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Frequency and risk factor of typhoid fever in Khyber Pakhtunkhwa, Pakistan

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Abstract

Typhoid fever, caused due to *Salmonella Typhi* (*S. Typhi*), is considered as one of the deadliest diseases, and a serious public health problem around the world. The prevalence of typhoid fever in city of Saidu Sharif Sawat, Khyber Pakhtunkhwa province of Pakistan was investigated in this study from October 26, 2017 to February 25, 2018. The blood samples of 400 patients of age group 1- 50 years old were used for clinical diagnosis applying widal test and their results were compared for analysis. A total of 76 patients were found positive of *S. Typhi*. The ratio of typhoid occurrence in males (66%) was found higher as compared to typhoid positive cases of females (34%). The ratio of typhoid patients was greater in young people having ages between 11-30 years. This study provides significant statistics regarding net incidence of typhoid in the city of Saidu Sharif Sawat that would help in proposed future health policies. Preventive strategies such as immunization programs, improved sanitary standards, clean water supply and proper sewerage system should be the focus of typhoid control in cities like Saidu Sharif Sawat.

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Introduction

In tropic and subtropical areas, the most common thing for consultation is fever and these are mostly infectious in nature. Typhoid fever is not easy to understand with normal human knowledge as it shows very bleak symptoms such as fever and headache in absence of diarrhea at early stages. However, in contrast to typhoid, malaria and other infectious diseases also show similar symptoms that's why it becomes difficult for physician to predict about the disease with simple diagnostic in absence of a laboratory diagnostic (Cheesbrough, 1985). Prevalence of typhoid varies from region to region across the globe; however, it is estimated to infect about 21.6 million people and cause 216,500 deaths across the globe annually (Shen *et al.,* 2013). Developing countries are more prone to this disease due to their poor hygienic standards of living (Kirkwood *et al.,* 2010). It is of utmost importance to have an updated epidemiological data on typhoid and its prevalence to make effective administrative decisions and preventive measures accordingly (John *et al.,* 2016).

Epidemiological data can be used to assess the ratio of its occurrence, prediction of new cases to emerge in future years and future studies to coup with this menace. There is an urgent need of preventive measures such as vaccination campaigns to be carried out in moderate to high alert areas, to fight the prevalence of typhoid. Epidemiological data is also necessary for vaccine producers to plan and modify their production line according to public demand. As such measures are taken, the decrease in the incidences of infection becomes the proof of effectiveness of ongoing campaigns and boost the morale of decision makers to further enhance their capabilities. Significance of epidemiological data for control and prevention of such type of diseases has long been recognized as an important document (Adhikari *et al.,* 2015).

However, important data on typhoid prevalence is rare in developing countries. Most of the diagnostics techniques used in developing countries are non-laboratory based and patients are diagnosed on clinical symptoms which leads to the absence of important data on disease's prevalence (Crump *et al.,* 2013).

Detection of typhoid fever on just mere clinical symptoms is very difficult and possess a greater challenge in control and prevention of such type of diseases in developing countries (Reddy, Shaw and Crump, 2010). Proper detection of typhoid fever requires proper and efficient use of laboratory-based techniques used by a trained official having up-to-date resources and standards of methods (Buckle, Walker and Black, 2012). Recent studies have advanced the knowledge on typhoid infections however developing countries still poses the highest challenge to understand its prevalence due to less available data (Acosta *et al.,* 2005). Morbidity related to typhoid fever is high in developing countries especially in Asia 93% as compared to other areas of the world. Asia also accounts for highest cases being reported in a population i.e., 274 per 100,000 people which is five times higher than Latin America (second highest) (Mogasale *et al.,* 2017).

Whereas, Southeast Asian countries have third highest rate of typhoid cases. Pakistan also comes into this region. Unfortunately, a proper population-based data on infectiousness of typhoid is rarely available, however various hospital-based studies from different localities of Pakistan shows that typhoid cases are very often and high rate especially in patients of young age (Khan *et al.,* 2013).

