ORIGINAL ARTICLE

The Relationship Between Ascariasis and Immunoglobulin E Levels in Farmers in Rural Jember Regency

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ABSTRACT

Introduction: Ascariasis, caused by *Ascaris lumbricoides*, remains prevalent in tropical areas and elicits a Th2-mediated immune response, including elevated Immunoglobulin E (IgE) levels. Farmers in rural Jember are at increased risk due to occupational exposure. This study aimed to investigate whether ascariasis infection is associated with elevated total IgE levels in farmers, and to clarify whether occupational exposure in endemic areas leads to a non-atopic immune response characterized by persistently high IgE. . **Methods:** A cross-sectional observational study was conducted involving 40 farmers from rural Jember (20 infected with ascariasis and 20 healthy). Blood samples were collected to measure total IgE levels using the ELISA method. The Mann-Whitney test was used to compare IgE levels between groups. Correlation tests (Pearson and Spearman) were used to analyze the relationship of age and work duration with total IgE levels in infected individuals. **Results:** The average total IgE level was higher in healthy farmers (401.78 ng/L) compared to those infected with ascariasis (335.67 ng/L), though both exceeded the standard IgE value of 200 ng/L. The Mann-Whitney test showed no significant difference in IgE levels between the two groups ($p = 0.304$). No significant correlations were found between total IgE levels and age ($p = 0.797$) or work duration ($p = 0.618$) in infected individuals. **Conclusion:** There was no significant difference in total IgE levels between ascariasis-infected and healthy farmers. Additionally, age and duration of occupational exposure did not correlate with IgE levels. These findings suggest a nonatopic chronic immune response in ascariasis-endemic populations. *Malaysian Journal of Medicine and Health Sciences* (2026) 22(SUPP7): 60-65. doi:10.47836/mjmhs.22.s7.10

Keywords: *Ascaris lumbricoides,* ascariasis, farmers, total immunoglobulin E level, immune response

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INTRODUCTION

Ascariasis is distributed throughout Indonesia with various prevalences between 10%-20% (1). Ascariasis interferes with food intake, digestion, absorption, and metabolism to the detriment of the host due to loss of calories and protein. The estimated value of the loss is due to the loss of carbohydrates worth 15.4 billion rupiahs per year and protein worth 162.1 billion rupiahs per year. (2). Indonesia's Health Ministry (2017) underlined that ascariasis harms the health condition, nutrition, intelligence, and productivity of the sufferer so that it can reduce the quality of human resources and cause massive economic losses.

Planters are an occupation susceptible to ascariasis outbreaks, especially those working in areas that support the transmission of *A. lumbricoides* through soil, water, or vegetables. Research (3) It was shown that ascariasis was prevalent (≥10%) in planters, with a prevalence rate of 18.2%. Moreover, Nurdian (2004) reported ascariasis outbreaks throughout the year in the region's dry and rainy seasons. This shows that the ascariasis outbreak in the rural area of Jember is stable. (4).

Individuals with ascariasis usually have an increase in IgE secretion. Immunoglobulin E (IgE) is thought to play an important role in protective immunity against ascariasis. The binding between *A. lumbricoides* surface antigen and specific IgE activates effector cells through binding to the FcεRI receptor, which results in the Antibody-Dependent Cellular Cytotoxicity (ADCC) mechanism that functions, among others, directly kills *A. lumbricoides*, directs the differentiation of naive Th cells (CD4+) into T2 cells, affects intestinal function so that the parasitic nematode release mechanism occurs. (5).

Ascaris lumbricoides is considered a master manipulator in the host immune response associated with chronic infection but is generally asymptomatic. Ascariasis

elicits a strong Th2 response, but the parasitic nematodes can survive in the host by switching the inflammatory immune response to a tolerant reaction to parasitic antigens. (6).

