

e-ISSN: 2654-9325

p-ISSN: 2715-9965

JURNAL BIDAN CERDAS

Volume 5 Nomor 3, 2023



Accredited

SINTA 2



Editor in Chief:

Sumiaty, SST., MPH.



Diterbitkan atas Kerjasama
Jurusan Kebidanan Poltekkes Kemenkes Palu
dengan Pengurus Pusat Ikatan Bidan Indonesia (PP IBI)



INDEXING:



The Prevalence of Trichuriasis in School-age Children in Asia: A Systematic Review

Ivan Elisabeth Purba¹, Vierto Irennius Girsang², Amila², Toni Wandra¹

¹Directorate of Postgraduate, Sari Mutiara Indonesia University, Medan, Indonesia

²Faculty of Pharmacy and Health Science, Sari Mutiara Indonesia University, Medan, Indonesia

 Corresponding author: poerba.ivanelis@gmail.com



ARTICLE INFO

Article History:

Received: 2023-07-02

Accepted: 2023-09-28

Published: 2023-09-30

Keywords:

Trichuriasis; soil transmitted helminths; school-age children; systematic review; Asia

ABSTRACT

Introduction: *Trichuris trichiura*, hookworms, and *Ascaris lumbricoides* are known as soil-transmitted helminths that commonly infect humans. Transmission is more common in areas with poor personal hygiene and environmental sanitation. **Objectives:** The aim of this study was to determine available information on the prevalence of *T. trichiura* infection in school-age children in Asia. This information can be used for additional studies to evaluate the prevalence and risk factors for *T. trichiura* infection locally that can inform regional control programs and look at laboratory examination techniques to diagnose this parasite disease. **Methods:** Multiple databases (Web of Science, PubMed, ProQuest, Scopus, and Google Scholar) were searched for literature on the trichuriasis prevalence published from 2011 to January 2021. **Results:** A total of 13,836 studies were identified through database searches. The included studies represent 16 countries, with the highest number of study conducted in Yemen. **Conclusions:** The prevalence of trichuriasis in school-age children was found to vary widely by country. The Kato-Katz technique was commonly used to detect *T. trichiura* eggs in school-age children in Asia. Health sector should implement surveillance programs, particularly in countries with high infection prevalence. Educational programs aimed at improving personal hygiene and environmental sanitation to decrease trichuriasis transmission.



©2023 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY SA) license (<https://creativecommons.org/licenses/by-sa/4.0/>)

INTRODUCTION

Trichuris trichiura (whipworm), *Ancylostoma duodenale* and *Necator americanus* (hookworm), and *Ascaris lumbricoides* are known as soil-transmitted helminths (STHs) that commonly infect humans (Badri et al., 2021; Kapti et al., 2021). Transmission is more common in areas with poor personal hygiene and environmental sanitation (WHO, 2023; Sutisna et al., 2021).

T. trichiura infection (trichuriasis) is caused by ingesting parasite eggs (CDC, 2023). Infection often occurs via ingesting food or water contaminated with infective embryonated eggs (Izurieta et al., 2018; Peradotto et al., 2021). Most individuals with a light *T. trichiura* infection are asymptomatic or subclinical. However, the public health impact of trichuriasis is considerable for cases with a high worm burden. The majority of trichuriasis cases with severe clinical manifestations are in children 5 - 15 years of age (Stephenson et al., 2000). People with heavy infections can experience

frequent painful bowel movements that contain a mixture of mucus, water, and blood (CDC, 2023). Severe morbidity, consisting of malnutrition, anemia, and stunting, can occur with chronic infections, with preschool- and school-age children often most severely impacted (Dickison et al., 2000; Badri et al., 2022).

Worldwide, an estimated 604-795 million people are infected with *T. trichiura* (CDC, 2023). In Indonesia, the prevalence of STH infection was reported to range from 2.5% to 62.0% (MHRI, 2017). The current study, the prevalence of *T. trichiura* infection in the Simanindo and Ronggur Nihuta sub-districts of Samosir Island, North Sumatra, was 15.3% and 7.4% in the community (Wandra et al., 2020), and in school-age children was 4.8% and 5.9%, respectively (Wandra et al., unpublished).

Diagnosis of trichuriasis is typically based on fecal sample examination. The Kato-Katz technique is commonly used to detect *T. trichiura* eggs. The control and treatment of trichuriasis are mainly through the administration of antiparasitic medications, such as albendazole (400 mg) and mebendazole (500 mg) (Namwanje et al., 2011). One of Indonesia's current STH control programs, including trichuriasis, is mass drug administration (MDA). Using a three-dose treatment regimen enhances the therapeutic outcome of these drugs against *T. trichiura* (MHRI, 2017). The aim of this study was to determine available information on the prevalence of *T. trichiura* infection in school-age children in Asia. This information can be used for additional studies to evaluate the prevalence and risk factors for *T. trichiura* infection locally, and look at laboratory examination techniques to diagnose this parasite disease.

METHODS

This systematic review based on PRISMA (Systematic Reviews and Meta-Analyses) guidelines (<http://www.prisma-statement.org/>). Web of Science, PubMed, ProQuest, Scopus, and Google Scholar databases were searched for literature on *T. trichiura* prevalence in Asia. Keywords, used (alone or in combination) were *Trichuris trichiura*, *T. trichiura*, *Trichocephalus trichiuris*, *trichuriasis*, soil-transmitted helminth (STH), Neglected tropical disease (NTD), humans, Asia, intestinal helminthiasis, intestinal diseases, prevalence, and frequency, including the names of the 48 Asian countries.

After screening for titles (including abstract), duplicates and irrelevant records were removed. The full texts of the remaining articles were obtained and evaluated independently by two data analysers (A.V. E. and M.B.). References of full-text articles were assessed to find any potentially applicable articles not identified through the database search. The following a priori inclusion criteria were applied: 1) peer-reviewed articles containing original data, 2) published in English prior to January 31, 2021, 3) cross-sectional study evaluating the prevalence of *T. trichiura* infection in some region of Asia, 4) accessible abstract and full-text article, and 5) numerator and denominator data available to confirm prevalence values.

The exclusion criteria were included: 1) peer-reviewed articles did not contain original data, 2) studies were written in other languages, 3) unaccessible abstract and full-text articles, and 4) numerator and denominator data were unavailable to confirm prevalence values. Articles not meeting the above criteria, including letters, editorials, and articles with confusing/undetermined results were excluded. Since studies were conducting using numerous diagnostic methods, the decision was made to not restrict inclusion to a single method. It was also decided to restrict included publications to those written in English based on the language limitations of the research team.

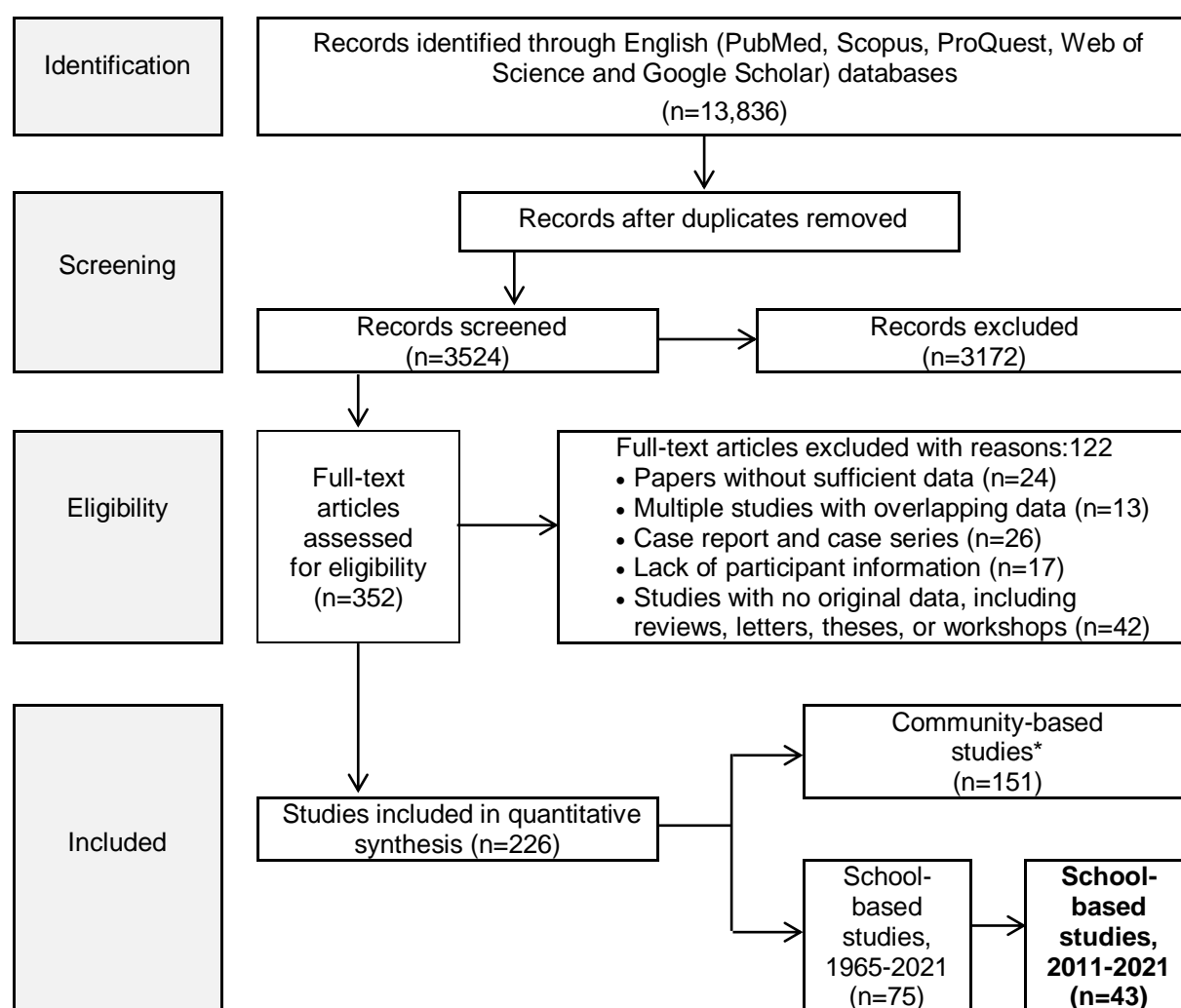
A Microsoft Excel® spreadsheet was used to extract the following data from included articles: first author name, country where the study was conducted, year of

publication, and diagnostic method (s) (parasitological and molecular). The number of children sampled and the number of children positive were obtained.

A Newcastle–Ottawa Quality of Assessment Scale adapted for cross-sectional studies was used to evaluate included studies (Modesti et al., 2016). Scoring was based on three domains: selection (maximum of 5 stars), comparability (maximum of 2 stars), and outcome (maximum of 3 stars).

