Contamination of Soil Transmitted Helminth Eggs in Lettuce (Lactuca sativa) in Traditional Markets

Hebert Adrianto
Departemen Parasitologi Fakultas Kedokteran Universitas Ciputra Surabaya

ABSTRACT

Fast food with fresh raw vegetables which can be easily found in Surabaya has a potential to be the source of contamination of Soil Transmitted Helminth (STH) eggs. This research aimed to know the distribution and the number of STH egg contamination on lettuce sold in traditional markets in Surabaya. The survey was conducted by taking lettuce from six markets in Surabaya as samples. Worm identification was done in a parasitology laboratory using sedimentation method. Contamination data is presented in a form of frequency distribution tables. On the examination, soil was found attached to the lettuce leaves. As many as 61.90% of sellers sell lettuce that positively contained worm eggs. STH eggs found were only Ascaris spp eggs with a proportion of contaminant findings based on sellers vary from 25% to 100% if divided by market region. This study proves the presence of Ascaris spp worm egg contamination in most of the lettuce sold in traditional markets in Surabaya.

Keywords: Ascaris spp., lettuce, traditional market

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Original Research

Kontaminasi Telur Soil Transmitted Helminth pada Sayur Selada (Lactuca sativa) di Pasar Tradisional

Hebert Adrianto
Departemen Parasitologi Fakultas Kedokteran Universitas Ciputra Surabaya

ABSTRAK

Makanan cepat saji dengan sayur segar mentah (lalapan) banyak ditemui di Surabaya yang berpotensi menjadi sumber kontaminasi telur cacing Soil Transmitted Helminths (STH). Tujuan penelitian ini adalah untuk mengetahui distribusi dan angka kontaminasi telur cacing STH pada sayur selada yang dijual di pasar tradisional di Surabaya. Survei dilakukan dengan objek sayur selada yang diambil dari enam pasar di Surabaya. Identifikasi cacing dilakukan di laboratorium parasitologi menggunakan metode sedimentasi. Data kontaminasi disajikan dalam bentuk tabel distribusi frekuensi. Pada pemeriksaan ditemukan tanah yang menempel pada daun sayur selada. Sebanyak 61,90% penjual menjual selada yang positif mengandung telur cacing. Telur cacing STH yang ditemukan hanya telur cacing Ascaris spp dengan proporsi temuan kontaminasi menurut penjual bervariasi mulai dari 25% hingga 100% jika dibagi menurut wilayah pasar. Penelitian ini membuktikan adanya kontaminasi telur cacing Ascaris spp pada sebagian besar penjual sayur selada di pasar tradisional Surabaya.

Kata Kunci: Ascaris spp., pasar tradisional, selada

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INTRODUCTION

Problems on diseases caused by Soil Transmitted Helminths (STH) worms are still found in tropical countries including Indonesia and have not been eradicated (1). Rahmawati et al. stated that the helminthiasis prevalence in Surabaya is still quite high at around 36% (2). Toddlers, school-aged children (5-15 years), and pregnant women are the groups that have high risk of STH infection (1,3,4). Worm parasites that are often found to contaminate raw vegetables are STH worms that are groups of worms transmitted through soil, including Ascaris lumbricoides (roundworms), Trichuris trichiura (whipworms), hookworms (Ancylostoma duodenale and Necator americanus) (5).

Surabaya is the capital city of East Java Province and the largest city in Indonesia with the second largest population in Indonesia as many as 2,848,583 citizens (6), and has tourism and culinary business potentials. DPD Chairman of Association of Indonesian Cafe and Restaurant Entrepreneurs (Apkrindo), East Java, Tjahjono Haryono, said there were 2,000 culinary businesses in Surabaya (7). The citizens of Surabaya now have a lifestyle of dining out, so it becomes a culinary business opportunity in offering many variations of fast food (8). The type of food that consumers buy will indirectly affect health.

Lettuce (Lactuca sativa) is a kind of vegetable that is often consumed raw and found in foods both Indonesian and international specialties that are sold to urban citizens. Many fast food with raw fresh vegetables are found in Surabaya, for example in chicken noodles, gado-gado, tahu campur, hamburgers, salads, grilled chicken and fish that are accompanied with lettuce (Lactuca sativa) (5). Lettuce is often consumed in fresh and raw condition because when cooked the texture will become rubbery.

The condition of lettuce growth has the risk of worm contamination. Lettuce grows in a sitting position and the leaves are in direct contact with the soil, thus increasing the risk of STH worm transmission. Previous research stated that lettuce sold in Traditional Markets in Padang were containing Ascaris sp eggs (79%) and hookworm eggs (5%) (5). In Vietnam, research also reported to find eggs of Ascaris (88.89%) and Trichuris (66.67%) (9). This study was conducted to examine the prevalence of STH worm contamination in lettuce sold in traditional markets in the city of Surabaya. The results of the study were expected to be the basis for managing food hygiene in food distribution chain.

