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Determinants of maternals' handwashing practices in rural Dayak community: Evidence from Tasik Payawan, Katingan Regency Central Kalimantan

Oktaviani[1*,2], Eti Poncorini Pamungkasari[1], Vitri Widyaningsih[1]

[1]Doctoral Program in Public Health, Faculty of Medicine, Universitas Sebelas Maret, Surakarta Indonesia.
[2]Dept. of Midwifery, Kemenkes Politeknik Kesehatan Palangka Raya, Central Kalimantan Indonesia

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Abstract

Water, sanitation, and hygiene (WASH) interventions, particularly handwashing practices, significantly impact children's growth and development by 20%. Primarily, handwashing pratice prevent chronic exposure to enteric pathogens. Therefore, this study aims to assess the determinants of handwashing practice in rural community with limited access to clean water. This was a cross-sectional study, conducted in the rural Tasik Payawan District, located by the Katingan River, from October-November 2024. Approximately 30 women with children aged 6 to 24 months were included. We gathered sociodemographic and behavioral data related to handwashing with a questionnaire. Two-way association tables, ⍰2 p-value were calculated using EasyR v 1.68 for Windows. The analysis revealed that maternal knowledge (p-value: 0.010), attitudes (p-value: 0.006), and water sources (p-value: 0.017) significantly influence handwashing behavior. The study indicated that mothers with strong decision-making skills regarding handwashing positively impact these behaviors. Our findings suggest that maternal knowledge and attitudes are crucial for effective handwashing practices in the Tasik Payawan sub-district of Katingan. Enhancing maternal knowledge is essential for improving handwashing behaviors, suggesting that mothers require targeted educational interventions.

Correspondence Address:
Jl George Obos No. 30 Palangka Raya, Central Kalimantan, Indonesia 73112
E-mail: Oktaviani@polkesraya.ac.id

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Introduction

Children in rural Indonesia experience disproportionate stunting. UNICEF Indonesia's 2023 report, "Towards a Future in Indonesia Without Child Undernutrition," indicates that 20% of children under five are stunted, with elevated rates in rural areas: Papua Tengah (39.4%), Nusa Tenggara Timur (37.9%), and Pegunungan (37.3%). UNICEF reported that inadequate rural water, sanitation, and hygiene exacerbated undernutrition by elevating the incidence of diarrheal diseases and environmental enteric dysfunction. The report indicates that chronic inflammation and nutrient malabsorption resulting from WASH-related infections contribute to the persistence of stunting. Coordinated nutrition and WASH interventions, particularly during the first 1,000 days, mitigate rural stunting and enhance child development. Water, sanitation and hygiene, WASH, interventions were suggested to have a significant detrimental effect on child growth and development resulting from sustained exposure to enteric pathogens (Beal et al., 2019; Cumming & Cairncross, 2016; Torlesse et al., 2016). It is also considered as priority areas to investment, as for STOP Stunting campaign in South Asia(Aguayo & Menon, 2016; Humphrey et al., 2019). Studies highlighted the WASH intervention effects on linear growth and diarrhoea(Pickering et al., 2019), also its associations with sanitation, enteric infections in rural northwest Ethiopia (Aziz et al., 2023; Cumming et al., 2019; Gizaw et al., 2022). Hidenoriiharadaa have specifically review these factors as the Sanitation Triangle, which comprises the Socio-culture, health and materials aspects (Seijiinakao Hidenoriiharadaa, 2022). However, little attention has been conducted in Indonesia towards research recommendations.

Recent evidence from Indonesia has been drawn from the socio-economic and rural-urban disparities aspect (Widyaningsih et al., 2022).

This study addresses a critical gap in public health research by examining the determinants of maternal handwashing practices in the Dayak rural community of Central Kalimantan. Handwashing with soap is a proven, cost-effective intervention to reduce diarrheal and respiratory infections, particularly among children under five (Dhital et al., 2024). However, indigenous communities often face unique barriers—including cultural beliefs, limited access to sanitation infrastructure, and low maternal decision-making autonomy—that influence hygiene behavior. In the Dayak context, traditional practices such as open defecation and reliance on river water for daily hygiene persist despite awareness of sanitation benefits (Indrayadi et al., 2023; Ngambut et al., 2023). By focusing on maternal decision-making in hygiene within this indigenous setting, the study contributes novel insights into behavioral determinants that are often overlooked in broader national surveys. These findings are essential for designing culturally appropriate WASH interventions and advancing equitable public health outcomes.

