



## **Intestinal parasites from fingernails of sidewalk food vendors**

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### **ABSTRACT**

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Intestinal infections with soil-transmitted helminths and protozoa are still prevalent in Indonesia, particularly in urban communities. Transmission of parasitic infections is effected directly or indirectly through objects contaminated with feces, including food, water, fingers and fingernails, indicating the importance of fecal-oral human-to-human transmission. Sidewalk food vendors (SFVs) preparing food for their customers are a potential source of infections with many intestinal helminths and protozoa. Compared to other parts of the hand, the area beneath fingernails harbors the most microorganisms and is most difficult to clean. The objective of this cross-sectional study was to determine the prevalence of intestinal parasites in fingernail dirt of SFVs and to identify the associated factors. This study involved 112 SFVs in the vicinity of Hospital X in Central Jakarta, and used microscopic examination of SFV fingernail dirt for determining species prevalence of intestinal parasites. This study showed that 94 samples out of 112 (83.9%) were positive for intestinal parasites; 60 samples (63.8%) represented single infections and 34 (36.2%) mixed infections. *Ascaris lumbricoides* eggs were found in 30 (26.8%) samples and *Giardia lamblia* cysts in 12 (17.89%). The highest prevalence was found in subjects with primary school education, among whom 20 (30.8%) had single infections of *A. lumbricoides* and 16 (24.6%) mixed infections with *A. lumbricoides* and *Trichuris trichiura*. In conclusion, prevalence of intestinal parasites in SFV fingernail dirt is extremely high, with the highest prevalence among less educated SFVs. It is recommended to provide health education and training to all SFVs.

**Key words:** Parasites, intestinal, fingernails, food vendors

### **INTRODUCTION**

In tropical countries, parasitic infections remain a serious public health problem, in view of the high prevalence of protozoan and

helminth infections.<sup>(1)</sup> The World Health Organization has estimated that helminth infections affect around 2 billion people, among whom 5-10% are children under 24 months of age.<sup>(2,3)</sup> Helminth infections may lead to

malnutrition, anemia, and disturbed appetite.<sup>(4,5)</sup> and may ultimately result in retarded physical and cognitive development in children.<sup>(6)</sup> A study in North Sumatra reported a prevalence of ascariasis of 76.7% among primary school pupils.<sup>(7)</sup> In Jakarta, a study conducted among female workers showed a prevalence of intestinal parasitic infections of 70.47%, comprising *Ascaris lumbricoides* (38.13%), *Trichuris trichiura* (28.13%), *Necator americanus* and *Ancylostoma duodenale* mixed infection (13.59%), and *Enterobius vermicularis* (4.84%).<sup>(8)</sup>

The factors associated with intestinal parasitic infections in tropical countries include poverty, illiteracy, poor hygiene, poorly organized clean water supply, and hot and humid environmental conditions. Protozoa and helminthic parasites are responsible for the prevalence of diseases capable of affecting an individual's health. Intestinal parasitic infections (IPI) are global health problems causing clinical illness in 450 million inhabitants, particularly children and women of reproductive age in developing countries.<sup>(9)</sup> IPI, and helminths in particular, are associated with increased risks for nutritional anemia, protein-energy malnutrition, growth retardation in children, poor increase in body weight in pregnancy, intrauterine growth retardation, and low birth weight.<sup>(10,11)</sup> Children infected with soil-transmitted helminths (STHs) have poor educational level and performance at school and a high level of truancy, thus impacting on their future earnings and productivity.<sup>(12,13)</sup> The most important STHs are the common roundworm (*Ascaris lumbricoides*), the whipworm (*Trichuris trichiura*) and the hookworms (*Necator americanus* and *Ancylostoma duodenale*), which currently are a group of neglected tropical diseases.<sup>(14)</sup>

Food vendors with poor personal hygiene could be potential sources of infections of many intestinal helminths and protozoa. Food vendors who harbor and excrete intestinal parasites may cause fecal contamination of foods via their

fingers and their preparation of foods, and finally to healthy individuals. Compared to other parts of the hand, the area beneath fingernails harbors the most microorganisms and is most difficult to clean.<sup>(15)</sup> The presence of sidewalk food vendors (SFVs) is essential for the middle-class society to satisfy their daily food needs away from home. The types of food sold by SFVs include meatballs, chicken noodles, fried noodles, *gado-gado* (Jakarta salad), dumplings, and chicken porridge. These traders of foods and beverages are much in demand at lunchtime. However, SFVs are a source of infectious parasitic diseases if hygiene is not maintained. Intestinal parasites are found everywhere, such as in fingernail dirt, in areas abounding in flies and cockroaches, and in contaminated foods. The aim of the present study was to determine the prevalence of intestinal parasites from fingernail dirt and to identify the associated factors among SFVs.

