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Universities and research institutions in Switzerland	Medicine Infectious Diseases Public Health, Environmental and Occupational Health		
Media Ranking in Switzerland			
PUBLICATION TYPE	ISSN	COVERAGE	INFORMATION
Journals	24146366	2016-2021	Homepage How to publish in this journal peter.leggat@jcu.edu.au

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SCOPE

Tropical Medicine and Infectious Disease publishes on all tropical diseases of global significance, as well as neglected tropical diseases as defined from time-to-time by the World Health Organization. The scope of the journal includes, but is not limited to: Clinical tropical medicine; Tropical public health; Tropical infectious diseases; Parasitology and entomology; Bacteriology, mycology and virology; Epidemiological and social science studies; Chemotherapy and pharmacology; Immunology; Disease prevention, control and elimination; Emerging and re-emerging infectious diseases; Emerging public health threats; Global health and One Health.

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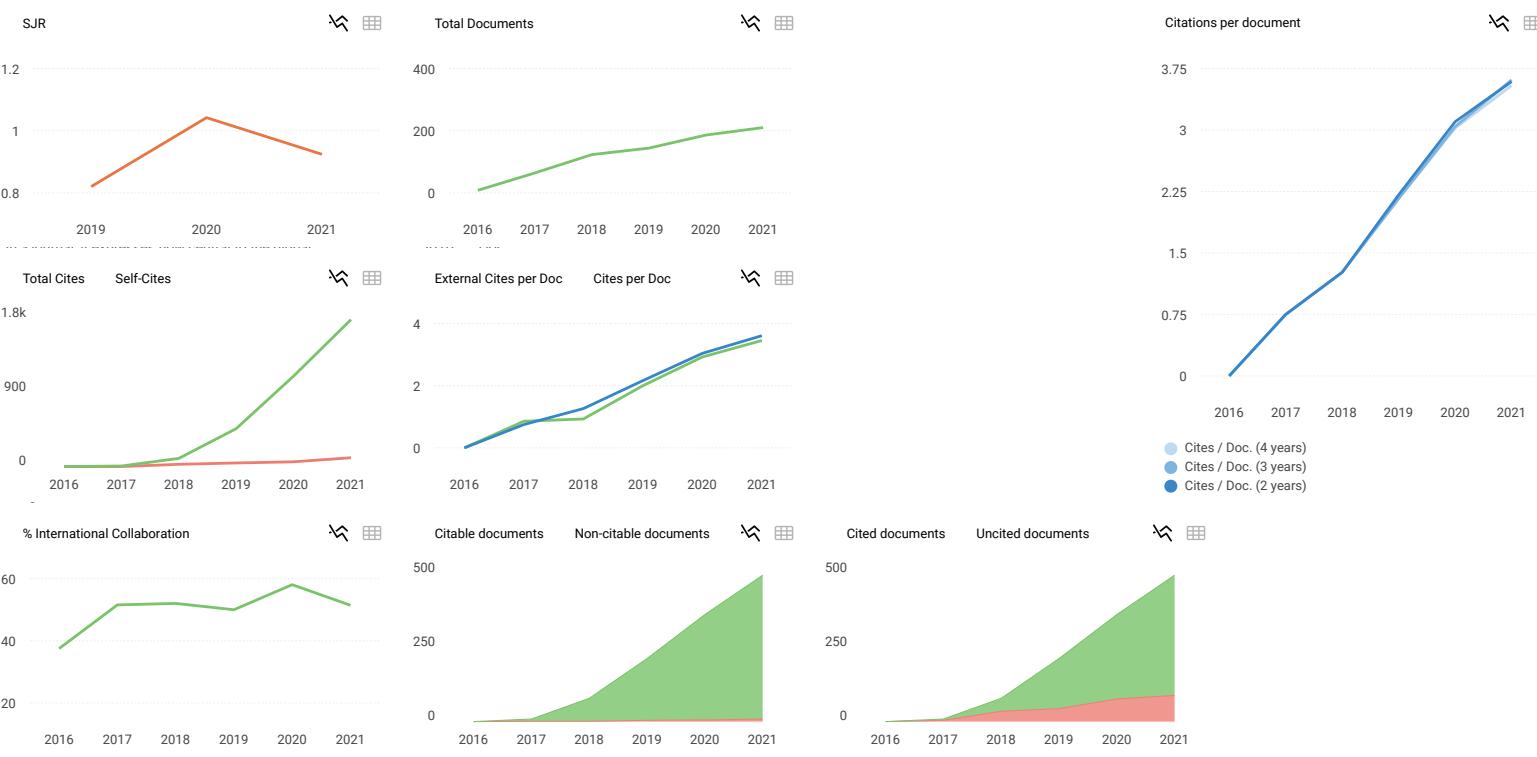
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H Huseyin Elci 2 months ago

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Coverage of the journal is seen as 2016-2021, what is the reason of non-coverage of 2022, is it no longer a sci-e journal?

reply

SCImago Team



Melanie Ortiz 2 months ago

Dear Huseyin,
Thank you very much for your comment.
All the metadata have been provided by Scopus /Elsevier in their last update sent to SCImago, including the Coverage's period data. The SJR for 2021 was released on 11 May 2022. We suggest you consult the Scopus database directly to see the current index status as SJR is a static image of Scopus, which is changing every day.
The Scopus' update list can also be consulted here:
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Best Regards, SCImago Team

S Silvia Jaqueline Souza 8 months ago

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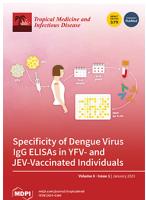
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Cover Story ([view full-size image \(/files/uploaded/covers/tropicalmed/big_cover-tropicalmed-v8-i1.png\)](#)): Dengue virus antibody assays frequently cross-react with sera from individuals that were infected with or vaccinated against related flaviviruses. This makes it challenging to monitor the prevalence of dengue virus infections in regions where several flaviviruses co-circulate. The study examined the diagnostic specificity of two dengue virus ELISAs with sera obtained 3-4 weeks or 0.5-6 years after yellow fever virus (YFV) and Japanese encephalitis virus (JEV) vaccination. Sera were from individuals living in a non-endemic area and dengue virus neutralization was used as control for probable dengue virus infection. The two assays showed varying degrees of cross-reactivity. The specificity of one of the assays may be suitable for seroprevalence studies in areas with a high prevalence of dengue virus infections. [View this paper \(<https://www.mdpi.com/2414-6366/8/1/7>\)](#)

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Epidemiological Profile and Spatial Patterns of Enterobiasis in Children Aged 3–9 Years in China from 2016 to 2020 (2414-6366/8/1/25)

by Jilei Huang (https://sciprofiles.com/profile/2619241).

Huihui Zhu (https://sciprofiles.com/profile/author/V1ZLT1ZpYk1mSVBsVEk4a1I4SDBsSW1ITFZLk3NSckJDUUVYMpFZSs2TT0=).

Changhai Zhou (https://sciprofiles.com/profile/author/YkJSBVURHBxCE0VVM1Z0pTOE4rK2w5OWZhWTlyTWJPL2hNSEN4l2I0TT0=).

Tingjun Zhu (https://sciprofiles.com/profile/author/bVircUhsOEs1a0h4R3BzQWUyQjMzQstKy9zaW9lQnYxDVZQZWxCa2v5bzD=).

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Yingdan Chen (https://sciprofiles.com/profile/author/bpQTlhKWC8rZ1BpY0RsaxGxFvNRIeDlvam0tVNQd2JEb0tpL2VSG9vUT0=).

Menbao Qian (https://sciprofiles.com/profile/2627098) and Shizhu Li (https://sciprofiles.com/profile/2246107).

Trop. Med. Infect. Dis. 2023, 8(1), 25; https://doi.org/10.3390/tropicalmed8010025 (https://doi.org/10.3390/tropicalmed8010025) - 29 Dec 2022

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Abstract(1) Background: *Enterobius vermicularis* infection causes a significant health burden in children. The infection occurs throughout the country and remains a serious public concern in China. Therefore, it is necessary to know the situation of *E. vermicularis* infection, to provide a scientific basis [...] [Read more](#).

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Transmission Risk Predicting for Schistosomiasis in Mainland China by Exploring Ensemble Ecological Niche Modeling (2414-6366/8/1/24)

by Jingbo Xue (https://sciprofiles.com/profile/eFFpQzVhdFkybnNkc2pIQ2hSMkJVaWhtlClzaER3ZkZEdU10dVpOSU9qcz0=).