Handwashing with soap is a simple, cost-effective, and efficient way to manage and prevent communicable diseases, especially in settings with limited resources like Tasik Payawan Sub-district. Tasik Payawan is a district in Katingan Regency, situated next to the Katingan River. This river is a vital source of sustenance and serves as a hub for daily activities. However, it also has the potential to act as a pathway for the spread of infectious diseases, such as diarrhea. The geographical conditions in this area can significantly influence mothers' behaviors and hygiene practices, particularly regarding handwashing. In children under five, it is essential for the prevention and treatment of skin infections, acute respiratory infections, and diarrhea (Aiello et al., 2008; Prüss-Ustün et al., 2019). Campaigns to prevent the spread of COVID-19 have made this clear on a global scale by emphasizing the importance of handwashing with soap (Amegah, 2020; Dwipayanti et al., 2021; Wu et al., 2023). Handwashing with soap significantly reduces the risk of infection, as demonstrated by the COVID-19 pandemic (Dhital et al., 2024). As a result, public health campaigns have placed a greater emphasis on encouraging good hygiene habits and the value of accessible sanitary facilities in reducing the spread of infectious diseases.

The observed drop in infection rates highlights the importance of maintaining proper hygiene habits after the pandemic. Therefore, it is essential to observe these hygiene practices in rural communities. We examined maternal hygiene in the Tasik Payawan Sub-District to provide empirical evidence that can assist policymakers and stakeholders in improving the quality and safety of water sources in these communities.

Methods

This research utilizes a Systematic Literature Review (SLR) approach with a descriptive design to collect 50 articles and analyze articles available on the internet. Searching for scientific publications by identifying articles published between 2020-2024 using keywords: microplastics, drinking water, and packaged water, from Indonesian electronic databases such as *Google Scholar*, *PubMed* and *Scoopus.* Data analysis using PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis). The analysis focuses on the presence and identification of microplastic content in drinking water consumed in Indonesia by identifying articles published between 2020 and 2024, using keywords such as microplastics and drinking water.

Results

This study examines aspects of maternal behavior related to handwashing before feeding a child, preparing meals, using the toilet, and breastfeeding. Figure 1 illustrates the proportion of handwashing practices among mothers. Figure 1 demonstrates that all four markers of handwashing behavior are predominantly observed.

Table 1 Association of respondents' characteristics (mothers' age, households' income, education level, occupation, and behaviour predictors (knowledge, attitude) with hand-wash practices.

Characteristics	Hand-wash		χ^2 p-value
	Excellent n:16 (%)	Poor n:14 (%)	
Mothers age			
<20	0 (0.0)	2 (14.3)	0.218
20 - 35	13 (81.2)	11 (78.6)	
>35	3 (18.8)	1 (7.1)	
Mothers Education			
Elementary	9 (56.2)	6 (42.9)	0.714
Middle to Higher Edu	7 (43.8)	8 (57.1)	

Mothers Occupation			
Unemployed	15 (93.8)	11 (78.6)	0.495
Employed	1 (6.2)	3 (21.4)	
Households Income			
< Rp. 3.230.700,39	10 (62.5)	9 (64.3)	1.000
≥ Rp. 3.230.700,39	6 (37.5)	5 (35.7)	
Knowledge			
Excellent	12 (75.0)	3 (21.4)	0.010*
Poor	4 (25.0)	11 (78.6)	
Attitude			
Excellent	10 (62.5)	1 (7.1)	0.006*
Poor	6 (37.5)	13 (92.9)	
Water-sources			
Artesian-well/water-pump	8 (50.0)	0 (0.0)	0.017*
Protected dug-well	4 (25.0)	6 (42.9)	
Refill-water	4 (25.0)	7 (50.0)	
Tap-water/PDAM	0 (0.0)	1 (7.1)	
Drinking water-sources			
Artesian-well/water-pump	5 (31.2)	6 (42.9)	0.579
Protected dug-well	10 (62.5)	6 (42.9)	
Tap-water/PDAM	0 (0.0)	1 (7.1)	
Unprotected dug-well	1 (6.2)	1 (7.1)	
Water-treatment			
Boils	12 (75.0)	8 (57.1)	0.518
Refill	4 (25.0)	6 (42.9)	

