

Association Between Personal Hygiene Practices and Typhoid Fever Among Patients Attending a Primary Healthcare Centre in Highland Papua, Indonesia: A Cross-Sectional Study

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ABSTRACT

Background: Typhoid fever remains a public health concern in developing countries, particularly in areas with poor sanitation and inadequate personal hygiene. Poor hygiene practices increase the risk of *Salmonella Typhi* transmission and contribute to the persistence of the disease.

Objective: This study aimed to analyze the relationship between personal hygiene and the incidence of typhoid fever in the working area of Awimbon Primary Health Centre, Pegunungan Bintang Regency, Indonesia.

Methods: A cross-sectional study was conducted among 45 respondents using a total sampling technique. Data on hand hygiene, drinking water hygiene, food hygiene, and toilet sanitation were collected using a structured questionnaire. Typhoid fever status was obtained from medical records. Data were analyzed using the Chi-square test and Cramer's V, with a significance level of $p < 0.05$.

Results: Poor hand hygiene, drinking water hygiene, food hygiene, and toilet sanitation were all significantly associated with typhoid fever ($p < 0.05$). Hand hygiene (Cramer's V = 0.617) and food hygiene (Cramer's V = 0.566) showed strong associations, while drinking water hygiene (0.388) and toilet sanitation (0.326) demonstrated moderate associations.

Conclusion: Personal hygiene was significantly associated with the incidence of typhoid fever. Improving hygiene practices through community-based health education and sanitation interventions is recommended to reduce the burden of typhoid fever.

Keywords: Typhoid fever, Personal hygiene, Hand hygiene, Sanitation, Cross-sectional study.

INTRODUCTION

Typhoid fever remains a major public health concern, particularly in low- and middle-income countries where access to safe drinking water, sanitation, and hygiene remains inadequate. The disease, caused by *Salmonella enterica* serovar *Typhi*, is transmitted primarily through the fecal–oral route via contaminated food and water. Despite advances in prevention and treatment, typhoid fever continues to impose a substantial disease burden, with an estimated 9–14 million cases and more than 100,000 deaths annually worldwide (GBD 2021 Typhoid and Paratyphoid Collaborators, 2024; World Health Organization [WHO], 2023).

Indonesia remains one of the endemic countries for typhoid fever, where the disease continues to contribute significantly to morbidity, particularly in areas with inadequate sanitation and poor environmental hygiene (Kementerian Kesehatan Republik Indonesia, 2023). In remote regions such as Highland Papua, geographical barriers, limited access to clean water, and inadequate sanitation infrastructure further increase the risk of typhoid transmission. These conditions highlight the importance of preventive strategies targeting environmental and behavioural risk factors.

Personal hygiene is recognized as one of the most important modifiable determinants of typhoid fever. Proper handwashing with soap before eating, consumption of safe drinking water, hygienic food handling, and appropriate sanitation practices are

essential interventions to interrupt the fecal–oral transmission of *Salmonella Typhi* (Prüss-Ustün et al., 2023; WHO & UNICEF, 2023). Conversely, poor hygiene behaviours increase exposure to contaminated food and water, thereby elevating the risk of infection.

Previous studies have consistently demonstrated that inadequate hand hygiene, unsafe drinking water, poor food hygiene, and lack of improved sanitation are significantly associated with typhoid fever (Birhan et al., 2023; Kim et al., 2022; Marchello et al., 2022). However, most published studies have been conducted in urban or densely populated settings, whereas evidence from geographically isolated communities remains scarce. Environmental conditions, cultural practices, and access to health services differ considerably between urban and remote populations, suggesting that the determinants of typhoid fever may also vary.

Awimbon Primary Health Centre, located in Pegunungan Bintang Regency, Highland Papua, serves communities with limited sanitation facilities and restricted access to clean water. According to the health centre records, typhoid fever remains one of the leading infectious diseases reported in the area. Nevertheless, evidence regarding the association between personal hygiene practices and typhoid fever in this remote setting is still limited.

Therefore, this study aimed to analyze the relationship between personal hygiene practices,

including hand hygiene before meals, drinking water hygiene, food hygiene, and toilet sanitation, and the incidence of typhoid fever among residents in the working area of Awimbon Primary Health Centre, Pegunungan Bintang Regency, Indonesia.

METHODS

This analytical observational study employed a cross-sectional design to investigate the association between personal hygiene practices and the incidence of typhoid fever in the working area of Awimbon Primary Health Centre, Pegunungan Bintang Regency, Highland Papua, Indonesia. The study was conducted between July and November 2024. The study population comprised all patients who attended the primary health centre during the study period. A total of 45 respondents were included using a total sampling technique.