## METHODS

### Research design

This study used a cross-sectional design and was conducted from 15 June to 15 August 2010.

### Study subjects

A total of 112 SFVs in the vicinity of a large hospital in Central Jakarta participated in this study. The inclusion criteria were: male and female SFVs selling foods to employees and patients of the hospital, and having dirty (blackish) fingernails. Informed consent was obtained verbally after informing the SFVs of the purpose of the study. The study location was around abovementioned hospital in Central Jakarta.

### Data collecting

A structured questionnaire was used for collecting information on age, sex, education, types of food sold, and hygienic status of each SFV. Fingernail clippings were collected from

both hands of each subject using clean nail clippers and placed in labeled containers.

### Laboratory investigation

The following procedure was used for preparing wet mounts of the nail clippings: Initially the clippings were immersed in 10% potassium hydroxide solution for 24 hours, and subsequently centrifuged at 2500 rpm. The supernatant and sediment of each specimen were then stained with eosin and Lugol, and examined by light microscopy at low to medium magnifications (100-400x) for species identification. Helminths were identified from their characteristic egg morphology, and protozoa from their cysts and/or vegetative forms. Trichrome staining was used for preserving positive preparations for future reference. The microscopic work was done in the Department of Parasitology, Faculty of Medicine, University of Indonesia, Jakarta.

### Data analysis

The collected data were analyzed using SPSS version 15.0. The prevalence of parasites was presented as descriptive statistics, while the relationship between several variables (age, gender, educational level) and presence of parasites was determined by the chi-square test. The level of significance used was 0.05.

## RESULTS

A total of 112 SFVs were recruited for this study, consisting of 62 (55.4%) male and 50 (44.6%) female SFVs. Most SFVs (65.2%) went to primary school, and only 1.8% had tertiary education. The subjects' age ranged from 12 to 40 years, with mean age of  $23.7 \pm 8.6$  years (Table 1).

With regard to the types of foods for sale, 20.5% of SFVs prepared meatballs, 15.2% sold chicken noodles, and only 3.6% of SFVs had fried foods for sale. *Gado-gado* (a kind of salad with peanut sauce) was sold by 7.1% of SFVs

Table 1. Distribution of respondent characteristics (n=112)

Characteristic	n (%)
Gender	
Male	62 (55.4)
Female	50 (44.6)
Age (years) *	23.7 $\pm$ 8.6
< 20	40 (35.7)
20 – 29	39 (34.8)
30 – 40	33 (29.5)
Education	
Primary school	73 (65.2)
Junior high school	29 (25.9)
Senior high school/ vocational school	8 (7.1)
Academy	2 (1.8)

\* Mean  $\pm$  SD

and drinks were sold by 5.4%. A total of 94 nail samples (83.9%) were positive for intestinal parasites, while 18 samples (16.1%) were negative. Of the positive samples, 60 (63.8%) had a single parasite species, while 34 (36.2%) had two or more species. *Ascaris lumbricoides* eggs were found in 30 (26.8%) samples and *Giardia lamblia* cysts in 12 (17.89%). (Table 2)

Table 2. Prevalence of intestinal parasites in fingernail samples of food vendors (n=94)

Parasite species isolated	n (%)
Helminth eggs	
<i>A. lumbricoides</i>	30 (31.9)
<i>T. trichiura</i>	6 (6.4)
Hookworm	2 (3.3)
Protozoan cysts	
<i>E. histolytica</i>	10 (10.7)
<i>G. lamblia</i>	12 (12.8)
Combined presence of parasite species	
<i>A. lumbricoides</i> + <i>T. trichiura</i>	20 (21.2)
<i>A. lumbricoides</i> + Hookworm	1 (1.1)
<i>A. lumbricoides</i> + <i>E. histolytica</i>	3 (3.2)
<i>T. trichiura</i> + Hookworm	2 (2.1)
<i>T. trichiura</i> + <i>E. histolytica</i>	1 (1.1)
<i>G. lamblia</i> + <i>E. histolytica</i>	7 (7.6)

Table 3. Presence of parasites by gender, age, and educational level of subjects (n=112)

Variable	Parasites from fingernail dirt		P
	Positive (n=94)	Negative (n=18)	
Gender			
Male	49 (79.1%)	13 (21.0%)	0.116
Female	45 (90.0%)	5 (10.0%)	
Age (years)			
< 20	36 (90.0%)	4 (10.0%)	0.398
20 – 29	32 (82.1%)	7 (8.9%)	
30 – 40	26 (78.8%)	7 (21.2%)	
Education			
Primary school	65 (89.0%)	8 (11.0%)	0.005*
Junior high school	23 (79.3%)	6 (20.7%)	
Senior high school/vocational school	6 (75.0%)	2 (25.0%)	
Academy	0 (0.0%)	2 (100.0%)	

Chi-square test results; \* Significant

Gender and age of the subjects did not show any differences in parasite prevalence between males and females or between age groups ( $p=0.116$  and  $p=0.398$ ). Subjects with primary school education significantly had the highest prevalence of parasites in fingernail dirt, as compared with subjects at other educational levels (junior high school, senior high school, academy) with  $p=0.005$  (Table 3). In the subjects with primary school education, the highest prevalence was 20 (30.8%) for a single parasite species, namely *A. Lumbricoides*, while for the combined presence of *A.lumbricoides* and *T. trichiura* it was 16 (24.6%) (data not shown).