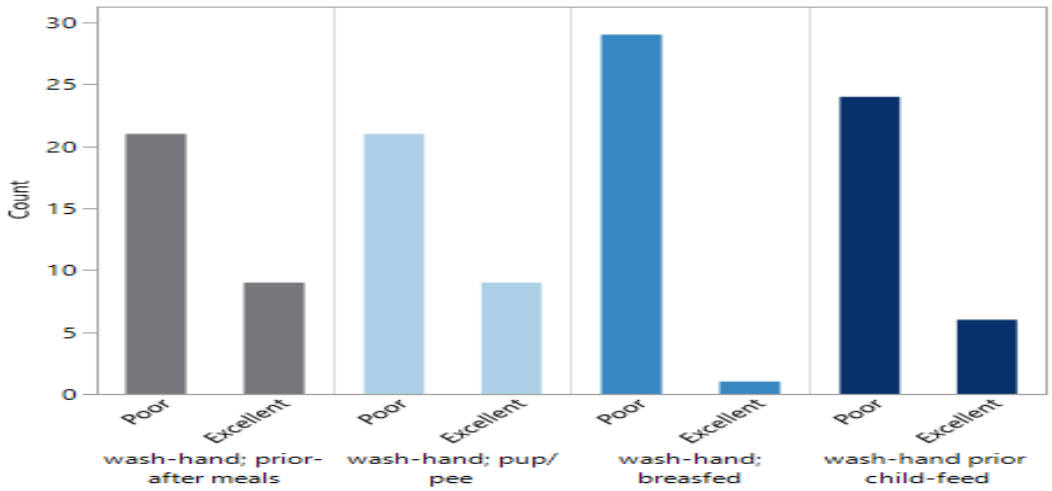

Figure 1 The proportion of mother hand-washing practices as per indicator: prior and after meals, toilet, breastfed and prior to child-feed.

Each category with inadequate adherence comprised over 20 mothers. Only one in thirty mothers washes their hands before breastfeeding, making it the practice that is followed the least. Consequently, further association analysis is necessary to identify the factors that may affect handwashing behaviors, specifically the knowledge and attitudes of mothers.

Association between demographics, behavior predictors, and hand-washing practices.

A difference exists among the factors of age, household income, education level, occupation, and handwashing practices (Table 1). This variance is evident in the statistical significance of attitude (p = 0.006) and knowledge (p = 0.010). The study found that mothers with strong decision-making skills regarding appropriate handwashing procedures were significant contributing factors. These educational initiatives are recommended due to the significant differences in water sources (p: 0.017). The study indicates that community water sources mainly consist of protected dug wells and artesian wells or water pumps. However, the actual condition of the protected dug wells is inadequate (Figure 2), as they are combined with water pumps and surrounded by overgrown vegetation. This situation implies that the

maintenance and management of the protected dug wells are insufficient, potentially compromising water quality. As a result, the surrounding environment may increase contamination risks for the community.

Figure 2 The actual condition of modified dug-well (combined with a water-pump or many water pumps). All wells are overgrown and does not meet the WHO criteria for protected well.

Discussion

Each category with inadequate adherence comprised over 20 mothers. Only one in thirty mothers washes their hands before breastfeeding, making it the practice that is followed the least. This condition was also identified in Nepal (Dhital et al., 2024), where the authors concluded that insufficient information about handwashing, especially before breastfeeding and feeding a child, poses a challenge and hinders proper hygiene practices. Consequently, further association analysis is necessary to identify the factors that may affect handwashing behaviors, specifically the knowledge and attitudes of mothers.