Data were collected through face-to-face interviews using a structured questionnaire that assessed four domains of personal hygiene: hand hygiene before meals, drinking water hygiene, food hygiene, and toilet sanitation. Each domain consisted of 10 dichotomous (Yes/No) items, with higher scores indicating better hygiene practices. Based on the total score, participants were classified into good or poor hygiene categories according to predefined criteria. The outcome variable was the incidence of typhoid fever, which was determined from physician-confirmed diagnoses documented in the medical records of Awimbon Primary Health Centre.

Data were analyzed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize participants' characteristics and study variables, and the results were presented as frequencies and percentages. The association between personal hygiene practices and typhoid fever was examined using the Chi-square test. The strength of the associations was evaluated using Cramer's V coefficient, and statistical significance was established at a two-sided *p*-value of <0.05.

Ethical principles were maintained throughout the study by obtaining written informed consent from all participants prior to data collection. Participants were informed about the purpose of the study, and their participation was entirely voluntary. To ensure privacy, respondents' identities were anonymized using identification codes, and all personal information was kept confidential and used solely for research purposes.

RESULT

A total of 45 participants were enrolled in this study. Among them, 22 (48.9%) were diagnosed with typhoid fever, while 23 (51.1%) had no history of the disease. The majority of participants were aged <20 years (48.8%), followed by those aged 21–30 years (31.1%) and >30 years (20.0%). Male participants accounted for 55.6% of the sample, and primary school was the most frequently reported educational level (33.3%) (**Table 1**).

Table 1. Sociodemographic characteristics of the participants (n = 45)

Variable	Category	n (%)
Typhoid fever	Yes	22 (48.9)
	No	23 (51.1)
Age (years)	<20	22 (48.8)
	21–30	14 (31.1)
	>30	9 (20.0)
Sex	Male	25 (55.6)
	Female	20 (44.4)
Education	Kindergarten	5 (11.1)
	Primary school	15 (33.3)
	Junior high school	13 (28.9)
	Senior high school	8 (17.8)
	Higher education	4 (8.9)

The distribution of personal hygiene practices is presented in **Table 2**. Poor hand hygiene before meals was reported by 27 participants (60.0%), while inadequate food hygiene was observed in 26

participants (57.8%). Inadequate toilet sanitation was identified in 27 participants (60.0%), whereas inadequate drinking water hygiene was reported by 16 participants (35.6%).

Table 2. Distribution of personal hygiene practices among participants (n = 45)

Variable	Category	n (%)
Hand hygiene before meals	Good	18 (40.0)
	Poor	27 (60.0)
Drinking water hygiene	Adequate	29 (64.4)
	Inadequate	16 (35.6)
Food hygiene	Adequate	19 (42.2)
	Inadequate	26 (57.8)
Toilet sanitation	Adequate	18 (40.0)
	Inadequate	27 (60.0)

The associations between personal hygiene practices and typhoid fever are presented in **Table 3**. Participants with poor hand hygiene before meals accounted for 90.9% of typhoid fever cases,

compared with 9.1% among those with good hand hygiene. Similarly, participants with inadequate drinking water hygiene, poor food hygiene, and inadequate toilet sanitation showed higher

proportions of typhoid fever than their respective comparison groups. Chi-square analysis demonstrated statistically significant associations between all personal hygiene variables and the incidence of typhoid fever ($p < 0.001$). The strongest

association was observed for hand hygiene before meals (Cramer's $V = 0.617$), followed by food hygiene (Cramer's $V = 0.566$), drinking water hygiene (Cramer's $V = 0.388$), and toilet sanitation (Cramer's $V = 0.326$).

Table 3. Association between personal hygiene practices and typhoid fever (n = 45)

Variable	Category	Typhoid n (%)	Non-typhoid n (%)	Cramer's V	p-value
Hand hygiene before meals	Poor	20 (90.9)	7 (30.4)	0.617	<0.001
	Good	2 (9.1)	16 (69.6)		
Drinking water hygiene	Inadequate	12 (54.5)	4 (17.4)	0.388	<0.001
	Adequate	10 (45.5)	19 (82.6)		
Food hygiene	Inadequate	19 (86.4)	7 (30.4)	0.566	<0.001
	Adequate	3 (13.6)	16 (69.6)		
Toilet sanitation	Inadequate	17 (77.3)	10 (43.5)	0.326	<0.001
	Adequate	5 (22.7)	13 (56.5)		

Abbreviations: p-values were obtained using the Chi-square test. The strength of the associations was evaluated using Cramer's V.