The organism responsible for causing typhoid fever is called *Salmonella* Typhi (*S. typhi*). It is non-spore forming, non-capsulated rod shape bacteria responsible for causing other infections such as gastroenteritis, enteric fever and bacteremia (Naheed, Ram and Brooks, 2010). *Salmonella* are highly invasive species and have become the focus of scientific studies now days (Haraga *et al.,* 2008).

There are various serological, biochemical and culture techniques to identify microorganisms of genus

Salmonella (Niemann *et al., 2011),* whereas serological techniques are more popular because they are easy to carry out and quickly in diagnosis of *Salmonella*. Serological techniques include Widal test, Dot immunosorbent assay (DIA), dip stick assays etc. (Aziah *et al.,* 2007)**.** However, among various serological techniques, Widal test is widely used method for diagnosis of *S.typhi* in developing countries (Bhan, Bahl and Bhatnagar, 2005), and it is used in determination of homologous antibodies.

Material and methods

Patients

We studied 400 patients aged between 1 year and 60 years old tested in various laboratories of Saidu Sharif Sawat. Patients with fever over 72 hours, no obvious focus of infection and clinically suspected for typhoid fever (high fever, malaise, headache, constipation or diarrhea) were included. Informed consent was obtained from a parent or guardian of patients under 18 years of age and direct consent from patients above 8 years of age for his: her participation in the study. Those patients were selected which were prescribed by Physicians to get their serological test done based on typhoid symptoms.

Sample collection

Three (3) ml of blood sample was withdrawn through aseptic venipuncture using a disposable syringe and was transferred into sterile gel test tube without any anticoagulant.

Widal test

Blood and fecal cultures were obtained for *S. typhi*, and Widal test was performed as previously directed (Choo *et al*., 1994). Blood sample was taken using aseptic technique, incubated in liquid broth with regular subculture on blood agar. Deoxycholate-citrate agar and MacConkey were used for culturing stool Species identification in positive cultures was performed by biochemical and agglutination tests (Wellcome Reagents, Kent, and England). Antigens from Wellcome Diagnostics was used to conduct Widal test (Dartford, England) and serial dilutions of serum in normal saline starting at 1:40. A positive Widal test was taken as a titre of at least 1 in 80 (Choo *et al.,* 1993).

Typhi dot test

Typhi dot test is used to detect the presence of antibodies (IgG and IgM) to a 50kDa (outer membrane protein). A visible reaction of an intensity equal to or greater than that of the control reaction on the commercially prepared filter paper is defined as positive Typhi dot. Both, Typhi dot-M tests and Typhi dot were employed for Serodiagnosis (Ismail *et al.,* 1991), and serum samples were used to perform Typhoid test, according to the procedure specified by the manufacturer. Positive and negative controls of kit were applied for each test.

Results

In this study, 400 typhoid suspected patients were tested in laboratories upon Physicians prescription. The age of subjects ranged from one year to 60 years. Suspected patient's serum was tested for the detection of typhoid fever. Test revealed that 76 (19%) patients were found to be typhoid positive out of 400 patients studied. Gender wise analysis showed that 50 (66%) of overall typhoid positive patients were found to be male and 26 (34%) of overall typhoid positive patients were found to be female (figure 1 and 2).

Table 1. Age wise prevalence of typhoid in city of Saidu Sharif Sawat.

Serial No.	Age group	Suspected subjects	Positive	Percent positivity
1	1-10 years	121	14	18.42
2	11-20 years	134	21	27.63
3	21-30 years	101	24	31.57
4	31-40 years	28	10	13.15
5	41-50 years	8	4	5.26
6	51-60 years	13	3	3.94
Total		400	76	19

Prevalence of Typhoid fever was recorded highest in age group 21-30 years. Among 400 subjects tested, 101 patients fell in this group. Whereas age groups 11-20 and 1-10 years remained on second and third positions respectively in terms of most positive patients and tested patients fall in these groups. Patients tested in age group 41-50 years scored the lowest and lowest number positive subjects was scored by patients of age group 51-60 years of age (table 1).

