Available online freely at www.isisn.org

Animal Science Journal

Print ISSN: 2220-9549 Online ISSN: 2220-9557

Journal by Innovative Scientific Information & Services Network

RESEARCH ARTICLE ANIMAL SCIENCE JOURNAL, 2023 14(1):33-41. **OPEN ACCESS**

Epidemiological Assessment of Typhoid Fever in Upper Swat, Pakistan

Abdullah Khan[*1], Ahmad Ali [1], Bilal Ahmad[2], Noor Muhammad[2], Jalander Shah[1], Ateeq Ullah[2], Syed Sabir Hussain Shah[2], Sajidur Rahman[2], Irfan Khan[2]and Izhar Ullah[2]

[1]Department of Zoology Islamia College Peshawar**, Pakistan**
[2]Department of Zoology Hazara University Mansehra, **Pakistan**

***Correspondence:** abdullahsheikhbkuc@yahoo.com **Received:** 05-09-2023 **Accepted: 30-09-23 Published online:** 10-10-23

Typhoid fever stands as a significant global health concern, affecting millions of individuals worldwide. The infection caused by Salmonella Typhi has impacted around 17 million people. The prevalence is more pronounced in Pakistan, with a rate of 451.7 cases per 100,000 people annually, in contrast to India's 214.2 cases per 100,000 people per year. Within Pakistan, the Upper Swat region, situated in the Khyber Pakhtunkhwa province, was the subject of a study on typhoid fever frequency spanning from August 2018 to June 2019. The Upper Swat region comprises three Tehsils: Matta, Khwazakhela, and Behrian. During the study period, a total of 270,813 patients sought medical attention at THQ Matta, among whom 829 were diagnosed with typhoid fever (0.306%). Additionally, THQ Khwazakhela received 188,525 patients, with 1,856 cases of typhoid fever reported (0.984%). Similarly, THQ Bahrain recorded 116,282 patients, of which 1,942 were afflicted with typhoid fever (1.670%). Consequently, a cumulative total of 4,627 cases out of 575,622 patients (0.803%) were identified as typhoid fever cases. An intriguing finding is the higher incidence of typhoid fever in females as opposed to males, with females accounting for 52.62% (2,435 out of 4,627) and males comprising 47.38% (2,192 out of 4,627) of the cases. In terms of age distribution, the prevalence of enteric fever is highest among young adults (aged 21-30 years) at 42.34%, followed by a lower incidence in older individuals (12.68%) and children (8.46%). This study's determination of the typhoid fever frequency in Upper Swat offers valuable insights into the disease's local incidence. These insights can prove instrumental in formulating future health policies aimed at tackling the challenge of typhoid fever effectively

Keywords: Enteric Fever, Salmonella typhi, Incidence, Typhoid fever

INTRODUCTION

Reason of Typhoid fever is *Salmonella typhi,* it is also called enteric fever, and *Salmonella typhi*is a rod shape, gram negative, non-capsulated, aerobic, non-spore forming and flagellate bacilli bacteria (Archer & Young, 1988). Typhoid fever most complicated problem in Asia and developing country which is cause due to unhygienic condition and circulated through contaminated water, food and close connection with the person who is affected by disease (Bhan et al. 2005; Crump et al. 2004; Karkey et al. 2008).*Salmonella* having many grades, they belong to a group called Enterobacteriaceae; *Salmonella* has two species; i.e *Salmonella bongori* and *Salmonella enterica. Salmonella enteric* have six sub-species (Su & Chiu, 2007). On a fixed pattern of serotype or serovers *Salmonella enteric* is split into 2600 sub species or serotype (Gal-Mor et al. 2014). *Salmonella* name was given by Daniel Elmer-salmon. *Salmonella enterica, Salmonella bongori. Salmonellaenterica*having six sub-species: *Salmonella entericasalamae,Salmonella entericaarizonae*, *Salmonella entericahoutenae*, *Salmonella entericadiarizonae*, *Salmonella entericaenterica*. Worldwide 17 million people are infected by Typhoid fever and 6 lac people are died due to Typhoid fever (Ivanoff et al. 1994). An estimate show that 11 to 20 million people get sick due to Typhoid and 1,28,000-