Xiaokang Hu (https://sciprofiles.com/profile/author/T3Q4cTlydW4emY5SF1HaXILMUNnZTzOEgZQS9UQUpnR1F0clQyZ1lwcz0=).

Yuwan Hao (https://sciprofiles.com/profile/2246124). Yanfeng Gong (https://sciprofiles.com/profile/2246803).

Xinyi Wang (https://sciprofiles.com/profile/author/VURVTWJHOUN6eHp3TUpvQ291TFYrThdXSTMxZ2hkyUDuTeTZ0K3A3K0pBRT0=).

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Shang Xia (https://sciprofiles.com/profile/2379579).

Trop. Med. Infect. Dis. 2023, 8(1), 24; https://doi.org/10.3390/tropicalmed8010024 (https://doi.org/10.3390/tropicalmed8010024) - 28 Dec 2022

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AbstractSchistosomiasis caused by *Schistosoma japonicum* is one of the major neglected tropical diseases worldwide. The snail *Oncomelania hupensis* is the only intermediate host of *S. japonicum*, which is recognized as an indicator of the schistosomiasis occurrence. In order to evaluate the risk of [...] [Read more](#).

(This article belongs to the Special Issue [Control of Schistosome Intermediate Hosts](#) (Journal/tropicalmed/special_issues/6772K925EH))

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Antibiotic Consumption in Vanuatu before and during the COVID-19 Pandemic, 2018 to 2021: An Interrupted Time Series Analysis (2414-6366/8/1/23)

by Nicola D. Foxlee (https://sciprofiles.com/profile/624420).

Amsaline Lui (https://sciprofiles.com/profile/S0NoWFRDvZNudkpPZjBSV2RkV0ErZjdheGh6S0tQdmdES3QzYXRvcEVCMD0=).

Agnes Mathias (https://sciprofiles.com/profile/author/MTd4L01ueVNuVFNGV0pXdTNX1czQTN6QUV6VXA5NFx4bnk2TUnrNER5TT0=).

Nicola Townell (https://sciprofiles.com/profile/1028494) and Colleen L. Lau (https://sciprofiles.com/profile/395418).

Trop. Med. Infect. Dis. 2023, 8(1), 23; https://doi.org/10.3390/tropicalmed8010023 (https://doi.org/10.3390/tropicalmed8010023) - 27 Dec 2022

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AbstractThis study objective was to characterize antibiotic consumption in Vanuatu before and during the COVID-19 pandemic. Data on antibiotic usage were obtained from the Pharmacy database. [...] [Read more](#).
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Prevalence and Associated Risk Factors of Intestinal Parasitic Infections: A Population-Based Study in Phra Lap Sub-District, Mueang Khon Kaen District, Khon Kaen Province, Northeastern Thailand (2414-6366/8/1/22)

by Sirintip Boonjarasapinyo (https://sciprofiles.com/profile/2731977). Thidarat Boonmars (https://sciprofiles.com/profile/1826536).

Nuttapon Ekobol (https://sciprofiles.com/profile/author/UUF6Z3JiZWtwCTtaEdMbzZlMy5bDrQUEYUU0RmxGOG3RGNcakRNQTo=).

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Amornrat Juasook (https://sciprofiles.com/profile/1372407) and Nadchanan Wonkchalee (https://sciprofiles.com/profile/2674781).

Trop. Med. Infect. Dis. 2023, 8(1), 22; https://doi.org/10.3390/tropicalmed8010022 (https://doi.org/10.3390/tropicalmed8010022) - 27 Dec 2022

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AbstractIntestinal parasitic infections are still a crucial problem among communities in Northeast Thailand. Misuse of antiparasitic drugs and unhealthy food behaviors are known. This study aimed to explore the prevalence, behavioral health factors, and motivation for self-treatment of anti-parasitic drugs in this area. [...] [Read more](#).

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No Evidence of Ntwtwe Virus Infections in Children Presenting to Kiboga Hospital, Uganda (2414-6366/8/1/21)

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● [Zhihang Peng \(https://sciprofiles.com/profile/119158\)](https://sciprofiles.com/profile/119158)

Trop. Med. Infect. Dis. 2023, 8(1), 17; [\(https://doi.org/10.3390/tropicalmed8010017\)](https://doi.org/10.3390/tropicalmed8010017) - 27 Dec 2022
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Abstract Varicella (chickenpox) is highly contagious among children and frequently breaks out in schools. In this study, we developed a dynamic compartment model to explore the optimal schedule for varicella vaccination in Jiangsu Province, China. A susceptible-infected-recovered (SIR) model was proposed to simulate the [...] [Read more](#).
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Vertical Transfer of Humoral Immunity against Nipah Virus: A Novel Evidence from Bangladesh (https://doi.org/10.3390/tropicalmed8010016)

by [Syed Moinuddin Satter](https://sciprofiles.com/profile/2045113) (https://sciprofiles.com/profile/2045113), [Arifa Nazneen](https://sciprofiles.com/profile/67628) (https://sciprofiles.com/profile/67628),
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Trop. Med. Infect. Dis. 2023, 8(1), 16; [\(https://doi.org/10.3390/tropicalmed8010016\)](https://doi.org/10.3390/tropicalmed8010016) - 27 Dec 2022
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Abstract A major obstacle to in-depth investigation of the immune response against Nipah virus (NiV) infection is its rapid progression and high mortality rate. This paper described novel information on the vertical transfer of immune properties. In January 2020, a female aged below five [...] [Read more](#).

(This article belongs to the Special Issue [The Immunology of Zoonotic Infection](#) (https://journal/tropicalmed/special_issues/Immun_zoonotic))

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Open Access Case Report

≡ (2414-6366/8/1/15/pdf?version=1672110802)

Mpox Infection in a Developed Country: A Case Report (https://doi.org/10.3390/tropicalmed8010015)

by [Tal Patalon](https://sciprofiles.com/profile/2627931) (https://sciprofiles.com/profile/2627931), [Galit Perez](https://sciprofiles.com/profile/1) (https://sciprofiles.com/profile/1), [Guy Melamed](https://sciprofiles.com/profile/1) (https://sciprofiles.com/profile/1), [Tamar Wolf](https://sciprofiles.com/profile/1) (https://sciprofiles.com/profile/1) and [Sivan Gazit](https://sciprofiles.com/profile/1) (https://sciprofiles.com/profile/1)

Trop. Med. Infect. Dis. 2023, 8(1), 15; [\(https://doi.org/10.3390/tropicalmed8010015\)](https://doi.org/10.3390/tropicalmed8010015) - 27 Dec 2022
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Abstract This is the first Israeli case report of mpox (monkeypox) disease, as it is manifested in the current outbreak. This manuscript depicts two detailed patient journeys of Israeli men in their 30s who were diagnosed in recent months, depicting their symptoms, presumed exposure, [...] [Read more](#).

(This article belongs to the Special Issue [Rising Stars in Mpox Research](#) (https://journal/tropicalmed/special_issues/Monkeypox_Research))

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≡ (2414-6366/8/1/14/pdf?version=1672045079)

Comparison of the PF07598-Encoded Virulence-Modifying Proteins of *L. interrogans* and *L. borgpetersenii* (https://doi.org/10.3390/tropicalmed8010014)

by [Dieison S. Vieira](https://sciprofiles.com/profile/2622974) (https://sciprofiles.com/profile/2622974), [Reetika Chaurasia](https://sciprofiles.com/profile/2683719) (https://sciprofiles.com/profile/2683719) and [Joseph M. Vinetz](https://sciprofiles.com/profile/1) (https://sciprofiles.com/profile/1491094)

Trop. Med. Infect. Dis. 2023, 8(1), 14; [\(https://doi.org/10.3390/tropicalmed8010014\)](https://doi.org/10.3390/tropicalmed8010014) - 26 Dec 2022
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Abstract Leptospirosis is an emerging infectious disease, with increasing frequency and severity of outbreaks, a changing epidemiology of populations at risk, and the emergence of new strains, serovars, serogroups, and species. Virulence-modifying (VM) proteins encoded by the PF07598 gene family are hypothesized to be [...] [Read more](#).
(This article belongs to the Special Issue [New Insights in Leptospirosis](#) (https://journal/tropicalmed/special_issues/Leptospirosis))

