scale cross-sequential study involving 13,561 young Chinese adults aged 19–22 years from Singapore and Malaysia. Lim et al. performed correlation analyses of four dietary patterns, one of which was a plant-based dietary pattern, and its association with reduced atopic dermatitis exacerbation.

Atopic dermatitis exacerbation was assessed based on chronicity (complete resolution of itchy rash within the preceding 12 months) and severity (frequency of nocturnal sleep disturbance caused by itchy rash within the preceding 12 months). The study found that dietary fiber intake was protective against atopic dermatitis exacerbation.[44]

Several methodological differences may explain the discrepancy between the present findings and those of Lim et al. First, Lim et al. (2023) employed a dietary pattern approach rather than quantifying daily fiber intake in grams. Second, the outcome measure utilized was a categorical variable defined as the presence or absence of chronic atopic dermatitis and moderate-to-severe atopic dermatitis, rather than continuous SCORAD values. Third, the population of Lim et al. consisted of young adults who had been exposed to long-term dietary patterns over many years, with considerable inter-individual variability in fiber intake, whereas the present study was conducted among toddlers aged 6 months to 5 years, all of whom were in a state of severe and homogeneous fiber deficit (mean 2.41 g/day), resulting in insufficient intake gradation to detect a dose-response relationship with SCORAD values.[44]

Correlation Between Animal Protein Intake and SCORAD Value

Spearman's correlation analysis showed a weak, positive, and non-significant correlation between animal protein intake and SCORAD values in absolute terms ($r = 0.146$; $p = 0.33$) and per body weight ($r = 0.198$; $p = 0.19$). No significant change in the correlation was observed after controlling for confounding factors including AD treatment, age, sex, nutritional status, and parental atopy history. These findings are consistent with Bachelli et al. (2026), who found no significant association between dietary intake and SCORAD ($p>0.05$) in 104 children and adolescents with AD in Brazil. A notable finding in that study was that subjects undergoing dietary elimination of milk and eggs had significantly higher mean SCORAD compared to those without dietary restriction.[31]

Contrasting findings were also reported by Lim et al. (2023), who demonstrated that high dietary protein scores and high animal protein scores were significantly associated with an increased risk of developing AD.[17] High protein intake, particularly from animal sources such as meat, poultry, and dairy products, may contribute to the clinical manifestation of atopic dermatitis.[17]

The potential mechanisms underlying the relationship between high animal protein intake and atopic dermatitis severity involve several pathophysiological pathways.[17] Animal protein may influence the composition and function of gut microbiota, as high animal protein intake is associated with an increase in proteolytic bacteria and a reduction in microbiota diversity, subsequently affecting immune system maturation and susceptibility to inflammatory disease. Intestinal protein digestion generates metabolites such as ammonia, amines, short-chain fatty acids, and hydrogen sulfide, which may trigger pro-inflammatory signaling pathways in epithelial cells and potentially contribute to the pathogenesis of AD.[17] In vitro and animal model studies have demonstrated that diets high in animal protein, particularly chicken protein, can upregulate the expression of pro-inflammatory cytokines such as IL-1β, IL-6, and TNF-α, which play a role in exacerbating skin inflammation in atopic dermatitis.[17] Conversely, plant-based proteins tend to exert anti-inflammatory effects through downregulation of TGF-β1 expression and pro-inflammatory adipokines such as chemerin and progranulin in serum.[17]

Correlation Between Simple Sugar Intake and SCORAD Value

Spearman's correlation analysis showed a very weak, negative, and non-significant correlation between simple sugar intake and SCORAD values, in absolute terms ($r = -0.046$; $p = 0.76$) and per body weight ($r = 0.365$; $p = 0.14$). This indicates that simple sugar intake does not have a linear

relationship with AD severity in this population. These findings suggest that the relationship between dietary intake and atopic dermatitis severity is considerably more complex than previously anticipated, involving multiple confounding factors that warrant careful consideration.

The findings of the present study are consistent with those of Ehlers et al. (2001), who conducted a double-blind, placebo-controlled sugar challenge trial in 20 adults and 9 children. That study found no significant difference in SCORAD values or eosinophilic cationic protein (ECP) levels between the group receiving sucrose challenge and the placebo group ($p>0.05$), leading to the conclusion that sugar is not a factor that aggravates atopic dermatitis.[45]

Several studies have reported contrasting findings when accounting for age and the type of sugar consumed. Tan et al. (2025), in a longitudinal study utilizing data from the Korea National Health and Nutrition Examination Survey (KNHANES) 2017–2023, found that a Western dietary pattern dominated by highly processed foods, sugar, and saturated fat resulted in an increase in the Dietary Inflammatory Index (DII) of 2.3–3.3 units compared to traditional dietary patterns such as the Mediterranean diet.[33] This elevation in DII creates a pro-inflammatory metabolic environment that increases the prevalence of inflammatory diseases, including AD.[33]

A more specific longitudinal cohort study by Shan et al. (2025), conducted among 5,372 children from the Avon Longitudinal Study of Parents and Children (ALSPAC), found no significant association between sugar consumption and atopic dermatitis at ages 1, 3, 5, and 7 years.[36] However, at age 13 years, a 10% increase in sugar consumption as a proportion of total caloric intake was associated with a 22% increase in the odds of atopic dermatitis (95% CI = 7–40%; $p<0.05$).[36] Furthermore, a dose-response relationship was observed with disease severity: the odds of mild atopic dermatitis increased by 19% (95% CI = 0–42%) and moderate-to-severe atopic dermatitis by 32% (95% CI = 5–86%). This effect was confined to non-milk extrinsic sugars (simple sugars not derived from milk), and was not observed for intrinsic sugars or lactose.[36]

The discrepancy between the present findings and those of Shan et al. (2025) may be explained by several factors. First, the present study employed a cross-sectional design with a 3-day food recall, whereas Shan et al. utilized a longitudinal design with a 13-year follow-up period, enabling the observation of temporal changes.[36] Second, the study population of the present study was predominantly composed of preschool-aged children (median age 2 years 5 months), whereas the effect of sugar in Shan et al. only reached statistical significance at 13 years of age, suggesting the possible existence of a window period during which sensitivity to the effects of sugar increases with advancing age.[36] Third, the median sugar consumption in the present study was 6.22 grams (range 0.40–48.71 grams), which is relatively low compared to sugar consumption in Western populations, and may therefore not have reached the threshold required to elicit a significant pro-inflammatory effect.[36]

Limitations

The cross-sectional design precludes causal inference. Analysis of total SCORAD without stratification by severity category may have missed threshold effects or non-linear relationships. Topical steroid use as a confounding variable could not be fully controlled.

CONCLUSION

No significant correlation was found between average dietary intake of fiber, fat, animal protein, and simple sugar with AD severity as assessed by the SCORAD index in toddlers aged 6 months to 5 years in Padang. Dietary restriction without clear clinical indication is not recommended in the management of AD in children. Future studies should consider performing a mean difference test of fat, fiber, animal protein, and simple sugar intake across the three severity categories of atopic dermatitis —

mild, moderate, and severe. This approach is expected to detect threshold effects or non-linear relationships that may not be captured by correlation analysis.

Declaration by Authors

Ethical Approval: Approved

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