The research indicated that the number of mothers displaying excellent handwashing behaviors (n = 16) was nearly equal to those showing poor behaviors (n = 14). Research has confirmed that there is a linear relationship between maternal knowledge and their hand-washing behavior in Nepal (Andualem et al., 2019) and Bangalore, India (Divya et al., 2015). This suggests a need for targeted educational initiatives to enhance handwashing practices among individuals with inadequate habits (Mekonen et al., 2021). Furthermore, understanding the barriers that hinder proper handwashing could aid in creating more effective community health programs (Null et al., 2018). The low levels of handwashing knowledge and attitudes observed in the Dayak rural community are shaped by a complex interplay of cultural norms, infrastructural limitations, and restricted access to health information. Culturally, hygiene practices are often embedded in traditional beliefs and daily routines, such as reliance on river water for bathing and defecation, which may not align with modern sanitation standards. Infrastructure remains a major barrier: many households lack access to clean water, soap, or functional latrines, making consistent handwashing impractical even when awareness exists (Indrayadi et al., 2023; Ngambut et al., 2023). Additionally, geographic isolation and limited health outreach programs contribute to poor dissemination of hygiene education. Government interventions often fail to consider indigenous knowledge systems and local customs, resulting in low community engagement and adoption of recommended practices. These factors collectively explain why knowledge and attitudes toward handwashing remain low, despite national campaigns and global comparisons.

Improving maternal knowledge through community programs could lead to significant public health benefits, as proper handwashing is crucial for preventing the spread of infectious diseases. By focusing on education and awareness, we can foster healthier practices that will ultimately contribute to better health outcomes for families and communities. Furthermore, understanding the barriers that hinder proper handwashing could aid in creating more effective community health programs(Null et al., 2018). These programs can also empower mothers to become advocates for health within their communities, promoting a culture of hygiene and wellness. We can tailor initiatives to address specific needs and challenges faced by families in diverse settings by engaging local leaders and utilizing culturally relevant materials.

During the study period, we received valid evidence related to the results of water quality measurements in the upper catchments. The results of the inspection showed that the content of heavy metals, such as chromium (Cr (VI), Fe, Mn, and Al), in the sampled water source used by the villagers exceeded the threshold value. In addition, the presence of E. coli and total coliform bacteria is also observed (Primary Health Centre-BB, 2025). Research has shown that the presence of heavy metals in the community water sources as water contaminants have adverse effects on human health, especially the

health of mothers and children (Arun et al., 2022; Cameron et al., 2021; Green et al., 2019; Rahman et al., 2015).

The available research demonstrates that the implementation of reverse osmosis has effectively diminished the concentration of chromium in treated water. Nonetheless, the investigators have underscored that effective chromium extraction necessitates the implementation of diverse filter membranes and the strategic manipulation of pH levels(Kocurek et al., 2014). Therefore, although this experiment has been demonstrated to effectively eliminate chromium under controlled conditions, it may be difficult to implement in a realistic setting.

This study reveals two principal findings. The initial finding highlights the crucial influence of social interactions on cognitive development, whereas the subsequent one stresses the importance of customized educational approaches that cater to varied learning styles. Collectively, these insights provide a basis for enhanced pedagogical approaches in diverse educational settings. Furthermore, there exists an urgent necessity for educational initiatives that advocate enhanced hand-washing practices, aimed at both mothers and the broader community. To engage their interest, we proposed a secondary initiative utilizing water quality measurements as a reminder, akin to the strategy employed during the Covid-19 pandemic.

Conclusion

Our study's findings suggest that both maternal knowledge and attitudes are linked to hand-washing practices in the Tasik Payawan Sub-district of Katingan, Central Kalimantan. It is essential that educational interventions for mothers focus on enhancing their knowledge, as their understanding is a crucial factor in improving their decision-making regarding handwashing practices.

Limitations of the Study

The limitation of this study is that mothers' handwashing practices were assessed solely through a questionnaire, and the sample size was minimal. Further research is needed to explore the causal relationship between WASH (Water, Sanitation, and Hygiene) conditions, water quality, and the risk factors linked to enteric infections, with an emphasis on a broader geographical area and a larger population. We acknowledge that our sample size may seem modest (n=30), which could restrict the generalizability of our findings. Consequently, future studies with larger and more diverse samples are recommended to validate and expand upon these results.