RESULTS

A total of 13,836 studies were identified through database searches. After removing duplicates and selecting based on inclusion criteria, 352 studies were evaluated at the full-text level. Forty-three studies were included in the systematic review (Fig. 1). Table 1 shows the study's first author, publication year, country, and prevalence of trichuriasis. Table 2 includes the diagnostic method by year, number of countries, and studies.



*Badri et al., 2022

Fig. 1. Flow diagram of systematic review process

The included studies represent 16 countries, with the highest number of studies conducted in Yemen (6 studies), which had the prevalence ranged from 0.5% (6/1218) to 18.0% (36/200), followed by Thailand (5 studies) with the prevalence ranged from 5.3% (4/75) to 50.5 (188/372), and China (5 studies) with the prevalence ranged from 1.9% (7/369) to 94.3% (183/194), respectively (Table 1).

Table 1. The prevalence of trichuriasis in school-age children in 16 countries in Asia, 2011-2021

	First author	Year	Country	Prevalence (%)
1.	Naimullah et al.	2019	Afganistan	1.0 (23/2.263)
2.	Benjamin-Chung et al.	2015	Bangladesh	21.0 (342/1.630)
3.	Benjamin-Chung et al.	2019	Bangladesh	27.7 (775/2.799)
4.	Sohn et al.	2011	Kamboja	0.9 (1/116)
5.	Moore et al.	2012	Kamboja	0.1 (9/16.372)
6.	Bless et al.	2015	Kamboja	14.0 (32/228)
7.	Kuong et al.	2016	Kamboja	0.3 (5/1.760)
8.	Yap et al.	2012	China	81.2 (56/69)
9.	Yap et al.	2013	China	94.3 (183/194)
10.	Xu Li et al.	2015	China	1.9 (7/369)
11.	Lei Xiao et al.	2015	China	39.3 (172/438)
12.	D Yang et al.	2018	China	25.2 (81/321)
13.	Ashok et al.	2011	India	0.5 (1/208)
14.	Ganguly et al.	2017	India	4.6 (295/6.421)
15.	Kumar et al.	2017	India	14.4 (72/500)
16.	Subahar et al.	2020	Indonesia	1.8 (4/219)
17.	Ahmed et al.	2012	Malaysia	84.4 (244/289)
18.	Alaribi et al.	2020	Malaysia	12.8 (19/148)
19.	Vorasan et al.	2015	Myanmar	2.0 (9/457)
20.	Oo et al.	2020	Myanmar	17.1 (171/1.000)
21.	Chai et al.	2020	Myanmar	19.4 (432/2.227)
22.	Oo et al.	2021	Myanmar	17.0 (170/1.000)
23.	Bhattachan et al.	2015	Nepal	4.1 (12/296)
24.	Yadav et al.	2016	Nepal	9.7 (49/507)
25.	Rai et al.	2017	Nepal	0.9 (3/329)
26.	Papier et al.	2014	Filipina	17.9 (124/693)
27.	Mationg et al.	2017	Filipina	38.8 (102/263)
28.	Sagnuankiat et al.	2016	Thailand	50.5 (188/372)
29.	Punsawad et al.	2017	Thailand	8.3 (27/324)
30.	Kaewpitoon et al.	2018	Thailand	5.2 (21/403)
31.	Yanola et al.	2018	Thailand	16.0 (60/375)
32.	Sedionoto et al.	2019	Thailand	5.3 (4/75)
33.	Hung et al.	2016	Vietnam	0.3 (4/1206)
34.	De Gier et al.	2016	Vietnam	53.7 (274/510)
35.	Al-Mekhlafi et al.	2016	Yemen	0.5 (6/1218)
36.	Alwabr et al.	2016	Yemen	18.0 (36/200)
37.	Alsubaie et al.	2016	Yemen	9.3 (24/258)
38.	Alharbi et al.	2019	Yemen	3.1 (24/780)
39.	Alharazi et al.	2020	Yemen	0.8 (3/385)
40.	Mogalli et al.	2020	Yemen	1.8 (7/400)
41.	Ullah et al.	2014	Pakistan	6.8 (15/222)
42.	Galgamuwa et al.	2017	Sri Lanka	1.0 (2/206)
43.	Jameel et al.	2017	Iraq	1.0 (1/103)

The highest prevalence of trichuriasis was reported from China (94.3%; 183/194) in 2013, followed by Malaysia (84.4%; 244/289) in 2012. The lowest prevalence was recorded in Vietnam (0.3%; 4/1206).

There were 43 studies that applied laboratory diagnostic techniques. The Kato-Katz (10 studies) was the most frequently used technique in 2011 – 2021. There were 2 studies in 2017-2019 that applied molecular techniques to identification of *T.*

trichiura infection. All of the molecular analyses in the included studies were conducted using the Polymerase Chain Reaction (PCR) (Table 2).

Table 2. Laboratory examination techniques for fecal samples to detect trichuriasis in school-age children in Asia, 2011-2021

Laboratory examination techniques for fecal sample	Year	No. of country*	No. of study	
			n	%
Kato-Katz	2011-2021	10	19	44,2
Formalin-ether concentration	2016-2020	3	6	14,0
Direct smear	2012-2017	5	5	11,6
Direct smear, Formalin-ether concentration	2011-2020	3	4	9,2
Direct smear, Kato-Katz	2019-2021	3	3	7,0
Formalin-ether concentration, Kato-Katz	2015-2017	3	3	7,0
Kato-Katz, PCR	2017-2019	2	2	4,7
Kato-Katz, Mini-FLOTAC	2015	1	1	2,3
Total	--	--	43	--

*Each of the 16 countries in Asia uses one or more different laboratory examination techniques

DISCUSSION

Based on this systematic review, the highest prevalence of trichuriasis was reported in China (2013) and Malaysia (2012), which may be associated with heavy rainfall, high temperatures, and high humidity in these countries. These factors have increased the survivability of *T. trichiura* eggs and larvae in the environment (Afsah-Hejri et al., 2013). However, to confirm the results (pooled prevalence), a meta-analysis is needed due to the potential for bias or heterogeneity among studies.

A study by Silver et al. (2018) looking at the geographic distribution of STHs found the overall prevalence of *Trichuris* was 14% (95%CI: 9–19%) in countries located in South and Southeast Asia. Another study found that infection was most prevalent in the South-east Asian region (18.6%, 95%CI: 11.8–26.5%), which is known to have large numbers of cases of NTDs, including STHs (Hotez et al., 2015).

STH infections, including due to *T. trichiura*, are also common in tropical and sub-tropical regions (Molla & Mamo, 2018). The study also found that the highest prevalence of trichuriasis was in tribal communities (38.3%, 95%CI: 18.5% - 63.3%) (Silver et al., 2018).

In Indonesia, it is estimated that around 13 million children (< 6 years) and 37 million children (aged 6 to 12 years) live in endemic areas due to STH infections (Tan et al., 2014; Sutisna et al., 2021). In children, STH infections, especially *T. trichiura*, remain public health problems (Kapti et al., 2021).

In 2023, the prevalence of STH infections in school-age children (6 -11 years) in the Simanindo sub-district of Samosir Island was lower (4.8%, 9/187), and all infections were due to *T. trichiura* (Wandra et al., unpublished). This finding may be due to the impact of the MDA program in elementary schools on Samosir Island (MHRI, 2012; 2017). The national MDA program for elementary school children in Indonesia includes the administration of a single dose of albendazole (400 mg) two times a year if the local prevalence is > 50% and one time a year if the local prevalence is 20-50% (MHRI, 2017).

In contrast, the prevalence of STH infections in the community-based study in Samosir Island, North Sumatra, Indonesia (2015) was 46.8% (147/314). Infections were caused by *T. trichiura* (32.7%, 48/147), *A. lumbricoides* + *T. trichiura* (6.8%, 10/147), and *T. trichiura* + hookworms (1.4%, 2/147) (Wandra et al., 2020).

Simanindo sub-district of Samosir Island is predominately rural with a small tourist industry (Wandra et al., 2020). Therefore, in this destination needs to have data on the transmissions of this parasite to domestic and foreign tourists.

Infection with *T. trichiura* often only presents with minor clinical manifestations; however, this chronic infection has several hidden sequelae, including nutritional deficiencies (Modesti et al., 2016) and anemia (WHO, 2001).

Laboratory diagnostic techniques can impact *T. trichiura* apparent prevalence values. The Kato-Katz technique is widely used to identify *T. trichiura* eggs in fecal samples since it is low-cost and relatively simple to apply (Knopp et al., 2009; Tarafder et al., 2010) (Table 2, Fig.2). In contrast, the FLOTAC method has a higher sensitivity with a low parasite burden but is more complicated and expensive (Speich et al., 2010). Compared to molecular methods (PCR), microscopic examination is known to have lower sensitivity (Knopp et al., 2009; Badri et al., 2020; 2022).

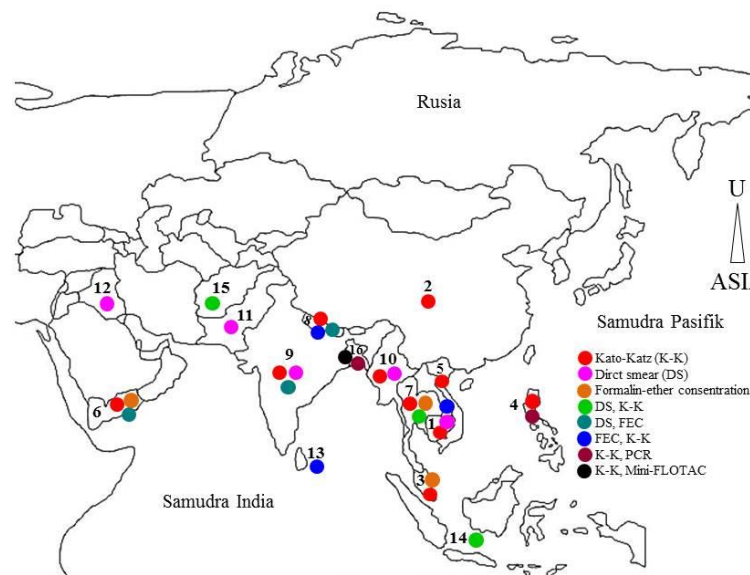


Fig. 2. Map of Asia. Countries included in the systematic review: Cambodia (1), China (2), Malaysia (3), Philippines (4), Vietnam (5), Yemen (6), Thailand (7), Nepal (8), India (9), Myanmar (10), Pakistan (11), Iraq (12), Sri Lanka (13), Indonesia (14), Afghanistan (15), and Bangladesh (16). Colored circles indicate laboratory examination techniques used in each country in school-age children in Asia

This systematic review did have some limitations since the diagnostic tests used in the various studies are low sensitivity. Moreover, some studies were likely published in languages other than English that were not included in this review.