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≡ (2414-6366/8/1/13/pdf?version=1672037343)

The Role of Post-Bronchoscopy Sputum Examination in Screening for Active Tuberculosis (https://doi.org/10.3390/tropicalmed8010013)

by [Gawahir A. Ali](https://sciprofiles.com/profile/2066062) (https://sciprofiles.com/profile/2066062), [Wael Goravey](https://sciprofiles.com/profile/2551695) (https://sciprofiles.com/profile/2551695),

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Trop. Med. Infect. Dis. 2023, 8(1), 13; [\(https://doi.org/10.3390/tropicalmed8010013\)](https://doi.org/10.3390/tropicalmed8010013) - 26 Dec 2022
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Spatial Distribution and Temporal Trend of Childhood Tuberculosis in Brazil ([/2414-6366/8/1/12](#))

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Trop. Med. Infect. Dis. 2023, 8(1), 12; <https://doi.org/10.3390/tropicalmed8010012> (<https://doi.org/10.3390/tropicalmed8010012>) - 25 Dec 2022

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Abstract Tuberculosis (TB) in children presents specificities in its diagnosis, which makes it prone to underreporting: therefore, the disease in this group is still a serious public health problem in several countries. We aimed to analyze the spatial distribution and temporal trend of childhood [...] [Read more](#).

(This article belongs to the Special Issue **Global Burden of Infectious Diseases in Children** ([/journal/tropicalmed/special_issues/Burden_Disease_Children](#)))

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Prevalence of Mosquito Populations in the Caribbean Region of Colombia with Important Public Health Implications ([/2414-6366/8/1/11](#))

- by [Eder Cano-Pérez](#) ([https://sciprofiles.com/profile/2335379](#)), [Martha González-Beltrán](#) ([https://sciprofiles.com/profile/author/ZmpXMKZFd2dScUFFOWRORDVsQkFranlaVlp3eE16cDJQcTRDMEZOb1Nvdz0=](#)), [Julia S. Ampuero](#) ([https://sciprofiles.com/profile/author/QjBVWjNQSE9lctI2aTfIT19CUxdZb3dXeldYYjQbG5vS2g2MGg3L0RVQT0=](#)), [Doris Gómez-Camargo](#) ([https://sciprofiles.com/profile/2225748](#)), [Amy C. Morrison](#) ([https://sciprofiles.com/profile/author/OTFFWmFzN1E1dINDSTIYUDFcDk0emYycHE5SFVFVFBMY3daWEZicFBvST0=](#)), and [Helvio Astete](#) ([https://sciprofiles.com/profile/author/Tmt2TuZNk9qa3BKeHwVVERpNVU0VkhNQnlpAuUpiSDNnZFJIouZ4UDQrVT0=](#))

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Abstract Mosquito studies are important for understanding their role in the transmission of pathogens including arboviruses, parasites, and protozoa. This study characterized the prevalence of Culicidae fauna in rural and peri-urban areas with human populations in the Colombian Caribbean region to establish the risk [...] [Read more](#).

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Prevalence of JC and BK Polyomavirus Infection in Patients with Chronic Kidney Disease in the State of Pará, Brazil ([/2414-6366/8/1/9](#))

- by [Scheila do Socorro Vasconcelos Ávila da Costa](#) ([https://sciprofiles.com/profile/YnR2bXpXY1BrQnJzSnpSYnduciZNUkpacVE5bld6NTVwSnFXNIRVc1ZNNk1wZHY0SEVXYjR6dmM](#)), [Jacqueline Cortinhas Monteiro](#) ([https://sciprofiles.com/profile/author/V010a2NaR3BHOVNnKytwWnJwMERIWHBLRDRPS1VmK1hIMkjSVJmWldMM0=](#)), [Ana Paula do Vale Viegas](#) ([https://sciprofiles.com/profile/author/K2VIsk3Q1pRZ02hMu9bnBubW4reSsvWnfQQIBIVzLck03VjCaG42MD0=](#)), [Keyla Santos Guedes de Sá](#) ([https://sciprofiles.com/profile/YitwUFM4ZlZNbjgvTno0QXh4VXdNz09](#)), [Silvia Regina da Cruz](#) ([https://sciprofiles.com/profile/c3dlL0FrUFg5TEJ3eklvdTVOY0NCcHk1bXNTR3ExMUEvRUN3NytcTE1Zz0=](#)),

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Trop. Med. Infect. Dis. 2023, 8(1), 9; <https://doi.org/10.3390/tropicalmed8010009> (<https://doi.org/10.3390/tropicalmed8010009>) - 23 Dec 2022

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Abstract The polyomaviruses that infect humans, JC virus (JCV) and BK virus (BKV), can establish persistent infections in the cells that make up the renal system, causing nephritis and BKV-associated nephropathy in up to 10% of renal transplant patients, and of these, 90% lose [...] [Read more](#).

(This article belongs to the Section **Infectious Diseases** ([/journal/tropicalmed/sections/Infectious_Diseases](#)))

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A Use of 56-kDa Recombinant Protein of *Orientia tsutsugamushi* Karp Serotype in Serodiagnosis of Scrub Typhus by Enzyme-Linked Immunosorbent Assay in Thais ([/2414-6366/8/1/10](#))

- by [Phanita Chanilate](#) ([https://sciprofiles.com/profile/bllpRlgzTXZKSmxDTWNGT05xFeVXQi9YaGz0VmZsMWphYklrNxDkcTdmTT0=](#)), [Thareerat Kalambaheti](#) ([https://sciprofiles.com/profile/author/bW9OUlVqNgdvNmZ4NGVkJZ3laZlUvU0NoblZTMwdLtnBWQjZhMuPnzUrUT0=](#)), [Nathamon Kosoltanapiwat](#) ([https://sciprofiles.com/profile/1804983](#)), [Ampai Tanganuchitcharnchai](#) ([https://sciprofiles.com/profile/NU1pYXRRFQ2K2JocmruN2xVFpQdplpIk9Bd3p4Tlp2YXpLaUZ5bGZMUT0=](#)), [Stuart D. Blacksell](#) ([https://sciprofiles.com/profile/359315](#)), [Narisara Chanratita](#) ([https://sciprofiles.com/profile/author/OEJ0TTZGYVB3JFTd1c4d083TFJ4cDIKSDBtSkdpR2RuUHhTQUFpN0YvQT0=](#)) and [Pornsawan Leangwutiwong](#) ([https://sciprofiles.com/profile/1582842](#))

Trop. Med. Infect. Dis. 2023, 8(1), 10; <https://doi.org/10.3390/tropicalmed8010010> (<https://doi.org/10.3390/tropicalmed8010010>) - 23 Dec 2022

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Abstract Scrub typhus is a mite-borne disease caused by a Gram-negative obligately intracellular bacillus, *Orientia tsutsugamushi*. The disease is endemic in the Asia–Australia-Pacific region, including Thailand. Scrub typhus generally manifests as acute undifferentiated febrile fever along with myalgia, rash, and lymphadenopathy. An eschar [...] [Read more](#).

(This article belongs to the Special Issue **The Past and Present Threat of Rickettsial Diseases (Volume II)** ([/journal/tropicalmed/special_issues/rickettsial_diseases_ii](#)))

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Article

Mono-Parasitic and Poly-Parasitic Intestinal Infections among Children Aged 36–45 Months in East Nusa Tenggara, Indonesia

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Abstract: The prevalence of intestinal parasitic infection remains high in developing countries, especially because of geographic and socio-demographic factors. This study aimed to evaluate intestinal parasitic infection, as well as its risk factors, among children aged 36–45 months in a rural area (North Kodi) and an urban area (Kupang) of East Nusa Tenggara, Indonesia. Anthropometry, socio-demographic factors and personal hygiene practices were assessed. A total of 214 children participated in the study, and 200 stool samples were collected for intestinal parasite examination. Approximately 30.5% (61/200) of the children were infected with one or more intestinal parasites (67.2%; 41/61 being mono-parasitic infections and 32.8%; 20/61 being poly-parasitic infections). A total of 85 intestinal parasites were detected, consisting of 35.3% (30/85) protozoa and 64.7% (55/85) helminths. The predominant protozoa were *Giardia lamblia* (43%; 13/30) and *Blastocystis* spp. (33.3%; 10/30), whereas the predominant helminths were *Trichuris trichiura* (50.9%; 28/55) and *Ascaris lumbricoides* (43.6%; 24/55). Moreover, intestinal parasitic infection was associated with rural area (OR 4.5; 95%CI 2.3–8.6); the absence of treatment with deworming drugs (OR 2.56; 95%CI 1.3–5.0); sanitation facilities without a septic tank (OR 4.3; 95%CI 2.1–8.5); unclean water as a source of drinking water (OR 4.67; 95%CI 2.4–9.4); no handwashing practice after defecation (OR 3.2; 95%CI 1.4–7.3); and stunted children (OR 4.4; 95%CI 2.3–8.3). In conclusion, poly-parasitic infections were common in this study. Poor personal hygiene practice and sanitation factors contributed to the high prevalence of intestinal parasitic infection in 36–45-month-old children in East Nusa Tenggara, Indonesia.



