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MALARIA/TYPHOID CO-INFECTION AMONG PATIENTS ATTENDING HEALTH FACILITIES IN GARKI, ABUJA, NIGERIA

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ABSTRACT

Most cases of malaria/typhoid co-infections are based on mere assumptions, so this study was carried out to determine the actual rate of co-infection of Malaria/Typhoid fever in patients attending health facilities in Garki Abuja. A total of eight hundred (800) blood samples were collected from patients with febrile illness attending a health facility in Area 11, Garki and another in Garki 2, Abuja between the month of April and July. Blood samples were subjected to microscopic examination for the identification of *Plasmodium* parasites, Widal agglutination test for the identification of antibodies of *Salmonella typhi*. Overall malaria/typhoid co-infection rate from this study was 50.63%. Malaria infection accounted for 76.13% while typhoid infection was 69.25%. Male gender recorded a higher co infection rate of 54.29% when compared with the female with 48.10%. Age group 31-40 years had the highest co-infection rate (58.50%) and the least was recorded at the age group 51-60 years. PCV range <31% had significant highest prevalence of 90.20% and 72.55% for malaria and typhoid respectively ($p<0.05$). Observation from the study area showed that they were endemic for malaria parasite infection/*Salmonella* sp infection. There should be public enlightenment on the preventive and control measures of the two diseases. Also, personal hygiene is hereby encouraged among the populace.

KEYWORDS: Malaria, Typhoid fever, Co-infection, Health facility, Widal agglutination test, *Salmonella* sp.

INTRODUCTION

Malaria is a tropical disease of man caused by some species of plasmodium and characterized by fever and weakness. Malaria is an infectious disease that causes an estimate of 2 to 3 million deaths and 300 to 500 million clinical cases in the world.[1] There are four species of Plasmodium that infect humans: *Plasmodium falciparum, Plasmodium vivax, Plasmodium malariae* and *Plasmodium ovale.* The most common cause of malaria in sub Saharan Africa is *P. falciparum* (Iwuafor *et al*., 2016). Infection with *P. falciparum* is associated with developing fever, a high number of parasites in the blood and pathogenesis, including severe anaemia and body weight loss.[1] 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.[2] It is considered a disease of poverty and duly recognized as a public health problem with overwhelming medical, social and economic implications.[3]

Typhoid fever which is also called enteric fever (i.e related to the intestine) is also an infectious disease endemic in Africa and more sever in infants and elderly.[4] It is acquired by the ingestion of food and/or water contaminated with the feces of an infected person, which contain the bacterium, *Salmonella enterica* serovar *typhi*; humans are the only infected.[5] In the year 2000 and 2010, an estimated 21.7 million and 13.5 million typhoid fever illnesses were recorded. Between years 2000 and 2013, it resulted in estimated 217,000 and 161,000 deaths respectively.[6] Outbreaks of typhoid fever are frequently reported from sub-Saharan Africa.[7] The different species of *Salmonella* can co-infect an individual or cause infections differently. Like malaria fever, *Salmonella* infection is characterized by fever, weakness, anaemia, body weight loss, vomiting and sometimes diarrhea.[8,9]

Typhomalaria was first described by an army doctor, Woodward (1833 - 1884) in 1862 among young soldiers during the American Civil War who were suffering from febrile illness that seemed to be typhoid (including

intestinal lesions found at postmortem) but with fever patterns also suggestive of intermittent fever. He believed that it might be a hybrid rather than a new species of disease.[10,11]

Malaria parasite and Typhoid fever are a major public health problem in tropical and sub-tropical countries. They are caused by quite different organisms: protozoa in the case of malaria, and gram-negative bacilli in the case of typhoid. Furthermore, each is transmitted through a different mechanism, and there is a considerable overlap in the signs and symptoms of either disease.[12] People living in endemic areas run the risk of contracting both infections concurrently.[12] Unfortunately, the similarity of clinical features of both diseases tend to lead to the misdiagnosis, mistreatment and over-diagnosis (especially of typhoid disease) of febrile patients. Over-diagnosis of typhoid fever leads to unnecessary exposure to anti-biotic drugs, and their abuse, while misdiagnosis invariably leads to delay in correct diagnosis and treatment of malaria.

