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Status of Malaria and Typhoid Fever in Febrile Patients Attending Health Facilities in Kwali and Gwagwalada Area Councils of FCT, Abuja, Nigeria

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Abstract **Original Research Article**

Malaria and Typhoid fever are major public health problems in Tropical and Sub-tropical countries. Because of the high prevalence of malaria and typhoid fever in Nigeria, co-infections are common. This study investigated the prevalence of malaria and typhoid fever in febrile patients attending public health facilities in Kwali and Gwagwalada, Abuja. Venous blood sample was collected from 250 patients from each of the study populations, and these were analyzed using parasitological examination and serum agglutination (Widal) methods. Out of the 500 samples examined, the overall infection rates were 64% for malaria, 34.6% for typhoid and the co-infection, 12%. Chi square analysis showed that the infection rates were independent of gender (P> 0.05) T-test on relationship between infection rates recorded from both location in relation to age group showed that there is no significant difference between infection rates in the age groups from the two locations (P>0.05). The Pack Cell Volume of patients showed that 23% and 14.6% of malaria and typhoid fever patients were anemic (PCV<20%), while 9.6% and 18% of the infected patients had PCV greater than 40% (i.e. PCV>40%) respectively. T-test analyses showed there is no significant difference between co-infection and typhoid fever (P= 0.19), there is significant difference between co-infection and malaria (P= 0.04) and also between malaria and typhoid (P= 0.04) in relation to socioeconomic status of the patients. From the results of this study, it is obvious that there is a high prevalence of malaria parasite and typhoid infections and their co-infections in Kwali and Gwagwalada. To stem the infections and reduce the attendant morbidity will require public campaign to educate the public on the need to use Insecticide Treated Nets, keep their environment free of possible mosquito breeding sites and ensure that the level of personal hygiene of food handlers is optimally healthful.

Keywords: Malaria, Typhoid, Co- infection, Widal Agglutination Test, PCV, Venous blood.

INTRODUCTION

Malaria and typhoid fever are endemic diseases in Nigeria. While the high prevalence of malaria is an established fact, high number of illnesses has been diagnosed as malaria co-existing with typhoid fever too. Malaria and typhoid fever are among the most endemic diseases in the tropical and developing countries. Both diseases share similar transmission factor and often have the similar symptoms [1]. Due to the geographical overlap of both infections, co-infections are very common. However, the precise incidence of the concurrent malaria and typhoid fever in most geographical areas is largely uncertain, as both share social circumstances which are imperative to their transmission; individuals in areas endemic for both diseases are at substantial risk of contracting both these diseases [2].

Typhoid fever, also known simply as "typhoid" is a symptomatic bacterial infection due to *Salmonella typhi* equally called *Salmonella enterica* serotype Typhi [3,4]. It is acquired by the ingestion of food and/or water contaminated with the faeces of an infected person, which contain the bacterium, Salmonella enteric serovar typhi; humans are the only infected [5]. It is acquired by the ingestion of food and/or water contaminated with the faeces of an infected person, which contain the bacterium, Salmonella enteric serovar typhi; humans are the only infected [5]. The Widal test is widely used as laboratory test for the diagnosis of typhoid fever.

There are about 33 million cases of typhoid annually resulting in 216,000 deaths in endemic areas. The World Health Organization (WHO) identifies typhoid as a serious public health problem with high incidence on children and young adults [6]. Typhoid fever also has a very high social and economic impact

because of the hospitalization of patients with acute disease and the complications and loss of income during the duration of the clinical illness [7].

Malaria parasites are transmitted by the bites of an infected female Anopheles mosquito. The African continent is the most severely affected by malaria. For this reason, April 25 th of every year has been declared African Malaria Day and the Roll Back Malaria (RBM) campaign has Africa as its main focus [8].

Nearly all human deaths by malaria are caused by *P. falciparum*, mainly in sub-Saharan Africa. Globally, an estimated 3.3 billion people in 97 countries and territories are at risk of being infected with malaria and developing disease and 1.2 billion are at high risk [9,10]. Risk factors include poverty as a result of poor sanitation and poor hygiene [4].