1,61,000 people die per year in Pakistan due to Typhoid fever (Shah et al. 2003). More than 2500 serotype of *Salmonella* has been identified on the basis of antigens "H" and "O" (Radostits et al. 2006). Pakistan is present in those countries where Typhoid fever is exists in a certain place. Ratio of Typhoid fever is high in young children in Pakistan. Specifically present in those children who are < 2 years. In these, Children of age group 5-15 years, the Typhoid fever occurrence in endemic areas of Pakistan has been evaluated to be 451.7/100,000 people per year, Second highest in 5 existing in a particular region of countries that is India, Viet Nam, Indonesia, China and Pakistan (Ochai et al. 2008). Now, it has been found that multidrug resistance *Salmonella enterica*serover*typhi*(MDRSEST) segregate have towering emergence grade in Pakistan (Rahman et al. 2014). A meaningful quantity of examination struggle and lookout investigation has been achieved to make out the disorder epidemiology.

Materials and Method

Data during the current study, data was collected from three Tehsil: Matta, Khwazakhela and Bahrain of district Swat. For this purpose we made many visit to the THQ for collection of data from the daily visited patients and analyzed them.

Widal Test.

In Widal test, slide, micropipette, shaker machine, and reagent are used. Reagent contains of O, and H, antigens, these antigens react with the antibodies, produce against *Salmonella typhi*. O antigen present on the body and H antigen is present on tail of *Salmonella typhi.* Widal test is tow methods (Figure 1).

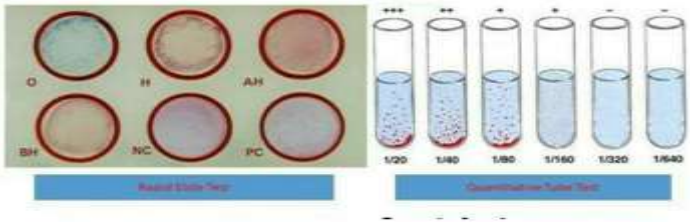

Figure 1: Widal test

Slide Test

The process of the Slide Testes of Typhoid fevers is that first will be taken the blood sample from the patient. This sample is put in tube and centrifuged for about 15 minutes at 200 speeds, for the separation of serum and blood cells. With the help of micropipette, one drop of serum is put on the slide; Slide having six circles as O, H, AH, BH, positive circle and negative circle. We put the serum only O and H circle, AH and BH circles are used for Paratyphoid detection. After the serum, we put one drop of reagent containing antibodies for O antigen, on O circle, another drop of reagent containing antibodies for H antigen, put on H circle. Then slide are put on shaker machine for some time, Shaker machine mix-up the content of serum and reagent. After shaking, slide is left for some time. When agglutination is occur in O or H circle, the result is positive, when agglutination does not occur, the result is negative.

Quantitative Tube Test

Quantitative tube test, tubes are used, to takes 6 tubes 0f 4 sets, put 0.9 ml of isotonic saline in first tube, and to take in all another tubes 0.5ml isotonic saline. Serum is taken in all tube 0.1 ml, to solution become 1 ml. Then 0.5ml solution is transferred from the first tube to the second, second to the third, fourth, fifth and then sixth tube. High rate of agglutination is occurred in 4th tube, this is called titer. When agglutination are occur it means, test is positive while agglutination is not occur it means, test is negative. For O antigen, titer is higher than 1:80 and for H antigen titer higher than 1:60.

Typhidot Test

Modern test, used for the detection of Typhoid fever, it determine the Typhoid fever within 2 dyes after the infection, while Widal test become positive in second weeks of infection. It determines the IgM and IgG antibodies in the blood; IgM positive shows the recent and acute infection while IgG positive shows the old and chronic infection. For the Typhidot test we use different kits and Typhidot buffer (Figure 2).

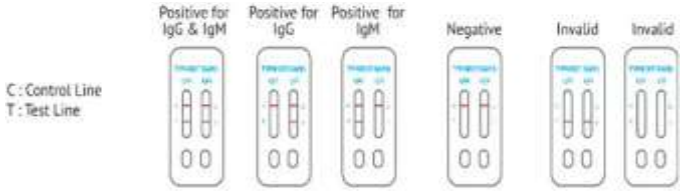

Figure 2: Typhoid test.