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1. Introduction

Intestinal parasitic infections, particularly those of protozoa and helminth, are responsible for morbidity in children worldwide and represent a major public health problem in developing countries that is often neglected [1–3]. Children are particularly susceptible to infection by these microorganisms, which further negatively affects their nutritional status and physical development [1,2]. The global prevalence of intestinal parasitic infections remains high, with approximately 3.5 billion people infected and more than 200,000 deaths [4,5]. Based on data from 118 countries, the highest prevalence for soil-transmitted helminth infections (STHs) is detected in South Asia, Southeast Asia, and Sub-Saharan Africa. Of these infections, 67.3% occur in Asia [6]. In Indonesia, the prevalence of helminth infections is reported to vary between 2.5 and 62% [7]. East Nusa Tenggara,

Indonesia, as a remote area, still experiences a high prevalence of parasitic infection. The STHs prevalence in Southwest Sumba and West Sumba in East Nusa Tenggara is >20%; however, the exact prevalence is difficult to ascertain. The prevalence of protozoan infections with *Entamoeba histolytica*, *Giardia lamblia*, and *Blastocystis hominis* (*Bh*) is reported to be 17.9% (76/424), 4.5% (19/424), and 34.4% (146/424), respectively [8].

In low- and middle-income countries, exposure to inadequate drinking water, sanitation, hygiene conditions, and hygiene behaviors are attributed to a greater proportion of intestinal parasite infections [9]. A recent systematic review reported that age, sex, residence, toilet facilities, washing hands with soap before a meal, shoe-wearing habits, trimming nails, eating undercooked food, personal hygiene and source of drinking water are the most risk factors for intestinal parasite infection [10]. Intestinal parasitic infections and their risk factors in Indonesia warrant further study. The current work was, therefore, carried out to evaluate the risk factors for intestinal parasitic infections among children aged 36–45 months in North Kodi and Kupang, East Nusa Tenggara, Indonesia.

2. Materials and Methods

2.1. Study Design and Ethical Clearance

A cross-sectional study was conducted on 214 children aged 36–45 months in Kupang and North Kodi, East Nusa Tenggara, Indonesia, from October to December 2021. The study protocol was approved by the Ethics Committee of the Research Institute of YARSI University, Jakarta, Indonesia, and registered at ClinicalTrials.gov with identifier number NCT05119218. The children's parents or caregivers provided oral and written informed consent and signed a letter of consent before the children were included in the study.

2.2. Fecal Analysis and Parasitological Diagnosis

The parents/caregivers were instructed to collect each child's stool and bring the stool specimen in a sterile container. All 200 collected stools were preserved in 10% formalin solution. The presence of parasites was detected via standard microscopy techniques (Olympus, Japan) using direct wet-mount smear methods, followed by staining with lugol solution, with six replications at the Laboratory of Malaria, Institute of Tropical Disease, Universitas Airlangga. The presence of eggs, larvae, trophozoites, or cysts was assessed for each type of helminth (*Trichuris trichiura*, Hookworm, *Ascaris lumbricoides*, and *Hymenolepis diminuta*) and protozoa (*Entamoeba histolytica*, *Entamoeba coli*, *Giardia lamblia*, and *Blastocystis*) spp., respectively. Positive parasitic infection was recorded by examining each prepared slide in which one or more parasites were detected. Mono-parasitic infection was defined as the presence of either one protozoan or one helminthic parasite in one child. Poly-parasitic infection was defined as (1) >1 positive protozoan parasites; (2) >1 helminthic parasites; and (3) mixed infection with both intestinal protozoan and helminthic parasites detected in one child.

2.3. Anthropometry

Height was measured using a wall stadiometer (Seca 208; precision, 0.1 cm) with the child's head positioned according to the Frankfurt plane by trained nurses and general practitioners. Z-scores of height-for-age were calculated using the WHO AnthroPlus software provided by the World Health Organization, Geneva, Switzerland, in 2007 [11]. The height-for-age was classified as severely stunted (height for age < -3SD); stunted (-3SD to <-2SD); and normal (-2SD to +3SD). For analysis, the subjects were divided into the stunted group (if the subjects were severely stunted and stunted) and the normal group.

2.4. Subject Characteristics

A structured questionnaire was administered by two pediatricians, four general practitioners, nurses, laboratory technicians, and a community health care worker for face-to-face interviews with the respective child's mother or caregiver, in order to collect sociodemographic information and hygiene practices. The independent variables were gender, locus

of the rural (North Kodi) and urban (Kupang) area, mother's education and occupation, family income, history of low birth weight, history of intake of deworming drugs in the last 6 months, family size, source of drinking water, type of sanitation facility, handwashing practice (before eating and after defecation), and handwashing facilities. Family size referred to the number of persons in the family and was categorized as small (<6 members), medium (6–8 members), and large (>8 members). Sanitation facility was defined as one that hygienically separates human feces from human contact and was categorized into a latrine with and without a septic tank. The mother's education was divided into educated (elementary school, junior high school, senior high school, and university graduate) and uneducated. Family income was considered based on the regional minimum wage in each city and classified as lower than the regional minimum wage and equal to or greater than the regional minimum wage. The source of drinking water was divided into clean water (from mineral water, spring, tap water, and dug well) and unclear water (rainwater collection). Handwashing facilities were either fixed or mobile and included a sink with tap water and other models designated for handwashing.

2.5. Statistical Analyses

The data are presented as numbers and percentages for descriptive data. The chi-square and Fisher's exact tests were used to assess differences in sociodemographic factors and hygiene practices between North Kodi and Kupang, as well as between stunted and normal children in categorical data. A univariate analysis was used to determine the odds ratio with the 95% confident interval of each variable that affected intestinal parasitic infection among children aged 36–45 months. Significance was set at $p < 0.05$. All statistical analyses were performed using the statistical program for social science (SPSS) Version 20.0 for Windows (SPSS Inc., Chicago, IL, USA).

3. Results

Intestinal Parasitic Infection and Risk Factors in 36–45-Month-Old Children in East Nusa Tenggara, Indonesia

This study included 214 children, and 200 stool samples were collected to analyze the parasitic infection status and its risk factors. The flow chart of this study is shown in Figure 1. Children with incomplete stool sample data were excluded from the study. Supplementary Data 1–3 show the demographic picture of Kupang and North Kodi. Kupang is a more densely populated urban area, whereas North Kodi is a rural area with mountains, hills and different types of housing compared with Kupang. A total of 30.5% (61/200) of the children were infected with intestinal parasites in this study, with 67.2% (41/61) of the cases being mono-parasitic infections and 32.8% (20/61) being poly-parasitic infections. Eighty-five intestinal parasites were detected in total, with 35.3% (30/85) being protozoan and 64.7% (55/85) being helminthic infections. *Giardia lamblia* (43%; 13/30) was the predominant protozoan parasite (Figure 2), whereas *Trichuris trichiura* (50.9%; 28/55) and *Ascaris lumbricoides* (43.6%; 24/55) were the predominant helminthic parasites (Figure 3) detected here.

