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## A Prevalence Study of Typhoid Fever in Taiz and Al-Hodiedah cities in Yemen

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### Authors' contributions

*This work was carried out in collaboration between all authors. Author GA designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Author NS managed the analyses of the study and managed the literature searches. All authors read and approved the final manuscript.*

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### ABSTRACT

**Aims:** Typhoid fever is an acute illness associated with fever that is most often caused by the *Salmonella typhi* bacteria. This study was carried out to determine the prevalence of typhoid fever and distribution among different groups in Al-hodiedah and Taiz hospitals, and to determine the relation between the two governorates.

**Study Design:** Seroprevalence survey.

**Place and Duration of Study:** This study was carried out in Taiz hospitals and Al-Hodiedah hospitals in Yemen for about 1500 cases during September to December 2012.

**Methodology:** A total of 1500 cases were randomly collected and examined by Widal test and blood samples for WBC to detect the typhoid fever. Also, the questionnaire data was used for determine the correlation between typhoid fever and other factors such as age, sex, and clinical symptoms, then the data analyzed by spss program.

**Results:** This study found that 151 cases of typhoid fever are positive for widal test from total 1500 specimens was collected from Al-hodiedah hospitals and Taiz hospitals. Also found from 151 positive cases 57 cases for male and 94 cases for female.

There were 55 cases the main complain was fever follow by diarrhea 42 cases then abdominal pain 31 cases.

**Conclusion:** The results of the study indicate that there is no significant different in the prevalence of typhoid fever between cases collected from Taizhospitals and Al-Hodeida hospitals. Also, no significant different between sex or age and the positive cases. The positive cases were come with different manifestations such as fever, abdominal pain and

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diarrhea.

**Keywords:** Taiz hospitals; Al-Hodiedah hospitals; typhoid fever; widal test; –WBC test.

## 1. INTRODUCTION

Typhoid or enteric fever is an ancient disease, which has afflicted mankind. It is caused by *Salmonella enteric serovar typhi* (Previously known as *salmonella typhi*), a pathogen specific only to humans, as well as by certain non-typhoid salmonella (NTS), particularly Paratyphoid strains A, B, C.

These waterborne gram negative aerobes are associated with poor sanitation and fecal contamination of water and food supplies. The syndrome needs to be distinguished from that caused by many other organisms. Today there are as many as 16-30 million cases per year, almost exclusively in the developing world, with a mortality rate of 10% [1].

Typhoid fever is a common infectious disease worldwide [2], and is common in Africa and South America, but the greatest risk seems to be on the Indian subcontinent [3].

About 16 million new cases of typhoid fever with 600000 deaths caused by *Salmonella enteric serotype Typhi* (*S. Typhi*) occur globally each year [1] with the highest incidence (1000 cases per 100000 people per year) in Southeast Asia. The incident rate of typhoid in Asia-pacific region is estimated at more than 100 cases/100,000 population per year [3]. The highest burden of disease has been observed in children. The disease is unique to human, it is characterized by malaise, fever, abdominal discomfort, transient rash, splenomegaly, hepatomegaly, bradycardia, and leucopenia, the most prominent major complications are intestinal hemorrhage, and perforation [4]. Typhoid fever is important surgically because abdominal complications such as intestinal perforation, bleeding, Cholecystitis and pancreatitis represent the most serious complications of the illness.

The disease is classical example of enteric fever caused by *Salmonella*, however Enteric fever, similar to typhoid fever, can also be caused by other *Salmonella* serotypes and is termed paratyphoid fever [4]. In our community as in other parts of the developing countries, febrile illness other than typhoid are common, e.g., Brucellosis, Tuberculosis, Meningitis, Hepatitis, and certain other acute fevers with an overlapping clinical picture leading to diagnostic confusion [5].

The common renal complications of typhoid fever are pyelonephritis and cystitis. Patients with typhoid glomerulonephritis may present with acute renal failure, hypertensive encephalopathy or nephritic syndrome. Presence of typhoid nephritis increases mortality to 20-30% in untreated typhoid fever [4,6].