Chronic ascariasis outbreaks can trigger the formation of specific IgE and polyclonal IgE, called total IgE. Total IgE production is triggered by massive IL-4 secretion and a mitogenic effect on B cells due to the Ascaris antigen. (7). One of the secretion effects of total IgE is the suppression of specific IgE so that it does not cause allergy-like symptoms in ascariasis, and specific IgE cannot be used as a supporting examination for the diagnosis of ascariasis so that alternative examination that can be done is to measure total IgE levels in the body.

Farmers in rural endemic areas represent a group in which occupational exposure to *Ascaris lumbricoides* is directly linked to immunological changes, particularly shifts in IgE that indicate adaptation to chronic infection. Ongoing contact with contaminated soil and crops not only maintains transmission but also modulates long-term immune regulation. Measuring total IgE in this high-risk population provides a means to examine how persistent exposure influences host immunity. This study therefore compared total IgE levels between ascariasis-infected and uninfected farmers, and assessed whether age and work duration were associated with IgE variation.

While ascariasis infection is known to induce IgE production, it remains unclear whether farmers living in endemic areas but without detectable infection also exhibit elevated IgE, and whether such elevations reflect an atopic response or a chronic non-atopic adaptation to environmental exposures. Therefore, this study aimed to compare IgE levels between ascariasis-infected farmers and apparently healthy farmers, and to identify factors that may contribute to persistently high IgE levels in both groups.

MATERIALS AND METHODS

This research was observational research with a cross-sectional approach. The population in this research were planters who lived and worked in rural Jember and were willing to have their blood drawn. The rural areas are Gunung Pasang Village, Garahan Kidul Village, and Sumber Wadung Village, totalling 40 people including 20 planters infected with ascariasis and 20 samples of healthy planters. Ascariasis infection in the case group was confirmed through stool examination for *A. lumbricoides* eggs using the flotation and sedimentation technique. This location was chosen as the research location due to previous research conducted by Muttaqien (2018) on the soil contamination rate by *A. lumbricoides* eggs in the area of 29.41%, and based on research of Primadana et al. (2019) showed the prevalence rate of ascariasis outbreaks in the rural area is 18.2% (3,8). Sampling in this research used non-probability sampling as a sampling technique using a purposive sampling method, namely planters who work in the rural area of Jember with age >18 years except for planters who have a history of using drugs such as antihistamines, corticosteroids, and antihelminths 12 hours before blood sampling.

Research subjects were asked for their willingness to take 3cc of blood as samples by signing an informed consent form. Blood samples of research subjects were used to examine total IgE levels using the ELISA method. Blood samples from research subjects were examined at the Biomolecular Laboratory, Faculty of Medicine, University of Jember.

There are three statistical tests used in this research: Mann-Whitney test to test differences in total IgE levels in healthy and ascariasis-infected planters, the Pearson correlation test to analyse the relationship between age and total IgE levels in planters infected with ascariasis, and the Spearman correlation test to examine the relationship between duration of exposure with total IgE levels in planters infected with ascariasis. The results of the research were declared significant if $P < 0.05$.

This study was approved by the Ethics Committee of the Faculty of Medicine, Jember University No. 1309/H25/1.11/KE/2019.

RESULTS

The rural area of Gunung Pasang has the most ascariasis cases in this research compared to other places. Some of the work carried out by people living in rural areas of Jember, closely related to work in the agro-industry sector, also relates to the incidence of ascariasis. This is shown in the results of this research, where coffee trimming and coffee maintenance have the highest infection rates compared to other occupations, with 11-20 years of service also having the highest prevalence rates in this research. The job characteristics of the research subjects can be seen in Table I. These findings are significant as they provide insights into the occupational risk factors for ascariasis, which can inform public health interventions and occupational safety measures.

Females were the most researched subject (77.5%), and females were the most infected with ascariasis (37.5%). The age of the research subjects who were most infected with ascariasis from this research was 36-45 years, namely nine people (22.5%). Characteristics of research subjects can be seen in Table I.

