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Epidemiological Review: Mapping Cases and Prevalence of Helminthiasis in Indonesia on 2020-2022

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ABSTRACT

Background: Helminthiasis cannot be separated from society in Indonesia. In 2020, the World Health Organization (WHO) classified helminth infections as neglected tropical diseases (NTD) that require large-scale control, because morethan 23% of the world's population is infected with helminthiasis. In Indonesia, there are still few articles that comprehensively review the epidemiological mapping of the latest helminthiasis cases. The purpose of writing this article is to map the prevalence of helminthiasis in Indonesia in 2020-2022. This article is a systematic studyconducted from January-April 2023. The literature search was carried out through an electronic database.

Result: The findings of this study indicate that in the last three years, helminthiasis has not been eliminated in Indonesia. The results of helminth species found to infest communities in several provinces in Indonesia include *Ascaris lumbricoides, Trichuris trichiura, Hookworm, Hymenolepis nana, Taenia saginata, Taenia solium, Oxyuris vermicularis, Schistosoma japonicum, Strongiloides stercoralis,* and *Wuchereria bancrofti.* The diagnosis of helminth infestation and infection is confirmed through microscopic examination by finding eggs, larvae, proglottids, and even adult worms that come out spontaneously through defecation. In addition, helminth transmission can occur through food contaminated with worm eggs. The government has tried to control helminthiasis through Permenkes number 15 of 2017 concerning Helminthiasis Management. However, the indicators of achieving the target of reducing the prevalence of intestinal worms to below 10% in eachRegency/City as stated in Pasal 3 ayat 2 of the Permenkes have not been fully met.

Conclusion: It can be seen in this study that there are still many provinces that have not reached the helminth control target. This condition is especially experienced by high-risk groups, such as children, mining workers, plantation workers, farmers, livestock workers, staff at slaughterhouses, and waste collectors.

Introduction

Helminthiasis are still a widespread health problem in tropical and subtropical regions. According to WHO, more than 1.7 billion people worldwide suffer from helminthiasis, making this disease classified as a neglected tropical disease. (WHO, 2020) This is due to the chronic and asymptomatic nature of helminth infections, especially in the early stages. (Idris et al, 2019) When the infection becomes more severe, it will be associated with anemia, nutritional malabsorption, general malaise, gastrointestinal symptoms,

also resulting in impaired physical development and cognitive performance. (Makata, 2020) The morbidity associated with these tropical diseases creates a substantial disease burden, which promotes the formation and defense of endless cycles of infection, decreased productivity, poverty and inadequate socioeconomic status. (WHO, 2020)

More than 266 million preschool-aged children and more than 567 million school-age children infected with helminthiasis live in areas where this parasite is intensively transmitted. (Sofiana et al, 2022) In Indonesia, helminthiasis is widespread in rural and urban areas. The survey results of helminth infections in primary schools in several provinces show a prevalence of around 61% - 79%, while for all ages it is around 41% - 59%. Surveys in Indonesia also show that the high prevalence of *Ascaris lumbricoides* is often followed by a high incidence of *Trichuris trichiura* as well. A high prevalence of Ascariasis was found in several villages in Sumatra (77%), Sulawesi (87%), West Java (89%), Kalimantan (78%), and West Nusa Tenggara (91%). Trichuriasis prevalence is also high in Kalimantan (82%), Sumatra (82%), West Nusa Tenggara (83%), West Java (90%) and Sulawesi (82%). On the other hand, hookworm prevalence ranges from 31% - 49% in various regions in Indonesia. (Nainggolan, 2022)

Approximately 69% of infections from the Soil Transmitted Helminth (STH) nematode group occur in Southeast Asia and more than 25% of the study population in Asia is infected with at least one species of helminth. (Silver et al, 2018) The prevalence of helminthiasis in Indonesia is close to 30% with the incidence in elementary school students around 61-79%. (Suharmiati et al, 2018) The prevalence of helminthiasis in Central Java is almost 27% and dominated by *Ascaris lumbricoides* 7.3%, Hookworm 4.9%, *Trichuris trichiura* 5.9%, *Necator americanus* 2.9%, *Strongyloides strercoralis* 4.9 %. (Subagiono, 2019)

Helminthiasis cases in Banten Province were 60.6% with the highest number being Lebak Regency at 63.3%. (Dinkes Lebak, 2019) These cases were dominated by elementary school children who were the group most at risk for helminth infections. Factors that will lead to a high rate of worm infection in children are factors of children, parents and the environment:

a. Child factors: not washing hands before eating and after defecation, cleanliness of nails, eating snacks in any place, open defecation behavior that causes soil and environmental pollution by worm eggs contained in feces, consumption of deworming medicine every 6 months.