Since the clinical presentation may not be specific; much falls on the laboratory for the rapid, reliable, and accurate early diagnosis of typhoid fever. The laboratory diagnosis directly depends on the day of illness and the investigation sought. Blood cultures carry 70-75% of diagnostic yield in the first week of illness and are still regarded as the gold standard for diagnosis [7]. The culture is often not possible in developing countries, where the disease is common and endemic, because bacteriological facilities are not available in many of the smaller hospitals, under these circumstances the diagnosis has to be made by the

association of a clinical picture compatible with typhoid and a significant titer of agglutination antibodies in the blood against the H, and/or, O antigen of *Salmonella typhi* (Widal test) [8].

The commonly used Widal test reaction is an agglutination test using bacterial suspensions of *Salmonella typhi* and *Salmonella paratyphi* A and B, treated to retain only the somatic (O) or flagellar (H) antigens, these are used to detect the corresponding antibodies in patient serum, the earliest serological response in acute typhoid fever is said to be arise in the titer of the O antibody, the H antibody usually develops more slowly but persists longer than O, towards the end of the first week of illness titers of either antibody may be as high as 1:160 but paired sera taken 4 to 5 days apart give more reliable information, as an acute infection they should show an obvious rise [9].

Two safe and efficacious typhoid vaccines, the inject able vi polysaccharide and the oral Ty21a, have been licensed; and new, improved candidate vaccines are currently being tested [10,11]. However, typhoid vaccination has not been implemented as a routine public health measure in most typhoid- endemic countries despite the low price of the vaccine (Vi polysaccharide costs ca. US\$ 0.50 per dose) and the high cost of treating the disease [12]. Policy-makers in several developing countries have indicated that updated data on the incidence of typhoid in their countries are essential before they introduce the vaccines into programmers [13,14]. We try to find information about typhoid fever in Yemen but we can't so the present work aimed to determine the prevalence of typhoid fever and distribution among different groups in Al-hodiedah and Taiz hospitals, and to determine the relation between the two cities.

## 2. MATERIALS AND METHODS

### 2.1-Samples Collection

The study was taken in Taiz and AL-Hodeida cities of Republic of Yemen during September to December 2012 (Fig. 1).

We collected 1500 blood samples randomly from two cities, then extracted the serum from blood samples.

Our study has done in those cities in following hospitals:

1. Hospitals in Taiz (AL-askri-AL-jomhwr-AL-thawrh-AL-rawda-AL-safwaand-AL-khalide).
2. Hospitals in AL-Hodeidah (AL-askri-AL-thawrth-AL-amal-and Al-nadia).

All the samples have taken with respect of the age (5- 25 years), and gender, regardless the season.

We used pre designed questionnaire for each case (1500 cases), which included information about location, time of collection, name of hospitals and method which used for diagnosis of typhoid.



Fig. 1. Map of Yemen

## 2.2 Diagnosis of Typhoid Fever

### 2.2.1 Serological tests: widal agglutination test (WAT)

The Widal test was performed with standardized kits (Difco). Serum samples of patients were screened with a slide agglutination test which measures agglutinating antibodies against the lipopolysaccharide 'O' and protein flagellar 'H' antigens of *S. typhi* and Para typhi A and B. Serial dilution of sera starting at a dilution of 1:20 to 1:320 were made with 0.9% saline and examined for visible agglutination [15,16].

### 2.2.2 Hematological tests

White Blood Cells Count (WBCs) Twenty milliliters of blood was mixed with 0.4 ml of WBCs solution for 10 minutes and 0.01 ml was added to WBCs chamber and WBCs were counted [17,18].

### 2.3 Statistical Analysis

The statistical analysis was done with Statistics software version 17. The correlation coefficients were calculated to determine the correlations between the two governorates typhoid fever incidence and between positive cases with other factors such as sex or age and clinical symptoms.