Specimens required for culturing are stool, blood and bone marrow or urine. These samples are placed in a specific media, which are Macckonkey agar, Nutrient agar, Xylose lysine deoxycholate (XLD) and Hekon enteric agar etc. On the first day of analysis we take the Mackonkey agar and Nutrient agar for 24 hours. We Stretch the specimens on both agar so white colonies appear on Nutrient agar and pale yellow colonies appear on Macckonkey agar under the microscope. Then on second day we do the biochemical testing in a tube for oxidase negative and catalase positive in TSI agar. The tube is placed in an incubator for 24 hours. On the third day they showed us results. Yellow acidic color appeared on slant and butt region of the tube and black precipitate is appeared in butt region of the tube. Black color indicates hydrogen sulphide (H_2S). Indication of H_2S shows the presence of *Salmonella typhii*f H_2S do not appear then there will no *Salmonella typhi*. On the fourth day we do the

Antibiotic Sensitivity test on MHA media for 24 hours to determine the antibiotic sensitivity and resistance.

Figure 3: Blood culturing of *S.typhi*, TSI agar S.thphi, Gydrogensulphide production and*S.typhi* and*S.paratyphi* positive and negative.

RESULTS

We collected the data of the 11 months, August, September, October, November and December of the 2018 year. January, February, March, April, May and June of the 2019. Upper Swat consists of three Tehsil, Bahrain, Khwazakhela and Matta. Approximately total population of Upper Swat is 833,820, in which population of Matta is 465,996, population of Khwazakhela 265,571 and population of Bahrain is 102,253. Results of Typhoid fever in these three Tehsil are discussed below.

(A)Tehsil Matta

Tehsil Matta is a largest Tehsil in upper Swat on the basis of population, approximately 465,996, in these populations there are 829 Typhoid patients from August 2018 to June 2019. Total 270,813 patients came to Hospitals in which 829 were Typhoid patients, In August 2018; total 29,564 patients came to Hospitals in which 197 Typhoid patients. September 2018, total patients were 25, 417 in which 119 Typhoid fever patients. October 2018, total patients 26,490, in which 89 patients are infected with Typhoid fever. In November 2018 total 23,170 patients came to the Hospitals, in which 77 patients were of Typhoid fever. December 2018 total patients were 24,732 while January 2019 totals patients 23,126 of Typhoid fever. In February 2019 total patients were 24,159; among them affected patients of Typhoid fever are 41, March 2019 total patients 27,979 came to the Hospital in which 52 patients of the Typhoid fever. In April 2019 total patients are 22,678 in which 42 are Typhoid patients. May 2019 total patients are 19,230, among them 49 are Typhoid patients. Last month, June 2019 total patients are 24,268 among them 48 are Typhoid affected patients (Table 1; Figure 4).

(B)Tehsil Khwazakhela

Tehsil Kwazakhela is the second largest tehsil of the upper Swat on the basis of population. Tehsil Khwazakhela consists of total 18, 8525 patients from August 2018 to Jun 2019, in which total 1856 infected patients from Typhoid fever. Total 18, 8525 patients came to Hospital, among them, 19,142 came in August, 18243 in September, 15,332 in October, 20,125 in November and 17,481 in December of the year 2018. While in January 2019, 16,188 patients came, 15,627 in February, 13,243 in March, 16,464 in April, 18,796 in May and 17884 patients came in Jun 2019. There are total 1856 Typhoid patients in Khwazakhela, among them 172 came in August, 150 in September, 201 in October, 190 in November and 181 in December of the 2018. In January 2019, 160 Typhoid patients came, 134 in February, 155 in March, 165 in April, 183 in May and 165 in June of the 2019 (Table 2; Figure5).