Author Contributions

Conceptualization, investigation, original draft preparation: OM; Methodology and Supervision: VW and EPP; Writing—review and Editing: VW. All authors have read and agreed to the published version of the manuscript

Institutional Review Board Statement

The research was acquired ethical clearance from Research ethic committee, Faculty of Medicine Universitas Sebelas Maret, No. 218/UN27.06.11/KEP/EC/2024, issued on Oct, 8th 2024

References

Aguayo, V. M., & Menon, P. (2016). Stop stunting: Improving child feeding, women's nutrition and household sanitation in South Asia. Maternal and Child Nutrition, 12, 3–11. https://doi.org/10.1111/mcn.12283

Aiello, A. E., Coulborn, R. M., Perez, V., & Larson, E. L. (2008). Effect of hand hygiene on infectious disease risk in the community setting: A meta-analysis. American Journal of Public Health, 98(8), 1372–1381. https://doi.org/10.2105/AJPH.2007.124610

Althubaiti, A. (2023). Sample size determination: A practical guide for health researchers. Journal of General and Family Medicine, 24(2), 72–78. https://doi.org/10.1002/jgf2.600

Amegah, A. K. (2020). Improving handwashing habits and household air quality in Africa after COVID-19. The Lancet Global Health, 8(9), e1110–e1111. https://doi.org/10.1016/S2214-109X(20)30353-3

Aziz, I., Noreen, Z., Ijaz, U. Z., Gundogdu, O., Hamid, M. H., Muhammad, N., Khan, A., & Bokhari, H. (2023). A prospective study on linking diarrheagenic E. coli with stunted childhood growth in relation to gut microbiome. Scientific Reports, 13(1). https://doi.org/10.1038/s41598-023-32491-x

Beal, T., Le, D. T., Trinh, T. H., Burra, D. D., Huynh, T., Duong, T. T., Truong, T. M., Nguyen, D. S., Nguyen, K. T., de Haan, S., & Jones, A. D. (2019). Child stunting is associated with child, maternal, and environmental factors in Vietnam. Maternal and Child Nutrition, 15(4). https://doi.org/10.1111/mcn.12826

Cumming, O., Arnold, B. F., Ban, R., Clasen, T., Esteves Mills, J., Freeman, M. C., Gordon, B., Guiteras, R., Howard, G., Hunter, P. R., Johnston, R. B., Pickering, A. J., Prendergast, A. J., Prüss-Ustün, A., Rosenboom, J. W., Spears, D., Sundberg, S., Wolf, J., Null, C., … Colford, J. M. (2019). The implications of three major new trials for the effect of water, sanitation and hygiene on childhood diarrhea and

stunting: A consensus statement. BMC Medicine, 17(1). https://doi.org/10.1186/s12916-019-1410-x

Cumming, O., & Cairncross, S. (2016). Can water, sanitation and hygiene help eliminate stunting? Current evidence and policy implications. Maternal and Child Nutrition, 12, 91–105. https://doi.org/10.1111/mcn.12258

Dhital, S. R., Chojenta, C., Bagade, T., & Loxton, D. (2024). Maternal Handwashing with Soap Practices and Associated Risk Factors in Nepal: A Systematic Review. Hygiene, 4(1), 14–22. https://doi.org/10.3390/hygiene4010002

Dwipayanti, N. M. U., Lubis, D. S., & Harjana, N. P. A. (2021). Public Perception and Hand Hygiene Behavior During COVID-19 Pandemic in Indonesia. Frontiers in Public Health, 9(May), 1–12. https://doi.org/10.3389/fpubh.2021.621800

Gizaw, Z., Yalew, A. W., Bitew, B. D., Lee, J., & Bisesi, M. (2022). Stunting among children aged 24–59 months and associations with sanitation, enteric infections, and environmental enteric dysfunction in rural northwest Ethiopia. Scientific Reports, 12(1). https://doi.org/10.1038/s41598-022-23981-5