MATERIALS AND METHODS

Study Area

Abuja is situated at 9.06° North latitude, 7.49° East longitude and 476 meters i.e. 1561 ft. elevation above the sea level; a big town with a population of about 590,400. The FCT experiences three weather conditions annually, this includes the warm, humid rainy season and the blistering dry season, in between the two seasons there is a brief interlude of harmattan occasionally. Rainy season begins from April and ends in October, with total annual rain fall range of 1100mm to 1600mm. The Federal Capital Territory falls within the savannah zone vegetation of West African sub-region.

Study population and sample size

The study population consists mainly of adults and children with febrile illness seeking medical assistance at the Kwali General Hospital and University of Abuja Teaching Hospital (UATH) Outpatient Department (OPD). Individuals of all ages and both sexes were involved in the study. A total of 500 samples were collected (250 patients were examined from each health facility) for the period of three months (August to October, 2018).

Blood Sample Collections

The method of blood collection is the venipuncture technique [11]. Soft tubing turniquete is tied to the upper arm of the patient while the patient holds the palm closed, the puncture site is cleaned with methylated spirit (methanol) and venipuncture is made with the aid of a 21 guage needle attached to a 5ml syringe. When sufficient blood is collected, the patients open the palm while the tourniquet is released and the needle is removed immediately. The blood is emptied into an EDTA bottle to prevent clotting.

Laboratory Analysis

Parasitological Examination of Blood Samples

A thick blood film for each blood sample was made on clean grease-free glass slide and stained by the Giemsa Staining Technique as described by [12]. Just before use, the commercially prepared Giemsa stain was diluted 1 in 10 by adding 5 ml of stain to 45 ml buffered distilled water (pH 7.0) and mixed. The blood films were flooded with freshly diluted Giemsa stain for 30 minutes. The stain was then washed off and slide allowed air-drying in a draining rack after the underside was cleaned with cotton wool. The dried smear was examined on at least 100 high powered microscope fields before considered as negative. The presence significant as the entire patient presented with fever.

Widal agglutination test for *Salmonella* antibodies

Widal agglutination test was performed on each blood sample using the Widal agglutination kit (Biotech lab, United States) containing somatic (O) and flagella (H) antigens of *Salmonella typhi* and *Salmonella paratyphi* A-C. A negative saline control was introduced in each batch of test. The procedure used was as described by [12]. Drops of sera from each patient were made on a clean tile, mixed with the antigens rocked for 3 minutes and observed for agglutination. A positive Widal test was considered as one that gave a reaction titre of 1/80 or greater in a single test.

PCV (Packed Cell Volume) Test

Collected blood through venous method i.e. using a syringe and EDTA bottle was filled into a capillary tube and one edge of the tube is sealed using blue flame from a lighter before placing the capillary tube into a Hematospine (mini centrifuge) and spin for 15minites at 1500rm. Use a hematocrit reader to measure the volume of the blood. In male adult PCV of 40% above were rated normal, in female adult PCV of 38% were also normal and in children below 10years PCV of 36% is normal.

Ethical Consideration

Before commencement of the study, ethical clearance was obtained from the Management Boards of the Kwali General Hospital and University of Abuja Teaching Hospital (UATH). Oral informed consent was obtained from each of the volunteer study subjects and parents/guardians of the children.

STATISTICAL ANALYSIS

Data recorded from this study were analyzed statistically for significant differences in the prevalence of co-infection of malaria and typhoid with respect to age, sex and PCV using Chi square and t- Test, values were considered to be statistically significant at $p<0.05$. Percentages and bar charts were also employed in the analyses of data collected.

RESULTS

Out of 500 consenting febrile patients examined for the presence of Plasmodium and Salmonella in their peripheral blood, 320 (64%) tested positive for Plasmodium alone, 173 (34.6%) were positive for Salmonella alone and 60 (12%) were positive for both infections (Table 1). 93(47.2%) male patients were positive for malaria infection and 119 (60.4%) were positive for typhoid. females had 133(43.9%) that were positive for malaria and 148 (48.8%) were positive for typhoid (Figure 1).

