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MALARIA AND TYPHOID FEVER CO-INFECTION AMONG FEBRILE PATIENTS IN KUMBOTSO LOCAL GOVERNMENT AREA KANO, NIGERIA

[1]Nas, F. S., *[2]Ali, M. and [3]Yahaya, A.
[1]Department of Biological Science, Bayero University, Kano
[2]Microbiology Department, Kano University of Science and Technology Wudil Kano
[3]Department Biology, Kano University of Science and Technology Wudil Kano
*Correspondence author: alimuhd4real@gmail.com

ABSTRACT
Malaria and typhoid fever are of tremendous public health concern in sub-Saharan Africa (Nigeria inclusive). Because of the high prevalence of malaria and typhoid fever in Nigeria, co-infection is common. This study was aimed at determining the prevalence of Malaria, Typhoid fever and their co-infection among febrile patients in Kumbotso Local Government Area Kano, Nigeria. A Total of 125 subjects of both age and sex suggestive of Malaria and/or typhoid fever were used as participants. Five milliliter (5 ml) of blood samples were collected from each of the participant for widal tests and blood film from a period of April, 2015 to October, 2015. The results revealed a malaria prevalence of 55% (69/125). The sero-prevalence of typhoid fever was 18% (22/125) while 22% (28/125) had malaria and typhoid fever co-infection and 5% (6/125) appeared to be negative for both malaria and typhoid fever. However, the result showed that malaria is more likely to cause fever than typhoid infection. Statistical analysis of the result showed that there is significant different on the incident of malaria and that of typhoid fever among febrile patients at p > 0.05. It is recommended that intervention programs aimed at reducing malaria and typhoid infections should be increased in such areas, especially in the wet seasons.
Keywords: Blood film, Co-infection, Malaria, Typhoid fever, Widal test.

INTRODUCTION

Malaria is one of the febrile illnesses and the most common fatal disease in the world caused by one or more species of Plasmodium. These are *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium ovale*, and *Plasmodium malariae*. Approximately half of the world population is at risk of malaria. Most of malaria cases and deaths occur in sub-Saharan Africa. According to the World malaria report (2011), there were about 216 million cases of malaria and an estimated 655,000 deaths in 2010 (WHO, 2013).

Typhoid fever, also known as typhoid, is a symptomatic bacterial infection due to *Salmonella typhi* (Wain *et al*., 2015). It is largely a disease of developing nations due to their poor sanitation and poor hygiene (Wain *et al*., 2015). It is spread by eating food or drinking water contaminated with faeces of an infected person (WHO, 2008). Like malaria, there is a popular belief that typhoid fever is endemic and quite prevalent in Nigeria (Ohanu *et al*., 2003). Patients, who fail to respond to the first line of malaria treatment usually suspect typhoid fever (Onuigbo, 2014). Malaria and typhoid fever usually present similar symptoms particularly at the beginning of typhoid fever (Nsetubu *et al*., 2001).

Malaria and typhoid fever remain the diseases of major public health importance and cause of morbidity and mortality in tropical Africa (CDC, 2009). Both diseases are common in many countries of the world where the prevailing environmental conditions of warm humid climate, poor sanitary habits, poverty and ignorance exist. These two diseases have been associated with poverty and underdevelopment (CDC, 2009). Malaria and typhoid fever are usually associated with areas or regions with high poverty and under development (Uneke, 2008). In 2012, the World Health Organization (WHO) estimated that there was an approximately 207 million cases of malaria with an estimated 627,000 deaths (WHO, 2013). Annual typhoid fever infection is estimated at 21 million cases with a case fatality rate of 1% - 4%. These statistics become worse when related to countries where these diseases are endemic. 90% of all malaria deaths occur in Sub-Saharan Africa (WHO, 2013).

Geographic distribution of both diseases shows that a co-infection of both diseases is imperative. Also overlap in the social dynamics of communities with high incidence of both diseases gives further credence to the co-infection of both diseases (Keong and Sulaiman, 2006). Due to common clinical manifestations of both diseases, there is a common belief in most endemic communities that malaria and typhoid fever are concurrent diseases and therefore should be treated as such (Uneke, 2008). There is a considerable overlap of signs and symptoms of malaria and typhoid fever (Chessbrough, 2006). Thus the similarity of clinical features of both diseases leads to misdiagnosis and mistreatment of the febrile patients (Chessbrough, 2006; Abdel wahab *et al*., 2012). So, reliable diagnostic method is important for effective management of cases to reduce misuse and wastage of drugs (Chessbrough, 2006). A number of studies have shown that malaria could be co-infecting with typhoid (Eze *et al*., 2011). This research was conducted to determine the prevalence of malaria, typhoid fever, and their co-infection among febrile patients attending various primary health centers in Kumbotso Local Government Area Kano, Nigeria.