(C)Tehsil Behrian

Tehsil Behrain is the third largest Tehsil of the upper Swat, on basis of population.Tehsil Behrain has total 116284 patients, in which 1942 Typhoid infected patients. In August 2018 total 11,568 patients came, 11,144 in September, 8,241 in October, 11,156 in November and 10400 in December, while in January 2019 total patients are 11,624, In which 9819 patients came in February, 10,345 in March, 11931 in April, 10,897 in May and 9,159 in June. There are total 1,942 Typhoid fever patients, among them, 114 patients came in August, 186 in September, 260 in October, 144 in November and 188 in December of the year 2018. While in 2019, 138 Typhoid patients came in January, 198 came in February, 148 in March, 151 in April, 216 in May and 199 in Jun (Table 3; Figure 6).

Table 1: Result of frequency of Typhoid fever in Tehsil Matta

Month	Year	Typh- patients	Total patients
August	2018	197	29,564
September	2018	119	25,417
October	2018	89	26,490
November	2018	77	23,170
December	2018	61	24,732
January	2019	54	23,126
February	2019	41	24,159
April	2019	42	22,678
May	2019	49	19,230
June	2019	48	24,268
Total		829	270,813

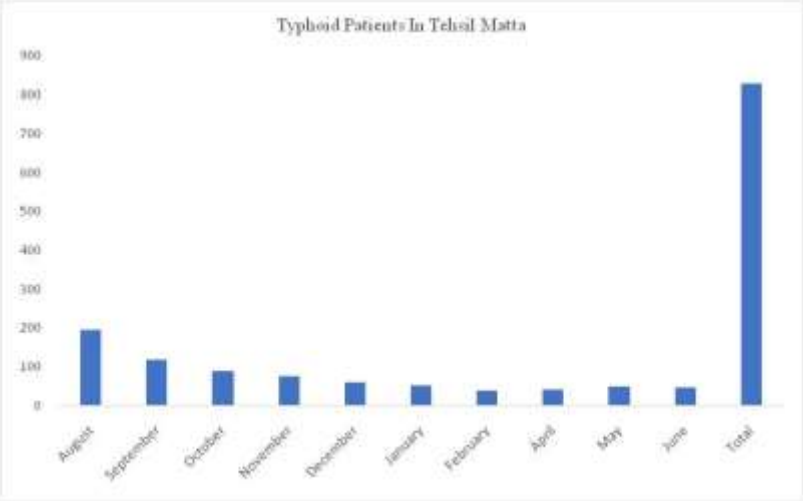

Figure 4: Prevalence of typhoid fever in tehsil Matta

Table 2: Result of frequency of Typhoid fever in Tehsil Khwazakhela

Month	Year	Typhoid patients	Total Patients
August	2018	172	19,142
September	2018	150	18,243
October	2018	201	15,332
November	2018	190	20,125
December	2018	181	17,481
January	2019	160	16,188
February	2019	134	15,627
March	2019	155	13,243
April	2019	165	16,464
May	2019	183	18,796
Jun	2019	165	17,884
Total		1856	188525

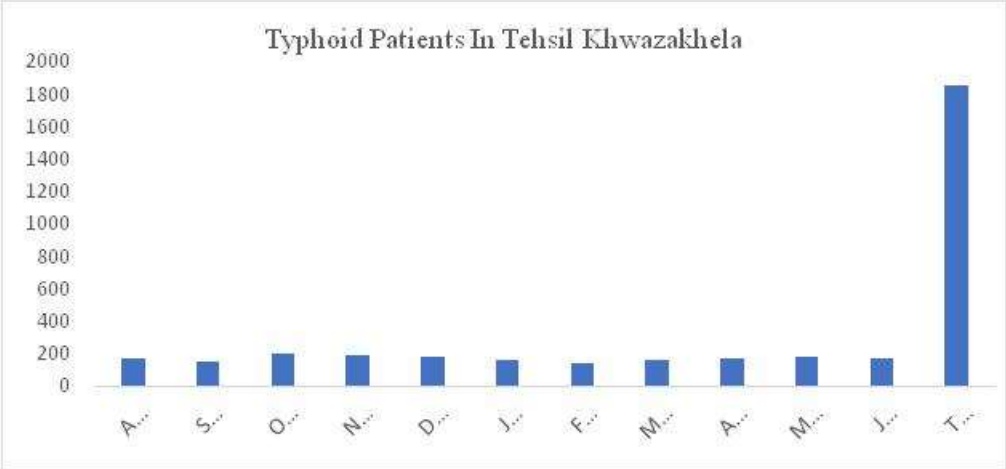

Figure 5: Prevalence of typhoid fever in tehsil Khwazakhela

Table 3: Result for frequency of Typhoid fever in Tehsil Bahrain.

