

Research Article



Typhoid fever: prevalence and risk factors among symptomatic Sudanese patients

Abstract

Background: Typhoid fever is still a major public health issue in Sudan, notably in communities with limited healthcare systems, with an uneducated population that lives in unhygienic environments, and with residents who habitually drink unsafe water from tube wells rather than washing their hands after using the restroom.

Objective: To clarify the prevalence and risk factors for typhoid fever among those who are symptomatic and consult the Omar Bin Al-Khattab Health Center, the current study was performed.

Methods: To clarify the incidence and predisposing factors of typhoid fever among patients presenting at Omar Bin Al Kattab Health Center, a retrospective analytical study was performed in 2022. From each level, 50 respondents in total were selected randomly. The tool for gathering information was an open-ended questionnaire included personal data as well as risk factors. History of typhoid fever was confirmed by detection of antibodies of *S. typhi* by using ICT for enteric fever (ICT INTERNATIONAL ,South Africa, with sensitivity: 86.7%,specificity: 99.7%, and accuracy: 99.0%),and *S. paratyphi* were not detected .The statistical program for the social sciences (SPSS), version 16, was used to describe and interpret the study's statistics. With the use of an anonymous research tool, respondent confidentiality was secured. Informed consent was obtained from the patients by making voluntary contact with them via their registered phone numbers. The gathered information was only intended to further the priorities of the research.

Results: The plurality of study participants (66%) were between the ages of 21 and 40, and 54% (27) were undergraduates. 58% of participants have experienced typhoid (*S. typhi*), and 90% of interviewees were knowledgeable of the infection. In accordance with the allocation of participants based on the mode of transmission, food and drink account for 74% of all participants, making them more fundamental precepts of typhoid fever transmission. Summer was the most common season for typhoid (64%), and 52% of participants had fever as a distinct feature. 42 % of respondents claimed that the water supply was healthy. The food is heated before meals by 50% of participants, prepared at home by 40% of respondents, and purchased ready-to-eat by 18% of informants. Furthermore, 34% of people use heating to kill microbes, with vaccination being the least effective approach.

Conclusion: The study revealed that the total prevalence of typhoid fever in the group studied was 58%, and knowledge, awareness, healthy and well-prepared food, as well as water supply, are significant risk factors.

Keywords: typhoid fever, *Salmonella*, khartoum, Sudan

Introduction

The bacterium *Salmonella enterica* serovar Typhi causes typhoid fever, an acute systemic infection, and *Salmonella enterica* serovars Paratyphi A, B, and C cause paratyphoid fever, a clinically similar condition. The bacterium *Salmonella enterica* serovar Typhi causes typhoid fever, an acute systemic infection, and *Salmonella enterica* serovars Paratyphi A, B, and C cause paratyphoid fever, a clinically similar condition.¹ It is extremely infectious since the bacterium is often carried in the blood, intestines, and feces of a human host. Humans are the only known reservoir and host for typhoid fever, which is spread via the faecal- oral route by contaminated water and food, especially by those who handle food. It can be passed from person to person or from the consumption of contaminated food and drink from affected people's faces.¹

The Middle East, a few southern and eastern European nations, central and south America, Africa, and Asia are all regions where typhoid disease is endemic.² With the exception of sporadic point-source outbreaks, typhoid is mostly a disease of returning travelers in

the USA and the majority of Europe. Based on recent studies, there are at least 200,000 deaths from typhoid annually, with an estimated 22 million cases.³ Typhoid fever is a significant global cause of morbidity and mortality, with an estimated 12-33 million cases and 216,000–600,000 fatalities yearly.⁴ The clinical picture is mistaken for many other febrile illnesses, and most typhoid-endemic areas lack facilities to confirm the diagnosis, so it is difficult to estimate the true magnitude.³

Nevertheless, the major concern is the growth and spread of antibiotic-resistant bacterial strains that cause typhoid fever and the complicating factor of co-infection with malaria, which causes severe morbidity and death. Typhoid fever and malaria have different etiologies- typhoid fever is caused by bacteria, whereas malaria is caused by a protozoan- but they both have symptoms that are quite similar.⁵ Those who reside in communities where both diseases are endemic are significantly more likely to contract both of them, either concurrently or as an acute infection on top of a chronic one, because both diseases share influences that are crucial to their transmission.⁶