CONCLUSIONS

The prevalence of trichuriasis in school-age children was found to vary widely by country in Asia. The Kato-Katz technique was commonly used to detect *T. trichiura* eggs in school-age children in Asia. Health sector should implement surveillance programs, particularly in countries with high infection prevalence. Educational programs aimed at improving personal hygiene and environmental

sanitation to decrease trichuriasis transmission. Further study in school-age children in Asia using meta-analysis is needed.

ACKNOWLEDGEMENTS

We sincerely thank Milad Badri and Aida Vafae Eslahi (Medical Microbiology Research Center, Qazvin University of Medical Sciences, Qazvin, Iran) for evaluating duplicates and irrelevant records after screening for titles and abstracts, including the full texts of the articles in school-age-children in Asia.

REFERENCES

- Afsah-Hejri L, Jinap S, Hajeb P, et al., 2013. A review on mycotoxins in food and feed: Malaysia case study. *Compr Rev Food Sci Food Saf* 12:629–651. <https://doi.org/10.1111/1541-4337.12029>
- Badri M, Ghaffarifar F, Hassan ZM, et al., 2020. Immunoregulatory effects of somatic extract of *Toxocara canis* on airway inflammations in murine model. *Iran J Parasitol* 15:500–510. <https://doi.org/10.18502/ijpa.v15i4.4855>
- Badri M, Eslahi AV, Olfatifar M, et al., 2021. Keys to unlock the enigma of ocular toxocariasis: A systematic review and meta-analysis. *Ocul Immunol Inflamm*:1–12. <https://doi.org/10.1080/09273948.2021.1875007>
- Badri M, Olfatifar M, Wandra T, et al., 2022. The prevalence of human trichuriasis in Asia: a systematic review and meta-analysis. *Parasitol. Res.* 121 (1), 1–10. <https://doi.org/10.1007/s00436-021-07365-8>
- CDC (Centers for Disease Control and Prevention), 2013. Parasite - Trichuriasis (also known as Whipworm Infection). <https://www.cdc.gov/parasites/whipworm/index.html>
- Dickson R, Awasthi S, Demellweek C, Williamson P., 2000. Anthelmintic drugs for treating worms in children: effects on growth and cognitive performance. *Cochrane Database Syst. Rev.* 2, CD000371. <https://doi.org/10.1002/14651858.CD000371>
- Hotez PJ, Bottazzi ME, Strych U, et al., 2015. Neglected tropical diseases among the Association of Southeast Asian Nations (ASEAN): overview and update. *PLoS Negl Trop Dis* 9(4):e0003575. <https://doi:10.1371/journal.pntd.0003575>. eCollection 2015 Apr.
- Izurieta R, Reina-Ortiz M, Ochoa-Capello T, 2018. *Trichuris trichiura*. *Glob Water Pathog Proj* <http://www.waterpathogens.org> (Robertson, L Part 4 Helminths) Michigan State Univ East Lansing, MI, UNESCO. <https://www.waterphatogens.org/book/trichuris-trichiura>.
- Kapti, N., Sutisna, P., Widjana, D.P., 2021. Prevalence and reinfection of *Ascaris lumbricoides* and *Trichuris trichiura* among elementary school children in rural villages of Bali. *J. Trop. Dis.* 9 (283), 1–6. <https://www.walshmedicalmedia.com/open-access/prevalence-and-reinfection-of-ascaris-lumbricoides-and-trichuris-trichiura-among-elementary-school-children-in-rural-vil.pdf>
- Knopp S, Rinaldi L, Khamis IS, et al., 2009. A single FLOTAC is more sensitive than triplicate Kato-Katz for the diagnosis of low-intensity soil-transmitted helminth infections. *Trans R Soc Trop Med Hyg.* <https://doi.org/10.1016/j.trstmh.2008.11.013>
- MHRI (Ministry of Health Republic of Indonesia), 2012. Guidelines of STH control, Jakarta, Indonesia (in Indonesia).
- MHRI (Ministry of Health Republic of Indonesia), 2017. Regulation of Minister of Health Republic of Indonesia Number 15 Year 2017 on STH control, 2017 (in Indonesia).
- Modesti PA, Reboldi G, Cappuccio FP, et al., 2016. Panethnic differences in blood pressure in Europe: a systematic review and meta-analysis. *PLoS One* 11:e0147601. <https://doi.org/10.1371/journal.pone.0147601>
- Molla, E. and H. Mamo, H., 2018. Soil-transmitted helminth infections, anemia and undernutrition among schoolchildren in Yirgacheffee, South Ethiopia. *BMC Res. Notes* 11 (1), 1–7. <https://doi.org/10.1186/s13104-018-3679-9>

- Namwanje H, Kabatereine NB, Olsen A, 2011. Efficacy of single and double doses of albendazole and mebendazole alone and in combination in the treatment of *Trichuris trichiura* in school-age children in Uganda. *Trans R Soc Trop Med Hyg.* <https://doi.org/10.1016/j.trstmh.2011.07.009>
- Peradotto M, Rolle E, Zaccaria T, et al., 2021. An unpleasant souvenir: Endoscopic finding of *Trichuris trichiura* (Nematoda: Trichuridae). *Parasitol Int* 80:102220. [https://doi: 10.1016/j.parint.2020.102220](https://doi.org/10.1016/j.parint.2020.102220). Epub 2020 Oct 31.
- Silver ZA, Kaliappan SP, Samuel P, et al., 2018. Geographical distribution of soil transmitted helminths and the effects of community type in South Asia and South East Asia--A systematic review. *PLoS Negl Trop Dis* 12:e0006153. [https://doi: 10.1371/journal.pntd.0006153](https://doi.org/10.1371/journal.pntd.0006153). eCollection 2018 Jan.
- Speich B, Knopp S, Mohammed KA, et al., 2010. Comparative cost assessment of the Kato-Katz and FLOTAC techniques for soil-transmitted helminth diagnosis in epidemiological surveys. *Parasites and Vectors.* <https://doi.org/10.1186/1756-3305-3-71>
- Stephenson LS, Holland CV, Cooper ES., 2000. The public health significance of *Trichuris trichiura*. *Parasitology.* <https://doi.org/10.1017/S0031182000006867>
- Sutisna, P., Kapti, N., Sudarmaja, M., Swastika, K., D.P. Widjana, D.P., 2021. Soil-transmitted helminth infection in general population and schoolchildren of Bali: A review. *J. Trop. Dis.* 9 (283), 1–8. <https://www.walshmedicalmedia.com/open-access/soiltransmitted-helminth-infection-among-elementary-schoolchildren-in-bali-indonesia.pdf>
- Tan, M., Kusriastuti, R., Savioli, L., Hotez, P.J., 2014. Indonesia: an emerging market economy beset by neglected tropical diseases (NTDs), *PLoS Negl. Trop. Dis.* 8 (2), e2449. <https://doi.org/10.1371/journal.pntd.0002449>.
- Tarafder MR, Carabin H, Joseph L, et al., 2010. Estimating the sensitivity and specificity of Kato-Katz stool examination technique for detection of hookworms, *Ascaris lumbricoides* and *Trichuris trichiura* infections in humans in the absence of a “gold standard.” *Int J Parasitol.* <https://doi.org/10.1016/j.ijpara.2009.09.003>
- Wandra, T., Darlan, D.M., Yulfi, H., Purba, I.E., Sato, M.O., Budke, C.M., Ito, A., 2020. Soil-transmitted helminth infections and taeniasis on Samosir Island, Indonesia, *Acta Trop.* 202,105250. <https://doi.org/10.1016/j.actatropica.2019.105250>WHO.
- WHO. Iron deficiency anaemia: assessment, prevention and control. A guide for programme managers. Geneva: World Health Organization; 2001. http://www.who.int/nutrition/publications/micro_nutrients/anaemia_iron_deficiency/WHO_NHD_01.3/en/.
- WHO (World Health Organization), 2023. Soil-transmitted helminth infections <https://www.who.int/news-room/fact-sheets/detail/soil-transmitted-helminth-infections>.

Prevention of STI Transmission among Men Who Have Sex with Men in Indonesia through Circumcision Behavior

Mona Safitri Fatiah¹, Rispah Purba²

¹Faculty of Public Health, Universitas Cenderawasih, Jayapura, Indonesia

²Faculty of Teacher Training and Education, Universitas Cenderawasih, Jayapura, Indonesia

Email korespondensi: mona.s.fatih@gmail.com



ARTICLE INFO

Article History:

Received: 2023-08-05

Accepted: 2023-09-28

Published: 2023-09-30

Keywords:

Circumcision;
Sexually Transmitted
Diseases (STIs)
Men who have Sex with
Men (MSM);
Preventive.

ABSTRACT

Introduction: The proportion of Sexually Transmitted Infections (STIs) among MSM has increased by around 0,2% from the first quarter and second quarter of 2023, for this reason, prevention efforts are needed in the form of implementing circumcision behavior among men. **Objective:** to understand the relationship between circumcision and transmission of STIs through MSM in Indonesia. **Method:** This research has a cross-sectional design with the population being men who have sex with men (MSM) across 24 provinces in Indonesia totaling 6,000 people, while the research sample is mostly MSM totaling 4,290 people with inclusion criteria being: men who are at least 15 years old, have ever had sex with men at least once in the past year, and have lived in the survey city for around one month. Samples were taken using the Respondent Driven Sampling (RDS) technique. The data used is secondary data in the form of 2018-2019 Biological Behavior Survey (STBP) data. Data in the study were analyzed using logistic regression analysis of risk factor models using STATA 14 software. **Results:** MSM who were circumcised had a 3.0 times greater chance of not having STI symptoms compared to MSM who were not circumcised (95% CI: 2.5- 3.7) after controlling for sex-buying and selling behavior. **Conclusion:** circumcision behavior is one of the efforts to prevent the spread of STI among MSM, recommending the need to create regulations regarding the importance of circumcision behavior in Indonesia.



©2023 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY SA) license (<https://creativecommons.org/licenses/by-sa/4.0/>)

INTRODUCTION

Sexually Transmitted Infections (STI) are one of three causes of public health problems that are a health burden throughout the world (CDC, 2022b; WHO, 2022b). In 2022, every day in the world, more than 1 million new people will be infected with STIs who do not show symptoms, whereas every year it is estimated that around 374 million new infections will be one of the four STIs, namely: Syphilis, Chlamydia, Gonorrhea and Trichomonas Vaginalis (WHO, 2022d). This number, when compared to the target desired by the World Health Organization (WHO) for 2030, which wants a reduction in new STI infections to 9.9 million per year, is certainly still very far away, so it requires great effort and synergy from various parties to be able to prevent the spread this disease (WHO, 2022a).

