



Research Article

# Risk Factors of Typhoid Fever in Adolescents in PKU Muhammadiyah Singkil Islamic Hospital, Tegal District

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## ABSTRACT

Typhoid fever is an acute infectious disease of the small intestine caused by the bacteria *Salmonella typhi* or *Salmonella paratyphi* A, B, and C. There are many factors affecting typhoid fever, including the habit of washing hands, eating snacks outside the home, and environmental conditions around the house. This study aims to determine the risk factors for the incidence of typhoid fever in adolescents at PKU Muhammadiyah Singkil Hospital, Tegal Regency. This research was conducted by analytical observation with a cross-sectional design in April–June 2021. The research method was the Widal test and filling out questionnaires. The data were analyzed by univariate and chi-square tests. The results of this study showed that there were 14 positive patients with typhoid fever with a Widal titer of 1/160 (40%) and a Widal titer of 1/320 in as many as 21 people (60%). There was no relationship between the habit of washing hands and the incidence of typhoid fever ( $p = 0,076$ ). There was no relationship between the habit of eating outside the home and the incidence of typhoid fever ( $p = 0,144$ ). There is a relationship between environmental conditions around the house and the incidence of typhoid fever ( $p = 0,009$ ). People need to improve personal hygiene and the environment around their homes to avoid *Salmonella typhi* infection

**Keywords:** *Salmonella typhi*, typhoid fever, widal test

## INTRODUCTION

Typhoid fever is common in the majority of developing countries. World Health Organization (WHO) data states that in 2013, there were 17 million cases of typhoid fever worldwide, with an incidence of 600,000 deaths each year (Sari, 2013). The Central Java Provincial Health Office stated that the incidence of typhoid fever ranks third after diarrhea and tuberculosis. There was an increase in cases, from 44,422 patients in 2009 to 46,142 patients in 2010. This shows that the incidence of typhoid fever in Central Java is high (DinkesProv Jateng, 2019). The national prevalence of typhoid fever is 1.60%. The prevalence of typhoid fever is mostly found in the school age group (5–24 years) at as much as 1.9%, while the lowest prevalence is in infants at as much as 0.8 (Ramaningrum et al., 2016). Typhoid fever cases in Tegal Regency in 2016 were 11,387. This shows that the incidence of typhoid fever in Tegal District is high. One of the factors causing the



high cases of typhoid fever in Tegal District is the lack of proper environmental conditions (Ulfa & Handayani, 2018).

The highest prevalence of typhoid fever occurs at the age of 3–19 years because at that age they tend to have a lot of physical activity but pay less attention to diet, so they have a tendency to eat food outside the home without paying attention to hygiene. The prevalence of typhoid fever sufferers is highest at the age of 10–15 years, with 22 people (55%). *Salmonella typhi* bacteria multiply in unhygienic food (Nuruzzaman & Syahrul, 2016). There is a relationship between the habit of washing hands before eating and the incidence of typhoid fever among people aged 15–44 years at the Tlogosari Kulon Health Center ( $p = 0.026$ ,  $OR = 4.250$ ,  $CI = 1.332-13.562$ ) (Afifah & Pawenang, 2019). There is a relationship between the habit of washing hands before eating and the incidence of typhoid fever in the working area of the Bandarharjo Public Health Center, Semarang City ( $p = 0.042$ ,  $OR = 2.870$ , and  $CI = 1.135-7.252$ ) (Malau et al., 2015).

This study aims to determine the risk factors for the incidence of typhoid fever in adolescents at the PKU Muhammadiyah Singkil Islamic Hospital in Tegal District. This is indicated by the continued increase in cases of typhoid fever in adolescents at the PKU Muhammadiyah Singkil Hospital in Tegal Regency.