Among children with mono-parasitic infection, 39% (16/41) had protozoan infection and 61% (25/41) had helminthic infection. *Giardia lamblia* and *Blastocystis* spp. were the most commonly detected parasites in protozoan mono-parasitic infection (50%; 8/16 and 25%; 4/16 of children, respectively). In turn, *Trichuris trichiura* and *Ascaris lumbricoides* were the most frequently detected parasites in children with helminthic mono-parasitic infection (44%; 11/25). In children with poly-parasitic infection, 10% (2/20) were infected with >1 protozoan, 50% (10/20) with >1 helminthic, and 40% (8/20) had mixed infections (both intestinal protozoan and helminthic parasites). Two children with >1 positive protozoa were detected to have *Entamoeba coli*–*Blastocystis* spp. and *Entamoeba coli*–*Giardia lamblia*. All children with >1 helminth infections were detected to have *Ascaris lumbricoides*–*Trichuris trichiura*. For mixed infection, two (25%) children were detected to have *Ascaris lumbricoides*–*Trichuris trichiura*–*Blastocystis* spp.; two (25%) with *Trichuris*

trichiura–Giardia lamblia–Blastocystis spp.; two (25%) with *Trichuris trichiura–Giardia lamblia*; one (12.5%) with *Trichuris trichiura–Blastocystis spp.*; and one (12.5%) with *Ascaris lumbricoides–Entamoeba coli*. The microscopic findings of *Giardia lamblia*, *Entamoeba coli*, and *Blastocystis* spp. are depicted in Supplementary Data 4, 5, and 6.

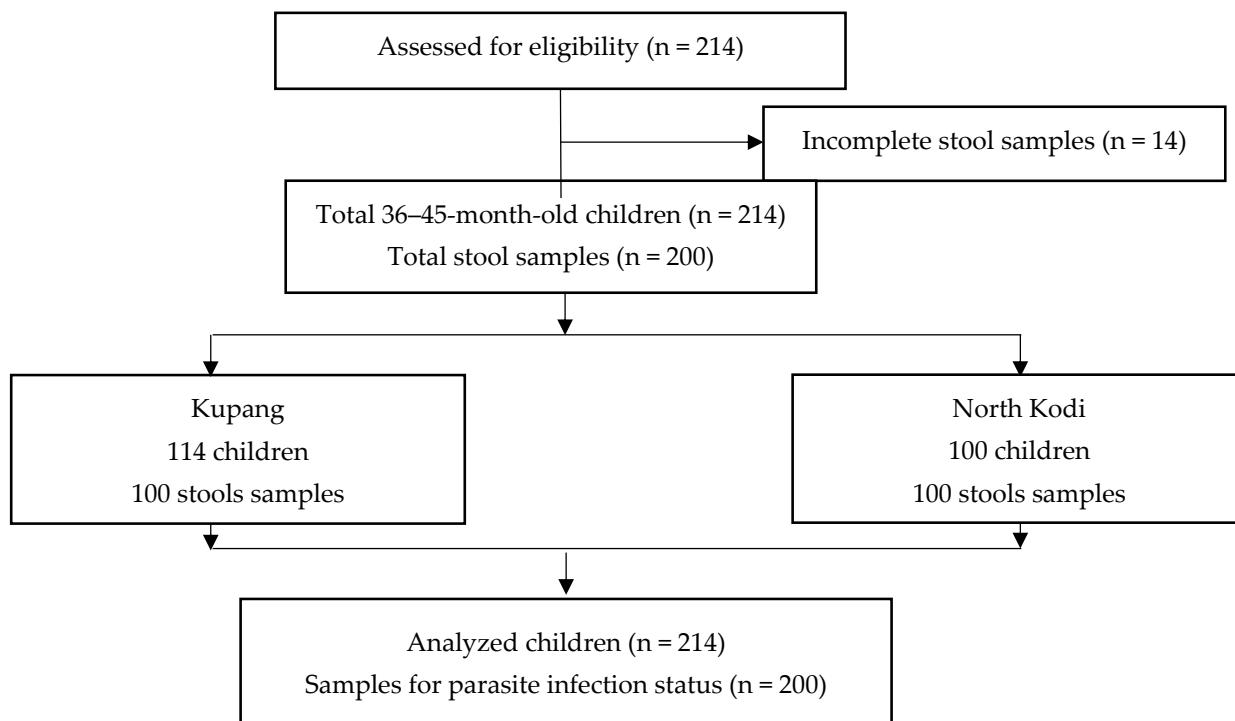


Figure 1. Flow diagram of this study.

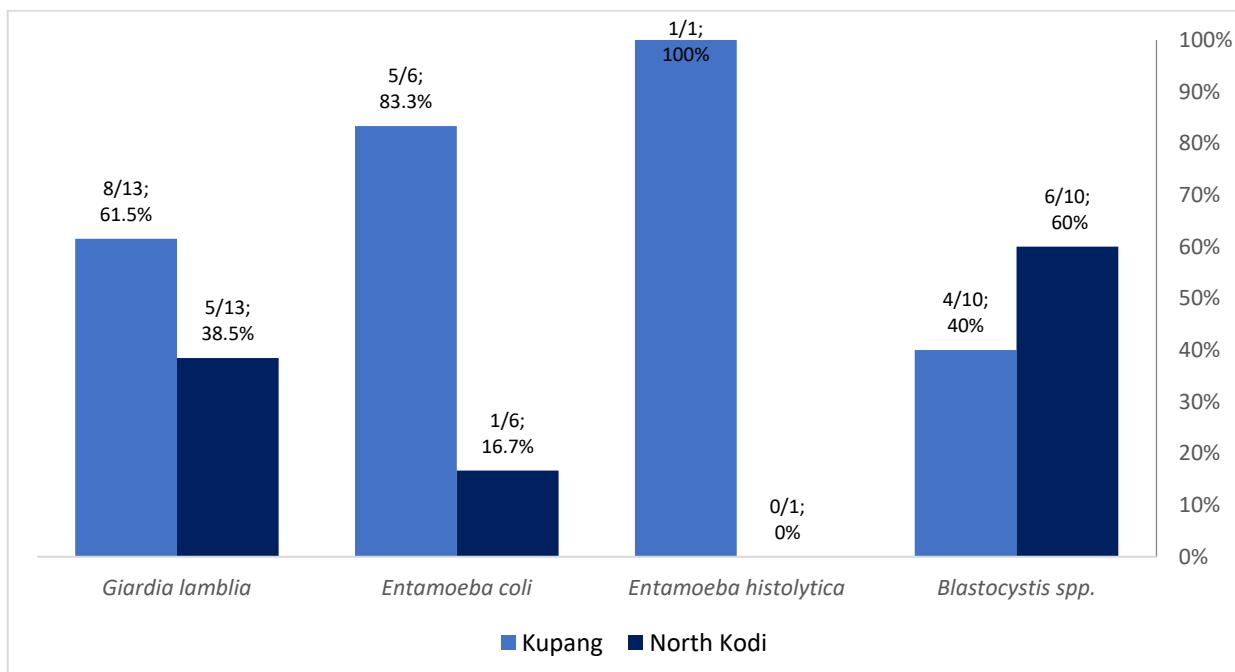


Figure 2. Intestinal protozoan distribution in Kupang and North Kodi, East Nusa Tenggara; n = 30 children. *Giardia lamblia* was detected in a total of 13 children; *Entamoeba coli* was detected in a total of 6 children; *Entamoeba histolytica* was detected in a total of 1 child; *Blastocystis* spp. was detected in a total of 10 children (one child had ≥ 1 protozoan parasites).