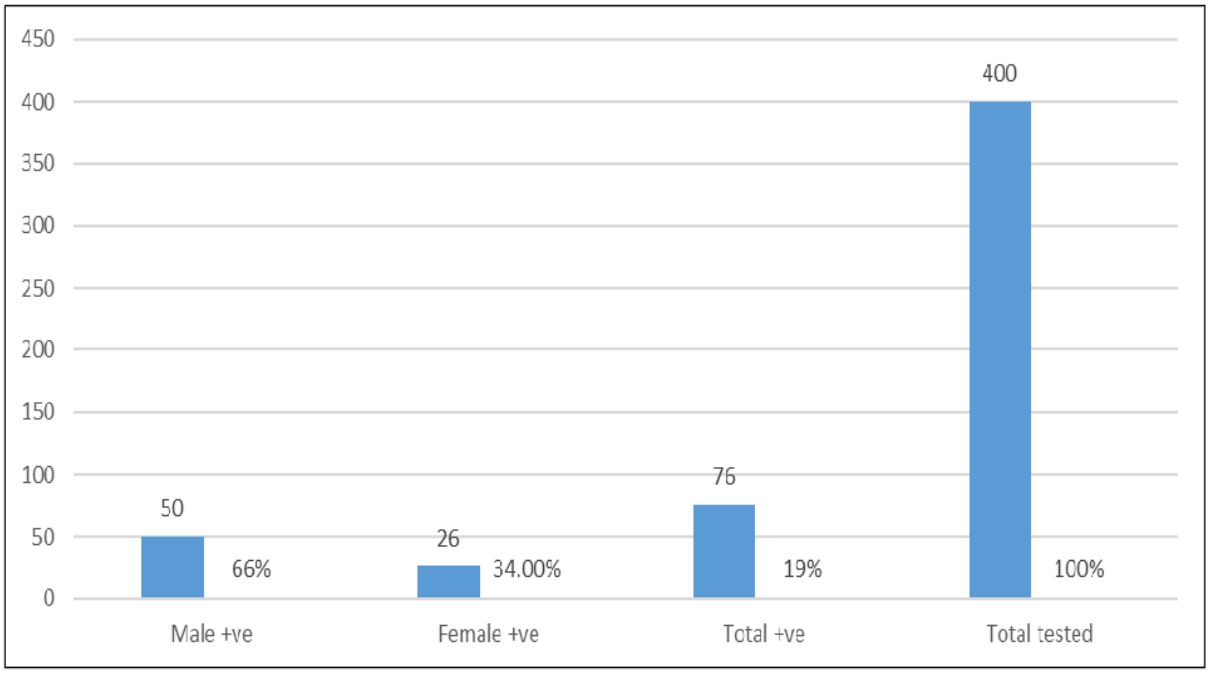

Fig. 1. Incidence of Typhoid fever in Saidu Sharif Sawat Patients were serologically tested based on the suspicion of having typhoid fever and were subsequently prescribed by Physician to have their serum tested. Sharp decline was observed in diagnostic tests prescribed by physician to females as compared to male subjects.

Discussion

In current study, clinical isolates from suspected patients were collected to check the epidemiological status of typhoid fever incidence in the city of Saidu Sharif Sawat. To diagnose the acute and chronic stage of typhoid fever, Widal serology test was used. Widal is cheap, single-use, easy to perform and less laborious test and Typhidot test (Clerc and Greub, 2010).There were no previous studies carried out on incidence of typhoid fever in city of Saidu Sharif Sawat. However, various studies of typhoid incidence can be found in other cities of Pakistan. Such as, a study carried out in Karachi to check typhoid incidence in the study showed 43% of serologically positive cases (Abdullah *et al.*, 2013). Previous research data showed that approximately 0.25 million deaths in Pakistan are caused due to water borne diseases (Shah *et al.,* 2003). Other factors such as unhygienic food, water and poor sanitation conditions are also responsible for high incidence rate of typhoid fever in sub-Saharan African countries and Indian sub-continent.

