

Association between nutritional status and scabies infestation in a boarding school in Indonesia: a cross-sectional study

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Background: Scabies is an infestation caused by *Sarcoptes scabiei* var. *hominies*, prevalent in children with poor nutritional status and hygiene, particularly in overcrowded communities. Indonesia has 14.5% cases of the double burden of malnutrition among school-aged children. As there has been no study establishing the role of nutritional status in the occurrence of scabies, this study aims to investigate the association between body mass index (BMI) and height with scabies infestation in an Islamic boarding school in Indonesia.

Methods: This was a cross-sectional study conducted in an Islamic boarding school in Indonesia with children aged 11-17 years old as participants. Physicians performed anthropometry measurements, and a dermatologist confirmed the diagnosis of scabies through history taking and physical examination. Logistic regression was used to analyze the association between BMI and height and the prevalence of scabies.

Results: Of 287 subjects, 135 (47%) were diagnosed with scabies, with a male predominance (66.1%). Most of the subjects had normal weight (76.7%) while 20 (7%) were underweight, and 153 subjects (53.3%) had short stature. Male subjects were four times more likely to be infested by scabies ($P < 0.001$). Obese and short subjects were 4 and 1.67 times more likely to develop scabies, respectively.

Conclusion: Poor nutritional status represented by BMI and height cannot be regarded as an independent risk factor for scabies, while environmental factors might be the most crucial factors in the development of scabies. A holistic approach addressing these factors should be implemented to eradicate scabies in addition to appropriate pharmacological management.

Keywords: body mass index, body height, children, scabies

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INTRODUCTION

Scabies is a skin infestation caused by *Sarcoptes scabiei* var. *hominis*, characterized by intense pruritus and transmitted from person to person.

It is particularly prevalent in tropical and humid countries with overcrowding and low-income communities¹. Vos *et al.* stated that over 200 million people worldwide suffer from this infestation². During the past few years, scabies was declared as

one of the neglected tropical diseases by the World Health Organization (WHO). According to the global burden study analysis by Karimkhani *et al.*, Indonesia ranked highest among countries with the greatest scabies burden worldwide. Scabies can affect any age regardless of gender, but the highest incidence is found in children, adolescents, and the elderly³.

Indonesia is a developing country known to have a double burden of malnutrition. While adults are often classified as overweight or obese, children are mostly stunted or wasting⁴. Syahrul *et al.* studied the prevalence of malnutrition among school-aged children in Indonesia and reported it at 14.5%. Most underweight children were boys⁵. Poor sanitation and housing facilities contribute to undernutrition in Indonesia. Undernutrition makes children more prone to infectious diseases⁵.

Scabies often infests children with poor nutritional status and hygiene in overcrowded communities, especially in countries with tropical climates^{6,7}. As poor nutritional status is often associated with scabies infestation in children, no study to date establishes the role of nutritional status in the development of scabies infestation. Therefore, we aim to establish the association of body mass index (BMI) and height, representing nutritional status, with the incidence of scabies in children residing at an Islamic boarding school in Indonesia. Suppose poor nutritional status represented by BMI and height is proven to be a crucial factor. In that case, we can reduce the incidence of scabies infestation by improving the children's nutrition as we treat the infestation.

MATERIALS AND METHODS

This cross-sectional study was conducted in an Islamic boarding school in Bogor, Indonesia, in September 2018. A representative population of students aged 10 to 17 years old from the Islamic boarding school were consecutively included to meet the sample size. The overall target sample size was 96 subjects based on a previous study reporting the prevalence of scabies¹. This study was approved by the Health Research Ethics Committee of the Faculty of Medicine, Universitas Indonesia.

The diagnosis of scabies was made by a dermatologist based on at least two of four cardinal symptoms of scabies, consisting of nocturnal

pruritus, history of similar symptoms in roommates or housemates, presence of mites, and presence of mite tunnels. Anthropometry measurements were performed in light clothing and unshod. Weight was measured to the nearest 0.1 kg using a calibrated analog bathroom scale, while height was measured to the nearest 0.1 cm using a calibrated wall-mounted stadiometer. As per the recommendations of the Indonesian Pediatric Society and Center for Disease Control and Prevention (CDC), the BMI-for-age and stature-for-age growth chart for age 2 to 20 years were used to assess the nutritional status⁸. Nutritional status was classified into underweight, normal, overweight, and obese, while height was classified into short, normal, and tall stature. Both data were combined, and the subjects were classified as stunted (underweight and short stature), underweight, normal (normal weight and overweight subjects), and obese.

Data were analyzed with Statistical Package for the Social Sciences (SPSS) for Windows version 23.0. The prevalence rate of scabies was calculated in total as well as in proportion for each variable using descriptive statistics. The chi-squared test of independence was used to determine the association between two nominal variables, and the independent t-test was used to determine the association between nominal and numerical variables. Logistic regression was used to analyze the association between combined nutritional status and the prevalence of scabies. Multivariate logistic regression was used to identify any independent association between combined nutritional status and prevalence of scabies. A P-value less than 0.05 was considered significant.

