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Determination of prevalence of Typhoid fever by Widal test in the population of Manyara region, Tanzania

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Abstract:

Typhoid fever caused by ingestion of contaminated food and water with *Salmonella typhi and paratyphi* is a major health problem in developing countries. The main aim of this study was to determine the prevalence of typhoid fever in the patients attending Haydom Lutheran Hospital, Haydom, Manyara region, Tanzania.

Blood samples were collected from 440 patients with symptoms clinically similar to typhoid fever and visiting Haydom Lutheran Hospital from April 2016 to May 2016. Widal slide agglutination test was used for the determination of antibody titer. An antibody titer of >1/80 was taken as a cut of value to indicate infection of typhoid fever. The questionnaire data collected from the participants was used to determine the correlation between typhoid fever and factors such as age and sex.

Out of 440 participants, two hundred and eighty three (64.31%) participants were females and one hundred and fifty seven (35.69%) were males. Among 440 blood samples collected, 119 samples were found to be positive for typhoid fever with an overall prevalence of 27.05%. Individuals of school going and college going age groups (11-20 years) was being more affected (43.33%), whereas others with age group 1-10 years were least affected (6.06%). Out of 119 positive samples, male subjects were more affected (38.85%).

The results of this study indicated that the typhoid fever can occur at any age group but school going and college going age population was more affected. In addition, male patients showed increase risk of getting infection than females.

Introduction:

Typhoid fever, also known as enteric fever or simply as typhoid, is a bacterial infection caused by the gram negative bacterium *Salmonella typhimurium*.[1] Symptoms may vary from mild to severe and include long term high fever, weakness, headache, stomach pain and loss of appetite.[2] A few patients have constipation and some have a rash (rose-colored spots). Rarely internal bleeding and death can occur. Typhoid is mainly associated with low socioeconomic status and poor hygiene.[2]

In 2000, it was estimated that about 21.7 million cases of typhoid fever and 217,000 related deaths occurred worldwide.[3] In 2013, it resulted in about 161,000 deaths.[4] Infants, children, and adolescents in south-central and Southeast Asia experience the greatest risk.[5] Typhoid fever is also frequently reported in sub-Saharan Africa and countries in Southeast Asia. [6-9]

Typhoid fever is endemic to Tanzania, quite often complicated with malaria co-infection leading to diagnostic complications and significant mortality.[10] This arises due to the fact that many diseases shows similar symptoms like fever. Being an important communicable disease in the national list, typhoid fever has received considerable control efforts at national, regional and district levels. Typhoid is much more common in our communities than is believed. Possible reasons for under-diagnosis may include:

- Failure of doctors and nurses to suspect it and to collect blood cultures from febrile patients
- Misdiagnosis as malaria or pneumonia. Clinical diagnosis is not reliable because based on symptoms some diseases could present the same in terms of signs and symptoms which will lead to improper treatment.

The situation is complicated. The disease may thrive and cause an increase in prevalence of typhoid fever in that;

- Firstly, some people may be carriers of typhoid so that although they exhibit no outward signs of the disease but they have the pathogens.
- Secondly, incorrect reporting of data could give a wrong impression on the prevalence of typhoid in the area of study.
- Thirdly, self treatment. Using drugs without proper diagnosis which could bring about drug resistance in the future.

We try to get information about typhoid fever in Haydom, Manyara region, Tanzania but we can't. Therefore, the present work is aimed to determine the prevalence of typhoid fever and distribution among different age groups in Haydom Lutheran Hospital, Haydom, Manyara region, Tanzania. In order to reduce the risk of infection health education about personal hygiene is of greater importance. The results from this study will expose the overall prevalence of typhoid fever and will help the health care service providers to design intervention measures and address the present problem.

Materials and methods:

Study area

The study was conducted in Haydom Lutheran Hospital, Haydom, Manyara region, Tanzania from April 2016 to May 2016. Haydom Lutheran hospital is located in the North of Tanzania, around 300 km South-West of Arusha. In Mbulu area, Haydom Lutheran is the largest hospital with more than 400 beds. This hospital serves approximately one million people in its direct catchment area and a population of 3 million for its secondary function (referral).

Study design and population

A cross sectional study was designed which employed quantitative methods of data collection. The study population involved all patients attended medical attention at Hydom Lutheran hospital for typhoid fever diagnosis. No specific age group had chosen on assumption that typhoid being transmitted by fecal-oral route. There are other factors that have been reported in different endemic settings that can increase risk of contacting typhoid to any age group. The study included individuals of all ages and sexes.