b. Parental factors: low personal hygiene behavior, not being able to keep children clean, not washing vegetables and fruit that will be consumed by children, level of education and knowledge of parents.

c. Environmental factors: latrine ownership, dirty house floors, availability of clean water and socio- economic conditions, as well as environmental sanitation. (Sadjimin, 2022)

In Indonesia, there are still few articles that comprehensively review the epidemiological mapping of the latest helminthiasis cases. Based on the explanation above, the purpose of writing this article is to map the prevalence of helminthiasis in Indonesia in 2020-2022. This article is a systematic study conducted from January-April 2023. The literature search was carried out through an electronic database. The publications selected in the selection of titles and abstracts were extracted using a standard format table and processed using a Microsoft Excel spreadsheet. The extracted data are the author, year of publication, journal, and conclusion. The results are then presented qualitatively.

Result

Helminthiasis Prevalence Mapping in Indonesia

From several literatures reviewed, the authors mapped cases of helminthiasis that spread in various provinces in Indonesia. (Figure 1)

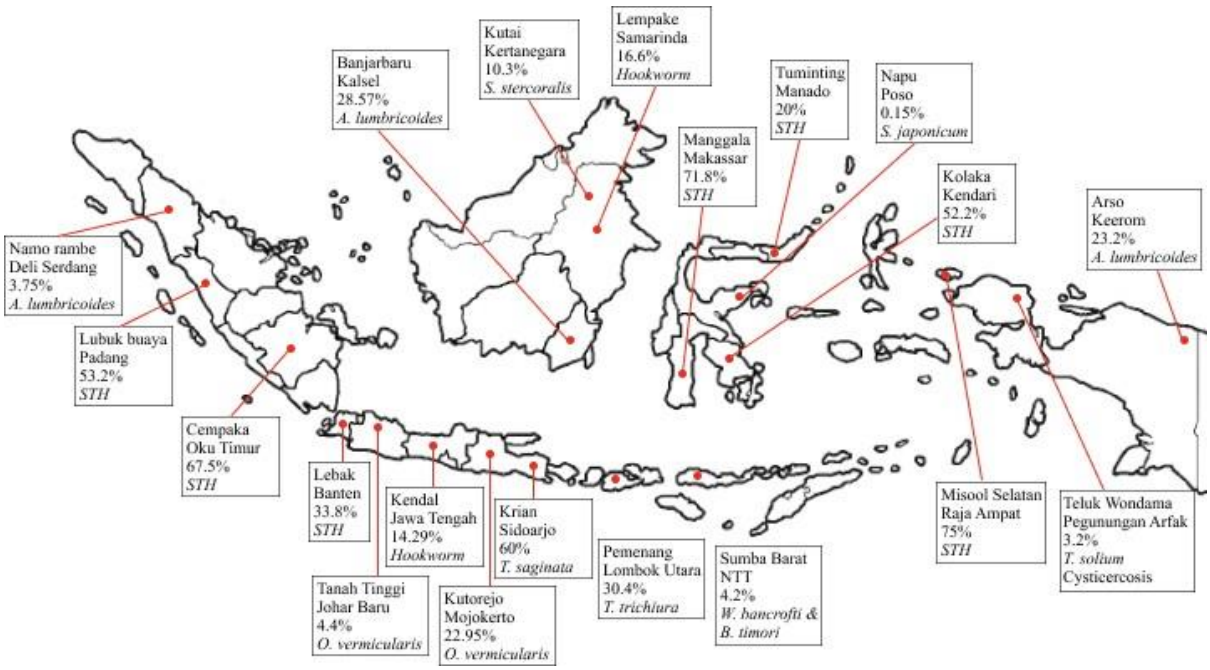

Figure 1. Helminthiasis Prevalence Mapping in Indonesia

Systematic Overview of Helminthiasis in Indonesia

From several publications reviewed, the authors systematically reviewed the incidence of helminthiasis studied in various cities/districts in Indonesia. (Table 1)