Table-1: Overall Prevalence of Malaria, Typhoid and their Co- Infection

INFECTION	NUMBER EXAMINED	NUMBER INFECTED	PREVALENCE %
MALARIA	500	320	64
TYPHOID	500	173	34.6
CO- INFECTION	500	60	12

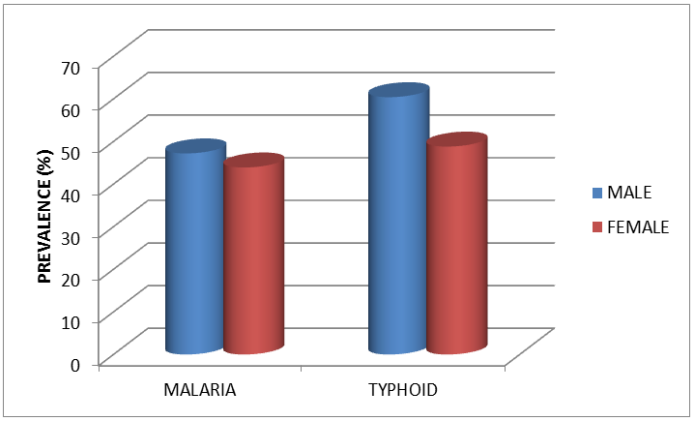

Fig-1: Overall Prevalence of Malaria and Typhoid Infections in Relation to Gender

The infection rates are independent of gender, Pearson Chi square asymptotic significance = 0.631

Chi-Square Tests					
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.230[a]	1	.631		
Continuity Correction[b]	.114	1	.736		
Likelihood Ratio	.230	1	.631		
Fisher's Exact Test				.671	.368
Linear-by-Linear Association	.229	1	.632		
N of Valid Cases	200				
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 42.32.					
b. Computed only for a 2x2 table					

In Kwali, 141 (56.4%) of the patients tested were positive for malaria, 88 (35.2%) were positive for typhoid fever while 21 (8.4%) tested positive for co-infection. In Gwagwalada, 71.6% tested positive for malaria, 34% for typhoid and 15.6% for patients having both infections. The male in Kwali and Gwagwalada had higher prevalence of malaria parasite (59.3% and 38.8% respectively) when compared to the female (55.0% and 29.9% respectively). Typhoid infection was higher among females in Kwali (36.1%) than among males (33.3%) but higher among male in Gwagwalada (79.3%) when compared with female (64.9%) (Tables 2 and 3, Figure 2).

Table-2: Prevalence of Malaria and Typhoid in Relation to Gender (Gwagwalada)

GENDER	**NUMBER EXAMINED**	**NUMBER INFECTED WITH MALARIA (%)**	**NUMBER INFECTED WITH TYPHOID (%)**
MALE	116	45 (38.8)	92 (79.3)
FEMALE	134	40 (29.9)	87 (64.9)

Table-3: Prevalence of Malaria and Typhoid in Relation to Gender (Kwali)

GENDER	NUMBER EXAMINED	NUMBER INFECTED WITH MALARIA (%)	NUMBER INFECTED WITH TYPHOID (%)
MALE	81	48 (59.3)	27 (33.3)
FEMALE	169	93 (55.0)	61 (36.1)

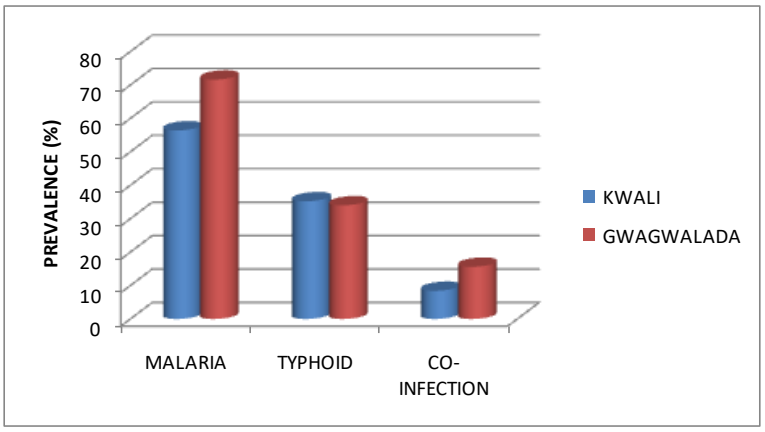

Fig-2: Overall Infection Rates in Relation to Location

Rate of infection is independent of the location, Pearson Chi square asymptotic significance = 0.315

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.313[a]	2	.315
Likelihood Ratio	2.340	2	.310
Linear-by-Linear Association	.078	1	.780
N of Valid Cases	221		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.75.			