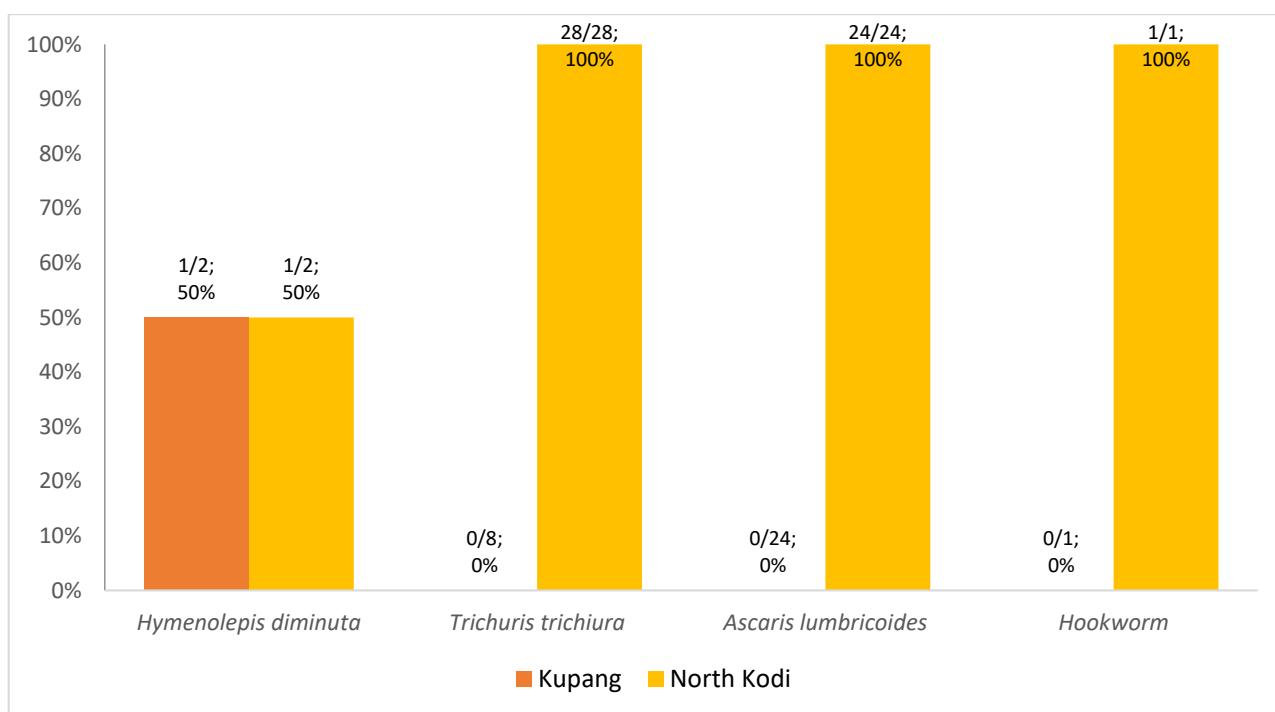


Figure 3. Intestinal helminthic distribution in Kupang and North Kodi, East Nusa Tenggara; n = 51 children. *Hymenolepis diminuta* was detected in a total of 2 children; *Trichuris trichiura* was detected in a total of 28 children; *Ascaris lumbricoides* was detected in a total of 24 children; Hookworm was detected in a total of 1 child (one child had ≥ 1 helminthic parasites).

More protozoa were detected in children from Kupang (60%; 18/30), whereas more helminths were detected in children from North Kodi (98.2%; 54/55) (Figures 2 and 3). *Entamoeba histolytica* (100%; 1/1), *Entamoeba coli* (83.3%; 5/6), and *Giardia lamblia* (61.5%; 8/13) were more frequent in Kupang children, whereas helminthic infection was exclusively caused by *Hymenolepis diminuta*. *Blastocystis* spp. (60%; 6/10) was the predominant pathogen among the protozoan infections recorded in North Kodi. All *Trichuris trichiura*, *Ascaris lumbricoides*, and Hookworm infections were detected in North Kodi (Figures 2 and 3). The majority of stunted children had intestinal protozoan (93.3%; 28/30) and helminthic (69.1%; 38/55) infection. *Giardia lamblia* was the predominant intestinal protozoa in stunted children (42.9%; 12/30), followed by *Blastocystis* spp. (33.3%; 10/30) (Figure 4). *Trichuris trichiura* was the predominant intestinal helminth (38.2%; 21/55), followed by *Ascaris lumbricoides* (25.5%; 14/55) (Figure 5).

The univariate analysis revealed that living in a rural area, lack of treatment with deworming drugs, a latrine without a septic tank, unclean water as the source of drinking water, no handwashing practice after defecation, and stunted children were risk factors for intestinal parasitic infection in this study (Table 1). Significant differences in the education level of the mother, family income, deworming status, source of drinking water, type of sanitation facility, handwashing practice (before eating as well as after defecation), and handwashing facility ($p < 0.05$) were observed between children from Kupang and those from North Kodi. Other characteristics are described in Table 2. A history of low birth weight, no deworming, drinking unclean water, using a latrine without a septic tank, and no handwashing practice (before eating and after defecation) were significantly different in stunted children compared with normal children ($p < 0.05$) (Table 3).

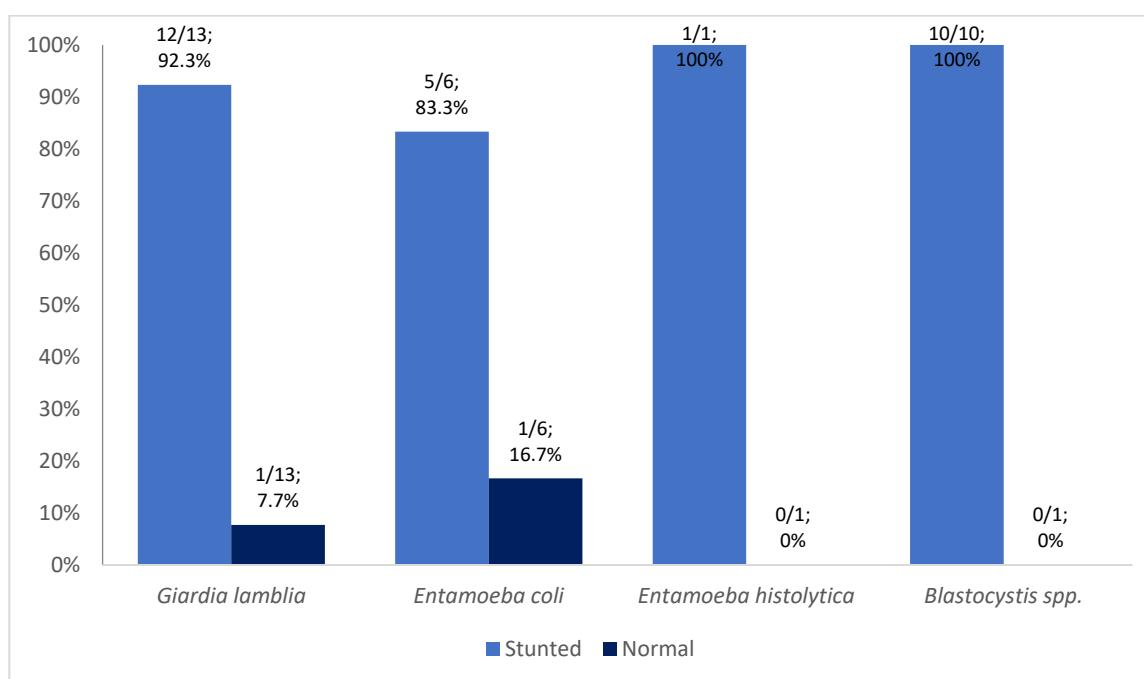


Figure 4. Intestinal protozoan distribution in stunted and normal children in East Nusa Tenggara; n = 30 children. *Giardia lamblia* was detected in a total of 13 children; *Entamoeba coli* was detected in a total of 6 children; *Entamoeba histolytica* was detected in a total of 1 child; *Blastocystis* spp. was detected in a total of 10 children (one child had ≥ 1 protozoan parasites).

