Research Article

Correlation between Serum Zinc Levels and Severity of Atopic Dermatitis

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ABSTRACT:

Background: Atopic dermatitis is an inflammatory skin disease commonly found in children with unknown etiology. Zinc is an important element that plays a major role in the immune system. The effect of zinc deficiency can be detrimental because it affects the growth and function of immune cells. Zinc deficiency is also believed to be one of the causes of severe atopic dermatitis.

Objective: To investigate the correlation between zinc deficiency and severity of atopic dermatitis in children.

Methods: An analytical observational study was performed using a cross-sectional approach. The study involved children with atopic dermatitis aged 2-5 years who visited Pediatric Allergy-Immunology Clinic and Dermatology and Venereology Clinic of Dr. Moewardi Hospital, Surakarta between January to December 2019.

Results: The incidence of zinc levels of <70 mcg/dl was more common in children with moderate (53.8%) and severe (46.2%) atopic dermatitis, while zinc levels of >70 mcg/dl found to be more common in children with mild (76.5%) and moderate (23.5%) atopic dermatitis. The contingency coefficient test results showed a coefficient value of rk = 0.629 indicating that there is a strong correlation between zinc levels and the degree of atopic dermatitis and the lack of serum zinc levels increases the risk of severe atopic dermatitis. The p value of <0.001 (p <0.05) translates to a significant correlation between zinc levels and the degree of atopic dermatitis.

Conclusion: There was a strong correlation (rk = 0.629) between zinc levels and the severity of atopic dermatitis which was statistically significant (p <0.05). The lower the zinc level, the more severe the atopic dermatitis severity.

Keywords: atopic dermatitis, scorad, zinc deficiency.

Introduction

Atopic dermatitis (AD) is an inflammatory skin disease commonly found in children that could persist in a long period time and is recurring.[1,2] The etiology of atopic dermatitis is still unclear. However, heredity, genetics, race, environmental factors including immunological abnormalities, exposure to allergens, and physiological and biochemical defects of the skin barrier structures have been identified as the causes of AD.[3] Effective AD therapy in AD patients is not only important for improving the patient's symptoms and quality of life but also to prevent progression of the disease to become chronic.[4]

Atopic dermatitis often affects children with a prevalence of 15-30% and about 1-3% incidence occur in adults. In Indonesia, the prevalence of atopic dermatitis is 23.67% according to the Child Dermatology Study Group (KSDAI). This prevalence constitutes the most common of the top 10 skin diseases in children.[5]

Vitamin and mineral intake is important for the development of immune system in healthy children. Zinc is an important element in cellular metabolism and growth as well as in supporting the immune system. Zinc plays a major role in the proliferation, apoptosis and differentiation process of the immune system. The effects of zinc deficiency can be detrimental because it affects the growth and function of the immune cells.[3,6,7]

There are some previous descriptive studies which revealed a relationship between zinc deficiency and the severity of AD. In these studies, patients experiencing severe form of AD tended to have significantly low

serum zinc levels.[3,8,9] However, there has been no analytical study that explains the correlation between zinc levels and the severity of AD. Therefore, the authors attempted to investigate whether there was a correlation between zinc deficiency and the severity of atopic dermatitis in children.

Methods

This is an analytical observational study performed using cross-sectional approach. The study was conducted at the Pediatric Allergy-Immunology Clinic and Dermatology and Venereology Clinic of Dr. Moewardi Hospital, Surakarta from January 2019 to December 2019. The target population included all atopic dermatitis patients aged 2 to 5 years. Subjects were recruited in a consecutive manner targeting patients who visited the respective outpatient clinics and were eligible for participation after screening using pre-determined inclusion and exclusion criteria until the minimum sample size was obtained. The inclusion criteria were a diagnosis of atopic dermatitis that was established by a physician through the available clinical criteria, children aged 2 to 5 years, AD patients with good nutritional status according to age, and whose parents/guardians were willing to sign a consent form for participation. The exclusion critera included patients who received zinc supplementation in the last 1 week and patients with other comorbid conditions that could also influence the risk of developing zinc deficiency. This study was approved by the Health Research Ethics Committee of the Faculty of Medicine, Sebelas Maret University/Dr. Moewardi Hospital, Surakarta.

Results

Descriptive Analysis

This study was conducted in 30 children with atopic dermatitis who visited Pediatric Allergy-Immunology Clinic and Dermatology and Venereology Clinic of Dr. Moewardi Hospital, Surakarta between January to December 2019. The baseline characteristics of the study subjects are presented in Table 1.

Tabel 1. Baseline characteristics of the study subjects

Characteristics	Results (n=30)
Age (years)	5.32 ± 0.60
Gender	
Male	10 (33.3%)
Female	20 (66.7%)
Degree of atopic dermatitis	
Mild	13 (43.3%)
Moderate	11 (36.7%)
Severe	6 (20.0%)
Zinc levels (mcg/dl)	
<70	13 (43.3%)
>70	17 (56.7%)

According to Table 1, it is known that the mean age of the study subjects was 5.32 ± 0.60 years. Majority of the subjects are female which comprised of 20 children (66.7%). A total of 13 (43.3%) children had a mild AD and only 6 (20.0%) children who experienced severe AD. Meanwhile, majority of children (n=17; 56.7%) showed serum zinc levels of >70 mcg/dl.