## **MATERIAL AND METHODS**

This research is an analytic observational type with a cross-sectional design and was carried out in April–June 2021 at the PKU Muhammadiyah Singkil Hospital in Tegal Regency after obtaining ethical approval from the Health Research Ethics Commission at the University of Muhammadiyah Purwokerto with Number: KEPK/UMP/49/IV/2021. This study involved 35 patients with confirmed typhoid fever using a quota sampling technique. The inclusion criteria for this study included typhoid fever patients aged 10–20 years, willing to sign informed consent, and newly confirmed positive for typhoid fever who were being treated at RSI PKU Muhammadiyah Singkil, Tegal Regency. Patients who withdrew during the study and were confirmed positive for dengue hemorrhagic fever (DHF) or had blood disorders or immune system disorders based on the results of laboratory tests were not included in this study.

The tools used in this study included questionnaires, Widal slide tests, centrifuges (DLAB Clinical), and vacutainer tubes, while the materials used included patient blood serum, *Salmonella typhi* O and H antigen suspensions, and *S. paratyphi* AH and BH antigen suspensions. The patient underwent a physical examination and filled out a questionnaire about the habit of washing hands before eating, eating habits outside the home, and conditions around the house.

Data on the characteristics of research subjects were analyzed by univariate tests, whereas data on the habit of washing hands before eating, eating habits outside the home, and conditions around the house with widal titers were analyzed using the Chi Square test ( $X^2$ ).

## **RESULTS AND DISCUSSION**

The majority of respondents were male, as many as 18 people (51.4%), aged 10-15 years, as many as 28 people (80%), the highest titers were on O antigen 1/320 and H antigen 1/160 each of 21 people (60%), the incidence of typhoid fever occurred in old cases, as many as 20 people (60%) and 20 people (54.1%), had a poor habit of washing hands before eating, as many as 20 people (57.14%), had a poor habit of snacking outside the home, as many as 24 people (68.57%), and in poor conditions around the house, as 30 people (85.71%). The characteristics of the research subjects are shown in Table 1.

**Table 1. The characteristics of the research subjects**

No.	The characteristics	Frequency (n)	Percentage (%)	Mean± SD	Median (Min-Max)
1	Gender				
	Male	18	51.4		
	Female	17	48.6		
2	Age (y.o)				
	10-15 y.o	28	80	12.91±2,984	12(10-20)
	16-20 y.o	7	20		
3	Widal Tests Results				
	O antigen				
	1/160	14	40		
	1/320	20	60		
	H antigen				
	1/160	20	54,1		
	1/320	5	13,5		
	negative	10	27		
	AH antigen	0	0		
	BH antigen	0	0		
4	the incidence of typhoid fever				
	New cases	15	42,9		
	Old cases	20	57,1		
5	Hand washing habits				
	Good	15	42.86		
	Poor	20	57.14		
6	Snacking habits outside the home				
	Good	11	31.43		
	Poor	24	68.57		
7	Environmental conditions around the house				
	Good	5	14.29		
	Poor	30	85.71		

The results showed that the majority of respondents aged 10-15 years were diagnosed with typhoid fever because, at that age, they did a lot of activities outside the home, so there was a high possibility of bacterial contamination from activities outside the home (Artanti, 2013). Most patients with typhoid fever are >9 years old because, at that age, there are many activities outside the home, increasing the possibility of being contaminated with *S. typhi*. In general, fever is more common in children than adults because adults often experience symptoms that are not typical and then disappear or heal on their own (Nuruzzaman & Syahrul, 2016).

Boys are more susceptible to typhoid fever because they have more activities outside the home than girls, so they often consume junk food or food stalls that contain lots of flavoring and lack hygiene (Agnes et al., 2019; Pramitasari, 2013). The results of this study showed that the most widal titers were on the O antigen 1/320 and the H antigen 1/160, inversely proportional to the study by Suryani et al., which shows that the most widal titers were on the AO 1/320 antigen (Suryani et al., 2018).