Table 1. Helminthiasis Prevalence in Indonesia

Province	City/Regency	District	Subject	Prevalence	Specimen	Finding
Jawa Tengah	Banyumas	Kembaran	Children	3,1%	Faeces	*Hymenolepis nana*
	Semarang	Bandarharjo	Children	2,9%	Faeces	STH
	Kendal		Plantation workers	14,29%	Faeces	Hookworm
Banten	Lebak	Cihara	Children	33,8%	Faeces	STH
Jawa Timur	Jember		Plantation workers	92,6%	Faeces	Hookworm
	Blitar	Plosokerep	Children	66%	Faeces	*Ascaris lumbricoides*
	Sidoarjo	Krian	Slaughter-house workers	60%	Nail	*Taenia saginata*
	Mojokerto	Kutorejo	Children & Adulthood	22,95%	Anal swab	*Oxyuris vermicularis*
Sumatera Barat	Padang	Lubuk buaya	Children	53,2%	Faeces	STH
Sumatera Utara	Deli Serdang	Namo Rambe	Children	3,75%	Faeces	*Ascaris lumbricoides*
	Karo	Naman Teran	Farmers	6,6%	Nail	STH
Sumatera Selatan	Oku Timur	Cempaka	Children	67,5%	Faeces	STH
Kalimantan Selatan	Banjarbaru		Miners	28,57% 9,52%	Faeces	Ascariasis Hookworm
Kalimantan Timur	Samarinda	Lempake	Farm workers	16,6%	Faeces	Hookworm
		Bukit pinang	Cleaning workers	3,3%	Nail	*Ascaris lumbricoides*
	Kutai kertanegara		Children	31,8% 10,3%	Faeces	Hookworm *Strongiloides stercoralis*
Sulawesi Selatan	Makassar	Manggala	Garbage collector	71,8%	Faeces	STH
Sulawesi Utara	Manado	Tuminting	Children	20%	Faeces	STH
Sulawesi Tenggara	Kendari	Kolaka	Children	52,2%		STH
Sulawesi Tengah	Poso	Napu	Children	0,15%	Faeces	*Schistosoma japonicum*
Jakarta Pusat	Johar Baru	Tanah Tinggi	Children	4,4%	Anal swabs	*Oxyuris vermicularis*
Nusa Tenggara Barat	Lombok Utara	Pemenang	Children	30,4%	Faeces	*Trichuris trichiura*

Finding Helminth Eggs Contamination in Food

In its life cycle, STH worms can enter the human body through contamination of worm eggs from the soil to food and drinks consumed by humans. Several studies related to the identification of parasitic contamination in food are summarized in table 2.

Table 2. Proportion of Helminth Eggs Contamination in Food

Province	City/Regency	District	Proportion	Sample	Finding
Sumatera Utara	Medan		17,5%	Cabbage & Lettuce	STH
Jawa Barat	Bekasi	Rawalumbu	100%	Basil	Hookworm
Jawa Tengah	Klaten	Pedan	14,3%	Basil & Cabbage	*Ascaris lumbricoides*
Riau	Pekanbaru		13,3%	Cabbage	*Ascaris lumbricoides*

Discussion

Helminthiasis in Children

Based on table 1, it is shown that the largest population with worms is children. Several studies have shown that there is a relationship between school age children and the incidence of worms, where the age group of toddlers and children has a high infection rate. (Mukti et al, 2022) The high incidence of worms in children is related to self-care habits. The world of children who often play barefoot makes them more susceptible to infection. Contact with the soil will cause larvae or worm eggs that stick to the skin to enter the body and infect them. (Kamila et al, 2018) Low personal levels such as lack of awareness of washing hands before eating, awareness of maintaining nail hygiene and transmission from school/play friends are contributing factors to the number infection. (Dinkes Lebak, 2019)

In addition to causing an acute impact on health, in the long term this infection can cause disturbances in the growth and development of children, iron deficiency anemia, short stature (stunting), malnutrition, and cause impaired intelligence in children, thus affecting the achievement and performance of the sufferer. If chronic and untreated, some of these infections can also lead to death due to the complications caused by the presence of parasites in a child's body. (Munawaroh et al, 2022)

However, there has been a shift in children's hygiene behavior as a result of the worldwide pandemic. This condition makes some parents forbid their children to play outside. Children then spend more time playing at home. The type of play that

is done at home makes children less and less direct contact with the ground. (Mukti et al, 2022) In addition, the production of kinetic sand toys is allegedly able to replace soil as a means of developing children's fine motor skills.