MATERIALS AND METHODS

Study Site

This research was conducted in Kumbotso Local Government Area of Kano State, Nigeria. The Local Government area was created in 1976 (NPC, 2006). The Local Government area has eleven (11) wards. It has an area of 158 km² and total population of two hundred and ninety four thousand, three hundred and ninety one (294,391) residents with population density of 2,197.47 inhabitant/ km^2 (NPC, 2006). According to National population commission (NPC, 2006), the populations are expected to reach to 374,200 by the year 2011. It is located at an elevation of 450 meters above sea level. Its coordinates on a map are $11°53'17"$ N latitudinally and $8°30'10"$E longitudinally (Muhammad *et al.*, 2016). Major towns in the local government are Kumbotso town, Chiranci, Sheka, Dan-bare, Challawa, Panshekara etc. Farming remains a major occupation in the area. However many educated indigenes in the area are employed in the formal sector while others engaged in various trading activities.

Study Population

A completely randomized design is used. A total of 125 subjects (male, n= 57 and female, n=68) presenting febrile conditions suggestive of malaria or typhoid in 4 different health care centers which are the most populated area in the Local Government (Chiranchi n= 43, Sheka n= 42, Dan-bare n=38 and Panshekara n=37) within Kumbotso Local Government Kano State were used for the study. It included individuals of all ages and sexes.

Sample Collection

Five milliliter (5 ml) of blood samples were collected from the participant for testing for malaria parasites, *Salmonella typhi* O and H antibodies from a period of April 2015 to October, 2015. Samples were stored in test tubes and stored at 4°C prior to laboratory analysis

Examination of Blood Samples

Examination of blood sample for malaria parasite was conducted with thick blood film using Giemsa Staining technique as described by Chessbrough (2006). 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 to air dry in a draining rack after the underside was cleaned using cotton wool. The dried smear was examined using X100 objective

Widal Agglutination Test for *Salmonella* Antibodies

Widal agglutination test was performed on each blood sample using the Widal agglutination kit (Biotech Lab, United States) as described by Ochei and Kolhatkar (2010). Drops of sera from each patient were made on a clean tile, mixed with the antigens rocked for 3 minutes and observed for agglutination.

Questionnaire Design, Distribution and Retrieval

A total of a hundred (125) questionnaires were designed using open ended questions to provide information about the socio-demographic factors of participants and predisposing factors to both infections. Informed consents were obtained from all participants before inclusion. The data obtained were tabulated (Table 1).

Statistical Analysis

Data were analyzed using basic descriptive statistics such as percentages and Student t-test. The data of incidence of Malaria, Typhoid fever and co-infection is analyzed using One-Way ANOVA for significance at 0.05 probability level using Statistical Package for Social Science (SPSS) 2010 version.

RESULTS

Socio-demographic Factors of the Participants

A total of 57 (46%) males and 68 (54%) females took part in this study with ages ranging from less than 20 to over 40 years. Majority of the participants were 20 to 40 years age bracket. Participant from rural area accounted for 58% (72 subjects) while 42% (53 subjects) are from urban area. Most female participants are house wives males participant are mostly students, civil servant and farmers.

Table 1: Socio-demographic Factors of the Participants with Percentage Frequency

Parameter	Male (n)	Female (n)	Total (n)
Age (**Years**)			
0 – 20	14 (12%)	18 (14%)	32 (26%)
21 – 40	25 (20%)	22 (17%)	47(37%)
41 – 60	12 (10%)	18 (14%)	30 (24%)
61 – Above	06 (05%)	10 (08%)	16 (13%)
Settlement			
Rural	33 (27%)	39 (31%)	72 (58%)
Urban	24 (19%)	29 (23%)	53 (42%)
Occupation			
Student	17 (13%)	12 (10%)	29 (23%)
Civil servant	12 (10%)	01 (01%)	13 (11%)
Farming	14 (11%)	05 (04%)	19 (15%)
Trading	08 (06%)	02 (02%)	10 (08%)
House wives	00 (00%)	48 (38%)	48 (38%)
Others	06 (05%)	00 (00%)	06 (05%)

Distribution of Malaria and Typhoid

The distribution of malaria and typhoid fever among febrile patients is presented in table 2. The summary of the distribution of the infections is presented in table 3. Among the 125 febrile patients tested for the plasmodium parasite and *S. typhi* only 6 (5%) tested negative or non-reactive for either the pathogen or bacteria. Twenty two 28 (22%) of cases had co-infections of malaria and typhoid while 69 (55%) and 22 (18%) had malaria and typhoid fever respectively.