**Table 2. The association between handwashing habits and the incidence of typhoid fever**

Handwashing habits	The incidence of typhoid fever		Total	P	95% CI
	New Cases	Old cases			
Good	9 (60%)	6 (30%)	15 (100%)	0,076	0,856-14,303
Poor	6 (40%)	14 (70%)	20(100%)		

Based on Table 2, it is known that new typhoid fever patients with good handwashing habits were 9 people (60%) and old typhoid fever patients with good handwashing habits were 6 people (30%). New typhoid fever patients with poor hand washing habits were 6 people (40%) while patients with old typhoid fever with poor hand washing habits were 14 people (70%). There was no relationship between handwashing habits and the incidence of typhoid fever in both new and old patients ( $p > 0.05$ ).

**Table 3. The association between hadwashing habits and O antigen**

Hand washing habits	O antigen		Total	P	95% CI
	1/160	1/320			
Good	6 (42.9%)	9 (60%)	15(100%)	1,0	0,255-3,922
Poor	8 (42.9%)	12(57.1%)	20(100%)		

**Table 4. The association between handwashing habits and H Antigen**

Hand washing habits	H antigen			Total	P
	1/160	1/320	negative		
Good	7 (46.7%)	1 (6.7%)	7 (46.7%)	15(100%)	0.101
Poor	13 (65%)	4(20%)	3 (15%)	20(100%)	

Table 3 shows that there are 12 people (57.1%) with a titer of 1/320 for bad handwashing habits, while Table 4 shows that 13 people (65%) had the worst hand washing habits with H antigen, with a titer of 1/160. There is no relationship between hand washing and the results of the O and H antigen widal tests. The results of this study differ from those of several previous researchers. There is a relationship between the habit of washing hands with clean water and soap and the incidence of typhoid fever in adults in the working area of the Dinoyo Health Center (Awa et al., 2019). There is a relationship between hand washing and the incidence of typhoid fever in Ethiopia (Birhanie et al., 2014). The habit of washing hands is part of personal hygiene so that it can prevent the transmission of typhoid fever, which is transmitted by hands either directly or indirectly. It should also be noted that the source of clean water used for washing hands, among other things, is tasteless, colorless, and odorless (Bakhtiar et al., 2020)

**Table 5. The association between snacking habits outside the home and the incidence of typhoid fever**

Snacking habits outside the home	The incidence of typhoid fever		Total	P	CI
	New Cases	Old cases			
Good	7 (63.6%)	4 (36.4%)	11 (100%)	0,144	0.786-15.578
Poor	8 (33.3%)	16 (66.7%)	24(100%)		

Based on Table 5, it is known that new typhoid fever patients with good eating habits outside the home are 7 people (63.6%), while old typhoid fever patients with good eating habits outside the home are 4 people (36.4%). New typhoid fever patients with poor eating habits were 8 people (33.3%), while old typhoid fever patients with poor eating habits were 16 people (66.7%). There was no relationship between eating habits outside the home and the incidence of typhoid fever in both new and old patients ( $p > 0.05$ ).

**Table 6. The association between snacking habits outside the home and O antigen**

Snacking habits outside the home	O antigen		Total	P	95% CI
	1/160	1/320			
Good	5 (45.5%)	6 (54.5%)	11 (100%)	0.721	0.327-5.898
Poor	9 (37.5%)	12 (62.5%)	24 (100%)		

**Table 7. The association between snacking habits outside the home and H Antigen**

Snacking habits outside the home	H antigen			Total	P
	1/160	1/320	negative		
Good	6 (54.5%)	3 (27.3%)	2 (18.2%)	11(100%)	0.284
Poor	14 (58.3%)	2 (8.3%)	8 (33.3%)	24 (100%)	

Based on Table 6, it is known that the poor eating habits outside the home are on the O antigen, with a titer of 1/320 for 15 people (62.5%), while Table 7 shows that the bad eating habits outside the home are most common on the H antigen, with a titer of 1/160 for 14 people (58.3%). There is no relationship between eating habits outside the home and the results of the O and H antigen widal tests. The results of this study are in line with Prehamukti's research, which also showed that there was no relationship between snacking behavior and the incidence of typhoid fever (Prehamukti, 2018). However, this is different from the results of other studies. There is a relationship between snacking habits and the incidence of typhoid fever in schoolchildren at Inpatient Hospital Petala Bumi, Riau (Khairunnisa et al., 2022). There is a relationship between snacking habits and the incidence of typhoid fever in children at Prof. R.D. Kandou Manado Hospital (Timah, 2020).