Infection with typhoid is typically described as being prevalent in developing countries with inadequate public hygiene.⁷ Typhoid is a condition that may develop around the world in settings with poor water supply and sanitation. It is most endemic in developing Asian countries, Africa, and Latin America. WHO indicates that there are approximately 10 and 20 million cases of typhoid fever annually, with 128 and 161 thousand deaths.⁸ Antimicrobial resistance was first documented in several Asian countries in 1989, when over 50% of strains emerged that were resistant to most antibiotics. Antibiotic-resistant organisms are currently an escalating problem.⁹

The majority of patients who attend general hospitals and public health centers display symptoms of typhoid fever, including headache, fever, nausea, diarrhea, a steadily rising temperature of upwards of 40°C (104°F), profuse sweating, and gastroenteritis. Studies of demography, social behavior, and health awareness, as well as an increase in the consumption of uncooked food (vegetables) during the summer, may all have an impact on the development of typhoid fever. Typhoid fever is thought to be controlled most effectively by immunizing high-risk groups due to the lack of an inexpensive program to provide safe water and better sanitary conditions in the study area.

Methodology

Study design, area, and population

In the Omar Bin Al Khattab Health Center in Arkawet-Khartoum, central Sudan, a retrospective analytic research with 50 participants was concluded to determine the prevalence and risk factors of typhoid fever among symptomatic patients between September and December 2022. The respondents have been reported to have typhoid fever.

Data collection

A close-ended questionnaire featuring personal details and predisposing factors was adopted as the data collection approach to accomplish the study's aims. The SPSS-16 program was used to analyze the information, which included frequencies, % standard deviation, minimum and maximum values, and pie graphs for graphical representation.

Principal

Many biochemical and serological assays can be used in the lab to identify *S. typhi*. One of the most distinctive is polysaccharide capsule VI, which is found in 90% of all newly isolated *S. typhi* and protects against the bactericidal effects of the serum of infected individuals. One of the vaccinations that is sold commercially is based on this capsule. *Salmonella paratyphi C*, *Citrobacter freundii*, and *Salmonella dublin* all have the Vi antigen, although not in the same genetic sequence. In most of the countries where this issue has been explored, the ratio of *S. typhi* disease to *S. paratyphi* disease is roughly ten to one.¹ History of typhoid fever was confirmed by detection of antibodies of *S. typhi* by using ICT for enteric fever (ICT INTERNATIONAL, South Africa, with sensitivity: 86.7%, specificity: 99.7%, and accuracy: 99.0%).

Ethical considerations

The coordinator of the medical program at the Riyadh International Faculty of Medicine granted ethical approval. It was optional to participate, and there was no consequence for declining. A detailed clarification of the study's purposes and procedures subsequent to registration, all subjects' explicit written authorizations were secured.

Results

66% of study participants were in the age group 21–40 years; 20% were above 40 years; and 14% were younger than 20 years. 54% (27) of participants were undergraduates, 10% (5) were postgraduates, 12% (6) were in secondary schools, and 24% (12) were illiterate. The current study revealed that 90% of the responders were aware of the disease (Figure 1). Study documented that 58 % of respondent's have had past medical history of typhoid fever (Figure 2). Dispersion of the population according to occupational type was 46 % (Figure 3).

Food and drinks are more aspects of transmission for typhoid fever, accounting for 74% of total participants. The most prevalent season of typhoid was in summer (64%) and 52% of participants had fever as clear symptom (Table 1).

Hand washing after visiting toilet was reported by 35 of study respondents 70% as preventive measure for typhoid and other related microbial infections (Figure 4).

Safe water supply was documented by 42% of study respondent's as water source (Figure 5). Heating food before a meal was noted by 25 interviewees (50%) as a preventive indicator (Figure 6).

Study stated that 40% of respondents were prepared food at their home, and 18% getting ready food. Moreover, 34% use heating for kill bacteria while immunization is the lowest method (Table 2).

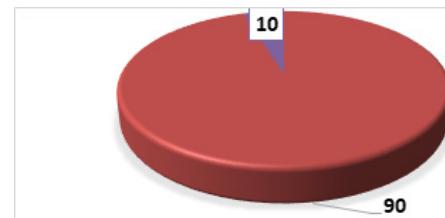


Figure 1 Respondents' acquaintance with typhoid fever.

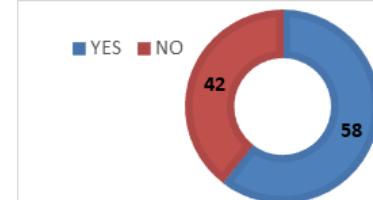


Figure 2 Dispersion of the study subject's according to past medical history of typhoid fever.