The age group 0-10 years recorded the highest co- infection rate in Kwali but age group 31-40 years had the highest co- infection rate in Gwagwalada (Tables 4 and 5, Figure 3). Table 6 showed the infection rates based on the percentage PCV of the patients. Plasmodium positive patients had the highest infection rate (23%) at PCV <20% and the lowest infection rate (9.6%) at PCV >40%.

Table-4: Prevalence of Malaria/Typhoid co-infection in relation to age group (Kwali)

Age group	Number examined	Number infected	Prevalence %
0-10	68	6	15.8
11-20	56	5	8.9
21-30	37	3	8.1
31-40	47	4	8.5
41-50	33	3	9.1
51-60	9	0	0

Table-5: Prevalence of Malaria/Typhoid co-infection in relation to age group (Gwagwalada)

Age group	Number examined	Number infected	Prevalence %
0-10	16	2	12.5
11-20	20	3	15.0
21-30	69	9	13.0
31-40	48	18	37.5
41-50	57	4	7.0
51-60	40	3	7.5

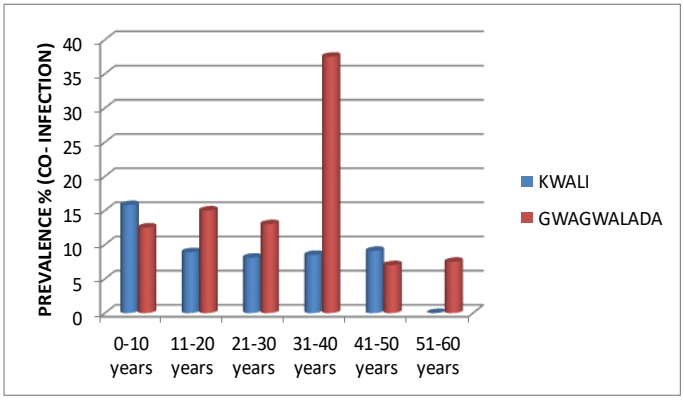

Fig-3: Co- Infection Rates of Malaria/Typhoid from the Two Study Areas in Relation to Age Group

There is no significant difference in rates of infections from the two sampled location in relation to age groups, P> 0.05.

t-Test: Paired Two Sample for Means		
	KWALI	*GWAGWALADA*
Mean	8.4	15.41666667
Variance	25.232	127.1416667
Observations	6	6
Pearson Correlation	0.147423	
Hypothesized Mean Difference	0	
Df	5	
t Stat	-1.47557	
P(T<=t) one-tail	0.100041	
t Critical one-tail	2.015048	
P(T<=t) two-tail	0.200082	
t Critical two-tail	2.570582	

Table-6: Prevalence of Malaria/Typhoid co-infection in relation to Pack Cell Volume

PCV %	Malaria Num infected (Prev %)	Typhoid Num infected (Prev %)	Co infection Num infected (Prev %)
< 21	115 (23.0)	73 (14.6)	19 (3.8)
21-40	63 (12.6)	104 (20.8)	31(6.2)
> 40	48 (9.6)	90 (18.0)	9 (1.8)

Figure 4 is a chart showing the prevalence of malaria, typhoid and their co- infection in relation to the social economic status of the patients. T-test analyses showed there is no significant difference between co-infection and typhoid fever (P= 0.19), there is significant difference between co-infection and malaria (P= 0.04) and also between malaria and typhoid (P= 0.04) in relation to socioeconomic status.

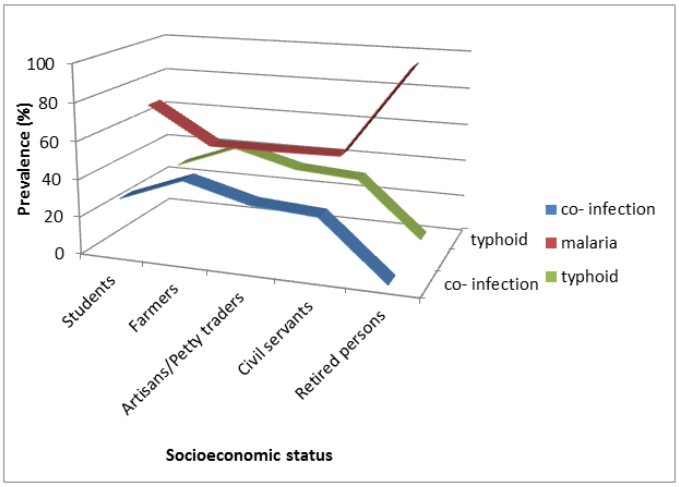

Fig-4: Prevalence of Malaria, Typhoid and Co- Infection in Relation to Socioeconomic Status