Sampling and sample collection

Simple random sampling was used to select a sample from a total study population. Sample used in this study was blood. About 5 ml of blood sample was aseptically collected with disposable sterile syringe by vene puncture from each patient into plain tubes without anticoagulant. The blood samples were centrifuged and the serum separated was used for the typhoid fever diagnosis. Structured questionnaires were administered and sociodemorgraphic information of each patient was obtained.

Diagnosis of typhoid fever

For diagnosis of typhoid fever, quantitative Widal slide agglutination test was performed as per the manufacturer's guideline. This test determines the presence of antibodies in the patient's serum against somatic (O) and flagella (H) antigens of *Salmonella.*[11] A saline control was employed in each batch of test as negative. Serial dilution of sera starting at a dilution of 1:20 to 1:320 was made with 0.9% saline. 50 µl of diluted sera from each patient were taken on a clean tile, mixed by stirring with one drop of antigens for few seconds and observed for agglutination. Agglutination within one minute and a reaction titre of >1/80 in a single test was considered as positive test. [12,13]

Results:

Distribution of participants

The study population involved 440 patients who were screened from April 2016 to May 2016. The distribution of participants according to age and sex is shown in Table 1. Out of 440 patients 283 (64.31%) were females while 157 (35.69%) were males. Among the 440 participants, the number and percentage of participants were more in the age group 31-40 years (20.0%) and less in the age group 81-90 years (0.68%).

Table 1. Distribution of participants according to age and sex

Parameter	Number of participants	Percentage of participants (%)
Based on age (years)		
1-10	33	7.5
10-20	60	13.64
21-30	68	15.45
31-40	88	20.00
41-50	75	17.05
51-60	60	13.64
61-70	35	7.95
71-80	18	4.09
81-90	3	0.68
Total	440	100
Based on sex		
Male	157	35.69
Female	283	64.31
Total	440	100

Knowledge about typhoid in the community:

The number and percentage of people with knowledge about signs & symptoms of typhoid, modes of transmission of typhoid and measures for controlling typhoid were presented in Table 2. From the results it was indicated that the participants were quite informed about the typhoid disease and its symptoms. However, majority of them were unaware of the mode of transmission and control of typhoid disease.

Table 2. Knowledge about typhoid in the community

Variable	Number of participants	Percentage of participants (%)
About typhoid		
Known	390	88.64
Not known	50	11.36
Signs and symptoms of typhoid		
Known	275	62.50
Not known	165	37.50
Transmission of typhoid		
Known	181	41.14
Not known	259	58.86
Control measures of typhoid		
Known	195	44.32
Not known	245	55.68

Prevalence of typhoid

Widal test results of samples showed that out of 440 samples, 119 samples were positive. The overall prevalence of typhoid fever in the participants was found to be 27.05%. From these 119 positive samples, 106 (24.10%) samples showed agglutination at 1:160 dilution while 13 (2.95%) samples showed agglutination at 1:320 dilution.

Prevalence of typhoid positive participants was checked according to their age and sex. The results are summarized in Table 3. The highest prevalence of typhoid was recorded among the age group of 11-20 years (43.33%) followed by age groups 31-40 years (38.64%) and 21-30 years (33.82%). The lowest prevalence was recorded among the age group of 1-10 years (6.06%) as is shown in Table 3. As shown in Table 3, the prevalence of typhoid was found to be higher in males (38.85%) in comparison with females (20.49%).

Table 3. Prevalence of typhoid

Parameter	Number of participants	Number of positive cases	Prevalence (%)
According to age (years)			
1-10	33	2	6.06
11-20	60	26	43.33
21-30	68	23	33.82
31-40	88	34	38.64
41-50	75	14	18.67
51-60	60	11	18.33
61-70	35	6	17.14
71-80	18	2	11.11
81-90	3	1	33.33
According to sex			
Male	157	61	38.85
Female	283	58	20.49
Over all prevalence			
---	440	119	27.05

Discussion:

The results of current study showed that the 119 cases are positive for typhoid fever by Widal test from a total of 440 samples collected from Haydom Lutheran Hospital. The study finds the prevalence of typhoid fever to be 27.05% among the patients screened at Haydom Lutheran Hospital from April 2016 to May 2016.

Out of 119 (27.05%) tested positive, 106 samples (24.10%) had an agglutinin titer level equal to 1:160 whereas 13 (2.95%) samples had an agglutinin titer level equal to 1:320. This shows that the disease prevalence is still high and a problem in the area although 321 (72.95%) of the tested samples showed no reaction (negative Widal test). The cases that are positive at a given time were high which means that if more research has been carried out annually or semiannually more data will be identified to explain more on the severity of the typhoid fever in the area.