Hence, some people treat malaria and typhoid concurrently once they have high antibody titre for *Salmonella* serotypes, even without adequate laboratory diagnoses for malaria and typhoid fever. This work is therefore aimed at determining the rate of co-infection of malaria and typhoid in an area where both seem to be endemic and have generated a lot of public health concern.

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. Area 1 and Garki 2 Districts are the South West area of the city.[13]

Study population

A total of 800 blood samples were collected from patients clinically suspected to be infected with malaria or typhoid fever attending the outpatient department of the Nigeria Police Hospital and Tayodek diagnostics/ Atlas Medical Centre, Garki, Abuja. It included individuals of all ages and sexes.

Sample Collections

The method of blood collection is the venipuncture technique.[14] 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.

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.[15] 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.[15] 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 10 years PCV of 36% is normal.

Ethical Consideration

Permission was obtained from the Management of Nigeria Police Hospital, Area 11, Garki Abuja and Tayodek diagnostic/ Atlas medical Centre, Garki 2 Abuja. Oral informed consent was obtained from each of the volunteer study subjects or parents/guardians of 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 analysis of variance (ANOVA), 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

Table 1 showed the overall prevalence of malaria and typhoid co infection amongst patients examined from the two health facilities in Area 1 and Garki 2, Abuja, Nigeria. 800 patients were examined and 405(50.63%) were found with co infection of malaria and typhoid fevers. 609 (76.13%) were infected with malaria while 554 (69.25%) were infected with typhoid fever (Table 1). Table 2 showed the co infection rate of malaria fever and typhoid fever in relation to sex, and it shows that 177 (54.29%) and 228 (48.10%) males and females were infected respectively. Table 3 showed that age group 21-30 years had the highest co infection rate while 51-60 years had the least. Females had higher malaria only infection (78.06%) than males (73.31%) while the male had a higher typhoid only infection when compared to the female (69.93%). Statistical analysis using Chi square showed no significant difference in the rate of the infections in relation to gender (Table 4). Age group >60 years had the highest infection rates for both infections followed by age group 0-10 years (Table5), there is a significant difference in relation to age group in both malaria and typhoid infections ($p= 0.00729$). Analysis of variance (ANOVA) showed a significant difference ($p= 0.0309$) between malaria fever and typhoid fever in relation to age groups (Figure 1). Figure 2 showed that the PCV range <31% had the highest prevalence of 90.20% and 72.55% for malaria and typhoid respectively. PCV range of >40% had the lowest infection rates 34.04% and 57.45% respectively (P value= 0.015).

Table 1: Overall Co Infection Rate of Malaria And Typhoid Fever.

Infection	Number examined	Number infected	Prevalence (%)
CO INFECTION	800	405	50.63
MALARIA	800	609	76.13
TYPHOID	800	554	69.25

Table 2: Co Infection Rate In Relation To Gender.

Gender	Number examined	Number infected	Prevalence (%)
MALE	326	177	54.29
FEMALE	474	228	48.10

Table 3: Co Infection Rate In Relation To Age Group.

Age group (years)	Number examined	Number infected	Prevalence (%)
0-10	70	27	38.57
11-20	150	73	46.67
21-30	250	144	57.60
31-40	200	117	58.50
41-50	84	33	39.29
51-60	26	4	15.38
>60	20	7	35.00

Table 4: Prevalence of Malaria And Typhoid In Relation To Gender.

Gender	Number examined	Number infected (%)	
		Malaria	Typhoid
MALE	326	239 (73.31)	232 (71.17)
FEMALE	474	370 (78.06)	322 (69.93)

0.731 is greater than 5% (0.05) level of significance. The infections are independent of gender

Table 5: Prevalence of Malaria And Typhoid In Relation To Age.

Age group (years)	Number examined	Number infected (%)	
		Malaria	Typhoid
0-10	70	59 (84.29)	59 (84.29)
11-20	150	93 (62.00)	86 (57.33)
21-30	250	180 (72.00)	152 (60.80)
31-40	200	148 (74.00)	100 (50.00)
41-50	84	68 (80.95)	57 (67.86)
51-60	26	16 (61.54)	14 (53.85)
>60	20	18 (90.00)	19 (95.00)
TOTAL	800	582 (72.75)	487 (60.88)

There is a significant difference among the age group in relation to infection and there is a significant difference between the two infections in relation to age group (P-value of 0.00729 and p-value of 0.0309 respectively).

