Evaluation of hematological change and seroprevelance of Typhoid fever using statistical tools in general population of Mardan, Pakistan

Ihteshamul haq[1], Fazli Zahir[2], Naumana Rehman[3], Saima Qayum[3], Sumbal Hussain[4], Zeeshan Shahzad[1], Shumaila Bakht[5], Fatima Syed[6], Ibrar Ahmad[1],Muhammad Salman munir malik[7] Maryam Hussain[1], Zeeshan Qamar[1], Shakir Ullah[1], Fawad Khalid[7], Taiba Bibi[1],

[1]Department of biotechnology and Genetic Engineering Hazara University Mansehra KPK **Pakistan**
[2]Department of Allied Health Sciences Iqra national University Peshawar Kpk**Pakistan**
[3]Department of Pathology Khyber Medical College Peshawar KPK **Pakistan**
[4]Department of Biotechnology Abdul Wali khan University Mardan KPK **Pakistan**
[5]Department of Human Nutrition the University of Agriculture Peshawar KPK **Pakistan**
[6]Institute of Biotechnology and Genetic Engineering Agriculture University Peshawar KPK **Pakistan**
[7]Department of Microbiology Government college university Faisalabad **Pakistan**
[8]Saidu Medical College Saidu Sharif Swat KPK **Pakistan**

*Correspondence:ihteshamulhaq384@gmail.com Received: 11-03-2021, Revised: 13-07-2021, Accepted: 20-07-2021, e-Published: 25-07-2021

The present was conducted to assess the prevalence of Salmonella typhi infection in Mardan, which cause typhoid fever. It is one of the most common infections across the globe mainly affecting undeveloped and developing countries including Pakistan. It is known to cause millions of deaths annually. Contributing factors for the disease is primarily unhygienic environment, contaminated food items and poor life styles. Symptoms of the disease vary based on its stage. All the samples were taken from patients who visited Mardan Medical Complex and the samples were screened using Typhidot test at pathology department to diagnose the infection. Out of the total subjects examined, 575 were deemed as positive due to the presence of either IgM, IgG or both antibodies, which represents an overall prevalence of 13.16%. Data was presented in the form of charts and comparison was made on monthly basis.

Keywords: Typhoid, Screening, Prevalence

INTRODUCTION

Typhoid fever is a systemic bacterial disease in human caused by the highly strong and persistent Salmonella typhi bacteria. *Salmonella typhi is* Gram-negative rod shapebacteria belong to family Enterobacteriaceae which is closely related to Escherichia coli. Mostly *Salmonella typhi*bacteria present in the intestinal tract of human and inhibit the intestinal tract of human body. About 35-37°C, temperature is required for the growth of *Salmonella typhi*bacteria. Salmonella typhi bacteria can be survived in sewage and seawater for about 9 days and for week respectively (Todor K et al. 2008).Mostly Typhoid fever is causing due to contaminated drinking water and eating junk food also the important causative factor of typhoid infection is raw vegetable, fruit and contaminated dairy milk product. At least $10^5 S$ oral dose of Salmonella. It penetrates the intestinal mucosa and multiplies in

the mesenteric lymph nodes, from which viable bacteria may enter the bloodstream. The time of incubation period of Salmonella typhibacteria is about 7 to 21 days (Guzman et al. 2006), after incubation period salmonella typhi bacteria enter to small intestine and there they attach with epithelium and then go to sub-mucosa where they engulfed by the monocytes. Salmonellatyphi resists intracellular killing and multiply in the monocytes. The salmonella typhi reach to mesenteric lymph nodes and then replicate there and reach to blood stream in the result in primary bacteremia, seeded in the liver, spleen, gall bladder, lymph node and bone marrow where they continue to multiply.

After primary bacteremia, bacteria gain access to bloodstream resulting in secondary bacteremia bacteria gain access to bloodstream resulting in secondary bacteremia. When bacteria are drop from the gall bladder along with the bile juice, they reach the small intestine again, and causing inflammation. (Rao et al.2009).There are different sign of typhoid infection which is malaise, sustained fever, vomiting, poor appetite, severe headache, and splenomegaly. In the adult

Individual diarrhea, Nonproductive cough can occur in the initial stage. Rose spots show on the trunk of 25% of patients, but maybe harder to be seen in patient with darker complexion.(Heymann et al. 2004)