STI cases in the world are spread throughout almost all WHO intervention areas, one of which is the South East Asian (SEA) Region. From data compiled by WHO (2021), member countries in the SEA region have contributed a third of new STI

infections, with an estimated STI prevalence of 87%, which based on this prevalence places SEA as the region with the third highest after America (90%) and Africa (96%) (WHO, 2022c). The perpetrators contributing most to these cases are key population groups, especially the group of men who have sex with men (MSM), which is in first place with an estimated MSM prevalence of 90% (WHO, 2021a). This prevalence is certainly still far from WHO desired target of reducing the prevalence of new STI infections by 2023 to 80% (UNHCR et al., 2021). The role of several SEA member countries in the high prevalence of STIs cannot be denied, and one of the countries that contributes to the high prevalence of STIs is Indonesia.

The number of STI cases in Indonesia in the first quarter (10,954 cases) and the second quarter (13,295 cases) of 2022 shows an increase of around 2,341 cases, where the proportion of STI in risk groups, especially MSM, increased by around 0,2% from the first quarter report (15.9%) to the second quarter (16.1%) (Subdit HIV dan PMS, 2022a, 2022b). The percentage of STI in the MSM group places MSM as the first group to contribute STI cases in Indonesia in the second quarter of 2022 (Subdit HIV dan PMS, 2022b). STI indirectly facilitates the occurrence of Human Immunodeficiency Virus (HIV) through sexual contact, where STIs and HIV are responsible for 2.3 million deaths and 1.2 million people acquire cancer every year in the world (CDC, 2022b; WHO, 2022b; UNAIDS, 2021). For this reason, it is necessary to carry out further studies regarding the relationship between circumcision behavior and the spread of STI in Indonesia, especially among MSM.

The limited information related to research on the risk of circumcision behavior on the incidence of STIs in Indonesia has attracted the attention of researchers because so far there is only information related to the theory of why the process of an uncircumcised penis can be a risk for contracting STI, such as the literature study conducted by Ganeswari et al. (2020). STIs themselves are infections caused by unsafe sexual behavior, which can include: not abstinence, and not using condoms when having sex (Kemenkes, 2016).

STI and HIV not only have an impact from a health perspective but also from a political, social, and economic perspective, the impact of STIs from an economic perspective is why developed countries like America have to allocate funds of around 1.6 billion each year for medical costs for STIs patients (UNAIDS, 2021; CDC, 2022a). For this reason, prevention efforts are needed, where WHO has recommended circumcision for men, apart from being faithful to their partner, using condoms during sex, and not using shared needles for Injection Drug Users (IDUs) (Afshar et al., 2018; Peraturan Bupati Tegal Tentang Pemberdayaan Masyarakat Dalam Upaya Penanggulangan HIV Dan AIDs Di Tingkat Desa, 2016; WHO, 2018).

Circumcision is recommended, of course, not without reason, this is because during sex, the part of the preputial skin of the penis that is not circumcised will move up and down, putting the preputial mucosa at risk of exposure to infection (Ganeswari et al., 2020). A penis without a circumcision is vulnerable to sex-related wounds or abrasions, which can serve as a point of entry for microorganisms that cause STIs. Men who practice circumcision are linked to a 23% lower risk of HIV infections and STI among MSM (Afshar et al., 2018; Ganeswari et al., 2020; Gao et al., 2021). Research conducted in America also found the same thing, whereby circumcision the spread of the virus through sexual intercourse can be suppressed (Morris et al., 2017). Departing from this background, and There is little research on the role of circumcision in preventing STI in the MSM group, so this research aims to determine the relationship between circumcision behavior and the incidence of Sexually Transmitted Infections (STIs) among MSM in Indonesia.

METHODS

This research is a quantitative study with a cross-sectional research design conducted in 24 provinces in Indonesia. This research uses secondary data from the 2018 - 2019 Integrated Biological Behavioral Survey (STBP), where this research was conducted for about three months, starting March - May 2023. The population of this research is MSM who have sex with men either once, occasionally, or intensely. a total of 6,000 people spread across 24 provinces in Indonesia, while the sample in this study was 4,290 MSM people with consideration of the exclusion criteria for districts/cities which were difficult to access because regional security was not guaranteed or there were too few subjects while the inclusion criteria in this study were: a man who is at least 15 years old, has had sex with a man at least once in the last year and has lived in the survey city for roughly one month. Sampling techniques applied in the research is the Respondent Driven Sampling (RDS) method which is part of Chain Referral Sampling (CSR) which is almost the same as snowballing sampling and Network Sampling.

The variables in this study are dependent variables in the form of incidence of STIs with the operational definition being admitting that MSM has symptoms or signs of one of the 8 symptoms of STIs, in the form of: pain when urinating, warts around the genitals, warts around the anus, scabs around the genitals, scabs around the anus, scabs around the penis, and lumps around the anus. The independent variables are: circumcision behavior and the confounding variables are: respondent characteristics (age, employment, and education), information (exposure to HIV information and internet access), sexual behavior (number of sexual partners, sex-buying behavior, and sex-selling behavior), drug use, and the use of tattoos. This research was analyzed starting from univariate analysis, bivariate analysis with the chi-square test, and multivariate analysis in the form of logistic regression risk factor models which were analyzed using STATA 14 software. This research has gone through an ethical review from the University of Indonesia with number: 727/UN2.F10/PPM .00.02/2018.

RESULTS

The proportion of MSM who do not have symptoms of pain when urinating is higher than MSM who have symptoms of pain when urinating, namely 85.9%. MSM who do not have symptoms of warts around the genitals are higher than those who have symptoms, around 97.3%. The proportion of MSM who do not have warts around the genitals is higher than those who have warts around the genitals, namely 97.6%. The proportion of MSM who do not have wounds around the genitals, do not have scabs around the anus, do not have abnormal discharge from the penis, do not have abnormal discharge from the anus, and do not have lumps around the anus are higher than those who have symptoms with the same percentage, namely: 97.4%; 98.3%; 94.5%; 98.8%, and 98.6% as seen in Table 1.

The proportion of circumcised MSM who did not have STI symptoms was 81.5% higher compared to circumcise MSM who had STI symptoms. The proportion of MSM between the ages of 15–19 years who do not have STI symptoms is less than those who have STI symptoms at 77.5%. The proportion of MSM whose educational background has completed academic education/PT does not have STI symptoms, which is higher than those who have STI symptoms, namely 77.0%. The proportion of MSM who work with a regular salary and do not have STI symptoms is higher compared to MSM who work with a regular salary and have STI symptoms, at 81.9%. In the information exposure variable, the proportion of MSM who were exposed to

HIV/AIDS information and did not have STI symptoms was higher than those who had STI symptoms, around 79.2%. These results can be seen in Table 2.

The proportion of MSM who frequently access the internet and do not have STI symptoms is higher than the proportion of MSM who have STI symptoms, around 78.7%. The proportion of MSM who have less than 2 sexual partners a week who do not have STI symptoms is higher than those who have symptoms, namely 78.8%. There are more MSM who have never purchased sex and do not have STI symptoms than those who have STI symptoms, around 80.1%. The proportion of MSM who sell sex and do not have STI symptoms is around 80.7% compared to those who have STI symptoms. The proportion of MSM who use drugs and do not have STI symptoms is higher (79.6%) compared to MSM who have symptoms. The proportion of MSM who have tattoos and do not have STI symptoms is higher (80.8%) than those who have STI symptoms. These results can be seen in Table 2.

Table 1. Distribution of Symptoms of Sexually Transmitted Infections (STIs) among Men Who Have Sex with Men (MSM) in Indonesia (STBP Data Analysis 2018 – 2019)

STI symptoms	Have no symptoms		Have symptoms	
	n	%	n	%
Very painful (like burning) when urinating	3,684	85.9	606	14.1
Warts around the genitals	4,172	97.3	118	2.7
Warts around the anus	4,187	97.6	103	2.4
Wounds or scabs around the genitals	4,178	97.4	112	2.6
Wounds or scabs around the anus	4,219	98.3	71	1.7
Abnormal discharge from the genitals	4,054	94.5	236	5.5
Abnormal discharge from the anus	4,240	98.8	50	1.2
Lump/swelling around the anus	4,230	98.6	60	1.4

The proportion of MSM who acknowledged having undergone circumcision was greater than MSM who had not been circumcised which is around 86.4%, as seen in Figure 1.

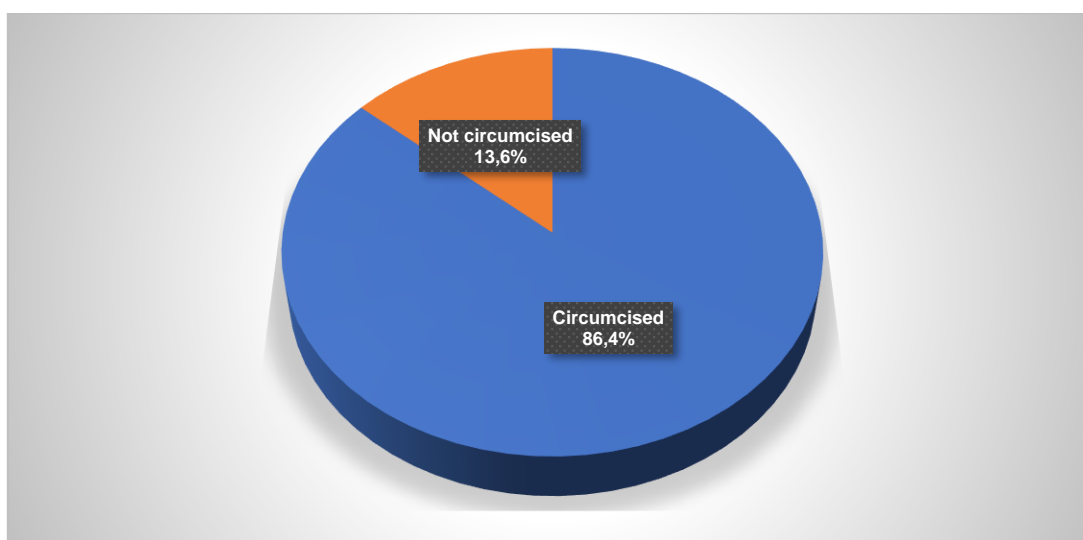


Figure 1. Distribution of MSM based on Circumcision Behavior in Indonesia (STBP Data Analysis 2018-2019).