## DISCUSSION

In the present study 94 (83.9%) of the 112 subjects was positive for enteropathogenic parasites, indicating the poor health status and hygiene of the SFVs. Similar results were found in a study in Abeokuta (Nigeria) where the prevalence of parasitic infections among street food vendors was 98.7%.<sup>(16)</sup> In contrast, a study on fingernails from 127 Ethiopian food-handlers showed a prevalence of intestinal parasites of 29.1%.<sup>(17)</sup> SFVs commonly do not have access to any toilet facilities, even when established semi-permanently at their locations. In addition,

public toilets commonly have an inadequate supply of clean water, and therefore SFVs cannot wash their hands properly after defecation, assuming they were highly aware of the importance of personal hygiene. The importance of food-handlers in the transmission of parasitic diseases has been stressed by many investigators worldwide.<sup>(18-20)</sup> The control and prevention of intestinal infections, either by parasites or bacteria, requires understanding of the epidemiological aspects of the problem, for guidance in the design of practical and economic control and prevention measures. Such a high prevalence of intestinal parasites is largely due to poor personal hygiene and environmental sanitation, lack of supply of safe water, poverty, ignorance of health promotion practices, and impoverished health services.

Most of the common intestinal parasitic infections of man are fecal borne infections and the transmission occurs either directly hand-to-mouth or indirectly through food and water. Their transmission within the community is predominantly related to human habits with regards to eating, defecation, personal hygiene, cleanliness and level of education. Their prevalence in the community can be used as an indicator of the living conditions, and environmental sanitation, as well as the socioeconomic status of the community. The

ingestion of parasitic cysts frequently occurs through contaminated fingers and there is an association between the presence of enteroparasites under the fingernails of SFVs and poor personal hygiene. Our study showed a high prevalence of intestinal parasites in fingernail dirt specimens of SFVs. To effectively prevent the transmission of pathogens from SFVs to consumers via the foods prepared by these SFVs requires good personal hygiene and hygienic food-handling practices. Therefore it is recommended that education and training in good hygienic practices should be provided to all SFVs.

Despite their high prevalence in developing countries, persons with intestinal parasites have very low morbidity and mortality rates, thus intestinal parasites are commonly viewed as low-priority health problems. However, ascariasis caused intestinal obstruction in 5-35% of pediatric cases in a comparison of studies conducted throughout the tropics. The intestinal obstruction by ascaris worms is often fatal. In addition, hookworm infection can cause iron deficiency anemia; and trichuriasis is associated with chronic dysentery and rectal prolapse. Amebiasis can result in dysentery and extraintestinal complications, while giardiasis is associated with acute diarrhea, steatorrhea and lactose intolerance.<sup>(21,22)</sup>

Our study indicates that there were no significant differences in prevalence of intestinal parasites in SFV fingernail dirt between male and female SFVs. However, studies from Iran and the Philippines obtained different results. In Iran the prevalence of intestinal parasites was higher in men than in women,<sup>(23)</sup> while in the Philippines the reverse was true.<sup>(24)</sup> These different results may possibly be explained by differences in environmental factors, where Philippine women do more farm work than their Iranian counterparts, while our study pertains only to SFVs and not the whole population as in Iran and the Philippines.

The results of our study showed that SFVs with low educational level had a significantly higher prevalence of helminths under their fingernails, as compared to the better educated SFVs. Similar results were obtained in an Nigerian study on prevalence of helminths in stools, which showed that the highest prevalence was in subjects with low education.<sup>(25)</sup> In this connection it should be conceded that an individual's educational level greatly influences his/her health related behavior, where poor education prevents a person from realizing the importance of personal hygiene. One limitation of the study was the relatively small sample size of SFVs, thus precluding the use of advanced analysis to make associations.

## CONCLUSIONS

In this study there was a high prevalence of intestinal parasites in fingernail dirt specimens of sidewalk food vendors. Low educational level was associated with high prevalence of intestinal parasites. An effective means of preventing the transmission of pathogens from sidewalk food vendors as food-handlers via food to consumers is strict adherence to good personal hygiene and to hygienic food-handling practices.

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