This study determined the relationship between typhoid fever and demographic data of the participants, including gender and age. The prevalence of typhoid fever was studied in different age groups from 1-90 years. The highest prevalence rate (43.33%) was found in 11-20 years of age group and lowest prevalence (6.06%) of typhoid fever was observed in the age group 1-10 years. The present study results are similar with the results reported by Tareen et al.[12] They reported high and low prevalence of typhoid fever in age group 11-20 years and 1-10 years, respectively in district Quetta, Balochistan, Pakistan.[12] The high prevalence of typhoid fever in adolescent and college age may be because of intake of unhygienic food and water. The present study findings slightly differ when comparing with the results reported by Ayaz et al in Pakistan[14] and Al-ameri & Saif in Yemen.[9] Ayaz et al reported that the prevalence of typhoid fever was high in <15 years of age group.[14] Al-ameri & Saif showed that the highest positive widal test result was found in the age group of >20 years while the highest negative Widal test result was found in the age group of 5-15 years.[9] The current study results have no similarity with results reported by Prajapati et al in Nepal.[15] Prajapati et al found highest prevalence of typhoid fever in 1-10 years of age group. This may be due to factors such as behavioral patterns, immunological status and environmental factors of the participants of their study.[15]

Current study showed that more sera from males (38.85%) were more Widal positive than sera from females (20.46%). This is maybe as a reflection of diverse eating habits and level of personal hygiene.[12,16] More prevalence of typhoid in males may be due to their extra outdoor activities, which increase the risk to consume unhygienic and contaminated food. Low prevalence in females may be due to the fact that they remain indoor and follow basic hygienic principles. These results are in agreement with the findings of Tareen et al,[12] Prajapati et al [15] and Okonko et al.[16]

Although contaminated food and water have been identified as the major risk factors for typhoid fever prevalence, there are some other factors that have been reported in different endemic settings such as poor sanitation, close contact with typhoid cases or carriers, level of education, larger household size, closer location to water bodies, flooding, personal hygiene, poor life style, and travelling to endemic areas where typhoid is present. [17]

The Widal test is commonly used in the diagnosis of typhoid fever in most of the hospitals in Africa.[10,18] It is inexpensive and easy to perform although the tube method is recommended to be performed for accurate results. As a step towards accurate laboratory diagnosis, it is important that the test is performed and interpreted by laboratory personnel per the manufacturer's instructions so as to avoid inaccurate reporting of results.

As some other diseases such as malaria, rheumatoid arthritis, chronic liver disease, nephrotic syndrome, and ulcerative colitis may show similar symptoms to typhoid fever and produce high O antibody titres, these conditions should also be evaluated as differential diagnoses in order to reduce cases of false positive Widal test results.[19] Although definitive diagnosis of typhoid is by isolation of the bacteria from blood, bone morrow or other body fluids, most of the developing nations due to limited access to laboratory facilities Widal test is still used.[20] There should be proper management and policy to ensure that there is effective confirmation test for typhoid fever and they must be used to reduce the cases of typhoid fever and the prevalence.

Conclusion and recommendations:

The present study determined that the prevalence of typhoid fever is higher in 11-20 years age group and male subjects. Widal test is commonly used for diagnosis of typhoid fever in most of the developing countries.

Typhoid fever remains a major public health challenge. This may be due to the fact that:

- The development of an adequate infrastructure for improved water and sanitation requires large investments, and is therefore a far-off objective for the poor countries in the world.
- Based on transmission, humans are the main source of infection and transmission of *S. Typhi* is by the faecal-oral route through contaminated water or food. Preventive measures need to include water and sanitation improvements, as well as health education.
- Typhoid fever can be effectively treated with antibiotics, but growing rates of antibiotic resistance in many countries are making this treatment option increasingly more difficult and costly.

Thus to reduce new cases of typhoid - proper diagnosis of typhoid should be done, health education should be given together with water and sanitation improvements.

Ethical consideration:

Ethical approval for the study was given by International Medical and Technological University Ethical committee, Dar Es Salaam, Tanzania and permission to conduct study at Hydom Lutheran hospital. Informed consent was obtained from the participants before sample collection. All the information obtained from the participants was treated confidentially. Data were collected anonymously and no data was tailed with any respondent's name. The respondents were assured that the information collected would be used only for purpose of the study.

Competing interests:

The authors declare that there is no conflict of interest in the present study.

Author's contribution:

All authors were involved in the conceptualization of the study. CBS and LMG contributed to the data acquisition and interpretation. KRK and DDK helped greatly in data analysis and interpretation. CBS and LMK drafted the manuscript. All authors have read and approved the submitted version of the manuscript.

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