A current study of worldwide ratio of typhoid

infection show that 26.9 million illnesses and 200,000 to 600,000 deaths annually due to typhoid infection. (Buckle et al. 2012) A study conducted in children in Pakistan show that 170/100,000 incidence of typhoid fever yearly. the high ratio of typhoid infection in Pakistan is due to unawareness, unhygienic food, Poverty and poor sanitation (Arif et al. 2012). There are different serological, molecular, cultural, ,biochemical and biotechnological assays are used for identification and characterization of genus Salmonella typhi (Deighan et al. 200).Serological assay are the simplest and quick technique for the detection of *Salmonella typhi* these assay include Dot Immunosorbent Assay (DIA), dip stick assays, widal test, and semi-quantitative tube agglutination test.(Aziah et al. 2007) Typhidot and Widal test is mostly used as a recommended investigation procedure in developing state and regarded as a useful test in endemic areas. This assay is based on the immunological reaction between the antibodies produced to viable bacteria (agglutinins) and their other different counterpart febrile antigens. (Pang et al.1983). Dot Immunosorbent test show the availability of IgG and IgM antibodies to a specific outer membrane protein (OMP) antigen, and is suggested as a confirmative test. (Ismail et al.1991)

Figure 1: Symptoms of typhoid Fever

MATERIALS AND METHODS

Study site

This present study was conducted from 1st of January 2017 to 30th April 2017 at Mardan Medical Complex and Teaching Hospital, KP with an aim to assess the prevalence of *Salmonella typhi* infection causing typhoid across population in district Mardan (fig. 1).

Data and samples collection

A total of 4368 patients which included referrals from both outpatient and hospital inpatient services were taken into consideration. All the subjects included males, females and children. Blood samples were taken and sent to pathology laboratory for further analysis. These patients were included only once in the process.

Typhidot assay

All the blood samples from patients were screened using Typhidot Antibodies test. The dot ELISA kit measures the level of IgG and IgM antibodies in the blood against the outer membrane protein (OMP) of the Salmonella typhi. It separately ascertains IgM and IgG antibodies. It is performed to confirm Typhoid Infection and also during the treatment and after the treatment of

Fever and Typhoid Infection IgM shows recent infection whereas IgG signifies remote infection.

Data analysis

Statistical analysis of the data was performed using MS excel. Percentages and values were presented in the form of figures and tables and comparisons were made among them.

RESULTS AND DISCUSSION

At the MMC pathology lab, blood samples of 4368 patients were screened for the presence of antibodies against salmonella typhi (fig. 2). The test performed was Typhidot standard test. Out of the total patients examined, 575 were positive for IgM, IgG and both of them, which shows a prevalence of 13.16%. Among these subjects, most of the patients are having only IgM which shows a primary infection, while IgG assures a secondary infection.

Moreover, the number of patients suspect for typhoid and then diagnosed as positive for the disease varied from month to month, with the highest number of patients in January and lowest in February (fig. 3). However, more positive cases were identified in month of January i.e. 14.68% followed by April and least in March 11.06%.
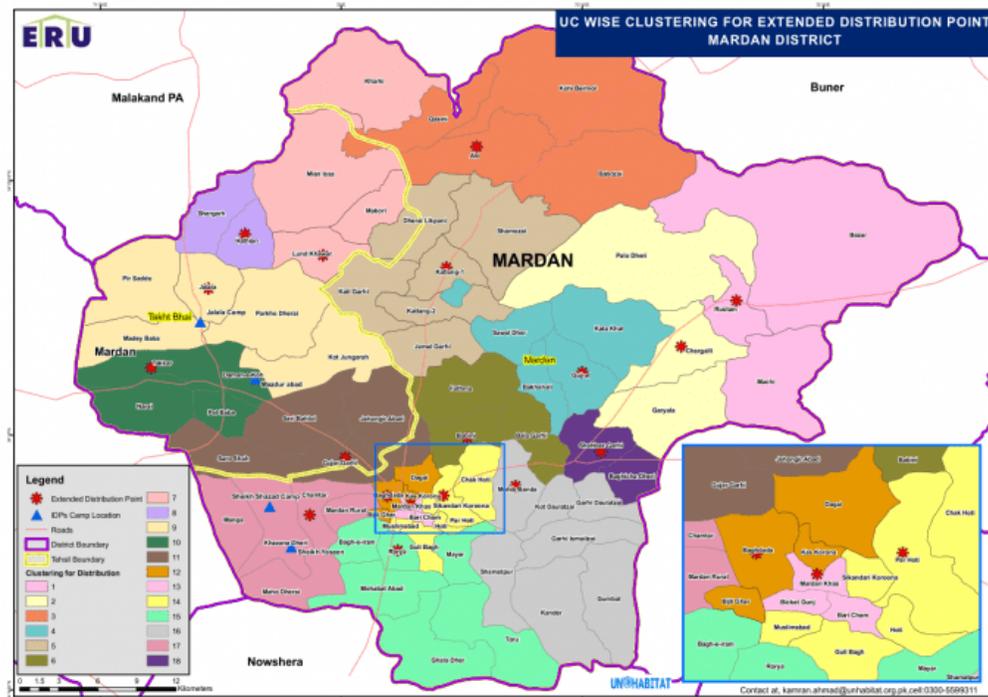

Fig. 1: Map of District Mardan.