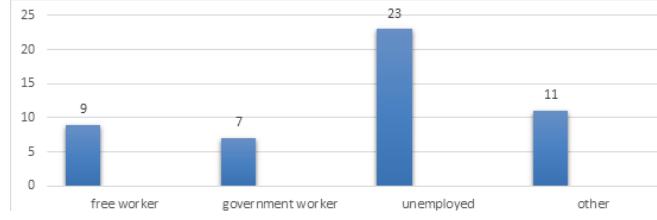


Figure 3 Participant distributions per type of occupation.

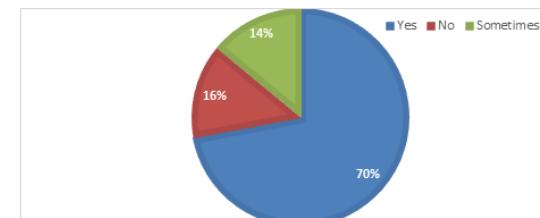


Figure 4 Distribution of participants' hand washing after using toilet.

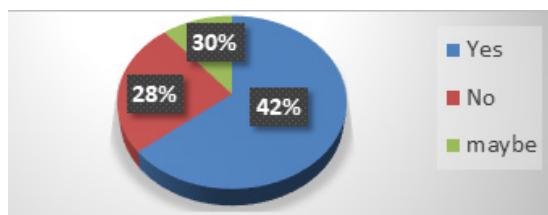


Figure 5 Distribution per source of water supply.

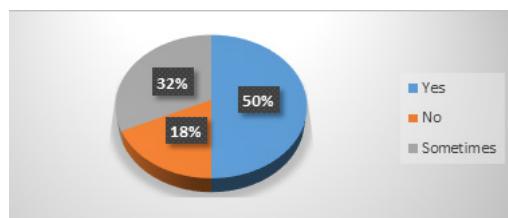


Figure 6 Distribution of participants per heating food before meal.

Table 1 Distribution per risk factors, informational source, and symptomatology

Parameter	Characteristics	Frequency	Parameter	Characteristics	Frequency
The agent factor	Food and drinking	74% (37)	Source of Information	Lecture	40% (20)
	Insect	10% (5)		Newspaper	8% (4)
	From patient to healthy	16% (8)		Television	14% (7)
	Through symptoms	58% (29)		Other	38% (19)
Methods	Laboratory diagnosis	32% (16)	Symptoms	Fever	52% (26)
	Form physician	10% (5)		Diarrhea	12% (6)
	Summer	64% (32)		Stomach pain	6% (3)
prevalence through The seasons	Autumn	20% (10)		Headache	28% (14)
	Winter	16% (8)		Nothing	2% (1)

Table 2 Distribution per food preparation and prevention

Prevention methods	Frequency	Methods for food preparation	Frequency
Heating food	34% (17)	Prepared in the house	80% (40)
Purification of drinking water	24% (12)	Ready to eat food	18% (9)
Improving basic sanitation	22% (11)	Uncooked food	2% (1)
Personal hygiene	18% (9)		
Immunization	2% (1)		

Discussion

Throughout many developing nations, as well as in Sudan, typhoid fever persists as a substantial public health issue. This is notably true in locations with few healthcare facilities, uneducated communities, unsanitary conditions, availability of raw water from tube wells, and a dearth of habitual hand-washing with soap after using the bathroom.¹⁰

The study noticed that the age spectrum between 21 and 40 represents the typical age range of cases (66%); however, this observation was disputed by Lemi BW¹¹ which showed that whereas typhoid fever can attack at any age, it is particularly common in children between the ages of 5 and 15 due to their activities and possibly lessened attention to personal hygiene. Moreover, this study found that the method of transmission of typhoid fever among the study population was increased because of the decreased knowledge about the mode of transmission. The conclusions revealed that the majority of participants (90%) and (74%), respectively, assumed that typhoid fever was most frequently disseminated via contaminated food and water. Furthermore, so far, more participants had a graduate degree (54%) than a postgraduate degree (only 1; 10%), which further supports the lack of any health concerns. These findings coincided with Salman, et al.¹²

The report demonstrates that (58%) of the respondents have encountered typhoid fever and the informants noted the disease through symptoms or signs due to a lack of health concerns and the availability of factors that contribute to typhoid fever predisposition. Although enteric fever is seen throughout the year, the present research demonstrated that the peak incidence occurred from July to

September during the summer, when the incidence was 64%. These results corresponded with those published by Jenkins and were made during the rainy season, when there is an upsurge in the mechanical factor (house flies) and food is a poor conductor of heat, offering dwellings to the bacilli that may amplify and do occasionally sustain in food.¹³ Regrettably, the study revealed that only 16% of participants washed their hands with soap after using the restroom, despite the fact that 70% of respondents do so on a constant basis. This demonstrated how human excretions can cause contamination.