Months	Years	Typhoid patients	Total patients
August	2018	144	11,568
September	2018	186	11,144
October	2018	260	8,241
November	2018	144	11,156
December	2018	188	10,400
January	2019	138	11,624
February	2019	198	9,819
March	2019	148	10,345
April	2019	151	11,931
May	2019	216	10,897
Jun	2019	199	9,159
Total		1942	116,284

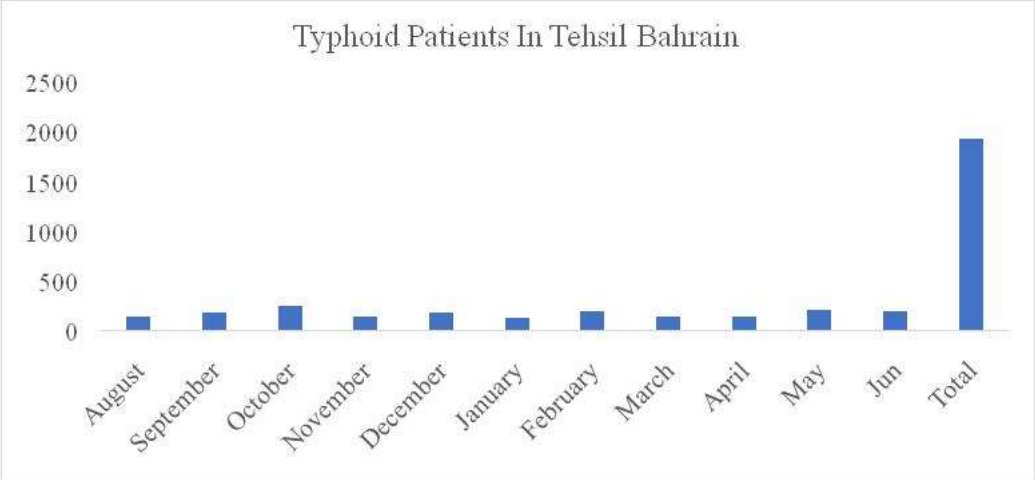

Figure 6: Prevalence of typhoid fever in tehsil Bahrain

Table 4: Result for the total frequency of Typhoid fever in upper Swat.

Tehsil	Total patients	Typhoid patients
Matta	270,813	829
Khwazakhela	188,525	1856
Behrain	116,284	1942
Total	575,622	4,627

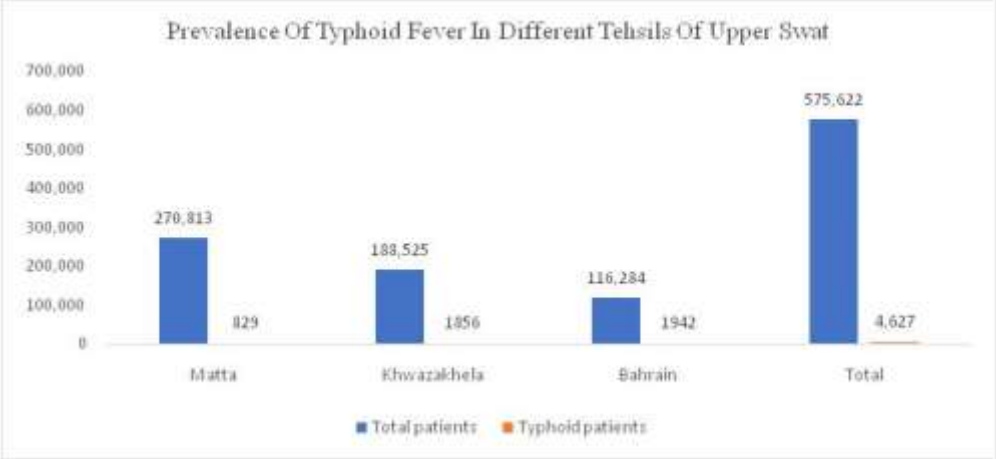

Figure 7: Prevalence of typhoid fever in different tehsils of upper Swat

Table 5: Typhoid fever in different age's group of people in upper Swat

Ages of groups	Numbers of Typhoid patients	%age of typhoid fever
1 to 10 years	396	8.46%
11 to 20 years	1400	30.42%
21 to 30 years	1948	42.32%
31 to 40 years	286	6.088%
41 to 50	311	6.61%
50 and above	286	6.084%
Total	4, 627	100%