Total IgE Levels in Healthy Planters and Ascariasis Infection

The results of the measurement of total IgE levels in this

Table I: Characteristics of the Research Subject

Characteristics	Ascariasis		Healthy	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Plantation Area				
Gunung Pasang	9	22.5	5	12.5
Garahan Kidul	4	10	6	15
Sumber Wadung	7	17.5	9	22.5
Type of Work				
Coffee Nursery	2	5	1	2.5
Coffee Pruning	5	12.5	4	10
Coffee Treatment	5	12.5	5	12.5
Coffee Farmer	4	10	5	12.5
Rubber Tapping	1	2.5	2	10
Cocoa Pick	1	2.5	-	0
Administration Staff	2	5	3	7.5
Length of Work (Years)				
≤10	6	15	6	15
11-20	6	15	9	22.5
21-30	3	7.5	2	5
31-40	3	7.5	2	5
>40	2	5	1	2.5
Gender				
Male	5	12.5	4	10
Female	15	37.5	16	40
Age (years)				
25-55	13	32.5	12	30
56-85	6	15	7	17.5
Not known	1	2.5	1	2.5

research showed that the average total IgE of planters infected with *A. lumbricoides* (335.67 ng/L) was lower than the average value of IgE levels of healthy planters (401.78 ng/L). The median calculation of total IgE levels in planters infected with *A. lumbricoides* was 126.4 ng/L. Still, there was an increase in total IgE levels in both ascariasis-infected and healthy planters compared to typical values for total IgE based on the research of Amarasekera (2011), which is 200 ng/L. The results of the calculation of total IgE levels in this research can be seen in Table II.

Table II: Total IgE Levels

Group	Total			
	Frequency (n)	Mean±SD	Median	IQR
Non-infected (normal)	20	401.78 ± 918.37	122.67	107.27
Infected with A. lumbricoides	20	335.67 ± 427.22	137.25	176.46

Data analysis determined differences in total IgE levels in healthy and ascariasis-infected planters. The normality test was carried out using the Shapiro-Wilk method with interpretation in the form of data from measurements of total IgE levels between healthy planters and ascariasis infections that did not have a normal data distribution ($p<0.05$) so that data transformation was carried out. The results of the normality test of the data after the transformation showed the value of $P = 0.01$, with an interpretation in the form of data not being normally distributed ($p <0.05$). The Mann-Whitney test was used with the result (p) = 0.304. The value (p) = 0.304 is more than 0.05, so the interpretation of the results of this test is that there is no significant difference in total IgE levels between healthy and ascariasis-infected planters ($p>0.05$).

Correlation of Age of Planters Infected with Ascariasis with Total IgE Levels

The Pearson correlation test was used to determine the relation between the age of planters infected with ascariasis and total IgE levels. The normality test of the data was carried out before the correlation test was performed using Shapiro-Wilk. The Shapiro-Wilk test showed that the data on age and measurement results of total IgE levels in planters infected with ascariasis had normal data distribution ($p>0.05$), so the Pearson correlation test could be used. The Pearson correlation test showed the results (p) = 0.797 with the interpretation that there was no significant relation between age and total IgE levels of planters infected with ascariasis ($p>0.05$).

Correlation of Length of Work with Total IgE Levels in Planters Infected by Ascariasis

Data analysis in the form of normality and correlation tests was used to determine the correlation between the length of work and total IgE levels in planters. The normality test was used to assess the sample data used in this research using the Shapiro-Wilk method. Shapiro Wilk's data normality test showed that the length of exposure data and IgE levels were not normally distributed ($p<0.05$), so the data were transformed. The results of the Shapiro Wilk test after the data transformation were carried out, the p-value = 0.017, with the interpretation of the data not being normally distributed ($p <0.05$). Spearman correlation test was used with the results of $p = 0.618$, which was the interpretation that the length of exposure was not significantly correlated with total IgE levels in planters infected with ascariasis ($p>0.05$).