Table 2. Distribution of Circumcision Behavior, Characteristics, Information, Sexual Behavior, Drug Use and Tattoo Use among Men Who Have Sex with Men (MSM) in Indonesia (STBP Data Analysis 2018 – 2019)

Variables	STI				p-value
	No		Yes		
	n	%	n	%	
Circumcision behavior					0,001
Yes, circumcised	3.036	81,5	688	18,5	
Not circumcised	353	60,6	229	39,4	
Characteristics of MSM					
Age in years					0,001
15 – 19	580	77,5	168	22,5	
20 – 24	950	76,3	295	23,7	
25 – 49	1.738	80,5	421	19,5	
≥ 50	121	90,3	13	9,7	
Education					0,023
Completed Academic/Higher Education	490	77,0	146	23,0	
Completed high school/ the equivalent	2.051	79,6	527	20,4	
Completed junior high school/ the equivalent	605	79,4	157	20,6	
Completed primary school/ the equivalent	230	78,2	64	21,8	
No school	13	81,3	3	18,8	
Work					0,001
Working with a regular salary	1.264	81,9	279	18,1	
Working with an irregular salary	631	83,9	121	16,1	
Freelance	600	73,8	213	26,2	
Not working	894	75,9	284	24,1	
Information					
Exposure to HIV/AIDS information					0,147
Exposed	2.687	79,2	706	20,8	
Not exposed	702	78,6	191	21,4	
Internet access					0,345
Yes, often	2.705	78,7	732	21,3	
Sometimes	327	77,7	94	22,3	
Never	357	83,4	71	16,6	
Risky sexual behavior					
Number of sexual partners during the week					0,023
≤2 people	2.946	78,8	794	21,2	
>2 people	442	81,1	103	18,9	
Sex buying behavior from men					0,001
Never have	3.029	80,1	754	19,9	
Have	360	71,6	143	28,4	
Sex selling behavior with men					0,001
Never have	2.593	80,7	621	19,3	
Have	796	74,3	276	25,7	
Drug use in the last 3 months					0,001
Never have	3.083	79,6	788	20,4	
Have	306	73,7	109	26,3	
Tattoo behavior					0,201
Never have	2.900	80,0	725	20,0	
Have	489	74,0	172	26,0	

MSM who are circumcised are 2.8 times more likely to not have STI symptoms compared to MSM who are not circumcised (p-value: 0.001 with AOR value: 2.8 and 95% CI value: 2.51 – 3.66) after being controlled by other variables seen in Table 3.

Table 3. Logistic Regression Results of Risk Factor Model Influence of circumcision on the incidence of STIs among MSM in Indonesia in 2018 - 2019

Variables	Incidence of STIs		
	p-value	AOR	95% CI
Circumcision Behaviour			
Yes, circumcised	reff		
Not circumcised	0,001	2,8	2,3 – 3,4
Age in years			
15 – 19	reff		
20 – 24	0,049	1,3	1,0 – 1,6
25 – 49	0,817	1,0	0,8 – 1,3
≥50	0,020	0,5	0,3 – 0,9
Education			
Completed Academic/Higher Education	reff		
Completed high school/ the equivalent	0,084	0,8	0,7 – 1,0
Completed junior high school/ the equivalent	0,162	0,8	0,6 – 1,1
Completed primary school/ the equivalent	0,686	0,9	0,6 – 1,3
No school	0,686	0,8	0,2 – 2,8
Work			
Working with a regular salary	reff		
Working with an irregular salary	0,381	0,9	0,7 – 1,2
Freelance	0,001	1,5	1,2 – 1,8
Not working	0,010	1,3	1,1 – 1,6
Exposure to HIV/AIDS information			
Exposed	reff		
Not exposed	0,147	1,2	0,9– 1,4
Internet access			
Yes, often	reff		
Sometimes	0,634	1,1	0,8 – 1,4
Never	0,419	0,9	0,7 – 1,2
Number of sexual partners during the week			
≤2 people	reff		
>2 people	0,023	0,8	0,6 – 0,9
Sex buying behavior from men			
Never have	reff		
Have	0,001	1,5	1,2– 1,9
Sex selling behavior with men			
Never have	reff		
Have	0,001	1,5	1,2–1,8
Drug use in the last 3 months			
Never have	reff		
Have	0,028	1,3	1,1 – 1,7
Tattoo behavior			
Never have	reff		
Have	0,201	1,2	0,9 – 1,4

DISCUSSION

STI is a disease that can be transmitted through sexual intercourse, whether vaginal or anal intercourse. STI is the entry point for HIV in both heterosexual groups and homosexual groups, namely MSM and gays (Australian Government et al., 2017; Chigorimbo-Murefu et al., 2022; Ditjen P3 Kemenkes, 2022). STI itself, once present in the human body, is usually characterized by pus coming out of the genitals, lumps

on the genitals, and wounds around the genitals ([Australian Government et al., 2017](#); [KPA et al., 2012](#)). This research found that almost all MSM have one of the 8 symptoms of STIs that are transmitted through sexual behavior. These results are consistent with previous research, namely: in America, young MSM and transgender women who have sexual activity more than once a week are at 1.13 times greater risk of experiencing gonorrhea ([Janulis et al., 2023](#)). Research conducted in South Africa reported that the proportion of MSM who had one of the symptoms of an STI was around 28.1%, this is because apart from not consistently using condoms, the number of sexual partners in a week also influences ([Le Roux et al., 2022](#))

Cases of chlamydia and gonorrhea in Indonesia in key populations have also increased by 30 times compared to the general population, this is due to inconsistencies in using condoms and also limited access to condoms in key population groups ([Ditjen P2PM, 2022](#); [Fatiah, 2023](#); [Fatiah & Tambing, 2023](#)). For this reason, preventive behavior is needed in the form of circumcision behavior.

Circumcision or circumcision aimed at men has many benefits, in the form of preventing transmission of STIs and HIV through sexual intercourse ([Spriritia, 2021](#); [WHO, 2022c](#)). This happens because the inner foreskin, penile shaft, and urethral introitus are potential entry points for HIV and STIs ([Anderson et al., 2011](#); [Spriritia, 2021](#)). Simply put, the outer skin of the penis or foreskin of an uncircumcised penis has folded, and the inner foreskin during sexual intercourse will experience a lot of friction during anal intercourse so that the mucosal epithelium will quickly fall off and become a gathering place for micro biochemistry which is the target of HIV ([Nshimirimana et al., 2022](#); [Sharma et al., 2018](#)). The inner foreskin of the penis that is injured or lesioned will be more easily penetrated by HIV and microbes that can cause STIs, especially when men infected with HIV/STIs release seminal fluid containing HIV/STIs and then enter the inner foreskin of the penis with the lesion ([Anderson et al., 2011](#); [Asa et al., 2023](#); [KPA et al., 2012](#)).

This research found a link between circumcision behavior in efforts to prevent the spread of STIs in this study, which is consistent with the theory that has been expressed and several previous studies, namely: circumcision behavior in heterosexual and homosexual groups prevents around 0.58 times greater than HIV and STI which are transmitted through sexual relations ([Sharma et al., 2018](#)). In South Africa, circumcision behavior can protect around 21.1% of Herpes Simplex Virus (HSV-2), and 31% prevent the occurrence of HIV and Hepatitis B in housewives compared to men ([Amusa et al., 2021](#); [Davis et al., 2019](#)).

There is no standard policy regarding the obligation to carry out circumcision procedures for men in Indonesia, it is only limited to the form attached to one of the efforts to prevent HIV and STIs through circumcision behavior, this can be seen in several policies that have been issued but have been revoked and do not apply as per the Ministerial Regulation Health No. 12 of 2013 concerning HIV and AIDS Management, then there is East Java Governor Regulation No. 35 of 2020, all of which only mentions additional efforts to prevent HIV transmission through circumcision, without any further intervention.

Prevention of transmission of STIs and HIV does not just depend on circumcision behavior but needs to be supplemented with consistent behavior of using condoms during sex and correct use of condoms, unfortunately, the availability of condoms in some localization places where MSM work is very minimal and there are rarely even condoms available in localizations so there are no It is believed that the increase in STI and HIV is high among MSM considering that the number of customers served in a week is around 2 people per week ([Fatiah, 2023](#); [Fatiah & Tambing, 2023](#)).

Limiting the number of sex clients in one week, being faithful to your partner not having sex before marriage, and increasing knowledge about the dangers of STI and HIV in key populations is one of the keys to efforts to prevent HIV transmission in key populations which will later have an impact on the general population (Purnamawati et al., 2022; Sabilla & Nurfadhilah, 2022).

This research has several limitations, including in terms of the research design used, it is cross-sectional which does not look at the effects of an exposure being studied simultaneously, another limitation is in terms of data collection, which we know that the population in this study falls into the category hidden population whose sampling is slightly different, where the sampling in this study uses the RDS technique, where the technique is similar to the snowball sampling data collection technique, so data processing using the RDS technique should use the RDSA data collection technique to avoid bias in processing research data. Other limitations include limitations in the variables to be analyzed, where not all variables to be studied are available in secondary raw data, such as oral sex variables which can also influence the incidence of STIs among MSM.

CONCLUSIONS

MSM who have been circumcised are 2.8 times more likely to not have STI symptoms compared to MSM who have not been circumcised after controlling for confounding variables in the form of buying sex behavior and sex selling behavior with men. This research suggests the need for special regulations governing circumcision behavior in men taking into account the need to look at it from a religious and cultural perspective, considering the benefits that circumcision behavior can provide for men. As we know, men are one of the groups with the highest proportion of male circumcision behavior. The largest person in Indonesia who transmits STI to his partner.

ACKNOWLEDGEMENT

The author would like to thank Lembaga Penelitian Pengabdian Masyarakat (LPPM) Universitas Cenderawasih (FKM) for facilitating the author and also the HIV, AIDS, and STI Sub-Directorate of the Ministry of Health for this research.