Contamination of drinking water and consumption of products that are not properly washed can trigger a high rate of typhoid fever infection (Prasad et al., 2018). Typhoid fever infection can become latent if food is served in an unsanitary condition and is undercooked. In addition, the conditions around the eating area that are not clean can trigger a typhoid fever (Bakhtiar et al., 2020).

**Table 8. The association between environmental conditions around the house and the incidence of typhoid fever**

Environmental conditions around the house	The incidence of typhoid fever		Total	P	95% CI
	New Cases	Old cases			
Good	5 (100%)	0 (0.0%)	5 (100%)	0.009	1.809-4.976
Poor	10 (33.3%)	20 (66.7%)	30 (100%)		

Based on Table 8, it is known that there are 5 new typhoid fever patients with good environmental conditions around the house (100%) while there are no old typhoid fever patients with good environmental conditions around the house. New typhoid fever patients with poor environmental conditions were 10 people (33.3%), while patients with old typhoid fever with poor environmental conditions were 20 people (66.7%). There is a relationship between the condition of the environment around the house and the incidence of typhoid fever in both new and old patients ( $p < 0.05$ ).

**Table 9. The association between environmental conditions around the house and O antigen**

Environmental conditions around the house	O antigen		Total	P	95% CI
	1/160	1/320			
Good	2 (40%)	3 (60%)	5 (100%)	1,0	0.145-6.907
Poor	12 (40%)	18 (60%)	30 (100%)		

**Table 10. The association between environmental conditions around the house and H Antigen**

Environmental conditions around the house	H antigen			Total	P
	1/160	1/320	negative		
Good	2 (40%)	2 (40%)	1 (20%)	5(100%)	0.207
Poor	18 (60%)	3 (10%)	9 (33.3%)	30 (100%)	

Based on Table 9, it shows that the environmental conditions around the house are mostly bad for the O antigen, with a titer of 1/320 for as many as 18 people (60%) while in Table 10, it shows that the environmental conditions around the house are mostly bad for the antigen H, with a titer of 1/160 for 18 people (60%) There is no relationship between environmental conditions and the results of the Widal test on O and H antigens. The results of this study, which showed that there was a relationship between environmental conditions around the house and the incidence of typhoid fever ( $p < 0.05$ ), were in line with the results of Fahlevi's study, which showed that there was a relationship between environmental factors and the incidence of typhoid fever (Fahlevi, 2019).

A poor environment will increase the potential for the spread of communicable diseases such as dengue hemorrhagic fever, diarrhea, intestinal worms, and typhoid fever (Seran et al., 2015). Environmental sanitation and health behaviors are risk factors for typhoid fever (Welong et al., 2017). Contamination of sanitation facilities and water sources can trigger a high rate of typhoid fever infections (Prasad et al., 2018). Co-infection of typhoid fever with malaria. The widal test can detect mixed infections so that patients can get the right treatment. However, typhoid fever can cross-react with malaria when the Widal test is performed. The diagnostic test for typhoid fever with co-infection using the blood culture method is only 0.5% effective (Birhanie et al., 2014).

## CONCLUSION AND SUGGESTION

There is no relationship between the habit of washing hands and the incidence of typhoid fever ( $p > 0.05$ ). There is no relationship between eating habits outside the home and the incidence of typhoid fever ( $p > 0.05$ ). There is a relationship between environmental conditions around the house and the incidence of typhoid fever ( $p < 0.05$ ). Communities need to improve personal hygiene and the environment around where they live to avoid *Salmonella typhi* infection.

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## CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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