RESULTS

Description of population

A total of 287 subjects were included in this study. The sociodemographic characteristics of the study subjects are presented in Table 1. There was a slight female predominance (56.8%). Based on age, all subjects can be categorized as adolescents according to WHO's classification. Most subjects were in the 13-15 years age range. Only 33 subjects (11.5%) had abnormal nutritional status based on BMI, including underweight (7%) and obese (4.5%). According to the CDC growth chart for children

Table 1. Sociodemographic characteristics of subjects
BMI: Body Mass Index

Characteristics	Total (N = 287)
Gender	
Female	163 (56.8%)
Male	124 (43.2%)
Age (years)	14 (11 – 18)
Age class	
11-12 years	52 (18.1%)
13-15 years	174 (60.6%)
16-17 years	61 (21.3%)
BMI (kg/m ²)	19.7 (13.52 – 30.64)
Z-score of BMI	0.1 (-3 – 2.2)
BMI class	
Underweight	20 (7%)
Normal weight	220 (76.7%)
Overweight	34 (11.8%)
Obese	13 (4.5%)
Height (m)	1.51 (0.07)
Z-score of height	-1.2 (-4.2 – 1.3)
Height class	
Short stature	153 (53.3%)
Normal stature	132 (46%)
Tall stature	2 (0.7%)

Categorical variables are presented in frequency (percentage); continuous variables are presented in mean (standard deviation) if the data distribution was normal or median (minimum-maximum) if the data distribution was not normal

aged 2 to 20 years old, most subjects (53.3%) fell into the short stature category.

Table 2. Association between gender and scabies

	Scabies		OR (95% CI)	P†
	Yes, n (%)	No, n (%)		
Gender				
Female	53 (32.5%)	110 (67.5%)	4.05 (2.47-6.65)	<0.001*
Male	82 (66.1%)	42 (33.9%)		

*Statistically significant

†Chi-squared test

OR: Odds Ratio; CI: Confidence Interval

Table 3. Association of BMI and height class with scabies

	Scabies		OR (95% CI)	P†
	Yes, n (%)	No, n (%)		
BMI class				
Underweight	13 (65%)	7 (35%)	2.23 (0.86 to 5.8)	0.025*
Normal weight	100 (45.5%)	120 (54.5%)	Reference	
Overweight	12 (35.3%)	22 (64.7%)	0.66 (0.31 to 1.39)	
Obese	10 (76.9%)	3 (23.1%)	4 (1.07 to 14.93)	
Height class				
Short stature	81 (52.9%)	72 (47.1%)	1.67 (1.04 to 2.67)	0.032*
Normal stature	54 (40.3%)	80 (59.7%)		

*Statistically significant

†Chi-square test

OR: Odds Ratio; CI: Confidence Interval

Prevalence of scabies

Among 287 subjects, 135 subjects (47%) were diagnosed with scabies. The proportion of subjects infested with scabies was higher in males (66.1%) than in females (32.5%). From univariate analysis (Table 2), we found an association between the prevalence of scabies and gender. On the other hand, we did not find any association between subjects' age and the prevalence of scabies ($P = 0.164$).

Association of BMI and height with scabies

Nutritional status according to BMI and height for subjects with and without scabies is presented in Table 3. From univariate analysis on the BMI class, subjects diagnosed with scabies were more likely to be obese (OR = 4; 95% CI 1.07-14.93). For univariate analysis, tall stature was classified as normal stature since the proportion was very small. From univariate analysis on the height class, subjects diagnosed with scabies were more likely to have short stature (OR = 1.67; 95% CI 1.04-2.67).

We combined the data of BMI and height to assess the final nutritional status presented in Table 4. Furthermore, we adjusted the age and gender for this analysis to eliminate the confounding factors of scabies infestation. Finally, it was found that

Table 4. Association between combined nutritional status and scabies adjusted for gender and age

Nutritional status	Scabies		OR (95% CI) ^a	P	Adjusted OR (95% CI) ^b	P
	Yes, n (%)	No, n (%)				
Stunted	8 (80%)	2 (20%)	5.07 (1.06 to 24.36)	0.016*	1.66 (0.31 to 8.94)	0.088
Underweight	5 (50%)	5 (50%)	1.27 (0.36 to 4.49)		0.7 (0.18 to 2.71)	
Normal	112 (44.1%)	142 (55.9%)	Reference		Reference	
Obese	10 (76.9%)	3 (23.1%)	4.23 (1.14 to 15.72)		4.86 (1.21 to 19.52)	

Stunted is a combination of underweight and short stature; underweight is a combination of underweight and normal stature; normal is a combination of normal weight and overweight with short and normal stature; obese is a combination of obese with short and normal stature

*Statistically significant

^aLogistic regression test

^bAdjusted for gender and age

OR: Odds Ratio; CI: Confidence Interval

subjects diagnosed with scabies were more likely to be obese (adjusted OR (aOR) = 4.86; 95% CI 1.21-19.52).