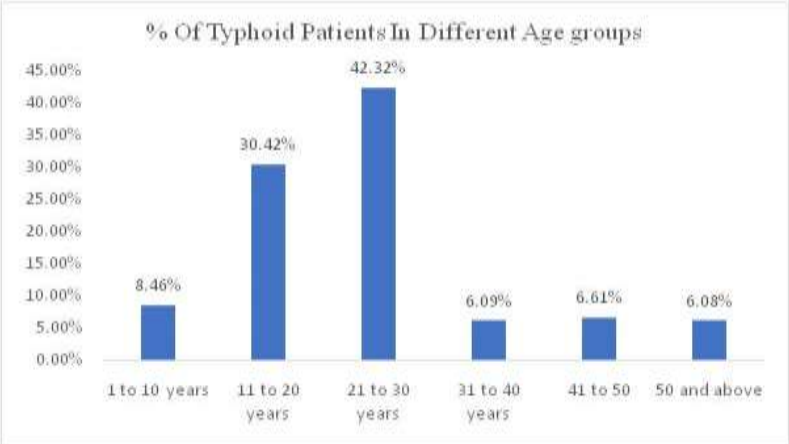

Figure 8: % of typhoid patients in different age groups

Table 6: Results for Typhoid fever in different gander in upper Swat

Gender	Numbers of Typhoid patients	%age of Typhoid fever
Male	2192	47.385%
Female	2435	52.62%
Total	4627	100%

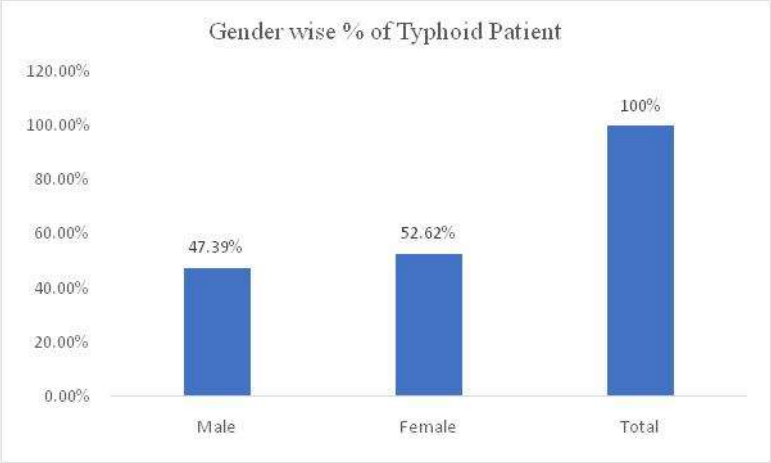

Figure 9: Gender wise % of typhoid patients

(D)Total Frequency of Typhoid fever in upper Swat

Upper Swat consists of three Tehsil, Tehsil Matta, Tehsil Khwazakhela and Tehsil Behrain. In Tehsil Matta total patients were 270,813 from August 2018 to June 2019, in which 829 were Typhoid fever patients; in Tehsil Khwazakhela total patients were 188,525 in which 1856 were Typhoid fever patients. In Tehsil Behrains, total patients were 116, 248 in which 1942 were Typhoid fever patients. Total patients of the upper swat were 575,622 in which 4,627 were Typhoid fever patients (Table 4; Figure 7).