DISCUSSION

This study demonstrated that all personal hygiene variables examined, including hand hygiene before meals, drinking water hygiene, food hygiene, and toilet sanitation, were significantly associated with the incidence of typhoid fever. Among these variables, hand hygiene before meals showed the strongest association, followed by food hygiene, drinking water hygiene, and toilet sanitation. These findings highlight the critical role of personal hygiene in interrupting the fecal–oral transmission of *Salmonella enterica* serovar *Typhi*, particularly in rural communities with limited access to water, sanitation, and hygiene facilities.

The strongest association observed in this study was between hand hygiene before meals and typhoid fever. Participants with poor hand hygiene were substantially more likely to develop typhoid fever than those who practiced appropriate handwashing. Hand hygiene is recognized as one of the most effective preventive measures against enteric infections because contaminated hands serve as an important vehicle for the transmission of pathogenic microorganisms from contaminated surfaces or fecal material to food and drinking water (World Health Organization [WHO], 2023; Freeman et al., 2022). Regular handwashing with soap significantly reduces microbial contamination and interrupts the transmission cycle of *Salmonella Typhi*. Similar findings have been reported in Ethiopia, Bangladesh, and Pakistan, where inadequate hand hygiene was consistently associated with an increased risk of typhoid fever and other enteric infections (Birhan et al., 2023; Qadri et al., 2024).

Food hygiene also demonstrated a strong association with typhoid fever. Participants reporting inadequate food hygiene experienced a considerably higher proportion of typhoid fever than those with adequate food hygiene. Improper food preparation, inadequate cooking, and unsafe food storage

facilitate bacterial contamination and increase the likelihood of ingesting *Salmonella Typhi*. Foodborne transmission remains one of the principal pathways for typhoid infection in endemic countries, particularly where food is prepared under poor sanitary conditions (Marchello et al., 2022). Previous epidemiological studies have similarly reported that unsafe food handling practices significantly increase the risk of typhoid fever in both rural and urban settings (Mogasale et al., 2023).

Drinking water hygiene was moderately associated with typhoid fever. Participants who consumed inadequately treated drinking water had a higher prevalence of typhoid fever than those with safe drinking water practices. Contaminated water is a well-established source of *Salmonella Typhi*, especially in communities lacking protected water supplies and effective water treatment systems (Prüss-Ustün et al., 2023). Improvements in drinking water quality, including household water treatment and safe water storage, have been shown to substantially reduce the incidence of enteric diseases in low-resource settings (WHO & UNICEF, 2023).

Toilet sanitation was also significantly associated with typhoid fever, although the strength of the association was lower than that observed for hand hygiene and food hygiene. Poor sanitation contributes to environmental contamination by facilitating the spread of human fecal waste into surrounding soil and water sources, thereby increasing opportunities for fecal–oral transmission (UNICEF, 2023). Communities with limited access to improved sanitation facilities frequently experience higher rates of enteric infections due to persistent environmental contamination and inadequate waste management (Prüss-Ustün et al., 2023).

Collectively, these findings support the concept that typhoid fever is not attributable to a single behavioural factor but rather results from multiple interconnected deficiencies in water, sanitation, and

hygiene (WASH). Effective prevention therefore requires integrated interventions that simultaneously promote handwashing with soap, improve household food hygiene, ensure access to safe drinking water, and expand sanitation infrastructure. Community-based health education combined with investments in WASH programmes may substantially reduce the burden of typhoid fever in remote settings such as Pegunungan Bintang Regency (WHO, 2023; UNICEF, 2023).

This study has several strengths. It provides evidence from a geographically isolated region of Highland Papua, where epidemiological data on typhoid fever remain limited. Furthermore, the study simultaneously evaluated multiple personal hygiene domains, enabling a more comprehensive understanding of behavioural risk factors associated with typhoid fever. Nevertheless, several limitations should be acknowledged. The cross-sectional design precludes causal inference because exposure and outcome were measured at the same time. The relatively small sample size from a single primary healthcare centre may also limit the generalizability of the findings to other populations. In addition, personal hygiene practices were assessed using self-reported questionnaires, which may be subject to recall and social desirability bias. Future studies employing prospective cohort designs with larger and more diverse populations are recommended to confirm these findings and establish causal relationships.

CONCLUSION

This study demonstrated that personal hygiene practices were significantly associated with the incidence of typhoid fever among residents in the working area of Awimbon Primary Health Centre, Pegunungan Bintang Regency. Hand hygiene before meals showed the strongest association, followed by food hygiene, drinking water hygiene, and toilet sanitation. These findings underscore the importance of comprehensive hygiene promotion and improved water, sanitation, and hygiene (WASH) interventions to reduce the burden of typhoid fever in rural and geographically isolated communities. Future studies with larger sample sizes and prospective designs are recommended to further clarify the causal relationship between personal hygiene practices and typhoid fever.

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