REFERENCES

- Afshar, K., Kazemi, B., & MacNeily, A. E. (2018). The Role of Circumcision in Preventing Sexually Transmitted Infections. In *Diagnostics to Pathogenomics of Sexually Transmitted Infections*. <https://doi.org/10.1002/9781119380924>
- Amusa, L., Zewotir, T., North, D., Kharsany, A. B. M., & Lewis, L. (2021). Association of Medical Male Circumcision and Sexually Transmitted Infections in a Population-Based Study using Targeted Maximum Likelihood Estimation. *BMC Public Health*, 21(1), 1–10. <https://doi.org/10.1186/S12889-021-11705-9/TABLES/3>
- Anderson, D., Politch, J. A., & Pudney, J. (2011). HIV infection of the penis. *American Journal of Reproductive Immunology (New York, N.Y.: 1989)*, 65(3). <https://doi.org/10.1111/J.1600-0897.2010.00941.X>
- Asa, G. A., Fauk, N. K., & Ward, P. R. (2023). Traditional male circumcision and the risk for HIV transmission among men: a systematic review. *BMJ Open*, 13(5), e072118. <https://doi.org/10.1136/BMJOPEN-2023-072118>
- Australian Government, Bappenas, Dinkes Provinsi Papua, Dinkes Provinsi Papua Barat, KOMPAK, & BaKTI. (2017). *Buku Kader Pemberdayaan Kampung Informasi Dasar HIV dan AIDS*. [https://batukarinfo.com/system/files/Informasi Dasar HIV %26 AIDS.pdf](https://batukarinfo.com/system/files/Informasi_Dasar_HIV_%26_AIDS.pdf)

- CDC. (2022a). *Sexually Transmitted Infections Prevalence, Incidence, and Cost Estimates in the United States*. Division of STD Prevention, National Center for HIV, Viral Hepatitis, STD, and TB Prevention, Centers for Disease Control and Prevention. <https://www.cdc.gov/std/statistics/images/FullSTI-Cost-Estimates-8.png>
- CDC. (2022b). *STD Facts – What Gay, Bisexual and Other Men Who Have Sex with Men Need to Know About Sexually Transmitted Diseases*. CDC. <https://www.cdc.gov/std/life-stages-populations/stdfact-msm.htm#print>
- Chigorimbo-Murefu, N. T. L., Potgieter, M., Dzanibe, S., Gabazana, Z., Buri, G., Chawla, A., Nleya, B., Olivier, A. J., Harryparsad, R., Calder, B., Garnett, S., Maziya, L., Lewis, D. A., Jaspán, H., Wilson, D., Passmore, J. A. S., Mulder, N., Blackburn, J., Bekker, L. G., & Gray, C. M. (2022). A Pilot Study to Show that Asymptomatic Sexually Transmitted Infections alter the Foreskin Epithelial Proteome. *Frontiers in Microbiology*, 13, 3536. <https://doi.org/10.3389/FMICB.2022.928317/BIBTEX>
- Davis, S., Toledo, C., Lewis, L., Maughan-Brown, B., Ayalew, K., & Kharsany, A. B. M. (2019). Does Voluntary Medical Male Circumcision Protect against Sexually Transmitted Infections among Men and Women in Real-world Cscale-up Settings? Findings of a household survey in KwaZulu-Natal, South Africa. *BMJ Global Health*, 4(3), e001389. <https://doi.org/10.1136/BMJGH-2019-001389>
- Ditjen P2PM. (2022). Laporan Kinerja 2022 Direktorat Pencegahan dan Pengendalian Penyakit Menular. Jakarta: Kementerian Kesehatan R.I. Retrieved from <https://p2pm.kemkes.go.id/storage/informasi-publik/content/GHwE3BiLbOrvZZPKY1Pm91BIRWqzE4-metaTGFwa2lulFAyUE0gMjAyMi5wZGY=-.pdf>
- Ditjen P3 Kemenkes. (2022). Laporan Eksklusif Perkembangan HIV AIDS dan PIMS triwulan III Tahun 2022. Jakarta: Kementerian Kesehatan R.I. Retrieved from https://siha.kemkes.go.id/portal/files_upload/Laporan_TW_3_2022.pdf
- Fatihah, M. S. (2023). Determinan Akses Memperoleh Kondom pada Lelaki Seks Lelaki (LSL) di Indoneisa. *Jurnal Kesehatan Reproduksi*, 14(1). <https://doi.org/10.58185/JKR.V13I1.22>
- Fatihah, M. S., & Tambing, Y. (2023). Pengaruh Akses Ketersediaan Kondom terhadap Perilaku Unsafe Sex pada Lelaki Seks Lelaki (LSL) di Indonesia. *Jurnal Ilmu Kesehatan Masyarakat*, 12(6). <https://journals.stikim.ac.id/index.php/jikm/article/view/2321>
- Ganeswari, putu ayu dewita, Maheswari, luh made shanti, & Puspawati, ni made dwi. (2020). Sirkumsisi dan Perannya dalam Pencegahan IMS. *Intisari Sains Medis*, 11(3), 1157–1164. <https://doi.org/10.15562/ism.v11i3.835>
- Gao, Y., Yuan, T., Zhan, Y., Qian, H. Z., Sun, Y., Zheng, W., Fu, L., Liang, B., Zhu, Z., Ouyang, L., Liu, M., Fitzpatrick, T., Wu, Z., Meng, X., Baeten, J. M., Zhao, J., Vermund, S. H., Yu, M., Wu, G., ... Zou, H. (2021). Association between Medical Male Circumcision and HIV Risk Compensation among Heterosexual Men: A Systematic Review and Meta-Analysis. *The Lancet Global Health*, 9(7), e932–e941. [https://doi.org/10.1016/S2214-109X\(21\)00102-9](https://doi.org/10.1016/S2214-109X(21)00102-9)
- Janulis, P., Goodreau, S. M., Morris, M., Birkett, M., Gregory Phillips, I., Risher, K., Mustanski, B., & Jenness, S. M. (2023). Partnership Types and Coital Frequency as Predictors of Gonorrhea and Chlamydia among Young MSM and Young Transgender Women. *International Journal of STD & AIDS*, 34(10), 694–701. Retrieved from <https://journals.sagepub.com/doi/abs/10.1177/09564624231173728>
- Kemenkes. (2016). *Pedoman Nasional Penanganan Infeksi Menular Seksual*. https://siha.kemkes.go.id/portal/files_upload/buku_pedoman_nasional_tatalaksana_ims_2016_ok.pdf
- KPA, Burnet Insitute, & Australian AID. (2012). *Modul Kesehatan Seksual Perempuan “Pemenuhan Hak, Kesehatan Seksual dan Reproduksi Perempuan.”* Lembaga Penelitian Pendidikan Penerbitan *Yogya*. https://siha.kemkes.go.id/portal/files_upload/2_1_j__MODUL_KESEHATAN_SEKSUAL__PEREMPUAN__revisi_31_5_2012__copy.pdf

- Le Roux, M., Ngwenya, I. K., Nemarude, A. L., De Villiers, B. E., Mathebula, M., & Nchabeleng, M. (2022). Sexually transmitted infections and sexual behaviour among men having sex with men from Tshwane, South Africa, 34(3), 183–190. <https://doi.org/10.1177/09564624221146673>
- Morris, B. J., Krieger, J. N., & Klausner, J. D. (2017). CDC's Male Circumcision Recommendations Represent a Key Public Health Measure. *Global Health Science and Practice*, 5(1), 15–27. <https://doi.org/10.9745/GHSP-D-16-00390>
- Nshimirimana, C., Vuylsteke, B., Smekens, T., & Benova, L. (2022). HIV testing uptake and determinants among adolescents and young people in Burundi: a cross-sectional analysis of the Demographic and Health Survey 2016–2017. *BMJ Open*, 12(10), e064052. <https://doi.org/10.1136/BMJOPEN-2022-064052>
- Peraturan Bupati Tegal tentang Pemberdayaan Masyarakat dalam Upaya Penanggulangan HIV dan AIDS di Tingkat Desa, (2016). <https://peraturan.bpk.go.id/Download/244048/16pbkabtegal020.pdf>
- Purnamawati, D., Nurfadhilah, N., Zam-zam, R., Amalia, K., & Ningsih, R. Z. (2022). Pengalaman Penderita HIV Pada Lelaki Suka Lelaki (LSL); Analisis Kualitatif tentang Persepsi Diri, Respon Saat Didiagnosis, Perilaku Pencegahan, dan Dukungan Pendamping Sebaya. *Jurnal Kedokteran Dan Kesehatan*, June, 155–163. Retrieved from <https://jurnal.umj.ac.id/index.php/JKK/article/view/13062>
- Sabilla, M., & Nurfadhilah. (2022). Pengetahuan Komprehensif Remaja tentang HIV di Kota Tangerang Selatan menuju End AIDS by 2030. *Jurnal Kesehatan Reproduksi*, 13(1), 1–23. <https://journaliakmitangsel2.iakmi.or.id/index.php/kespro/article/view/22>
- Sharma, S. C., Raison, N., Khan, S., Shabbir, M., Dasgupta, P., & Ahmed, K. (2018). Male circumcision for the prevention of human immunodeficiency virus (HIV) acquisition: a meta-analysis. *BJU International*, 121(4), 515–526. <https://doi.org/10.1111/BJU.14102>
- Spiritita. (2021). *Pria yang Tidak Disunat Berisiko Lebih Besar Tularkan HIV - Spiritita*. Yayasan Spiritita. <https://spiritita.or.id/informasi/detail/362>
- Subdit HIV dan PMS. (2022a). *Laporan Triwulan 1 Tahun 2022 tentang Perkembangan HIV, AIDS dan PMS*. https://siha.kemkes.go.id/portal/files_upload/Laporan_TW_1_2022.pdf
- Subdit HIV dan PMS. (2022b). *Perkembangan HIV AIDS dan Penyakit Infeksi Menular Seksual (PIMS) Triwulan II Tahun 2022*. https://siha.kemkes.go.id/portal/files_upload/Laporan_TW_2_2022.pdf
- UNAIDS. (2021). *UNAIDS data 2021*. https://www.unaids.org/sites/default/files/media_asset/JC3032_AIDS_Data_book_2021_En.pdf
- UNHCR, UNICEF, WFP, UNDP, UNFPA, UNODC, ILO, UNESCO, WHO, & World Bank. (2021). Fast-Track Ending the AIDS Epidemic by 2030. In *Nucl. Phys*. https://www.unaids.org/sites/default/files/media_asset/JC2686_WAD2014report_en.pdf
- WHO. (2018). Male Circumcision for HIV Prevention: Manual for Male Circumcision Under Local Anaesthesia and HIV Prevention Services for Adolescent Boys and Men. In *African journal of reproductive health* (Vol. 10). WHO. <https://doi.org/10.2307/30032467>
- WHO. (2021a). Assessment of country implementation of the WHO global health sector strategy for sexually transmitted infections (2016–2021): results of a national survey. In *World Health Organization*. WHO. <https://apps.who.int/iris/handle/10665/345086>
- WHO. (2021b). Global Progress Report on HIV, Viral Hepatitis and Sexually Transmitted Infections, 2021. In *WHO* (Vol. 53, Issue 9). <https://www.who.int/publications/i/item/9789240027077>
- WHO. (2022a). *2022 – 2030 Action Plans for ending HIV , viral hepatitis and STIs in the WHO European Region Draft for consultation*. WHO. https://www.euro.who.int/__data/assets/pdf_file/0007/524059/HIV-Hepatitis-STIs-actions-plans-consult-eng.pdf
- WHO. (2022b). *Global Health Sector Strategies on, Respectively, HIV, Viral Hepatitis and Sexually Transmitted Infections for the Period 2022-2030*. WHO. <https://www.who.int/publications-detail-redirect/9789240053779>


WHO. (2022c). *Sexually Transmitted Infections*. WHO.
<https://www.who.int/southeastasia/health-topics/sexually-transmitted-infections>