DISCUSSION

Scabies is a neglected skin infestation occurring worldwide and significantly impacts health and quality of life. The prevalence is high on children, especially those who live in overcrowded housing with low economic status. One of the most alleged risk factors of scabies infestation is poor nutritional status⁶. However, this allegation has not been proven by any studies. Therefore, this study assessed the association of nutritional status represented by BMI and height with the occurrence of scabies infestation in children living in an Islamic boarding school.

In this study, 47% of the subjects were infected with scabies, with a male predominance (66.1%). Males were four times more likely to develop scabies in the boarding school ($P < 0.001$). Scabies infestation is known to affect both genders without predominance⁶. Romani *et al.* reported the prevalence of scabies worldwide to be around 0.2–71.4%. The highest scabies infestation contributors in children were Panama, Fiji, and Australia¹. Osti *et al.* reported a slight female predominance (51.9%) in school-aged children⁹. However, Agrawal *et al.* reported a similar finding to our study, where a male predominance (88%) was recorded in an orphanage¹⁰. Distribution of gender was not uniform in the case of scabies¹¹. This statement is supported by the findings of Korte *et al.*, which reported no significant association between gender and the occurrence of scabies in schoolchildren in Timor Leste ($P = 0.05$)¹². Male

predominance in our study could be explained by the lifestyle of boys living in the boarding house; they tend to be untidy and have a habit of sharing clothes and beds in addition to poor hygiene.

In our study, age had no significant association with scabies infestation ($P = 0.164$). Age is known to have a variable distribution when it comes to scabies infestation¹¹. Amro *et al.* reported that the highest prevalence of scabies (48%) was found in the under 20 years age group in Palestine¹³. Similar findings were reported by Callum *et al.*, stating that children and young adults under 20 had a high prevalence of scabies, with the 6–10 years old age group having 2.4 times higher risk of being infected¹⁴. As mentioned in many literatures, younger age contributes to the development of scabies due to poor hygiene habits and less awareness to the disease. This case was seen in our subjects, whose hygiene habits were poor, leading to the outbreak of scabies in the boarding school regardless of their age. As this study only recruited subjects aged 11–17 years old, which is the peak incidence for scabies infestation, the limited age range made the association between age and scabies infestation not statistically significant.

From the univariate analysis, obese and short subjects were 4 times and 1.67 times more likely to develop scabies, respectively. Based on further multivariate analysis adjusted for age and gender, obese subjects were 4.86 times more likely to develop scabies. Thus far, no study has investigated the impact of nutritional status on scabies. Literatures often stated that poor nutritional status contributes as a risk factor to scabies^{6,15}. However, Sehgal *et al.* studied the morbidity and nutritional status of school children in Uttar Pradesh. They found that most of the children had normal weight (74.11%),

while 23.51% of the children were underweight and the rest were obese. Scabies occurred in 3.09% of the subjects. No direct association was found between the nutritional status and occurrence of scabies¹⁶. Similarly, Nowowiejska *et al.* analyzed the incidence of scabies in Department of Dermatology and Venereology, Medical University of Bialystok. They found that 44% of the subjects were overweight and obese regardless of age and gender. Furthermore, they concluded that obesity was a comorbidity contributing to scabies' incidence, especially in the elderly population¹⁷. Mellon *et al.* also reported a case of scabies infestation in a 40-year-old male with obesity¹⁸. To date, there is no study linking obesity directly to scabies. However, from these previous studies and our results, we can infer that obesity might play a role in the occurrence of scabies infestation.

As there is no previous similar study to compare our result, we conclude that a child's nutritional status is trivial compared with their lifestyle and awareness in causing scabies transmission. Despite a significant association between obesity and short stature with scabies, the wide range of confidence intervals made it clear that the association is not strong. In addition, the prevalence of abnormal nutritional status in this study might be overestimated since previous studies have reported discrepancies between CDC standards and Indonesia's data of BMI and height among children^{19,20}. However, a national reference is not yet available, so the CDC graph is still a standard measurement for the nutritional status of children in Indonesia⁸. Therefore, while it is vital to improve the children's nutritional status, environmental status should also be taken into account when treating scabies. A holistic approach should be implemented to eradicate scabies infestation, especially in children living in overcrowded communities.

Limitations of this study are the small sample size, the cross-sectional nature, and the method of diagnosing scabies. As this study was a part of a bigger study intending to analyze mass scabies treatment in an overcrowded community, the diagnosis was relied on DeSkab[®], a scabies detection form, which helps clinicians identify scabies infestation effectively and efficiently²¹. Further studies with larger sample sizes and prospective designs should be performed to establish the

association between various factors contributing to the development of scabies.

CONCLUSION

To conclude, poor nutritional status represented by BMI and height status cannot be regarded as an independent risk factor for scabies. Various factors play roles in the development of scabies, with environmental factors and poor hygiene being the most important ones. A holistic approach emphasizing these factors should be implemented alongside appropriate pharmacological management to eradicate scabies infestation.

Conflict of Interest: None declared.

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