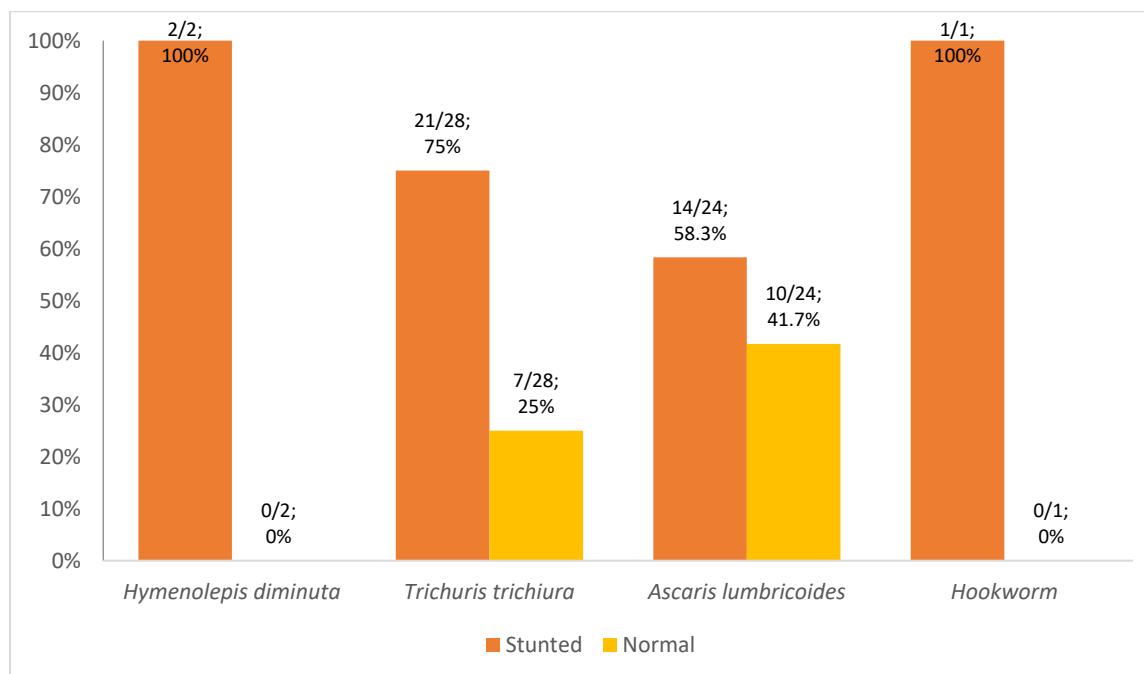


Figure 5. Type of helminthic in stunted and normal children in East Nusa Tenggara; n = 51 children. *Hymenolepis diminuta* was detected in a total of 2 children; *Trichuris trichiura* was detected in a total of 28 children; *Ascaris lumbricoides* was detected in a total of 24 children; *Hookworm* was detected in a total of 1 child (one child had ≥ 1 helminthic parasites).

Table 1. Univariate analysis of intestinal parasitic infection risk factors among children aged 36–45 months in Kupang and North Kodi, East Nusa Tenggara Timur, Indonesia.

Risk Factors	Intestinal Parasitic Infection		<i>p</i> Value *	OR (95% CI)
	Infected n (%)	Not Infected n (%)		
Gender				
Boy	33 (35.5)	60 (64.5)	0.203	1.5 (0.8–2.8)
Girl	28 (26.2)	79 (73.8)		
Locus				
Rural area	44 (44)	56 (56)	0.0001	3.8 (2.0–7.4)
Urban area	17 (17)	83 (83)		
Family size				
>8 members	10 (45.5)	12 (54.5)	0.171	2.1 (0.8–5.1)
≤8 members	51 (28.7)	127 (71.3)		
Mother's education (n = 198)				
Uneducated	14 (45.2)	17 (54.8)	0.094	2.1 (1.0–4.6)
Educated	47 (28.1)	120 (71.9)		
Mother's occupation (n = 194)				
Unemployed	47 (31.1)	104 (68.9)	0.609	1.3 (0.6–2.8)
Employed	11 (25.6)	32 (74.4)		
Family income (n = 192)				
<Regional minimum wage	45 (30.2)	104 (69.8)	0.692	1.3 (0.6–2.7)
≥Regional minimum wage	11 (25.6)	32 (74.4)		
Low birth weight (n = 181)				
Yes	11 (36.7)	19 (63.3)	0.406	1.6 (0.7–3.5)
No	41 (27.2)	110 (72.8)		
Deworming				
No	23 (44.2)	29 (55.8)	0.020	2.3 (1.2–4.4)
Yes	38 (25.7)	110 (74.3)		
Type of sanitation facility				
Latrine without septic tank	21 (58.3)	15 (41.7)	0.0001	4.3 (2.0–9.2)
Latrine with septic tank	40 (24.4)	124 (75.6)		
Source of drinking water				
Unclean water	24 (54.5)	20 (45.5)	0.0001	3.89 (2.0–7.8)
Clean water	37 (23.7)	119 (76.3)		
Handwashing before eating				
No	10 (35.7)	18 (64.3)	0.671	1.3 (0.6–3.1)
Yes	51 (29.7)	121 (70.3)		
Handwashing after defecation				
No	14 (51.9)	13 (48.1)	0.018	2.9 (1.3–6.6)
Yes	47 (27.2)	126 (72.8)		
Stunted growth (n = 199)				
Yes	43 (43.0)	57 (57)	0.0001	3.4 (1.8–6.6)
No	18 (18)	82 (82)		
Handwashing facility				
No	5 (55.6)	4 (44.4)	0.194	3.0 (0.8–11.6)
Yes	56 (29.3)	135 (70.7)		
Total	100 (50)	100 (50)		

* Chi-squared test, significance set at *p* < 0.05.

Table 2. Sociodemographic and hygiene practice characteristics of children aged 36–45 months from Kupang and North Kodi, East Nusa Tenggara Timur, Indonesia.

Variables	Kupang n (%)	North Kodi n (%)	p Value *
Gender			
Boy	51 (50.5)	50 (50)	0.442
Girl	63 (55.8)	50 (50)	
Family size			
Small (<6 members)	71 (62.3)	55 (55)	
Medium (6–8 members)	32 (28.1)	31 (31)	0.473
Large (>8 members)	11 (9.6)	14 (14)	
Mother's education			
Uneducated	4 (3.5)	28 (28)	0.0001
Educated	110 (96.5)	72 (72)	
Mother's occupation (n = 208)			
Unemployed	91 (56.9)	69 (43.1)	0.071
Employed	20 (41.7)	28 (58.3)	
Family income (n = 206)			
<Regional minimum wage	93 (58.5)	66 (41.5)	0.044
≥Regional minimum wage	19 (40.4)	28 (59.6)	
Low birth weight (n = 195)			
Yes	18 (58.1)	13 (41.9)	1.000
No	96 (58.5)	68 (41.5)	
Deworming			
Yes	107 (93.9)	55 (55)	0.0001
No	7 (6.1)	45 (45)	
Source of drinking water			
Clean water	114 (100)	54 (54)	0.0001
Unclean water	0 (0)	46 (46)	
Type of sanitation facility			
Latrine with septic tank	77 (67.5)	18 (18)	0.0001
Latrine without septic tank	37 (32.5)	82 (82)	
Handwashing practice (before eating)			
Yes	110 (96.5)	76 (76)	0.0001
No	4 (3.5)	24 (24)	
Handwashing practice (after defecation)			
Yes	112 (98.2)	75 (75)	0.0001
No	2 (1.8)	25 (25)	
Handwashing facility			
Yes	113 (99.1)	92 (92)	0.014
No	1 (0.9)	8 (8.9)	
Height for age status			
Stunted	49 (43)	52 (52)	0.187
Normal	65 (57)	48 (48)	
Total	114 (53.3)	100 (46.7)	

* Chi-squared test, significance set at $p < 0.05$.**Table 3.** Socio-demographic and hygiene practice characteristics of stunted and normal children aged 36–45 months in East Nusa Tenggara Timur, Indonesia.

Variables	Stunted n (%)	Normal n (%)	p Value *
Gender			
Boy	48 (47.5)	53 (46.9)	0.927
Girl	53 (52.5)	60 (53.1)	

Table 3. Cont.

Variables	Stunted n (%)	Normal n (%)	p Value *
Family size			
Small (<6 members)	63 (62.4)	63 (55.8)	0.449
Medium (6–8 members)	18 (21.8)	28 (36.3)	
Large (>8 members)	20 (15.8)	22 (8)	
Mother's education level			
Uneducated	16 (15.8)	16 (14.2)	0.730
Educated	85 (84.2)	97 (85.8)	
Mother's occupation (n = 208)			
Unemployed	77 (48.1)	83 (51.9)	0.909
Employed	22 (45.8)	26 (54.2)	
Family income (n = 206)			
<Regional minimum wage	76 (47.8)	83 (52.2)	0.834
≥Regional minimum wage	21 (44.7)	26 (55.3)	
Low birth weight (n = 195)			
Yes	21 (67.7)	10 (32.3)	0.015
No	69 (42.1)	95 (57.9)	
Deworming			
Yes		93 (82.3)	0.017
No	32 (31.7)	20 (17.7)	
Source of drinking water			
Clean water	73 (72.3)	95 (84.1)	0.036
Unclean water	28 (27.7)	18 (15.9)	
Type of sanitation facility			
Latrine with septic tank	30 (29.7)	65 (57.5)	0.0001
Latrine without septic tank	71 (70.3)	48 (42.5)	
Handwashing practice (before eating)			
Yes	82 (81.2)	104 (92)	0.019
No	19 (18.8)	9 (8)	
Handwashing practice (after defecation)			
Yes	83 (82.2)	104 (92)	0.030
No	18 (17.8)	9 (8)	
Handwashing facility			
Yes	94 (45.9)	111 (54.1)	0.060
No	7 (77.8)	2 (22.2)	
Locus			
Urban area	49 (43)	65 (57)	0.187
Rural area	52 (52)	48 (48)	
Total	114 (53.3)	100 (46.7)	

* Chi-squared test, significance was set at $p < 0.05$.