WHO. (2022d). *Sexually Transmitted Infections (STIs)*. WHO.
<https://doi.org/10.1201/9781003039235-48>

The Effect of Peer Assistance on Adherence to Consuming Iron Tablets and Anemia Status among Young Female Adolescents

Muhammad Hasyim, Erdiawati Arief, Nurbaya 

Department of Nutrition, Poltekkes Kemenkes Mamuju, Mamuju, Indonesia

 Corresponding author: nurbaya.m.gizi@gmail.com



ARTICLE INFO

Article History:

Received: 2023-08-01

Accepted: 2023-09-28

Published: 2023-09-30

Keywords:

adolescent; anemia;
iron supplementation;
peer;

ABSTRACT

Introduction: Basic Health Research stated that 76.2% of young women received iron supplements in the last 12 months, and only 2.13% of them consumed iron tablets as recommended. Anemia in adolescence causes reduced physical and mental capacity and diminished concentration in work and educational performance. **Purpose:** This study aimed to assess the impact of peer mentoring and its effect on tackling anemia in adolescent girls. **Methods:** The method used was quasy experiment and was conducted for 12 weeks from July-November 2022. The case group consisted of teenagers at SMP 1 Mamuju and the control group was at SMPN 1 Malunda 1. **Results:** Before the intervention, the anemia status in the case group was 19.2%, and post-intervention was 9%. The control group before intervention was 20.5%, and after intervention, it was 2.6%. There was no difference in the Hb test results for the two sample groups (p -value 0.319). After the intervention, the two sample groups had a difference in Hb changes (p -value 0.000). **Conclusion:** Changes in Hb before and after the intervention showed differences in the case and control groups (p -value 0.000). Peer assistance is highly recommended as one of the anemia interventions among female adolescents.



©2023 by the authors. Submitted for possible open-access publication under the terms and conditions of the Creative Commons Attribution (CC BY SA) license (<https://creativecommons.org/licenses/by-sa/4.0/>)

INTRODUCTION

Stunting is still a health problem for under-five children in Indonesia. In addition, Indonesia is currently experiencing a triple burden of excess and deficiency of macronutrients and micronutrients simultaneously (Titaley et al., 2019). Therefore, handling and managing nutritional problems in Indonesia is increasingly complicated and complex. Prevention of stunting, not only among stunted children but must start from the upstream, namely in pregnant women, even before women get married and become pregnant because women who experience nutritional problems before pregnancy will find it very difficult to improve their nutritional status after pregnancy, especially in the early stages of pregnancy (Laksono et al., 2022).

Based on the Basic Health Research (Riskesdas) data from 2007, 2013, and 2018, there is a trend of increasing prevalence of anemia in adolescents. In 2018, 32% of adolescents in Indonesia were anemic. Approximately 7.5 million Indonesian adolescents are at risk of experiencing obstacles in growth and development, cognitive abilities, and susceptibility to infectious diseases (Kemenkes RI, 2008, 2010, 2013, 2018b). In addition, adolescents experienced food insecurity during the Covid-19 pandemic, which could impact their food intake and nutritional status. Most

adolescents experienced food insecurity during the Covid-19 pandemic, ranging from mild (30.6%), moderate (58.6) to severe food insecurity (1.8). Only 9% of youth experience good food security (Nurbaya & Najdah, 2023).

The Ministry of Health has issued Permenkes No. 51 of 2016 concerning Standards for Providing Nutritional Supplements for the prevention and management of nutritional problems (anemia) in young female adolescents, namely the provision of Iron Supplement Tablets (TTD – *Tablet Tambah Darah*) through schools (junior high and high school) (Peraturan Menteri Kesehatan Nomor 51 Tahun 2016 Tentang Standar Produk Suplementasi Gizi, 2016). However, the results obtained are still very far from expectations. In 2018, 76.2% of young female adolescents received iron supplements in the last 12 months. However, only 2.13% of them consumed iron tablets as recommended (as many as ≥ 52 tablets in one year) (Kemenkes RI, 2018a).

Previous research on the effectiveness of giving iron tablets through the Bracelet Mia program reported a significant difference in the increase in Hb for young female adolescents (SMP) after being given iron tablets for one year. TTD purchasing program can increase Hb (12-14) mg/dl in risk groups (Nuraisya et al., 2019).

One of the causes of anemia for young female adolescents is the natural process experienced by young female adolescents who have gone through puberty every month, especially if they are not obedient in consuming iron tablets according to the rules. Research conducted in 2020, from research on the adherence of young female adolescents to taking iron tablets showed that parents have an essential role in adherence to taking iron supplements for young female adolescents (Ningtyias et al., 2020). The study results showed that adolescents with strong behavioral control had a level of adherence to taking iron tablets 3.90 (Runiari & Hartati, 2020). Several factors, including parental knowledge and supervision, can influence the adherence of adolescents to taking iron tablets. The results showed that there were differences in the level of adherence to drinking iron supplements in adolescents supervised by parents who received socialization with adolescents under parental supervision without socialization, p-value 0.000 (Nurjanah & Azinar, 2023).

The coverage of youth targets in West Sulawesi is still low (25.47%), lower than the national average coverage. Based on districts, the lowest coverage was Polewali Mandar district with 2.81%, and Mamuju with 12.71% (Kemenkes, 2013; Kemenkes RI, 2018b). Previous research recommended increasing the coverage of blood supplements, however there a lack of information on the effectiveness of peer assistance among young female adolescents in taking iron tablets. This study aimed to assess the impact of peer mentoring (adolescent girls who have previously been given training on adherence to taking iron supplement tablets) and its effect on tackling anemia in adolescent girls.

METHODS

The method used in this research is Quasy Experiment – pre-test–post-test group design. The population in this study were all teenagers who study in SMP in West Sulawesi Province. The total sample was 78 teenagers. The sampling technique uses random sampling with inclusive criteria: SMP students, young women aged 12-15, and those already getting menstruated.

The case group was teenagers at SMP 1 Mamuju in Mamuju Regency and the control group at SMPN 1 Malunda 1, Majene Regency. The case group facilitators are young female adolescents at the same school who have previously been given training. Companions are selected based on criteria such as role models and other female idols. The number of companions is ten people, each companion

accompanying eight people. A health center nutrition officer accompanied the control group. Participants consumed iron tablets every week together at school, and monitoring was carried out on companions weekly in both the case and control groups. The research time was 12 weeks (3 months) in July-November 2022. The Hb measurement was conducted twice, namely before being given the TTD tablet and one week after the 12th week of administration of the TTD. The Hb measurement before intervention was conducted to determine the initial state and differences between the groups.

Data were analyzed through univariate analysis to determine the distribution of values for each variable studied—bivariate analysis to assess the effect of the intervention given to each sample group. Hypothesis analysis was used to assess the difference in adherence between the case and control groups using an independent T-test and to assess the effect of adherence to anemia status using a paired T-test. A sample of 78 for each group using the proportional sampling method and the respondent have experienced menstruation.

RESULTS

The sample in this study were early adolescents ranging in age from 12 to 14 years. Table 1. illustrated characteristic of respondents. A total of 50% of the case group was 12 years old while the highest number of the control group was at 13 years age group. Table 1 also showed the level of adherence to taking TTD samples was assessed based on the number of TTD taken for 12 weeks. A total of 70.0% of the case group consumed >=11 tablets for 12 weeks while at the control group only 38.5% consumed >=11 tablets.

Table 1. Characteristics of respondents

Variables	Case		Control	
	n (78)	%	n (78)	%
Age (Year)				
12	39	50.0	15	19.2
13	23	29.5	33	42.3
14	16	20.5	30	38.5
Iron Tablets Consumption				
>=11 Tablet	70	89.7	30	38.5
<= 10 Tablet	8	10.3	48	61.5

The Hb test was carried out pre and post-in both sample groups as shown. The case group, as described in Table 2 of the anemia sample case group, was 19.2%, and post-intervention anemia 9%. The control group before the anemia intervention was 20.5% and after intervention the anemia was 2.6%.

Table 2. Hb test results before and after intervention

HB	Case				Control			
	Pre		Post		Pre		Post	
	n	%	n	%	n	%	n	%
Normal	63	80,8	78	100,0	62	79.5	76	97.4
Anemia	15	19,2	0	0,0	16	20.5	2	2.6
Total	78	100	78	98.7	78	100	78	100

Table 3 illustrates that the percentage, the average number of iron tablets consumed, and the number of adherent samples in the case group were higher than

in the control group. Statistical tests for the two groups of cases showed that there were differences in the cases with a p-value of 0.000.

Table 3 The Effect of peer assistance on compliance with taking iron tablets in young female adolescents.

Iron Tablets Consumption	Sample				p-value
	Case		Control		
	Adhering	Not Adhering	Adhering	Not Adhering	
Number of Iron Tables	89,7%	10,3%	38,5%	61,5%	0,000*
Average Adhering	70	11,43	7,91	48	0.000*

*Independent t-test. Significant P-value <0.05

Table 4. The effect of adherence to taking iron tablets on increased Hb in young female adolescents

Hb Status	Case		Control		p-value
	Normal	Anemia	Normal	Anemia	
Pre	80,8%	19,2%	79,5%	20,5%	0,319
Post	100%	0%	97,4%	2,6%	0,000*
Paired T-Test	0,000*		0,000*		

*) Paired t-test, significant p-value<0.05

Table 4 shows the differences in Hb changes in the two sample groups. Before the intervention, there was no difference in the Hb examination results for the two sample groups (p-value 0.319). After the intervention, the two sample groups had a difference in Hb changes (p-value 0.000). Changes in Hb before and after the intervention showed differences in the case and control groups (p-value 0.000).

DISCUSSION

This study showed the level of adherence to taking TTD samples was assessed based on the number of TTD taken for 12 weeks. A total of 70.0% of the case group consumed ≥ 11 tablets for 12 weeks while at the control group only 38.5% consumed ≥ 11 tablets. Young adolescent girls still lack awareness of the importance of iron tablets which affects their compliance. A previous study found that perceptions of susceptibility, seriousness, benefits, barriers, and beliefs affected teen girls' adherence to iron tablets (Thifal et al., 2023). Other reasons young female adolescents refuse to consume blood-boosting tablets are due to the effects after consuming iron tablets such as nausea, vomiting, pain, and dizziness (Fernández-Gaxiola & De-Regil, 2019).

This study found that anemia in the two case groups was 19.2% before the intervention, and in the control group was 20.5%. After the intervention, anemia in the case group was 0%, and the control group was 2.6%. Testing the hypothesis with the paired-T test obtained a p-value 0.000 for both the case and control groups. It illustrates the effect of the intervention given (giving TTD) for 12 weeks on changes in anemia status. It is important that compliance with consuming iron supplementation (TTD) affects the incidence of iron deficiency anemia in adolescents (Feriyanti et al., 2022). Studies mentioned that the low adherence of adolescents to consuming iron tablets (one tablet per week) has an impact on increasing cases of iron deficiency anemia in young women (Feriyanti et al., 2022).