Water is frequently obtained from a variety of dubious sources, the majority of which are tainted by human waste,¹⁴ based on the study, 42% of participants have access to safe water supplies, 30% are unsure, and 28% have unsafe water sources. Correspondingly, food preparation techniques impair the food's quality even though unhealthy behaviors can result in contaminated food, a further important implication of typhoid fever transmission. According to Brockett, who asserted that appropriately preparing food constituted one of the most crucial typhoid fever preventative measures, the study indicated that 80% of respondents prepared food at home, proving to be the perfect way to prepare healthy food.¹⁵⁻¹⁷

Conclusion

The study concluded that the overall prevalence of typhoid disease in the electorate surveyed was 58% and that knowledge, awareness, and healthy and well-cooked food consumption by the general public, as well as water supply, are significant indicators of risk for typhoid fever transmission.

Recommendations

- a) The ministry of health should adopt measures to consistently screen endemic diseases through surveillance to prevent the occurrence of typhoid fever and intensify initiatives to strengthen the health emphasis, purification of water, and solid waste management.
- b) The ministry of health ought to take action by implementing intervention policies and delivering strenuous community health education on the proposed guidelines for typhoid disease control.
- c) All Restaurants where cooking and food handling staff should be screened for Typhoid at the time of employment and hygiene courses should be delivered with certification.

Acknowledgments

None.

Conflicts of interest

The author declares there are no conflicts of interest.

References

1. Typhoid. Fact sheet. *World Health Organization (WHO)*. 2018.
2. Christie AB. *Infectious diseases: epidemiology and clinical practice*. 4th Ed. Edinburgh, Scotland, Churchill Livingstone. 1987.
3. Chitnis S, Chitnis V, Hemvani N, et al. Ciprofloxacin therapy for typhoid fever needs reconsideration. *J Infect Chemother*. 2006;12(6):402–404.
4. Butt MH, Saleem A, Javed SO, et al. Rising XDR-typhoid fever cases in Pakistan: are we heading back to the pre-antibiotic era? *Front Public Health*. 2022;9:794868.
5. Uneke CJ. Concurrent malaria and typhoid fever in the tropics: the diagnostic challenges and public health implications. *J Vector Borne Dis*. 2008;45(2):133–142.
6. Sulaiman W. Typhoid and malaria co-infection- an interesting finding in the investigation of a tropical fever. *Malays J Med Sci*. 2006;13(2):64–65.
7. Raffatellu M, Chessa D, Wilson RP, et al. Capsule-mediated immune evasion: a new hypothesis explaining aspects of typhoid fever pathogenesis. *Infect Immun*. 2006;74(1):19–27.
8. Parry CM, Hien TT, Dougan G, et al. Typhoid fever. *N Engl J Med*. 2002;347(22):1770–1782.
9. de Jong HK, Parry CM, van der Poll T, et al. Host-pathogen interaction in invasive *Salmonellosis*. *PLoS Pathog*. 2012;8(10):e1002933.
10. Gashaw T, Jambo A. Typhoid in less developed countries: a major public health concern. *Hygiene Health Develop Countries Recent Adv*. 2022.
11. Lemi BW. Typhoid fever in an Ethiopian health center. *J Microbiol Infect Dis*. 2019;9(4):150–154.
12. Salman Y, Asim H, Hashmi N, et al. Typhoid in Bangladesh: challenges, efforts, and recommendations. *Ann Med Surg (Lond)*. 2022;80:104261.
13. Jenkins A. *A nested environmental approach to typhoid epidemiology in Central Division, Fiji*. 2017.
14. Greenwell J, McCool J, Kool J, et al. Typhoid fever: hurdles to adequate hand washing for disease prevention among the population of a peri-urban informal settlement in Fiji. *Western Pac Surveill Response J*. 2013;4(1):41–45.
15. Brockett S, Wolfe MK, Hamot A, et al. Associations among water, sanitation, and hygiene, and food exposures and typhoid fever in case-control studies: a systematic review and meta-analysis. *Am J Trop Med Hyg*. 2020;103(3):1020–1031.
16. Issa R. *Musca domestica acts as transport vector hosts*. *Bull Natl Res Cent*. 2022;43:73.
17. Park K. *Parks textbook of preventive and social medicine*. 18th Ed. Jabalpur: Banarsidas Bhanot. 2005.