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Typhoid infection is one of the most common infection of South East Asian state such as Pakistan and is highly responsible for causing wide range of mortality and morbidity in this country. (Usman et al. 2015) Typhoid infection is still uncontrolled in rural area due unhygenic and awful foods, lack of safe drinking water supply Like other Asian countries, socio-economic condition of individual also play key role in causing typhoid infection (Bajracharya et al. 2014). A study show that the most effect country of typhoid infection is Egypt, India, Mexico, Pakistan, Indonesia, Nepal, and Peru (Sulaiman, et al .2007). Different study show different ratio of typhoid infection in varies cities in Pakistan like Karachi show about 43% of typhoid positive cases out of that about 1.47 % IgG were positive, 21% were IgM positive and 19.7 % were declared positive for both IgG and IgM antibodies (Abdullah et al. 2013). Another study in asia show that every year more than 13 million individual have typhoid infection and about 0.6 million deaths happened per year, (Ivanoff et al. 1994).
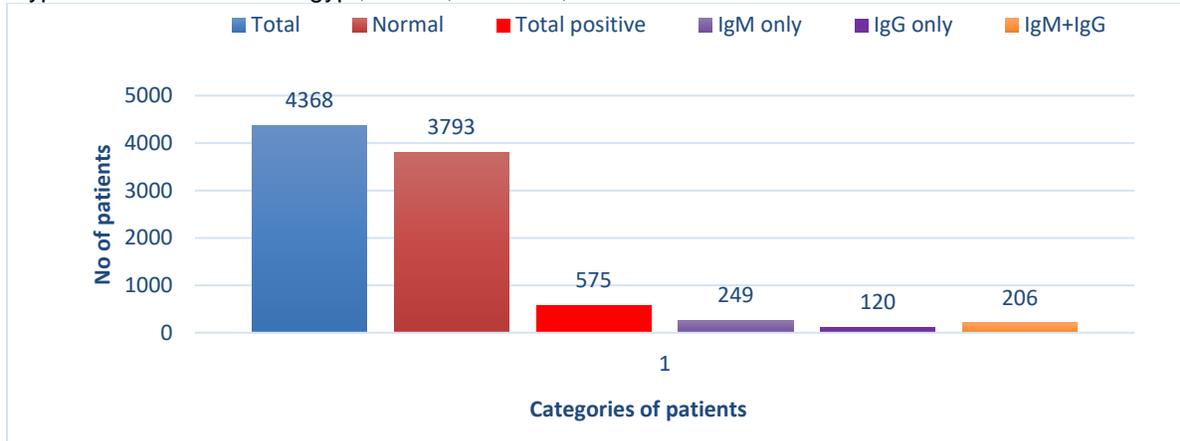