Correlation between age and gender with severity of atopic dermatitis

Since the data were presented as continuous and ordinal variables, correlation between age and severity of AD was investigated by performing Spearman rank correlation test because. On the other hand, contingency coefficient test was performed to investigate the correlation between gender and severity of AD as the data were presented as nominal and ordinal variables. The results are presented in Table 2.

Table 2. Correlation between age and gender with severity of atopic dermatitis

Zinc levels	Severity of AD			Total	rk	p
	Mild	Moderate	Severe			
Age[a]	5.12 +0.56	5.49 +0.58	5.47 +0.67	5.32 +0.60	0.256	0.157
Gender[b]					0.175	0.662
Male	5 (50.0%)	4 (40.0%)	1 (10.0%)	10		
Female	8 (40.0%)	7 (35.0%)	5 (25.0%)	20		

Annotations: [a] Spearman rank test, [b] Contingency coefficient test

Table 2 shows that patients with mild, moderate, and severe AD had a mean age of 5.12 ± 0.56 years, 5.49 ± 0.58 years old, and 5.47 ± 0.67 years, respectively. The spearman rank test results showed a coefficient value of rk = 0.256, which indicates that there is a weak correlation between age and AD severity. The p value of 0.157 (p >0.05) indicates that there is no significant correlation between age and AD severity.

In regard to gender difference, it is known that in both male and female subjects, majority of patients suffered from mild AD (prevalence of 50.0% and 40.0%, respectively). The contingency coefficient test results obtained a coefficient of rk = 0.175, which indicates a very weak correlation between gender and AD severity. The p value of 0.662 (p >0.05) indicates that there is no significant correlation between gender and AD severity.

Correlation between serum zinc levels and severity of atopic dermatitis

A contingency coefficient test was rather used for investigating the correlation between serum zinc levels and severity of AD since the data were presented as nominal and ordinal variables. The results are presented in Table 3.

Table 3. Correlation between serum zinc levels and severity of atopic dermatitis

Zinc levels (mcg/dl)	Severity of AD			Total	rk	p
	Mild	Moderate	Severe			
<70	0 (0.0%)	7 (53.8%)	6 (46.2%)	13	0.629	<0.001
>70	13 (76.5%)	4 (23.5%)	0 (0.0%)	17		

Annotations: Contingency coefficient test

Table 3 showed that serum zinc levels of <70 mcg/dl was more common in patients experiencing moderate (53.8%) and severe (46.2%) AD, while higher serum zinc levels of >70 mcg/dl was more common in patients with mild (76.5%) and moderate (23.5%) AD. The contingency coefficient test results showed a coefficient value of rk = 0.629, which indicates a strong correlation between zinc levels and AD severity where lower zinc level is attributed to higher risk of developing severe AD. The p value of <0.001 (p <0.05) indicates a significant correlation between zinc levels and AD severity.

Discussion

A total of 30 children with atopic dermatitis visited the Allergy-Immunology Clinic of Dr. Moewardi Hospital between January and December 2019. The patients were subjected to a detailed physical examination and scoring calculations using SCORAD to assess the severity of AD. Blood samples were collected for measurement of serum zinc levels.

The present study demonstrated that AD is more common in girls as compared with boys. The results showed the female-to-male ratio for the incidence of AD is 2:1. This is in accordance with the previous observations where gender-based ratio for AD incidence depends on the study conducted. Female predomination found in our study was similar with previous studies conducted in Turkey and Korea.[3,9]

A narrow age range was used for inclusion of our participants in order to facilitate the scoring process.

In addition, the age range selection of 2 to 5 years was based on the previous studies which reported that the onset of atopic dermatitis was most common at 2 years of age and that only a few were diagnosed after 5 years of age. In this study, it is also in accordance with the previous studies that most of the subjects experienced mild AD, followed by moderate and severe AD. There was no statistically significant correlation between age and gender with the severity of AD.

Almost all patients with moderate and severe AD showed a notable decrease in serum zinc levels. Only 4 out of the 13 patients with moderate AD had normal serum zinc levels. This is in accordance with the current theory where patients with AD will experience a decrease in serum zinc levels which causes dysregulation in many physiologic functions, especially in terms of adaptive immunity. These result in increased production of proinflammatory cytokines and a shift in the quilibrium of the Th1 and Th2 cell responses that eventually result in an imbalance between Th1 and Th2 cells. Furthermore, this can trigger the development of symptoms of allergic disease by promoting the dominance of the Th2 response. Zinc deficiency can reduce the anti-inflammatory effect and cause an increase in the relative Th2 cytokines, the cytokines actively work in the pathogenesis of AD.[6,7,10-12] Low zinc levels can also disrupt the membrane barrier integrity which increases transepidermal water loss that dehydrates the skin and helps to facilitate allergen penetration. This phenomenon can affect AD progression.[7,10,12,13]

Previous study revealed that there was a significant relationship between the severity of AD and serum zinc levels.[3] In contrary, another study reported that there is no significant relationship between zinc deficiency and AD severity.[14] In our analysis performed in 30 children with AD, we found a strong positive correlation between serum zinc levels and AD severity with a rk value of 0.629. The results of the spearman rank analysis demonstrated a p-value of <0.05 which indicates a positive and significant correlation between zinc deficiency and AD severity.

Conclusion

A strong correlation (r_k=0.629) was observed between serum zinc levels and severity of AD in the presented cohort and the result was statistically significant ($p < 0.05$). The lower the serum zinc levels, the more severe the atopic dermatitis.

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Conflict of interest

None declared.

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