METHOD

This research was a descriptive study using lettuce as the research sample from six traditional markets in four regions in Surabaya. Four sellers of lettuce determined by the researcher were chosen from every market. If there were less than four sellers in a market, all of the sellers were involved in the research. From each seller, four lettuces were taken. STH worm examination was carried out at the Parasitology Laboratory of the Faculty of Medicine, Ciputra University. The method used in examining the worm eggs in lettuce was the sedimentation method.

Sample of lettuce taken was put in a plastic bag and labeled with the market name and seller number, and then taken to the laboratory. Chunks of lettuce were soaked in 0.2% NaOH solution for 30 minutes. Subsequently, the chunks were removed, and the soaking solution was put into a sedimentation tube and then left for one hour. The upper solution was removed and left only 10-15ml and then put into a centrifugation tube to be centrifuged at 1,500rpm for 5 minutes. The supernatant was removed and the bottom sediment was taken and poured on a glass object. The sediment was dripped with lugol iodine reagent, and then covered with a glass cover (the liquid had to be evenly distributed, and there were no air bubbles). Microscopic examination was carried out at 40-400x magnification. Data were presented in a form of frequency distribution table.

RESULTS

Lettuce obtained from six traditional markets in the city of Surabaya were not all clean. In some lettuce there were still found soil attached to the base of the leaves, petioles, and leaf sheets (Figure 1).

![Figure 1. Soil on lettuce.](image)

Note: Yellow arrow = soil

In this study only one species of worm eggs was found, namely eggs of Ascaris spp. Vegetables taken from four sellers in market A were found to be positively containing Ascaris spp. The highest number of Ascaris spp. eggs was found in market B as much as 42.5% and the lowest contamination (5%) was found in market E in East Surabaya (Table 1). By region, the proportion of sellers with the most lettuce that positively contained Ascaris spp worm eggs was in the central Surabaya region (100%), and the lowest was in eastern Surabaya (25%). Overall the number of sellers with vegetables contaminated with Ascaris spp worm eggs was 13 sellers (61.9%).

DISCUSSION

In this study, worm parasites found in lettuce in six traditional markets in Surabaya was only one species, namely Ascaris spp. in egg stadium. Similar findings were also found in studies in Semarang, Nigeria, Ethiopia, although with different types of vegetables (cabbage, chili, spinach) (10-12). Fagbenro et al. found that Ascaris lumbricoides worms were more dominating and were found in vegetables in Nigeria with a higher prevalence
rate, which was 68.6% (13). In 12 vegetable species obtained from traditional markets in the city of Hue, Vietnam, the most common egg worm found were eggs of Ascaris (85%) (9). A low prevalence of Ascaris worms was found in the study of Eraky et al., which was 0.6% in five vegetable species studied (14). Other parasites found in the study by Benti et al. were from protozoa group (single-celled animals), namely G. intestinalis and E. histolytica (12).

The number of lettuce sellers and positively contained worm eggs in this study were 13 out of 21 people (61.9%). The number of Ascaris spp. on lettuce in six traditional markets in Surabaya was varied ranging from the lowest 5% to 42.5%. This proportion is higher than that of Lobo et al. who found that 46.4% of 28 sellers of lettuce in West Palu had vegetables contaminated with parasites (15). Likewise, research conducted on 26 pecel lele sellers in Yogyakarta identified 6 sellers (23.1%) whose cabbage was contaminated with egg worm (16).

Ascaris lumbricoides worms have a very wide geographical distribution in the world and have become the major cause of helminthiasis in humans in tropical and subtropical countries until now (17). The highest parasitic infection found in the world is Ascaris (20%), while Hookworm, Trichuris trichiura, and Entamoeba histolytica are 18%, 10%, and 10% (18) respectively. A study by Anbumani and Mallika found the prevalence of Ascaris worm infections in school children in Tamil Nadu, India, was 60% higher, followed by T. trichiura which was only 4.17% (18). Likewise, research carried out on farmers in South Ampenan, Mataram, West Nusa Tenggara Province showed that they were mostly infected with Ascaris lumbricoides (80%) (19).

That only did this research find Ascaris eggs in lettuce was different from the research by Chau et al. which found the contamination of Fasciola eggs (77.78%), Trichuris eggs (66.67%), Clonorchis sinensis eggs (33.33%), Oocyst Cryptosporidium (55.56%), Cyclospora oocysts (22.22%), and Isosporic oocysts (33.33%) besides Ascaris in lettuce (9). Benti and Gemechu's study also reported finding A. lumbricoides worm eggs, G. Intestinalis cysts, and E. histolytica cysts in lettuce in Ethiopia (12). Tefera et al. also reported the presence of Strongyloides parasites, Toxocara spp, Cryptosporidium spp, H. nana, G. Lamblia, A. lumbricoides, E. histolytica, Cyclospora spp, and H. diminuta (20). These differences in results can be due to different environmental factors, parasitic endemity in each country, economic and social status, hygienic behavior of individuals, and farming and irrigation systems (9,12,13). In addition, certain types of staining that can detect specific parasites can also determine the discovery of parasites, such as the modified Zeihl-Neelsen staining to color Cryptosporidium, Isospora, and Cyclospora cysts (14,20,21).