Typhoid fever is still one of the most widely spread disease in the world (Karkey *et al.,* 2013). Prevalence of typhoid fever is still on the rise in developing countries as compared to developed countries (Ochiai *et al.,* 2005). Previous study showed that typhoid fever is responsible for 0.6 million deaths annually with more than 13 million cases of typhoid fever reported each year throughout the world (Ivanoff *et al.,* 1994). In present study, it was found that males (66%) were more affected by typhoid in comparison to total number of females (34%) and these results collaborated with the previously conducted research on incidence of typhoid fever in Khyber-Pakhtunkhwa, Pakistan (Kulsoom *et al.,* 2014) and complementing the previous research done in Iran

(Masoumi *et al.,* 2013). Dominance of overall male patients and their high number of positivity in comparison with total number of females' patients may be due to more outdoor activities conducted making them vulnerable to typhoid infection upon consumption of unhygienic and contaminated food. These results corroborated with previous research of (Prajapati *et al.,* 2008). Age wise incidence of typhoid fever revealed in current study that typhoid fever prevalence was highest in age group 21-30 years (31.6%), with age group 11-20 years fell on second highest (27.6%). Whereas lowest rate of typhoid incidence was found in age group 51-60 years (3.9%). Prevalence of typhoid fever was found higher in patients with age lower than 30 years and present study corroborated with slight difference in comparison with the results reported by (Ayaz *et al.,* 2006).

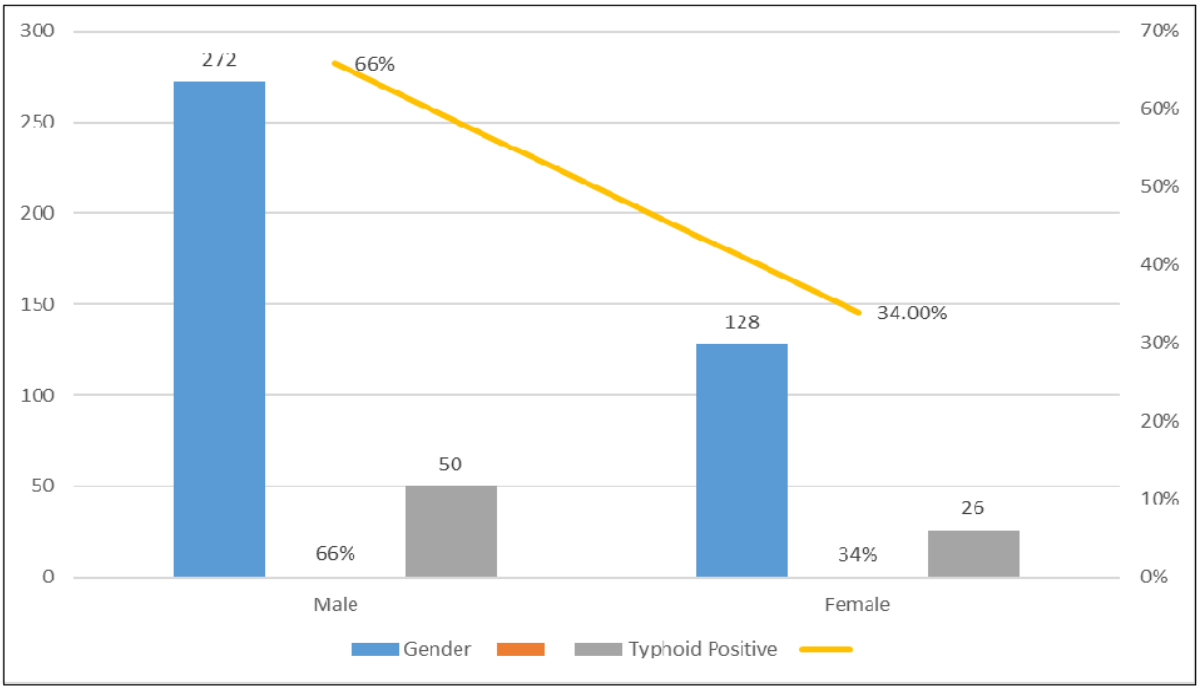

Fig. 2. Gender wise diagnostic and Incidence of Typhoid fever in Saidu Sharif Sawat Out of total 400 patients, 272 (66%) males were tested on suspicion of having typhoid and 128 (34%) were females. Male comprised 50 (66%) and female 26 (34%) of the total typhoid positive patients.