Humphrey, J. H., Mbuya, M. N. N., Ntozini, R., Moulton, L. H., Stoltzfus, R. J., Tavengwa, N. V., Mutasa, K., Majo, F., Mutasa, B., Mangwadu, G., Chasokela, C. M., Chigumira, A., Chasekwa, B., Smith, L. E., Tielsch, J. M., Jones, A. D., Manges, A. R., Maluccio, J. A., Prendergast, A. J., … Makoni, T. (2019). Independent and combined effects of improved water, sanitation, and hygiene, and improved complementary feeding, on child stunting and anaemia in rural Zimbabwe: a cluster-randomised trial. The Lancet Global Health, 7(1), e132–e147. https://doi.org/10.1016/S2214-109X(18)30374-7

Indrayadi, I., Pamungkasari, E. P., Padmawati, R. S., & Probandari, A. (2023). Why Do Villagers Hesitate To Use the Toilet for Defecation?: an Ethnographic Study in Dayak Bakumpai People in South Borneo, Indonesia. Malaysian Journal of Public Health Medicine, 23(1), 238–244. https://doi.org/10.37268/mjphm/vol.23/no.1/art.1794

Kanda, Y. (2013). Investigation of the freely available easy-to-use software "EZR" for medical statistics. Bone Marrow Transplantation, 48(3), 452–458. https://doi.org/10.1038/bmt.2012.244

Ngambut, K., Tondok, S. B., Albertus Ata Maran, Telan, A. B., Vanchapo, A. R., Purba, E. R. ., & Djunaedi. (2023). Determinants of Hand Washing with Soap (HWWS) in Rural Communities: Cross Sectional Study in Manggarai Regency East Nusa Tenggara Indonesia. International Journal Of Health Sciences, 1(2), 75–84.

Pickering, A. J., Null, C., Winch, P. J., Mangwadu, G., Arnold, B. F., Prendergast, A. J., Njenga, S. M., Rahman, M., Ntozini, R., Benjamin-Chung, J., Stewart, C. P., Huda, T. M. N., Moulton, L. H., Colford, J. M., Luby, S. P., & Humphrey, J. H. (2019). The WASH Benefits and SHINE trials: interpretation of WASH intervention effects on linear growth and diarrhoea. In The Lancet Global Health (Vol. 7, Issue 8, pp. e1139–e1146). Elsevier Ltd. https://doi.org/10.1016/S2214-109X(19)30268-2

Prüss-Ustün, A., Wolf, J., Bartram, J., Clasen, T., Cumming, O., Freeman, M. C., Gordon, B., Hunter, P. R., Medlicott, K., & Johnston, R. (2019). Burden of disease from inadequate water, sanitation and hygiene for selected adverse health outcomes: An updated analysis with a focus on low- and middle-income countries. International Journal of Hygiene and Environmental Health, 222(5), 765–777. https://doi.org/10.1016/j.ijheh.2019.05.004

Seijiinakao Hidenoriiharadaa, T. (2022). Global Environmental Studies The Sanitation Triangle Socio-Culture, Health and Materials. In T. Yamauchi, S. Nakao, & H. Harada (Eds.), The Sanitation Triangle Socio-Culture, Health and Materials (pp. 1–264). Springer. https://link.springer.com/bookseries/10124

Torlesse, H., Cronin, A. A., Sebayang, S. K., & Nandy, R. (2016). Determinants of stunting in Indonesian children: Evidence from a cross-sectional survey indicate a prominent role for the water, sanitation and hygiene sector in stunting reduction. BMC Public Health, 16(1). https://doi.org/10.1186/s12889-016-3339-8

Widyaningsih, V., Mulyaningsih, T., Rahmawati, F. N., & Adhitya, D. (2022). Determinants of socioeconomic and rural-urban disparities in stunting: evidence from Indonesia. Rural and Remote Health, 22(1), 1–9. https://doi.org/10.22605/RRH7082

Wu, Y., Luo, L., Wang, Y., Chen, X., Mo, D., Xie, L., & Sun, A. (2023). Strengthened public awareness of one health to prevent zoonosis spillover to humans. Science of the Total Environment, 879. https://doi.org/10.1016/j.scitotenv.2023.163200