Although rarely cause mortality, helminthiasis infection causes many complications such as malabsorption syndrome, chronic dysentery, gastrointestinal obstruction, rectal prolapse, airway complications, and growth faltering. The results of the analysis test in a study between helminthiasis and BMI/Age measurements showed that there was a significant relationship between worm status and BMI/Age. Degarege et al found that children infected with worms had a lower BMI/Age mean than with healthy children. (Ramarantika et al, 2022)

Symptoms of helminthiasis are generally almost the same, namely the child looks thin, easily tired, nausea and vomiting, flatulence, abdominal pain, and feces mixed with blood. Worms can interfere with children's growth and development, interfere with learning concentration, cause anemia, fatigue, weight loss, and diarrhea. This condition can be prevented by maintaining personal hygiene and environmental cleanliness. Clean and healthy living behavior can be done by washing hands with soap, using the latrine when defecating. Environmental sanitation can be done by using clean water and disposing of pet waste in a special disposal area. Food and beverage sanitation can be done by washing food ingredients with clean water, and cooking food until cooked. The behavior of washing hands before and after preparing food, wearing slippers outside the house and cutting nails regularly are also ways to prevent helminth infections. (Panjaitan, 2022)

STH class worms are widely distributed, both in tropical and subtropical regions. The determinants of transmission include humidity and hot temperatures that support optimal growth of worms. Transmission is supported by poor socio-economic conditions, insufficient clean water supply, lack of sanitation facilities, low education, poor personal hygiene, and non-standard housing. Other environmental factors in the public sphere include the state of drainage and the contribution of waste to individual exposure. These conditions have an impact on the condition of health, nutrition, and intelligence. Adult worms that live in the intestine will absorb nutrients, so that it becomes one of the causes of nutritional deficiencies in the food consumed by children. This will affect the potential and quality of human resources as the nation's next generation. (Konoralma et al, 2022)

WHO targets to reduce the incidence of helminthiasis in children in endemic

areas by 75% by implementing regular treatment. One of the drugs recommended to control STH infection in the community is Albendazole 400 mg single dose for adults and 200 mg for children aged 12-24 months. Albendazole belongs to the methyl carbamate group, which is a benzimidazole derivative with high anthelminthic activity with low doses and few side effects. The spectrum of activity is very broad, including nematodes, cestodes, and echinococcal infections in humans. The Indonesian Ministry of Health uses Albendazole 400 mg as a worm control program because it is relatively safe, single dose, cheap, and easy to obtain. (Munawaroh et al, 2022)

Children are very important human resources for the development of the Indonesian nation in the future. However, a report from the World Bank states that helminthiasis hampers development in the world because it is 12% of the total burden of illness in children aged 5-14 years. Although eradication has been carried out since the last 50 years by the government and various parties, the prevalence of this disease remains high. This is because some of the population is still living unhealthy and related to the economic status and cleanliness of the living environment. (Suriani et al, 2019)

Helminthiasis in Adult Workers

In the plantation area of a company in Kendal Regency, most of the soil is loose and slightly sandy, so it can be an appropriate medium for hookworm breeding. The condition of the village, which is inhabited by approximately 50 residents and there are only 20 dwellings with soil floors, has the potential to become a medium for hookworm larvae to live. The habit of Ungaran mountain climbers who cross the Kendal hiking trail often defecate along the tea plantations can also be a cause of contamination of hookworm eggs in plantation soil. Indeed, clean and healthy living behavior is not the only factor related to the transmission of hookworm infection because the main factor in hookworm transmission is the presence of worms in the infective stage that penetrate the legs. The incidence of hookworm infection among tea pickers in Kendal is very likely related to the entry of hookworm larvae attached to long fingernails and rarely cut. (Yuntrio et al, 2022)

Supporting factors that cause STH infection include the work of someone who is closely related to the soil, such as farmers, diamond miners and sand miners. One of the livelihoods of residents in Sungai Tiung Village, Banjarbaru City is sand mining. The sand mining workers do not use full PPE. The workers have a bad habit of washing their hands before eating,

which can lead to STH infection. Likewise, the sand miners in the Pemataan Village, Landasan Ulin Subdistrict, Banjarbaru, who mostly carry out their activities around the work environment that support the transmission of hookworm infection. This condition results in a decrease in Hb levels in workers to below normal due to high and chronic infection intensity. (Husniar et al, 2022)

Cattle breeders in Indonesia still pay less attention to the problem of parasitic diseases. Some cattle breeders still let the cows find their own food (shepherd system) and are not penned at all (traditional system). Cattle rearing with these two systems increases the chances for trematode, nematode and cestode parasites to continue their life cycle. Most of the population in North Samarinda sub-district work as farmers (78%) and ranchers (22%). As cattle breeders, their daily job is to take care of the cattle, such as cleaning the cage, bathing, separating the mother cow from her calf, and feeding the cows which encourages farmers to cut grass in the fields, roadside or in the field as cow food. The work is always in contact with the soil and usually they do not use PPE in their work, such as footwear and gloves, even though soil is an excellent medium for the growth of worm eggs. They also do not wash their hands with soap after doing these activities and live close to the cowshed. (Salsabila et al, 2021)