(E)Ages Wise

Individuals were divided into different groups on the basis of ages such as, 1 to 10 year, 11 to 20 years, 21 to 30 year, and 31 to 40 year, 41 to 50 year and above 50 year. Total 4627 infected patients with Typhoid fever, among them 396 patients of the age's group 1 to 10 years, with the 8.46%. In the age group from 11 to 20 years, 1400 patients were found infected with Typhoid fever with the 30.42%. Third group of the age, 21 to 30 years, total 1948 Typhoid fever infected patients were found with 42.32%. These third group highest prevalence of Typhoid fever. Another group of the ages, 31 to 40 years 286 Typhoid fever were found with the 6.088%. Another group of the 41 to 50 years were found total 311 patients with the 6.65%. Sixth group of the age 50 years or above 50 year, total patients were found 286 with 6.84% (Table 5; Figure 8).

(F) Gander Wise:

Total 4,627 confirmed Typhoid patients were visited different public and private Hospitals of district upper Swat, upper Swat have three Tehsil, Tehsil Matta, Kwazakhela and Tehsil Behrain, In these three Tehsil, prevalence of Typhoid fever is high in females than males, Total 2192 males were infected by *Salmonella typhi* which is 47.38%. Total 2,435 females were infected by *Salmonella typhi* which is 52.62% (Table 6; Figure 9).

DISCUSSION

(Bukhari et al. 2016) conducted a study on frequency of Typhoid fever and its connection with seasonal interpretation in Texila Pakistan. They analyze the number of Typhoid fever in the rural area of Texila. They collected the sample from 760 patients for the diagnosis of Typhoid fever who's have the symptoms, nausea, headache and decreased WBC and were analyze for seropositivity by immunochromatographic that is Typhoid and slide agglutination that is Widal test. In 760 patients 192 were positive for Typhoid fever which is 25.26% (Widal and Typhoid test). The maximum number of Typhoid fever is from April to June while the minimum number is from January to March which shows that rate of Typhoid fever in high in summer as compared to winter season. According to them, age wise analysis shows that rate of Typhoid fever is higher from 10 to 15 years and 25 to 35 years while less in 5 to 10 years and 60 to 71 years. Gender wise analysis shows that females were 24.49 percent while males were 25.9 percent which indicate that

rate of Typhoid fever is slightly more in males. In our study there is 4627out of 575622 (0.803%) were positive for Widal and Typhidot test in upper Swat Pakistan from August 2018 to June 2019 which have the symptoms nausea, headache and abdominal pain. Here the rate of Typhoid fever is less is compared to Taxila because of poor hygienic conditions and contamination in drinking water in Taxila. In our study the rate of Typhoid fever is slightly high in summer as compared to winter because the conditions for *Salmonella typhi* were good in summer. In our study, age wise analysis shows that, rate of Typhoid fever is higher from 21 to 30 years (42.32%). Gender wise ratio, indicate that rate of Typhoid is slightly higher in females (52.62%) as compared to males (47.385%). There is small difference in our study and Bukhari et al. 2016 due to poor hygienic condition, contamination in drinking water, poor sanitation, over population and sewerage system. The years and seasonal variation rates are almost same. Here the rate of Typhoid fever is higher in females because of the care of children make them infectious.

Typhoid fever is the most important infection in the south Asia including Pakistan and having a high rate in Pakistan. There are many causes of Typhoid fever in Pakistan. Frequency of Typhoid fever is higher in rural area because of contamination of food and water and poor hygienic conditions. High rate of Typhoid in Asia is over population (Bajracharya et al. 2014). Ayub et al. 2015 work on incidence of Typhoid fever in Islamabad, Pakistan (Ayub et al. 2015). They isolate the 1500 patients (through Typhidot test) of Typhoid fever who visited to CDA Hospital (capital development authority) from January 2014 to December 2014. Among these patients they separated them on the basis of gender wise and age wise. The tests were analyzed to detect the IgG (Acute infection) and IgM (Chronic infection). In 1500 patients 348 (23%) were positive for IgM, 74 (5%) were positive for both IgM and IgG and no one for IgM only. Gender wise was IgM 129 (37%) males and 219 (63%) females. While in both IgG and IgM 31 (42%) were males and 43 (48%) were females. The rate of Typhoid fever was high in Islamabad because of over population. In our study there is 4627 (0.803%) were positive for IgG and IgM. Gender wise ratio, indicate that rate of Typhoid is slightly high in females (52.62%) as compared to males (47.385%) for IgG and IgM. The frequency of Typhoid fever is lower in Swat as compared to Islamabad because of over population and contamination in water and food. Frequency of Typhoid fever in females is more as compared to males in both studies with the similarity. Frequency of Typhoid fever is increasing day by day in upper Swat so we should need better planning for it.