Hypothesis testing with an independent T-test to assess differences in changes in anemia status in the anemia status of the case group and the controls obtained a p-value of 0.000, illustrating that there was a difference in changes in anemia status between the case group and the control group, in which the change in anemia status in the case group was better than the case group because the case group's compliance with TTD was better than the control group. Some of the results of previous studies that have been reported regarding anemia in female adolescents include anemia in female adolescents at SMA Negeri 3 Kota Tangerang of 57.89% (Ayuningtyas et al., 2020). There is a relationship between nutritional status and the incidence of anemia. Research on differences in results at SMA Negeri 1 Pangkalan Kerinci found that 58.6% of adolescents experienced anemia and 47.4% were not anemic. There is a relationship between nutritional status and the incidence of anemia (Apriyanti, 2019).

Some studies reported a relationship exists between nutritional knowledge and adherence to the consumption of Fe tablets and no relationship between diet and anemia status in female adolescents. Training involving parents as companions and supervisors for taking iron supplements at home showed that the compliance rate for young women in taking iron supplements was 76.1%. There is a difference in the level of obedience of girls from parents who supervise their children and parents who do not supervise (p-value 0.000). The results of research on anemia and family support on adherence to drinking iron tablets in adolescents reported that the level of adherence of adolescents was 54.9%, hypothesis testing with chi-square obtained a p-value of 0.414, there was no relationship between family support and family adherence to consuming iron supplement tablets (Fitranti et al., 2022; Samputri & Herdiani, 2022). Moreover, peers and the social environment have a strong impact on adolescents on eating patterns (Rasmaniar et al., 2022).

Furthermore, this study showed that the adherence to iron supplements in the control group was 89.7%, and in the control group, 38.5%. Hypothesis testing with the Independent T-test obtained a p-value of 0.000. There was a difference in compliance between the group accompanied by peers and the group accompanied by a nutrition officer at the puskesmas (public health center). What was obtained from the results of this study and research that has been previously reported there are fundamental similarities; that is, accompanying young women in consuming iron tablets is very important because the assistance provided is the motivation for young women. Knowledge is essential but insufficient to change a person's behavior among young women to regularly consume iron tablets.

CONCLUSION

Before intervention, the anemia status in case group was 19.2% and post-intervention was 9%. While the control group before intervention was 20.5% and after intervention was 2.6%. The two sample groups had a difference in Hb changes (p-value 0.000). Changes in Hb before and after the intervention showed differences in the case and control groups (p-value 0.000). It is highly recommended that peer assistance as one of the interventions to encourage young adolescent girls to consume iron tablet supplements regularly to reduce anemia among female adolescents.

Peers is crucial to be involved in the anemia reduction intervention as one of the stakeholders that can improve nutritional status of adolescent girls and facilitate the provision of iron supplementation in their respective communities. Adolescent girls' use of iron supplements was found to be influenced by their peers. Adolescent girls who attend school or not can be greatly influenced by easy adopters when it comes to iron supplementation. This implies that peers can act as educators, motivators, and

supporters of better behavior regarding iron supplementation during adolescence.

REFERENCES

- Apriyanti, F. (2019). Hubungan Status Gizi dengan Anemia pada Remaja Putri SMAN 1 Pangkalan Kerinci Kabupaten Palalawan Tahun 2019. *Jurnal Doppler Universitas Pahlawan Tuanku Tambusai*, 3(2), 18–21. <https://journal.universitaspahlawan.ac.id/index.php/doppler/article/view/429>
- Ayuningtyas, G., Fitriani, D., & Parmah. (2020). Hubungan Status Gizi dengan Kejadian Anemia pada Remaja Puteri di Kelas XI SMA Negeri 3 Tangerang Selatan. *Prosiding Senantias* 2020, 1(1), 877–886. <http://openjournal.unpam.ac.id/index.php/Senan/article/view/9069>
- Feriyanti, A., Deviatin, N. S., Nurmala, I., Widati, S., & Atmaka, D. R. (2022). Determinant of Adherence to iron supplementation in Adolescent Girl In Spesific Intervention For Stunting Prevention: Systematic Review. *Media Gizi Indonesia*, 17(1SP), 90–96. <https://doi.org/10.20473/mgi.v17i1SP.90-96>
- Fernández-Gaxiola, A. C., & De-Regil, L. M. (2019). Intermittent Iron Supplementation for Reducing Anaemia and Its Associated Impairments in Adolescent and Adult Menstruating Women. *Cochrane Database of Systematic Reviews*, 2020(5). <https://doi.org/10.1002/14651858.CD009218.pub3>
- Fitranti, D. Y., Fitriyah, K., Kurniawati, M. D., Wardah, S., & ... (2022). Pencegahan Anemia Pada Remaja Putri dengan Metode Focus Group Discussion di SMA Negeri 3 Pekalongan. *Proactive* 1(1), 46–54. Retrieved from <https://ejournal2.undip.ac.id/index.php/proactive/article/view/13764>
- Kemkes. (2013). *Riset Kesehatan Dasar Propinsi Sulawesi Selatan 2013*. Jakarta: Kementerian Kesehatan. Retrieved from <https://repository.badankebijakan.kemkes.go.id/id/eprint/4831/>
- Kemkes RI. (2008). *Riset Kesehatan Dasar (RISKESDAS) 2007*. Jakarta: Kementerian Kesehatan R.I. Retrieved from <https://layanandata.kemkes.go.id/katalog-data/riskesdas/ketersediaan-data/riskesdas-2007>
- Kemkes RI. (2010). *Riset Kesehatan Dasar (Riskesdas) 2010*. Jakarta: Kementerian Kesehatan R.I. Retrieved from <https://layanandata.kemkes.go.id/katalog-data/riskesdas/ketersediaan-data/riskesdas-2010>
- Kemkes RI. (2013). *Riset Kesehatan Dasar (Riskesdas) 2013*. Jakarta: Kementerian Kesehatan R.I. Retrieved from https://repository.badankebijakan.kemkes.go.id/4467/1/Laporan_riskesdas_2013_final.pdf
- Kemkes RI. (2018a). *Laporan Nasional Riskesdas Tahun 2018*. Jakarta: Kementerian Kesehatan R.I. Retrieved from <https://repository.badankebijakan.kemkes.go.id/3514/1/Laporan%20Riskesdas%202018%20Nasional.pdf>
- Kemkes RI. (2018b). *Laporan Riskesdas Sulawesi Barat 2018*. Jakarta: Kementerian Kesehatan R.I. Retrieved from <https://repository.badankebijakan.kemkes.go.id/3893/1/Laporan%20Riskesdas%20Sulbar%202018.pdf>
- Laksono, A. D., Wulandari, R. D., Amaliah, N., & Wisnuwardani, R. W. (2022). Stunting among children under two years in Indonesia: Does maternal education matter? *PLOS ONE*, 17(7), e0271509. <https://doi.org/10.1371/journal.pone.0271509>
- Mitra. (2020). Adolescent Knowledge of Anemia and Iron Supplement Consumption Before and After Health Education. *International Journal of Science and Society*, 2(4), 10–18. <https://doi.org/10.54783/ijssoc.v2i4.187>
- Ningtyas, F. W., Quraini, D. F., & Rohmawati, N. (2020). Perilaku Kepatuhan Konsumsi Tablet Tambah Darah Remaja Putri di Jember, Indonesia. *Jurnal PROMKES*, 8(2), 154. <https://doi.org/10.20473/jpk.V8.I2.2020.154-162>

- Nuraisya, W., Luqmanasari, E., & Setyowati, A. (2019). Efektifitas Pemberian TTD Melalui Program Gelang Mia Pada Remaja Terhadap Tingkat Anemia (Studi Analitik Pada Remaja Putri di SMP Seluruh Kecamatan Pare). *Jurnal Ners Dan Kebidanan (Journal of Ners and Midwifery)*, 6(3), 310–319. <https://doi.org/10.26699/jnk.v6i3.ART.p310-319>
- Nurbaya, N., & Najdah, N. (2023). Food Security Status and Coping Strategies Among Adolescents During the Covid-19 Pandemic in Mamuju. *Poltekita : Jurnal Ilmu Kesehatan*, 17(1), 130–136. <https://doi.org/10.33860/jik.v17i1.1894>
- Nurjanah, A., & Azinar, M. (2023). Kepatuhan Konsumsi Tablet Tambah Darah pada Sekolah Percontohan Kesehatan. *Higeia Journal of Public Health Research and Development*, 7(2), 244–254. <https://doi.org/10.15294/higeia.v7i2.64227>
- Peraturan Menteri Kesehatan Nomor 51 Tahun 2016 tentang Standar Produk Suplementasi Gizi, (2016). Retrieved from <https://peraturan.bpk.go.id/Details/114009/permenkes-no-51-tahun-2016>
- Rasmaniar, R., Nurlaela, E., Ahmad, A., & Nurbaya, N. (2022). Pendidikan Teman Sebaya melalui Pemberdayaan Kader Posyandu Remaja terhadap Pengetahuan, Sikap, dan Perilaku Remaja tentang Manfaat Gizi dalam Pencegahan Stunting: Penelitian Kuasi Eksperimen. *Health Information : Jurnal Penelitian*, 14(1), 76–88. <https://doi.org/10.36990/hijp.v14i1.498>
- Runiari, N., & Hartati, N. N. (2020). Pengetahuan Dengan Kepatuhan Minum Tablet Tambah darah Pada Remaja Putri. *Jurnal Gema Keperawatan*, 13(2), 103–110. <https://doi.org/10.33992/jgk.v13i2.1321>
- Samputri, F. R., & Herdiani, N. (2022). Pengetahuan dan Dukungan Keluarga dengan Kepatuhan Konsumsi Tablet Tambah Darah pada Remaja Putri. *Media Kesehatan Masyarakat Indonesia*, 21(1), 69–73. <https://doi.org/10.14710/mkmi.21.1.69-73>
- Thifal, F., Noviasy, R., Ulfa, U. M., Farahita, L., Utari, A., Kurniawati, E. R., & Wisnuwardani, R. W. (2023). Factors related to the compliance to consuming iron-folic acid in young women in East Kalimantan, Indonesia. *Action: Aceh Nutrition Journal*, 8(2), 260. <https://doi.org/10.30867/action.v8i2.928>
- Titaley, C. R., Ariawan, I., Hapsari, D., Muasyaroh, A., & Dibley, M. J. (2019). Determinants of the Stunting of Children Under Two Years Old in Indonesia: A Multilevel Analysis of the 2013 Indonesia Basic Health Survey. *Nutrients*, 11(5), 1106. <https://doi.org/10.3390/nu11051106>