DISCUSSION

This study was aimed at evaluating the malaria/typhoid infection rates in febrile patients attending health facilities in Kwali and Gwagwalada. The total prevalence of malaria in this study was 64.0%. It shows that mosquitoes' breeding, inoculation and transmission rate is very high, hence the study area is endemic for malaria. The prevalence of malaria in this study is in tandem with the work of [13] who reported 66.9% in Suleja, Niger State. Malaria infection rate in this study is higher than the prevalence reported by [14] who reported a prevalence of 15.9% in Zaria, [15] reported 41.6% in Argungu, [2] and [16] 29.7% in Oyo. The malaria infection in this study is therefore lower than what was reported by [17], who reported a prevalence of 80.3% in Akure [18], 80.0% in Awka, [19] 88.8% in Benin. The difference in malaria prevalence may be as a result of variation in the study populations and season of the year. This rather high prevalence could be attributed to the rainy season (August- October) during which this study was carried out. High rainfall and humidity increases mosquito longevity and give room to the collection of clear, still, sun exposed waters, all of which enhance malaria transmission, serving as good vector breeding sites [20].

The Plasmodium infection rates are independent of gender in this study (Chi Square P>0.05). Both male and female patients were equally predisposed to malaria infection because any part of the body that is exposed to mosquito bite is an avenue for parasite innoculation and transmission irrespective of gender (Mbah and Agu, 2014).

Enteric fever (typhoid fever) constitutes a great socio-medical problem being responsible for many cases of pyrexia of unknown origin [21]. The observed 34.6% prevalence of S. typhi in this study is higher than 6.3% reported in Zaria by [22], 13.0% reported by [23] in Ekpoma and 21.2% reported by [24] in Abakaliki. The prevalence is lower than the 57.42% reported by [25], 49.4% by [2] in Ebonyi, and 58% by [1] in Pakistan. Inadequate supply of pipe borne water and drinking of water from stream and uncovered dug wells may explain the observed 34.6% overall prevalence of S. typhi in Kwali and Gwagwalada.

The 12.0% level of co-infection of malaria and typhoid observed in this study is higher than 10.1% reported by [22] in Zaria, 5.6% by [24] and 4% by [1]. The results of [23] 20.9% and [2] 36.2% were higher than the present study. As reported by [22], the presence of malaria parasites and S. typhi in the patients is also independent of each other in this study (Figure 1).

Result indicates that age group 31 – 40 years (37.5%) had the highest co- infection rate in Gwagwalada and age group 0-10 years (15.8%) in Kwali. t- Test therefore showed that there is no significant difference in rates of infections from the two sampled location in relation to age groups, P> 0.05. This could be due to the fact the two sampled locations are in close proximity to each other in terms of geographical location and also the socioeconomic status are on the same scale. The packed cell volume in this study indicated anemia in malaria infection and this is supportive of previous works by [26] and [27]. T-test analyses showed there is no significant difference between co-infection and typhoid fever (P= 0.19), there is significant difference between co-infection and malaria (P= 0.04) and also between malaria and typhoid (P= 0.04) in relation to socioeconomic status of the patients.

CONCLUSION

The current results indicate that Gwagwalada and Kwali are endemic for malaria and typhoid and co-infection. Infections from Kwali and Gwagwalada are independent of sex, age group and locations except between malaria and typhoid in relation to socioeconomic status.

Prevention of mosquito human contact by the use of barriers (Insecticide Treated Nets, repellent, wearing protective clothing) to deter mosquitoes from biting them could help the situation, especially as majority of the population engaged in outdoor activities for their living.

The introduction of typhoid vaccines in routine vaccination programs will greatly reduce the disease burden and cost of illness to governments and individuals in particular. Ensuring that the level of personal hygiene of food handlers is optimally healthful and the re- introduction of health inspectors to monitor the quality of food presented to the public by food vendors are hereby recommended.

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