### 3. RESULTS

This study found that 151 cases of typhoid fever are positive for widal test from total 1500 specimens were collected from Al-hodiedah hospitals and Taiz hospitals (Table 1). 'O' and 'H' agglutinin titer levels were assessed in a total of 151 cases of typhoid fever. It is seen from Table 1 that 31 (20.53%) out of 151 typhoid fever cases had an 'O' agglutinin titer level of more than or equal to 1:160. Ten (6.62%) out of 151 typhoid fever cases had an 'H' agglutinin titer level of more than or equal to 1:160. A significant number of typhoid cases obtained by 'O' and 'H' titers together 110 (72.85%).

**Table1. Positive cases for typhoid fever by widal test**

Widal test		Frequency	Percent
Positive	O	31	20.53%
	H	10	6.62%
	both	110	72.85%
Total		151	100%

The hematological changes are common in typhoid fever. It was found that 35.1% from 151 typhoid patients had leucopenia as show in Table 2.

**Table2. Serological and hematological data observed amongst 151 typhoid patients**

PositiveWidal test	WBCs<4000	WBCs>4000
O	9	22
H	4	6
Both	40	70
TOTAL	53	98

The 151 positive cases distributed between Al-hodiedah (41cases) and Taiz hospitals (110 cases). The distribution of the cases according to hospital in Al-hodiedha governorate as follow : al-asker 10 cases , al- thwarh 10 cases , al-amal 7 cases , Al-nadia 8 cases Al-safwa 6 cases as show in Table 3.

The distribution of the Positive typhoid cases according to hospitals in Taiz governorate as follow : Al-askri 15 cases, Al –jomhwri 20 cases, Al-thtawrh 10 cases, Al –Omani 21 cases, Al –badania 29 cases and Al – khalide 15 cases as show in Table 4.

**Table 3. Distribution of Typhoid fever in AL- hodiedah hospitals**

	<b>N</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>Std. Error</b>	<b>F</b>	<b>Sig.</b>
<b>AL-askri</b>	10	2.0000	.00000	.00000	2.813	.040
<b>AL-thawrh</b>	10	2.0000	.00000	.00000		
<b>AL-amal</b>	7	1.8571	.17817	.06734		
<b>AL-nadia</b>	8	1.8750	.17252	.06099		
<b>Saba</b>	6	1.9444	.13608	.05556		
<b>Total</b>	41	1.9431	.12698	.01983		

**Table 4. Distribution of Typhoid fever in Taiz hospitals**

	<b>N</b>	<b>Mean</b>	<b>Std. deviation</b>	<b>Std. error</b>	<b>F</b>	<b>Sig.</b>
<b>al-askri</b>	15	1.4444	.48250	.12458	7.346	.000
<b>al-jomhwr</b>	20	1.8667	.16754	.03746		
<b>al-thawrh</b>	10	1.4667	.28109	.08889		
<b>al- omania</b>	21	1.7143	.32121	.07009		
<b>al- badania</b>	29	1.8966	.15694	.02914		
<b>al- khalide</b>	15	1.6222	.37515	.09686		
<b>Total</b>	110	1.7182	.33845	.03227		

The prevalence of *S. typhi* infection was defined according to the different demographic data of the patients, including gender, age, and clinical symptoms.

The highest positive result was found in female and it constituted 94, while in male it constituted 57 as show in Table 5.

**Table 5. Distribution of the positive cases according to the gender**

<b>Sex</b>	<b>No.</b>	<b>Mean</b>	<b>Std. deviation</b>	<b>Std. error mean</b>	<b>t</b>	<b>Df</b>	<b>Sig. (2-tailed)</b>
Male	57	1.7953	.28698	.03801	.287	.491	624
Female	94	1.7695	.32801	.03383			

Among the 151 positive cases found the highest positive result was found in the age group of >20 years(102 cases) while the highest negative result was found in the age group of 5-15years (12 cases) Table 6.