Based on observations made of cleaning staff in Samarinda when collecting waste without using PPE, it is known that they are susceptible to helminthiasis due to contamination from the waste. From the results of the nail clippings of the cleaning staff taken as a sample in Samarinda, one of the samples was found to have detected Ascaris lumbricoides worm eggs.24 A similar thing happened in Manggala Antang District, Makassar City, where there were findings of 71.8% of STH eggs in the feces samples of waste transport workers. Due to poor personal hygiene and environmental sanitation. (Amalia et al, 2022)

Naman Teran Village is a village where 90% of the residents work as farmers. Soil conditions that are fertile, loose and mixed with pests in Karo Regency have the potential for the life cycle of STH worm eggs to become infective. In doing their job, farmers in Naman Teran Village still don’t care about personal hygiene. This can be seen from not washing hands with soap and running water after finishing work, before eating or chewing betel, not washing feet, and not wearing footwear and gloves when working. Based on this, it is very likely that farmers will be infected with STH because of their daily contact with the ground intensely. The use

of footwear is considered to limit their activities because the land used for farming is loose and waterlogged. (Napitupulu, 2022)

Slaughterhouse is an area that is vulnerable and at risk of endemic worm infection. Cattle imported from various regions in East Java have a risk of being infected with worms. Previous research found the prevalence of Taenia saginata was 62.3%. This prompted a study on slaughterhouse staff in Krian, Sidoarjo, by taking samples of their nails. Nails can be a place of attachment for various feces that contain parasites, one of which is worm eggs that get stuck in the nails and are swallowed when eating. The high contamination of dirty nails by intestinal cestode eggs is due to the presence of a thick hyaline layer and an albuminoid layer that serves to protect the egg contents, so that the eggs can last a long time on dirty nails. Then, fertile eggs will become infective after a few weeks depending on humidity, climate, and soil conditions. (Charisma et al, 2022)

Parasite Contamination Findings in Food

Vegetable traders in traditional markets in Medan City often do not pay attention to the hygiene of the vegetables they sell. Some vegetables are placed carelessly in dirty, muddy and earthy conditions. Some types of vegetables that are often consumed raw are watercress, cabbage, cabbage and basil. These types of vegetables are less delicious when cooked first. The habit of eating fresh vegetables in Indonesia must be more careful if the washing is not clean enough, thus providing an opportunity for contamination of worm eggs in raw vegetables. The wavy surface of the cabbage leaves makes it difficult to clean, thus allowing the worm eggs to still stick to the leaves, especially if the washing process is not carried out under running water. (Husaini et al, 2022)

In vegetable cultivation, contamination of worm eggs from soil to vegetables can occur in vegetables that spread or are close to the ground. In addition, the farmers' habit of using organic fertilizers in the form of humus or livestock manure also contributes to the attachment of STH eggs from fertilizers to vegetables. If someone eats these vegetables without being peeled, washed, and cooked first, of course there will be the potential for worm transmission. For this reason, a study conducted on food vendors along Dasa Darma Street, Rawalumbu District, Bekasi City found 100% of basil samples contaminated with Hookworm eggs. (Anindita et al, 2022) The same thing happened to the finding of 14.3% of STH eggs from fresh cabbage and basil in 14 lesehan food stalls in District of Pedan Klaten. (Pramana et al, 2022) A total of

13.3% of cabbage samples at the Pekanbaru City market were also positive for Ascaris lumbricoides worm eggs. (Yulianti et al, 2022)

Conclusion

Helminthiasis are included in 11 of the 20 neglected tropical diseases in Indonesia. The government has tried to control helminthiasis through Permenkes number 15 of 2017 concerning Worm Management. However, the indicators of achieving the target of reducing the prevalence of intestinal worms to below 10% in each Regency/City as stated in Pasal 3 ayat 2 of the Permenkes have not been met. It can be seen in the explanation above that there are still many provinces that have not reached the worm control target. This condition is especially experienced by high-risk groups, such as children, mining workers, plantation workers, farmers, livestock workers, staff at slaughterhouses, and waste collectors. The findings of this study indicate that the worm species found to infest communities in several provinces in Indonesia include *Ascaris lumbricoides, Trichuris trichiura, Hookworm, Hymenolepis nana, Taenia saginata, Taenia solium, Oxyuris vermicularis, Schistosoma japonicum, Strongiloides stercoralis, and Wuchereria bancrofti.*

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