Table 2: Distribution of Malaria and Typhoid Infections

Age group	TE	M+	T+	MT+	MT-
0 - 20	32	25^{a}	03^{d}	04^{d}	00^{d}
21 – 40	47	24^{a}	10^{c}	11^{c}	02^{d}
41 – 60	30	14^{b}	06^{c}	09^{c}	01^{d}
61 - Above	16	06^{c}	03^{d}	04^{d}	03^{d}
Gender					
Male	57	30^{a}	13^{c}	12^{c}	02^{d}
Female	68	39^{a}	09^{c}	16^{b}	04^{d}
Settlement					
Rural	72	40^{a}	12^{c}	17^{b}	03^{d}
Urban	53	29^{a}	10^{c}	11^{c}	03^{d}
Occupation					
Students	29	18^{b}	06^{d}	04^{d}	01^{d}
Civil servant	13	05^{d}	02^{d}	04^{d}	02^{d}
Farmers	19	10^{c}	03^{d}	06^{d}	00^{d}
Traders	10	04^{d}	03^{d}	03^{d}	00^{d}
House wives	48	31^{a}	08^{c}	06^{d}	03^{d}
Others	06	01^{d}	00^{d}	05^{d}	00^{d}

Key: Values having different superscript are considered to be significantly different at $p = 0.05$. TE = Total examined, M+ = Malaria positive, T+ = Typhoid positive, MT+ = Malaria and Typhoid positive, MT- = Negative for both Malaria and Typhoid.

Table 3: Summary of distribution of Malaria and Typhoid Fever Infections

Infection	Number (n)	Percentage (%)
Positive for malaria only	69^{a}	55
Positive for typhoid fever only	22^{b}	18
Positive for malaria and typhoid	28^{b}	22
Negative for malaria and typhoid	06^{c}	5
Total	**125**	**100**

Key: Values having different superscript are considered to be significantly different at $p = 0.05$.

DISCUSSION

Malaria and typhoid fever still remain diseases of major public health importance in the tropics. They are major aetiological considerations in both acute and prolonged fever of uknown origin in the tropics. Because of the high prevalence of malaria and typhoid fever in the tropics, co-infections are common. However, the actual and precise underlying mechanisms to explain the association between malaria and typhoid fever infection is still uncertain, although there are few postulations which may explain why malaria may predispose to *Salmonella* bacteremia and sepsis (Keong and Sulaiman, 2006)

This study investigated the association between malaria and typhoid infections among patients with fever symptoms that reported for testing at some selected health care centers in kumbotso Local Government Area of Kano State, Nigeria from April 2015 to October 2015. During the study period, a total of 125 febrile patients reported for testing, of these, 57 (46%) were males and 68 (57%) were females. Only 6 (5%) fever patients did not test positive for any of the two infections. A total of 69 (69%) fever patients tested positive for the plasmodium parasite. Among these, positive male cases were 30 (43%) and female positive cases were 39 (56%). The findings of this study indicated that the prevalence of malaria and typhoid co-infection though not significant stood at 18% (n = 28). This is close to Igharo *et al*. (2012) who reported a prevalence of 18.3% and Okpara *et al*. (2011) that also reported a non-significant co-infection prevalence of 22% in Imo State. In another study in Pakistan, it was found that subjects with co-infection were found to have significantly higher rates of nausea, vomiting, abdominal pain, and diarrhea, all common presenting features of enteric fever (Khan *et al*., 2009)

Based on the result of this study, Malaria and typhoid fever infections are higher in the raining/wet season (July - September) than drier seasons. This is mainly due to the mode of transmission and reproductive cycles of the *Plasmodium* parasite and *Salmonella* bacteria. This study recorded higher malaria and typhoid infections especially in the peak periods of the raining season and lower rates in the peak period of the dry season. Infections for both diseases were high from the months of July -August, coinciding with months of heavy rainfall. Trend analysis from this study showed a reduction in the number of malaria and typhoid cases as rainfall reduces.

Conclusion

Almost 95% of the febrile patient presenting with fever symptoms in this study had malaria, *S. typhi*, or both the infections. There was a strong association between having fever and that of having malaria or typhoid fever infections. Also fever among patients was more likely to be caused by *Plasmodium* parasites than *Salmonella* typhi according to this study. It is recommends that intervention programs aimed at reducing malaria and typhoid infections should be increased in endemic areas, especially in the wet seasons. Also particular attention should be paid to malaria fever infection rates in the study area.

Author's contribution

This work was carried out in collaboration between both authors. Both the authors designed the study, conduct the experiment and performed the statistical analysis and wrote the first draft of the manuscript. Author FSN managed the literature searches. Both authors read and approved the final manuscript.

Conflict of interest

Authors have declared that no conflicts of interests exist.

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