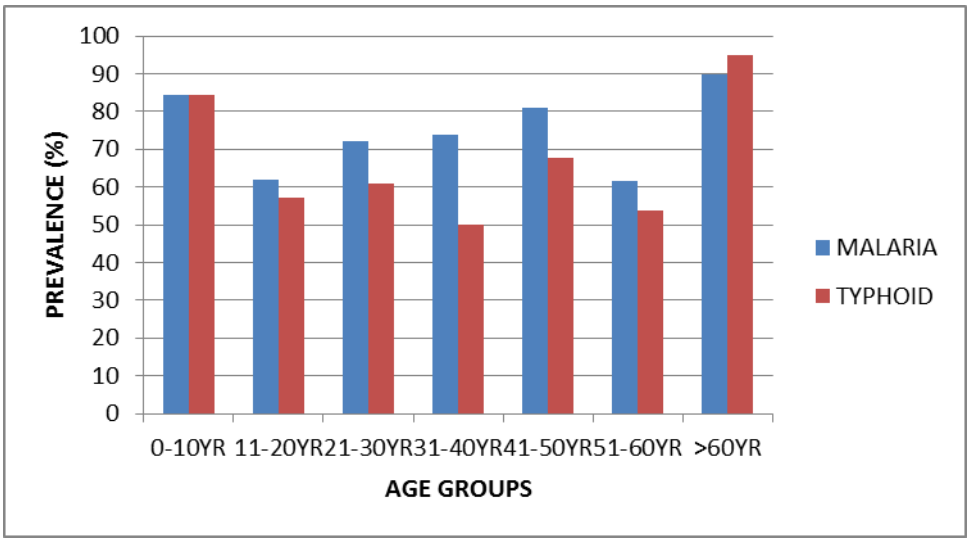

Figure 1: Prevalence of Malaria and Typhoid In Relation To Age.

There is a significant difference in malaria fever and typhoid fever in relation to age groups (p= 0.0309).

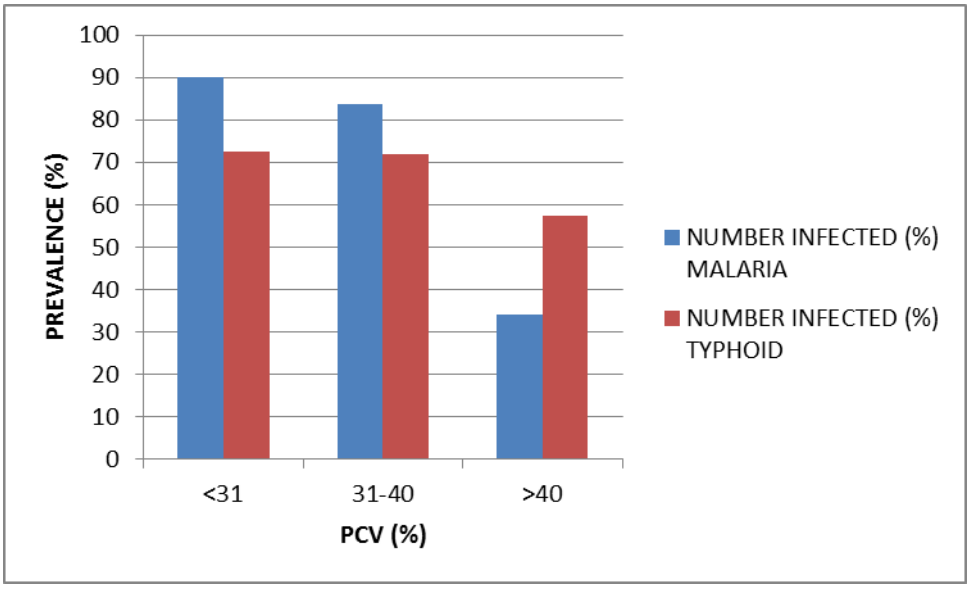

Figure 2: Prevalence Of Malaria and Typhoid In Relation To Pack Cell Volume (p-value of 0.015 i.e. there is significant difference in the infection rate in relation to PCV)

DISCUSSION

In this study, the result of malaria and typhoid co-infection is higher (50.63%) than the reports of Ebonyi State 5.6%,[16] Bo city Sierra Leone 14.1%,[17] Akoko 18.4%,[18] Ibadan 12%,[19] Enugu 16%,[20] Kaduna 10.1%,[21] Sokoto 10.3%,[22] and Imo state 22%.[23]

In this study the prevalence of malaria was higher in female (78.06%) than males (73.31%) but there was no statistically significant association.[17] in their study in Sierra Leone also showed that females (53.4%) are more affected than males (46.6%).