Conclusion

The present study reported that typhoid fever is endemic in the city of Saidu Sharif Sawat and is found higher in people below 30 years of age. In addition, economic and social conditions also play an important role in the prevalence of typhoid fever and other infectious diseases. It is therefore recommended through present study that all the stake holders must work together to provide hygienic food, clean drinking water, proper sanitation and good health care facilities to the people. Awareness campaigns must be conducted to prevent prevalence of typhoid through preventive measures. The above-mentioned measures are deemed to annihilate the risk of typhoid prevalence in the community.

References

Abdullah FE, Shaikh A, Abid M, Talib A. 2013. Enteric Fever in a Cross-section of Patients in Karachi: Current Correlation of Positive Blood Cultures with the Widal Agglutination and the Typhoid Immunoassay Tests. Journal of Dow University of Health Sciences **7,** 89-93.

Acosta CJ, Galindo CM, Ali M, Elyazeed RA, Ochiai RL, Danovaro-Holliday MC. 2005. A multi-country cluster randomized controlled effectiveness evaluation to accelerate the introduction of VI polysaccharide typhoid vaccine in developing countries in Asia: rationale and design. Tropical Medicine and International Health **10,** 1219-1228.

Adhikari A, Rauniyar R, Raut PP, Manandhar, KD, Gupta BP. 2015. Evaluation of sensitivity and specificity of ELISA against Widal test for typhoid diagnosis in endemic population of Kathmandu. BMC Infectious Diseases **15,** 523.

Ayaz A, Pervaiz MK, Azad MD, Pervaiz G. (2006). Risk Factors of Enteric Fever in Children Less Than 15 Years of Age. Journal of Statistics **13(1),** 84-100.

Aziah I, Ravichandran M, Ismail A. 2007. Amplification of ST50 gene using dry-reagent based PCR for the detection of S. typhi. Diagnosis and Microbiology of Infectious Diseases **59,** 373-377.

Ivanoff B, Levine M, Lambert P. 1994. Vaccination against typhoid fever: Present status. Bulletin of the World Health Organization **72,** 957-971.

Bhan MK, Bahl R, Bhatnagar S. 2005. Typhoid and paratyphoid fever. Lancet **366,** 749-762.

Buckle GC, Walker CLF, Black RE. 2012. Typhoid fever and paratyphoid fever: Systematic review to estimate global morbidity and mortality for 2010. Journal of Global Health **2(1),** 010401.

Cheesbrough M. 1985. Medical Laboratory Manual for Tropical Countries, 1st edition. Butterworth, Cambridge 257-261.

Clerc O, Greub G. 2010. Routine use of point-of-care tests: usefulness and application in clinical microbiology. Clinical Microbiology and Infection. **16(8),** 1054-1061.

Choo KE, Razif AR, Oppenheimer SJ, Ariffin WA, Lau J, Abraham T. 1993. Usefulness of the widal test in diagnosing childhood typhoid fever in endemic areas. Journal of Paediatrics and Child Health **29,** 36-39.

Choo KE, Oppenheimer SJ, Ismail AB, Ong, KH. 1994. Rapid sero diagnosis of typhoid fever by dot enzyme immunoassay in an endemic area. Clinical Infectious Diseases **19,** 172-176.

Crump JA, Morrissey AB, Nicholson WL. 2013. Etiology of severe non-malaria febrile illness in Northern Tanzania: a prospective cohort study. PLOS Neglected Tropical Diseases **7,** e2324.

Haraga A, Ohlson MB, Miller SI. 2008. Salmonellae interplay with host cells. Nature Reviews Microbiology **6,** 53-66.