**Table 6. Distribution of the positive cases according to the age**

Age	No.	Mean	Std. Deviation	Std. Error	F	Sig.
5-10	12	1.7778	.32824	.09476	1.285	.282
10-15	12	1.6111	.48893	.14114		
15-20	25	1.7867	.30246	.06049		
>20	102	1.7974	.28593	.02831		
<b>Total</b>	<b>151</b>	<b>1.7792</b>	<b>.31243</b>	<b>.02542</b>		

The association of *typhoid fever with other clinical pictures* indicates the clinical manifestations of the positive cases as follow:- 55 cases come complained of fever, 31 cases come complained of abdominal pain, 42 cases come complained of diarrhea, 29 cases come complained of constipation, and 19 cases were complained of joint, bone pain as show in Table 7.

**Table 7. Typhoid and other related conditions found during the study**

Widal test positive	fever	Abd.pain	diarrhea	constipation	Headache	Joint bone pain	Other
O	4	0	2	1	0	0	0
H	0	0	0	0	0	0	0
Both	51	31	40	28	29	19	1
Total	55	31	42	29	29	19	1

#### 4. DISCUSSION

Typhoid fever is a potentially life – threatening that is caused by the bacteria *Salmonella typhi*. Anyone can get typhoid fever if they drink water or eat food contaminated with the *S. typhi* bacteria.

Typhoid fever is a common problem in developing areas, such as India, Africa and South America, where food hygiene and sanitation standards may not be as high as in developed countries [3,4].

The world health organization estimates that there are approximately 16 million cases a year, which result in 600,000 deaths.

In UK, of the 1735 cases reported between 1980 and 1989. It is estimated that 87 % were infected abroad [14].

The present study reveals that a single Widal test is still a useful diagnostic tool in typhoid fever. An 'O' titer in isolation, an 'H' titer in isolation and an 'O' or 'H' titer when considered together. The results of present study showed that the 151 cases are positive for typhoid fever by widaltest from total 1500 specimens suffering from fever were collected from Al-hodiedah hospitals and Taiz hospitals. This result obtained during three months only sothese results were in agreement with the findings from several studies were done in many countries.

The significant leucopenia commonly observed in typhoid fever is attributed to invasion of haemopoietic organs such as lymph nodes, spleen, tonsils, bone marrow by *S. Typhi* which radically slowed down the rate of leucopoiesis [19]. In this study, leucopenia was observed only in 35.1% cases, whereas the frequency of leucopenia was observed in 18% and 11.2% by Ahmet et al. [20] and Rasoolinad et al. [21] respectively.

This study found that 151 positive cases were distributed between Al-hodiedah (41 cases) and Taiz hospitals (110 cases), there is no significant relation between the two governorates in the prevalence of typhoid fever. In Bangladesh, there was a study about diagnosis of typhoid fever by Widal test, same as in our study we used Widal test for diagnosis [22].

Also this study determines the relationship between typhoid fever and different demographic data of the patients, including gender, age, and clinical symptoms.

The highest positive result was found in female 94 cases and 57 cases for male. The highest positive result was found in the age group of >20 years (102 cases) while the highest negative result was found in the age group of 5-15 years (12 cases) table 4 and figure 5. In contrast there was a study in Pakistan about incidence of typhoid fever, they found that 452 cases affected from older children (2-15 years) [23]. There were no significant statistical results related to age or sex to be considered as a risk factor. In the present study, the main symptoms of children is fever, and this result agrees with our result, we found that the main symptoms were fever for the 55+ cases followed by diarrhea 42 cases then abdominal pain 31 cases. In Yemen the bad habits of food and the spread of cabbages and sewage lead to increase the number of typhoid cases.

## 5. CONCLUSION

The results of the study indicate that there is no significant difference between the spread of typhoid fever cases collected from Taiz hospitals and Al-Hodeida hospitals. Also, no significant difference between positive cases and demographic data of the patients, including gender and age. The positive cases were come with different manifestations such as fever, abdominal pain and diarrhea.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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