4. Discussion

The most common protozoa detected in all stool samples was *Giardia lamblia*, followed by *Blastocystis* spp. This result is in line with a study reported by Maru et al. in Ethiopia; among 235 infected children, the most prevalent parasite was *Giardia lamblia* (20%) [12]. Moreover, a study performed by Diarthini in Karangasem (Bali, Indonesia) reported that the prevalence of *Blastocystis* spp. in elementary school children was 33% (35/103), which was similar to the present study [13]. Both of those studies were conducted under geographic and socio-hygiene conditions that were similar to those of East Nusa Tenggara, which could explain the similar results. The most common helminth detected in this study was *Ascaris lumbricoides*, followed by *Trichuris trichiura*. *Ascaris lumbricoides* and *Trichuris trichiura* (whipworm) are soil-transmitted helminths (STHs) that are mostly found in tropical and subtropical areas [14–16]. A study performed by Pullan et al. in 118 countries revealed that

both *Ascaris lumbricoides* and *Trichuris trichiura* were the predominant global STHs infection agents [6]. Wani et al. reported a similar prevalence in India. Among 2256 children, the prevalence of *Ascaris lumbricoides* was the highest (68.3%), followed by *Trichuris trichiura* (27.9%) [17]. Higher *Trichuris trichiura* and *Ascaris lumbricoides* rates were also found in a study reported by Sungkar et al. in Sumba, Indonesia. Among 88 children, the rate of *Trichuris trichiura* was 85.2%, whereas that of *Ascaris lumbricoides* was 71.6% [18].

In addition to mono-parasitic infection, we also found poly-parasitic infection in this study. *Blastocystis* spp. was the predominant protozoa involved in poly-parasitic infections. This result was in line with the study performed by Diarthini et al. in Karangasem, Bali, Indonesia. *Blastocystis* spp. is a predominant parasite in under-developed countries, especially in children. *Blastocystis* spp. is often found in poly-parasitic infections with *Giardia lamblia*, *E. histolytica*, and *E. coli*. Moreover, it is detected in mixed infection with Hookworm [13]. In turn, *Ascaris lumbricoides* and *Trichuris trichiura* are the predominant helminths involved in poly-parasitic infections. In endemic areas, especially in warm tropical and sub-tropical areas, poly-parasitic infections occur frequently and might result in the exacerbation of morbidity, as well as a greater intensity of infection. Both helminths are transmitted via the faecal–oral route, which, because the exposure is similar, leads to a positive association. Poly-parasitic infections have no specific gastrointestinal symptoms; therefore, affected children are often underdiagnosed. If left untreated, moderate-to-heavy poly-parasitic infection could lead to chronic effects on the growth of children [14,19].

The total prevalence of intestinal parasitic infections in rural areas is notably higher than that recorded in urban areas. North Kodi is a rural area located in Southwest Sumba, whereas Kupang is the capital city, i.e., an urban area, and the administrative center of East Nusa Tenggara [20,21]. The hygiene and sanitation practices and facilities in urban and rural areas are different. The source of drinking water, type of sanitation facility, handwashing practice, and handwashing facility in North Kodi were significantly inferior compared with Kupang. Poor personal hygiene, poor environmental sanitation, low social economy, and population density will lead to an increase in soil-transmitted helminth and protozoa infections through the soil [22,23]. A greater number of children and their parents had no handwashing facility and used a latrine without a septic tank in North Kodi. In another study reported by Mane et al., students in a rural area reported a higher percentage (37.7%) of non-availability of a place for handwashing inside the home compared with only 17.9% in an urban area [24]. Based on the research of Idowu et al., a greater number of respondents (parents) from a rural community used an open pit. This was followed by the practice of open defecation by 46.7% of the responders. In contrast, the majority of the parents or caregivers from an urban area (49.1%) reported that they throw their children's feces into a water closet after they use a potty [25].

Darlan et al. reported a strong relationship between personal hygiene practices and environmental sanitation and the incidence of soil-transmitted helminthic infection [26]. Another study from Apidechkul (North Thailand) performed among hill-tribe school children showed that drinking water contaminated by soil was an important risk factor for intestinal parasitic infection [27]. The practice of poor hygiene behaviors leads to a higher prevalence of soil contamination. The soil around rural areas is profoundly contaminated with parasite eggs stemming from the tendency to defecate without using a septic tank; soil-transmitted helminths require soil for immature stage development, in order to be transmitted to a host [28–30]. Unclean water as the source of drinking water remains a potential risk for helminthic infections not only because of direct ingestion, but also due to the consumption of unwashed fruits and vegetables or those that are improperly cooked [31].

Our study found that the deworming programs in the rural area were less frequent (55%) compared with the urban area. This was in line with a study reported by Sungkar et al. The rate of STH in 88 children in Sumba significantly decreased after deworming using Albendazole (from 95.4% to 53.4%) [18]. Deworming programs are routinely provided by the Indonesian Ministry of Health, with the distribution of Albendazole

through primary healthcare or school-based deworming programs. Several lines of evidence suggest that these deworming drugs are used for public health intervention for preventing soil-transmitted helminth infection, with a lesser impact on protozoa. However, the outcome of this prevention strategy also depends on the environmental conditions and requires regular monitoring to observe the soil-transmitted helminths and the possibility of re-infection, which warrants the administration of an additional or adjusted dose of deworming drugs [32,33].

The lack of periodic evaluation of the nutritional status was one of the limitations of this study. Moreover, because some data were incomplete, the analyses were not performed using the same sample size. Finally, a PCR examination was not included as a diagnostic method for parasites; rather, wet staining and microscopic observation alone were used here. Conversely, the strength of this study was the employment of many types of variables, which allowed us to more precisely assess the risk of parasitic infection. The sample size was sufficient, and we compared samples from different geographic and social-hygiene conditions.

5. Conclusions

Mono-intestinal parasitic infections were most common in children aged 36–45 months in East Nusa Tenggara, Indonesia. Total intestinal protozoan infection was detected more in the urban area, Kupang, with *Giardia lamblia* and *Blastocystis* spp. being the predominantly detected pathogens. The total helminthic infection prevalence was higher in the rural area, North Kodi; the most-detected pathogen was *Ascaris lumbricoides*, followed by *Trichuris trichiura*. Poly-parasitic intestinal infection was observed in more than one-third of infected children. Living in a rural area, lack of treatment with deworming drugs, use of a latrine without a septic tank, unclean water as the source of drinking water, no handwashing practice after defecation, and stunted children were the risk factors for intestinal parasitic infection observed in this study. We urge routine deworming every 6 months, providing clean water by building a drill well, and educating the community with good personal hygiene practice. Further study is currently ongoing to prove the efficacy of these comprehensive and holistic treatments in eradicating the parasitic infection. The scientific evidence obtained in this study will be recommended to local government as public policy.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/tropicalmed8010045/s1>, Supplementary Figure S1–S3 were taken from Google Earth®. Supplementary Figure S4–S6 were examined in the Laboratory of Malaria, Institute of Tropical Disease, Universitas Airlangga.

Author Contributions: I.S.S. was the principal investigator of the study. A.F.A., R.G.R., A.D., S.M.S. and K.V. participated in the study design. A.F.A. and A.D. supervised the data collection and analysis. S.B. and L.R. participated in the parasitology examination. I.S.S., A.F.A., A.D. and K.V. drafted the manuscript. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of the Research Institute of YARSI University, Jakarta, Indonesia (No: 332/KEP-UY/BIA/X/2021, October 12, 2021, and registered at ClinicalTrials.gov with identifier number NCT05119218 for studies involving humans).

Informed Consent Statement: Informed consent was obtained from all subjects' parents involved in the study.

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