Ismail A, Hai OK, Kader ZA. 1991. Demonstration of an antigenic protein specific for S. typhi. Biochemical Biophysical Research Communication. **181,** 301-305.

Ismail AB, Kader ZSA, Ong KH. 1991. Dot enzyme Immunosorbent assay for the sero-diagnosis of typhoid fever. The Southeast Asian Journal of Tropical Medicine and Public Health **22,** 563-566.

John J, Van-Aart CJ, Grassly NC. 2016. The burden of typhoid and paratyphoid in India: systematic review and meta-analysis. PLOS Neglected Tropical Diseses **10(4),** e0004616.

Karkey A, Thompson CN, Tran-Vu-Thieu N, Dongol S, Le-Thi-Phuong T, Voong-Vinh P. 2013. Differential Epidemiology of Salmonella typhi and paratyphi A in Kathmandu, Nepal: A Matched Case Control Investigation in a Highly Endemic Enteric Fever Setting. PLOS Neglected Tropical Diseases **7(8),** e2391.

Kalsoom F, Akbar M, Younas U, Tasneem M, Suleman S, Ali S, Roohi A. 2014. Prevalence of typhoid fever in five Southern districts of Khyber Pakhtunkhwa, Pakistan: A preliminary study. International Journal of Biosciences **4(1),** 325-330.

Khan MN, Shafee M, Hussain K, Samad A, Arif AM, Manan A, Wadood A. 2013. Typhoid fever in pediatric patients in Quetta, Balochistan, Pakistan.

Pakistan Journal of Medical Sciences **29(4),** 929-932.

Kirkwood BR, Hurt L, Amenga-Etego S, Tawiah C, Zandoh C, Danso S. 2010. Effect of vitamin A supplementation in women of reproductive age on maternal survival in Ghana (ObaapaVitA): a cluster-randomized, placebo-controlled trial. Lancet. **375,** 1640-1649.

Masoumi AH, Gouya MM, Nabavi M, Aghili N. 2013. Epidemiology of Typhoid Fever in Iran during Last Five Decades from 1962-2011. Iranian Journal of Public Health **42(1),** 33-38.

Mogasale V, Ramani E, Park IY, Lee JS. 2017. A forecast of typhoid conjugate vaccine introduction and demand in typhoid endemic low- and middle-income countries to support vaccine introduction policy and decisions. Human Vaccines & Immuno-therapeutics **13(9),** 2017–2024.

Naheed A, Ram PK, Brooks WA. 2010. Burden of typhoid and paratyphoid fever in a densely populated urban community, Dhaka, Bangladesh. International Journal of Infectious Diseases. **15**: 93-99.

Niemann GS, Brown RN, Gustin JK, Stufkens A, Shaikh-Kidwai AS, Li J, McDermott JE, Brewer HM, Schepmoes A. 2011. Discovery of novel secreted virulence factors from Salmonella enterica serovar typhimurium by proteomic analysis of culture supernatants. Infection and Immunity **79** 33-43.

Ochiai RL, Wang X, von-Seidlein L, Yang J, Bhutta ZA, Bhattacharya SK. 2005. Salmonella paratyphi A rates, Asia. Emerging Infectious Diseases. **11(11),** 1764–1766.

Parajapati B, Rai SK, Rai GK, Singh G. 2008. Prevalence of Salmonella typhi and paratyphi in Children: A Hospital Based Study. Nepal Medical College Journal **10(4),** 238-241.

Reddy EA, Shaw AV, Crump JA. 2010. Community-acquired bloodstream infections in Africa: a systematic review and meta-analysis. The Lancet Infectious Diseases **10,** 417-432.

Shah SM, Yousafzai M, Lakhani NB, Chotani RA, Nowshad G. 2003. Prevalence and correlates of diarrhea. Indian Journal of Pediatrics. **70(3),** 207-211.

Shen X, Ou L, Chen X, Zhang X, Tan X. 2013. The Application of the Grey Disaster Model to Forecast Epidemic Peaks of Typhoid and Paratyphoid Fever in China. PLOS ONE. **8(4),** e60601.