Figure 2: Overall typhoid burden in distract mardan population
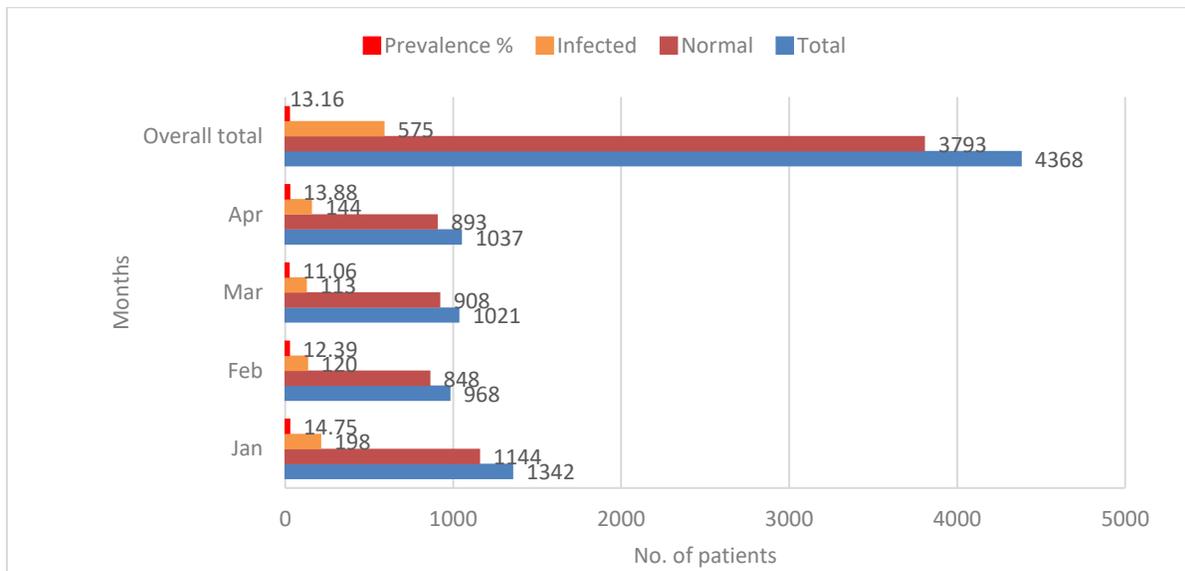

Figure: 3 Monthly distribution and prevalence

The worldwide death ratio of typhoid infection is about 0.2 million (Karkey et al. 2013).A study conducted in Khyber Pakhtunkhwa Pakistan show that the Prevelance ratio of typhoid infection is higher in female as compare to male because children are more susceptible to typhoid infection therefore child caring responsibilities of females make them more susceptible for infection. (Kalsoom et al. 2014).A study done in Khyber Pakhtunkhwa Pakistan shows that females are more affected than males in typhoid. One of the possible reasons why females are more affected than males is that as children are more susceptible to typhoid infection and so child caring responsibilities of females make them more susceptible for infection. (Kalsoom,et al. 2014). A study showed that 4.3 % healthy food handlers were carriers of typhoidal S. entericaserovars which is much higher than the study reported from Iran i.e., 1.88% (Yousefi et al. 2011). Another study directed in India showed 16.6 % carriers' rate which is comparably very high (Senthilkumar et al 2005). The overall carrier rate of Salmonella serovars was 9%. This is similar to studies from China and UK where 9.5 and 12.3 % were carriers of S. entericaserovars,(Dryden et al. 1994).The aforementioned reports depicted almost the same prevalence as noticed in our studies. Most of the Literature study show that highest ratio of typhoid effected patients was observed in age group of 21-30 which was about 43.32% (n=160)21(Jaafar et al. 2013). Most of the children having age group is 1-10 is very susceptible to typhoid infection due to their undeveloped immune system and the individual which is the age group 20-30 the probable cause is their unhealthy life style and awful food along with increased number of social gatherings. The highest prevalence was reported in summer season in Indonesia and Pakistan Karachi and Baluchistan 7% and 28% respectively. Eating locally prepared ice, ice creams and chilled drinks have been recognized as some of major associated risk factors for typhoid fever in children in Karachi during summer 22(Luby et al. 1998). The number of patients infected with typhoid fever was higher (58.37%) among those who drink non-filtered or poor quality water as compared to patients (41.63%) with the facility of filtered water. 23(Rahman et al. 2011). These values are significantly higher compared to our current results.

CONCLUSION

In present study 4368 patients were screened for the presence of antibodies against salmonella typhi to know the approximate burden of the said disease. Out of the total patients examined, a prevalence of 13.16% was recorder based on positive cases. Our result show the decreasing trend of salmonella typhi compared to other research studies performed at different regions of Pakistan. It may be due to increased awareness among people, improved facilities at health center, avoidance of contaminated food, early diagnostic facility, drinking filtered water and also improved sanitation system. Therefore, we have recorded comparatively low prevalence rate than the previous studies.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

AUTHOR CONTRIBUTIONS

Authors Iht, FZ, NuR, SQ, SH, ZH, and SB designed the Research and performed the experiments. FS, MH, ZQ, SU, and FK analyzed the data. TB, IBfig, MSMM wrote the manuscript. and reviewed the manuscript. All authors read and approved the final version.

REFERENCES

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

Arif A, Naheed R. Socio-economic determinants of diarrhoea morbidity in Pakistan. Academic

Research International 2.1 (2012): 23-9944.

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. http://dx.doi.org/10.1016/j.diagmicrobio.2007.05.01 4.