The selection of lettuce vegetables in this study compared to other vegetables was due to many previous studies suggesting that lettuce are the highest in worm parasite contamination. Olyaei et al. stated that the highest parasite contamination was in lettuce (86.7%) compared to eight other vegetables (22). Alsubaie et al. also found that high parasite contamination was found in lettuce (33.3%) compared to radish, leeks, and green onions (23). Twenty-five of the 45 lettuce vegetables (55.6%) obtained from markets in Jimma, Ethiopia positively contain worm eggs (20). In Egypt, 101 lettuce were also reported contaminated with worm eggs by 46% (14).

Ascaris spp. species found in this study cannot be ascertained that it was Ascaris lumbricoides species, moreover there were many worm eggs from the host in the vegetable, humans, animals, and others. The author found several research results which stated that the Ascaris genus consists of several species, namely Ascaris lumbricoides with definitive hosts are humans, Ascaris suum which is common in pigs but can cause creeping eruption in humans, and Ascaris vitulorum which is found in cattle, goats and sheep 5). Many Ascaris worms were written with spp., as an example, the study found by Ashika et al. that found the eggs of Ascaris spp. on lettuce sold in traditional markets and modern markets in Padang (5). Sunil et al. also found the presence of Ascaris spp. eggs. in chilli and onion (21). On the other hand, Leles et al. and Liu et al. stated that Ascaris lumbricoides with as same as Ascaris suum (24,25). Ascaris suum is considered a synonym for Ascaris lumbricoides while Ascaris vitulorum has not been revealed.

Contamination of worm eggs in lettuce by humans can be caused by the vegetables structure and the production process up to distribution. Lettuce which is very short causes contact with the soil, so contamination is easy. Ascaris worm eggs can come into the human body through vegetables contaminated with soil containing worm eggs (12,13). Research by Fagbenro revealed that from 18 sellers (respondents), only 1 seller did not wash vegetables before the vegetables were sold to consumers (13).

### Table 1. Distribution of Ascaris spp. eggs on lettuce among traditional markets in Surabaya

| Area  | Market | Number of sellers | Sellers with vegetables containing Ascaris spp eggs | Percentage of sellers with Ascaris spp egg contaminated vegetables per region | Mean of the number of Ascaris spp egg | Percentage of Ascaris spp egg (%) |
|-------|--------|------------------|---------------------------------------------------|-----------------------------------------------------------------------------|--------------------------------------|-----------------------------------|
| Center | A      | 4                | 4                                                 | 100                                                                         | 12                                   | 30                                |
| West  | B      | 3                | 3                                                 | 80                                                                          | 17                                   | 42.5                              |
|       | C      | 2                | 1                                                 | 75                                                                          | 6                                    | 15                                |
| South | D      | 4                | 3                                                 | 25                                                                          | 3                                    | 7.5                               |
| East  | E      | 4                | 2                                                 |                                                                              | 0                                    | 0                                 |
|       | F      | 4                | 0                                                 |                                                                              | 0                                    | 0                                 |
| Total |        | 23               | 13                                                | 40                                                                          | 100                                  |                                   |

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However, from 102 vegetable samples tested, the contaminated vegetables remained high at 75%. The difference in vegetable suppliers is also likely to be influential.

At the examination of worm eggs, soil was found attached to lettuce on the leaf sheet, leaf stalks, and base of leaves. Lettuce is a highly clustered plant, has broad leaf about 20-25 cm long and 15 cm wide. The temperature for high quality lettuce production is 20°C (26). The stem of lettuce is short so that the leaves can contact the ground. The presence of soil attached to lettuce leaves is a risk factor for the transmission of intestinal worm parasites (9,15,27). The habitat and cycles of Ascaris require clay/loose media (15,28). The use of fertilizers from feces can also be an intermediary for transmission of Ascaris worms (11,13,16). Ascaris eggs are resistant to disinfectants and can live for months in feces (15,16). The density of parasitic egg number in each part of the leaf bring out to future research opportunities to be examined deeper.

Preventive measures that can be taken so that lettuce does not contain egg worm is by washing in running water and washing each sheet of the vegetable (15,16,28). Washing the vegetables only on the outside will not reduce the level of worm egg contamination (16). Suryani (16) said that washing vegetables in a basin not in running water and not replacing water in the washing process will increase the chances of worm eggs to re-stick to the vegetables. In addition, it is also reported in the process of transporting lettuce from one place to another for selling is always wetted with river or gutter water to avoid withering (9,16,21). It is uncommon to cook lettuce because it will result in rubbery texture and unpleasant taste (15) so that the only way to prevent STH eggs among lettuce is by proper washing. In the future, culinary entrepreneurs and housewives who purchase lettuce should be more alert and wash the lettuce vegetables properly.

Based on the results of this study it can be concluded that the eggs of Soil Transmitted Helminth worms found in lettuce in several traditional markets in Surabaya are only Ascaris spp. eggs. The proportion of sellers with vegetables contaminated with STH worm eggs is quite high which requires attention to the management of food hygiene in traditional markets.

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