CONCLUSION

Our analysis indicates that frequency of Typhoid fever is high in Tehsil Madyan as compared to Tehsil Khwazakhela and Matta. It's due to poor hygienic condition, contamination in food and drinking water. Our results also show that frequency of Typhoid fever is high in females as compared to males it is due to child care. Rate of Typhoid are more in age of 21-30 years.

ACKNOWLEDGMENT

Authors acknowledge The Department of Zoology, Islamia Collage University Peshawar, Pakistan.

REFERENCES

Archer, D. L., & Young, F. E. (1988). Contemporary issues: diseases with a food vector. *Clinical microbiology reviews*, *1*(4), 377-398.

Ayub, U., Khattak, A. A., Saleem, A., Javed, F., Siddiqui, N., Hussain, N., & Hayat, A. (2015). Incidence of typhoid fever in Islamabad, Pakistan. *Am-Eurasian J Toxicol Sci*, *7*(4), 220-223.

Bajracharya, D., Khan, M. I., Pach III, A., Shrestha, P., Joshi, N., Upreti, S. R., . . . Ochiai, R. L. (2014). 25 years after Vi typhoid vaccine efficacy study, typhoid affects significant number of population in Nepal. *PloS one*, *9*(1), e77974.

Bhan, M., Bahl, R., & Bhatnagar, S. (2005). Typhoid and paratyphoid fever. *The Lancet*, *366*(9487), 749-762.

Bukhari, N., Saleem, A., Jabbar, A., Khan, S. N., Ahmad, B., Habib, N., . . . Khan, M. A. (2016). Frequency of typhoid fever and its association with seasonal variations in Taxila, Pakistan. *Asian Pacific journal of tropical disease*, *6*(8), 608-610.

Crump, J. A., Luby, S. P., & Mintz, E. D. (2004). The global burden of typhoid fever. *Bulletin of the World Health Organization*, *82*(5), 346-353.

Gal-Mor, O., Boyle, E. C., & Grassl, G. A. (2014). Same species, different diseases: how and why typhoidal and non-typhoidal Salmonella enterica serovars differ. *Frontiers in microbiology*, *5*, 391.

Ivanoff, B., Levine, M. M., & Lambert, P. (1994). Vaccination against typhoid fever: present status. *Bulletin of the World Health Organization*, *72*(6), 957.

Karkey, A., Aryjal, A., Basnyat, B., & Baker, S. (2008). Kathmandu, Nepal: still an enteric fever capital of the world. *The Journal of Infection in Developing Countries*, *2*(06), 461-465.

Ochai, R., Acosta, C., Danovaro-Holliday, M., Baiqing, D.,

Bhattacharya, S., & Agtini, M. (2008). A study of typhoid fever in five Asian countries: disease burden and implication for controls. *Bull WHO*, *86*(4), 260-268.

Radostits, O. M., Gay, C., Hinchcliff, K. W., & Constable, P. D. (2006). *Veterinary Medicine E-Book: A textbook of the diseases of cattle, horses, sheep, pigs and goats*. Elsevier Health Sciences.

Rahman, B., Wasfy, M., Maksoud, M., Hanna, N., Dueger, E., & House, B. (2014). Multi-drug resistance and reduced susceptibility to ciprofloxacin among Salmonella enterica serovar Typhi isolates from the Middle East and Central Asia. *New microbes and new infections*, *2*(4), 88-92.

Shah, S. M., Yousafzai, M., Lakhani, N. B., Chotani, R. A., & Nowshad, G. (2003). Prevalence and correlates of diarrhea. *The Indian Journal of Pediatrics*, *70*, 207-211.

Su, L., & Chiu, C. (2007). Salmonella: clinical importance and evolution of nomenclature. *Chang Gung medical journal*, *30*(3), 210.