Bajracharya, D., M.I. Khan, A. Pach, III, P. Shrestha N. Joshi, S.R. Upreti, T. Wierzba, M. Puri S. Sahastrabuddhe and R.L. Ochiai, 2014. 25 years after Vi typhoid vaccine efficacy study, typhoid affects significant number of population in Nepal PLoS. One., 9(1): e77974.

Buckle GC, Fischer Walker CL, Black RE. Typhoid fever and paratyphoid fever: systematic review to estimate global morbidity and mortality for 2010. J glob health. 2012;2(1).

Deighan T, Alwan A, Kelly J, Mcnair J, Warren T, Farrelly CO. 2000. Serum haptoglobin: an objective indicator of experimentally-induced Salmonella infection in calves. Research in Veterinary Science 69, 153-158.

Dryden MS, Keyworth N, Gabb R, Stein K. Asymptomatic foodhandlers as the source of nosocomial salmonellosis. J Hosp Infect. 1994;28–3:195–208.

Guzman CA, Borsutzky S, Griot-Wenk M, et al. Vaccines against typhoid fever. Vaccine. May 1 2006;24(18):3804-3811.

Heymann DL, ed Control of Communicable Diseases Manual. 18th ed: American Public Health Association; 2004.

Ismail A, Hai, OK, Kader ZA. 1991. Demonstration of an antigenic protein specific for S. Typhi. Biochemical Biophysical Research Communication 181, 301–305. http://dx.doi.org/10.1016/S0006-291X (05)81417-2

Ivanoff, B., M.M. Levine and P.H. Lambert, 1994 Vaccination against typhoid fever: present status Bull. World Health Organ, 72(6): 957-971

Jaafar NJ, Yuan XG, Nur FMZ, Heng CL, Hani MH, Wan MH, Subhash JB, Prabha B, Asma I, Kia KP. Epidemiological analysis of typhoid fever in Kelantan from a retrieved registry. Malay J Microbiol 2013; 9: 147-151.

Kalsoom, F. Akbar, M. Younas, U. Tasneem, M. Suleman, S.S. Ali, S. Ali and A. Roohi, 2014 Prevalenceof typhoid fever in five Southern districts of Khyber Pakhtunkhwa, Pakistan: A preliminary study,

International Journal of Biosciences, 4(1): 325-330.

Karkey, A., C.N. Thompson, T.N. Tran Vu, S. Dongol, P.T. Le Thi, V.P. Voong, A. Arjyal, L.B. Martin S. Rondini, J.J. Farrar, C. Dolecek, B. Basnyat and S. Baker, 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. Negl. Trop. Dis., 7(8): e2391.

Luby SP, Faizan MK, Fisher-Hoch SP, Syed A, Mintz ED. Risk factors for typhoid fever in an endemic setting, Karachi, Pakistan. Epidemiol Infect 1998; 120: 129-138.

Pang T, Puthucheary SD. 1983. Significance and value of the widal test in the diagnosis of typhoid fever in an endemic area. Journal of Clinical Pathology 36, 471–475.

Rahman A, Ahmad M, Begum RS, Hossain MZ, Hoque SA, Matin A, Mamun MGS, Yeasmin L. Prevalence of typhoid fever among the children in a semi urban area of Bangladesh. J Dhaka Med Coll 2011; 20: 37-43

Rao S. 2009. Salmonella entrica species Typhi: Enyeric (typhoid) fever. Applied Microbiology Cases. http://www.microrao.com/bact11.htm

Senthilkumar B, Prabakaran G. Multidrug resistant Salmonella typhi in asymptomatic typhoid carriers among food handlers in Namakkal district. Tamil Nadu Ind J Med Microbiol. 2005;23–2:92–4.

Sulaiman, K. and A.R. Sarwari, 2007. Culture-confirmed typhoid fever and pregnancy Int. J. Infect. Dis., 11(4): 337-341.

Todar K. Todar's Online Textbook of Bacteriology. 2008;http://www.textbookofbacteriology.net/index.html. Accessed 1-Dec-2010.

UsmanAyub, Aamer Ali Khattak, AfshanSaleem, American-Eurasian Journal of Toxicological Sciences 7 (4): 220-223, 2015 ISSN 2079-2050 © IDOSI Publications, 2015 DOI: 10.5829/idosi.aejts.2015.7.4.95188

Yousefi-Mashouf R, Rangbar M, Mossavi MJ, Ahmady M. Prevalence of Salmonella carriers among food handlers and detection of drug resistance of isolates in Hamadan. J Res Health Sci. 2011;3–2:25–8.