The prevalence of the typhoid fever using Widal titration test was higher (69.25%) when compared with the study in Ebonyi, 21.2%.[16] and Ibadan, 16.7%,[19] Lagos, 27.6%,[24] Benin, 39%,[25] and Imo State, Nigeria, 42%,[23] but lesser than the report from Akoko, 73.9%.[18] This might be due to the differences in Widal test kits, year of study, season, difference in cultural practices, and toilet facility.

Age group 31-40 years had the highest co-infection rate. There is a significant difference in malaria fever and typhoid fever in relation to age groups (p= 0.0309).

Total percentage prevalence of malaria parasite from this study was 76.13%. This is quite high. It shows that mosquitoes' breeding and transmission rate is very high, hence the study area is endemic for malaria. This high prevalence of malaria parasitaemia could be attributed to environmental factors such as onset of rainfall at the period of this study which promotes the intensity of mosquitoes breeding and transmission in Abuja.

The high percentage prevalence (69.25%) of *Salmonella typhi* infections recorded in this study could be due to haemolytic anaemia and malaria parasite-specific factors which increases the susceptibility of the patients to non-typhoidal salmonella serotypes (NTS) as reported by.[21] Here it was found out that an increased risk for developing systemic NTS infection during malaria is caused by haemolytic anaemia, which leads to reduced macrophage micro bactericidal activity.

It is very common to see patients in many parts of the tropics, undergoing both typhoid and malarial treatment even if their diagnosis has not been confirmed.[26] It is a well-known fact that anemia due to massive hemolysis or dyserythropoesis occur in malaria which leads to deposition of iron in the liver.[27] On the other hand, iron overload of the liver in malaria can support the growth of *Salmonella* in liver.[27] The extra iron seems to feed the bug that causes typhoid fever.[28] However intracellular bacteria such as *Salmonella* also have an obligate requirement for iron to support its intracellular growth and survival.[29] Hence the high co-infection rate recorded in this study (50.63%). 72.55% of those with Pack Cell Volume lower than 31% in this study were infected with *Salmonella* while 90.20% of them had malaria parasite. Patients suffering from severe anemia show increased susceptibility to *Salmonella*.[30,31]

Observation from a study carried out by,[32] showed that of the 38 patient's positive for both malaria and Widal tests, only 7 actually had typhoid fever as revealed by the results of the blood cultures. Therefore, one can conclude that the other 31patients were actually malarial patients who only tested positive for Widal test confirming the findings of,[33] and,[34] that malaria may lead to over-diagnosis of typhoid fever. This may be the case in the results collated from this present study. Misdiagnosis of typhoid fever leads to unnecessary expenditure and exposure of patients to the side-effects of antibiotics. But according to Prasanna,[27] an early morbidity and mortality can be prevented by adopting this method (Widal test).

CONCLUSION

There was a high co-infection rate of malaria and typhoid fever in the study areas. Malaria parasite infection was higher than *Salmonella* infection. The female were more infected with malaria than the male while the male had higher typhoid infection rate than the female but statistically, there is no significant difference in the rate of infections in relation to gender. Individuals with PCV less than 31% had significantly higher infection rates of both malaria and typhoid fever. There is a significant difference among the age group in relation to the rate of co-infection.

RECOMMENDATION

This study was carried out to understand and assess magnitude of these diseases in Garki 2 and 11 of Abuja, and also to suggest better control and preventive strategies. The following are hereby recommended.

- Creating and strengthening the malaria/typhoid fever awareness program,
- Improved personal hygiene and encourage proper sanitation to reduce the burden of high prevalence of *Plasmodium* and *Salmonella* infections.

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