DISCUSSION

Characteristics of Research Subjects

Coffee trimming and coffee care are the work of the people in rural Jember areas, who are the most infected with ascariasis. The two types of work do not always have direct contact with the soil daily, but planters can be infected by *A. lumbricoides* through food or drink contaminated with *A. lumbricoides* eggs. (9). This shows that hygiene plays an essential role in the process of ascariasis outbreak in planters. One of the hygiene patterns in question is the habit of washing hands, where 22.45% of planters in rural areas of Jember still have bad hand-washing habits, such as not washing their hands immediately after working on the plantation and not washing their hands after direct contact with the ground so that it can accidentally swallow infective eggs while eating. (10). Untreated planters' nails can also cause *A. lumbricoides* infective eggs to be swallowed while

eating; this condition is also found in the rural area of Jember, where 40.82% of the planters have untreated nails. (10). The following research conducted by Anuar et al. (2014) on Indigenous tribes in rural areas of Malaysia showed that the tribal population was infected by *A. lumbricoides* through food or drink contaminated by the infective eggs of the worm and poor hygiene patterns of the population.(11).

Another characteristic in this research was the gender of the planters; the most infected with ascariasis were female planters, which were 15 (37.5%), while the male planters who contracted ascariasis were only five (12.5%). It was concluded that women were the most infected gender with ascariasis. In contrast, in rural plantation areas with low socio-economic conditions and education, many women worked as planters in their area. This research results differ from studies conducted in the Mbeya area of Tanzania, where males and females have the exact prevalence of ascariasis outbreaks. (12). Other research by Ngui et al. (2011) in West Malaysia's rural areas also found no significant difference between the genders infected with ascariasis.(13).

Differences in Total IgE Levels in Planters

The increase in total immunoglobulin E in these planters indicates that the planters are infected with chronic ascariasis because total IgE is only secreted during chronic outbreaks due to massive IL-4 stimulation, so total IgE is formed, which has no protective properties. In this study, healthy planters had higher total IgE levels (401.8 ng/L) when compared to planters with ascariasis (322.3 ng/L). This can be explained by the fact that in chronic outbreaks, *A. lumbricoides* secretes IL-10 and TGF-β which can be referred to as regulatory B cells that work by suppressing the function of B cells so that the total IgE, which is a product of these B cells, is reduced (14). The finding that apparently healthy farmers had higher total IgE levels than those infected with *A. lumbricoides* may be explained by several factors. First, single stool examination has limited sensitivity and may miss low-intensity or intermittent infections, resulting in misclassification of infected individuals as uninfected (1). Second, chronic helminth infection has been shown to induce immune hyporesponsiveness through regulatory networks, which may suppress IgE production in infected individuals (6). Third, genetic predisposition to atopy can lead to naturally higher IgE levels regardless of infection status (17. Finally, cross-reactivity with other helminths or environmental allergens in rural tropical settings may also contribute to elevated IgE among those classified as healthy (15,13). Together, these factors highlight the complexity of interpreting IgE responses in endemic populations and warrant further investigation. The results of the univariate and bivariate analyses that have been carried out show that there is no significant difference in the total IgE of healthy planters and ascariasis infections. The results of this research are consistent with a study in Brazil that examined children and adolescents with ascariasis, where an increased total IgE response to *A. lumbricoides* infection is characteristic of atopic individuals (15). The increase in total IgE levels in children infected with ascariasis was accompanied by their atopic traits, which were nine times higher when compared to nonatopic children infected with ascariasis (15). Genetic conditions have a role in the immune system's response to ascariasis. Based on the research of Hinz et al. (2016), Nonatopic individuals have lower reactivity of their immune system when compared to atopic individuals, so the increase of total IgE is not too significant in nonatopic individuals with chronic ascariasis outbreaks (16). In the sample of healthy planters in this study living in areas where ascariasis is endemic, there is a possibility of contracting ascariasis. Still, it has not been diagnosed through a one-time stool examination, so no *A. lumbricoides* eggs have been excreted in the faeces.

The persistently high IgE levels in both infected and healthy farmers suggest that chronic exposure in endemic environments induces a predominantly non-atopic immune response. In helminth infections, repeated stimulation by parasite antigens leads to polyclonal IgE production, but regulatory pathways involving IL-10 and TGF-β suppress effector activity and allergy-like manifestations. This state of 'immune tolerance' explains why high IgE does not necessarily translate into clinical atopy in these populations. Furthermore, several factors may contribute to elevated IgE in apparently healthy farmers: (1) Subclinical or undetected helminth infection, as single stool examination may miss light or intermittent infections; (2) Cross-reactivity with other parasites or environmental allergens common in tropical agricultural settings; (3) Genetic predisposition to higher IgE production regardless of infection status; and (4) Constant environmental exposure (soil, plants, organic dusts) that may stimulate immune activation even in the absence of active helminth infection. These findings indicate that high IgE levels in endemic populations should not be interpreted solely as markers of atopy, but rather as part of a broader chronic adaptation of the immune system

Correlation of Age and Total IgE Levels in Planters Infected with Ascariasis

The Pearson correlation test that has been carried out to analyse the correlation between age and total IgE levels obtained results in the form of $p = 0.797$. The interpretation of the results of the data analysis is that there is no significant relation between age and total IgE levels in planters infected with ascariasis ($p>0.05$). These results are consistent with a study of total IgE levels in a population study of significance for the allergy diagnosis in children in Taiwan, where no significant correlation was found between age and total IgE levels. (17). According to Mediaty and Nueber. (2005) The significance of the correlation between age and IgE levels depends on several factors, including the total IgE level.

Where in the research conducted, individuals with total IgE levels > 300 ng/L did not find a significant correlation with the individual's age (18). This is consistent with the results of a research conducted where the total IgE level in planters infected with ascariasis (335.67 ng/l) and in healthy planters (401.78 ng/L) was more than 300 ng/L so that no significant correlation was found.

Correlation of Length of Work and Total IgE Levels in Planters Infected with Ascariasis

Most of the respondents in this research were planters with varying lengths of work ranging from 10 to 40 years. Based on research conducted by Muttaqien (2018) at the plantation area in the rural area of Jember, the soil contamination rate by *A. lumbricoides* eggs was 29.41%, so that it would increase the possibility of planters contracting *A. lumbricoides* caused by repeated exposure during work and accompanied by an understanding of poor hygiene. (8). Based on the results of the Spearman correlation test to test the correlation between length of work and total IgE levels in planters infected with ascariasis, p-value = 0.618 with the interpretation that there is no significant correlation between total IgE levels and length of work of farmers infected with ascariasis (p> 0.05). This can be explained by the planters who are not always in the plantation area so that they do not always have direct contact with soil contaminated by *A. lumbricoides* eggs, as evidenced by previous research conducted in the exact location by Primadana et al. (2019) The results showed that the intensity of ascariasis outbreaks in planters in rural areas of Jember was mild. (3). The intensity of this outbreak is directly related to the proportion of antigens and antibodies formed by the body.(19). Nutrition also plays a role in the state of the immune response. Good food will support the function of cells that play a role in the immune system against pathogens. Still, ascariasis can cause malnutrition, so it will affect the work of the immune response, one of which is B cells related to the production of antibodies such as immunoglobulins. (20).

Limitations

The findings of this study should be interpreted in light of several limitations. The relatively small number of samples (n = 40) may have reduced the statistical power to detect subtle differences or associations. Ascariasis diagnosis was based on a single stool examination, which may have missed light or intermittent infections (1). Only total IgE was measured, without parasite-specific IgE or other immune markers, limiting interpretation of the immune response (6). Participants who had taken anthelmintics within 12 hours before sampling were excluded. However, because several anthelmintics have relatively prolonged half-lives, this interval may not have been sufficient to fully avoid drug-related effects on parasite detection or immune parameters.

CONCLUSION

The total of IgE levels showed no significant difference in the total IgE levels of ascariasis-infected and healthy planters. Age and length of exposure did not correlate with total IgE levels in planters infected with ascariasis. These findings suggest a nonatopic chronic immune response in ascariasis-endemic populations.

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