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INCIDENCE OF MALARIA-TYPHOID CO-INFECTION AMONG PATIENTS ATTENDING GOMBE STATE UNIVERSITY CLINIC

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ABSTRACT

Malaria is one of the febrile illness and the most common fatal disease in the world caused by one or more species of plasmodium parasites. Both malaria and typhoid fever remain the disease of major public health importance and cause of morbidity and mortality in tropical Africa.. This study aimed to determine the incidence of Malaria and Typhoid fever co-infection amongst patients attending Gombe State University Clinic. Five milliliter of venous blood samples were collected from five hundred (500) febrile patients within the age group of 1-70 years old.The results obtained showed an overall incidences of malaria, typhoid and co-infection of 440(88%), 380(76%) and 380 (76%), respectively. Gender-based incidence confirmed higher co-infection in male with 200(80%) cases compared to female with 180 (72%) cases. In terms of age group, co-infection was higher amongst patients within the ages of 21-30 years with 60.5% followed by those in the age group of 11-20 years with 21.1%. In conclusion, high prevalence of malaria-typhoid fever co-infection was found amongst the febrile patients by this study.

Keywords: Malaria, Typhoid Fever, Co-Infection, Parasite, Incidence

INTRODUCTION

Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected female Anopheles mosquitoes. In 2018, about 228 million cases of malaria were estimated worldwide. The estimated number of malaria deaths stood at 405, 000 in 2018. Children aged under 5 years are the most vulnerable group affected by malaria accounting for 67% (272 000) of all malaria deaths worldwide in 2018 alone. According to WHO, African Region carries a disproportionately high share of the global malaria burden. This region was home to 93% of malaria cases and 94% of malaria deaths. Most malaria cases and deaths occur in sub-Saharan Africa. In 2018, 6 countries accounted for more than half of all malaria cases worldwide: Nigeria (25%), the Democratic Republic of the Congo (12%), Uganda (5%), and Côte d'Ivoire, Mozambique and Niger (4% each). There are 5 parasite species that cause malaria in humans, and 2 of these species – *Plasmodium* falciparum and *Plasmodium vivax* – pose the greatest threat. In most cases, malaria is transmitted through the bites of female *Anopheles* mosquitoes. *Anopheles* mosquitoes lay their eggs in water that hatch into larvae, which eventually emerge as adult mosquitoes (WHO, 2020; CDC, 2020).

Malaria is one of the febrile illness and the most common fatal disease in the world caused by one or more species of

plasmodium such as *P. falciparum, P. vivax, P. ovale, P. Malariae,* and *P. Knowlesi* (Samatha *et al*., 2015). The most virulent species in Africa is *P. falciparum* while the *P. vivax* is the most widely distributed parasite outside of Africa (Gething *et al*., 2012).

Typhoid fever is a systemic protracted febrile illness commonly caused by *Salmonella typhi*.The genus *Salmonella* includes 2400 different serotypes that are ubiquitous in the environment and can colonize and cause disease in a variety of animals (Antunes *et al*., 2002). They exhibit a clonal nature, are random in their infection dynamic, and are easily recovered in the environment (Sischo, 2006). Similar but mild form, Paratyphoid fever is caused by S. *paratyphi A, S. paratyphi B* and *S. paratyphi C* (Andualem *et al*., 2014). Typhoid fever causes serious morbidity in many regions of the world, accounting for 21 million cases and 222,000 deaths annually (Falola et al.,, 2007). Typhoid fever is common in malaria endemic settings, usually leading to mix-infections. South and Central Asia, Africa, South and Central America are considered endemic with rates exceeding 100 per 100,000 populations per year (Bhan *et al*., 2005).

In Africa, due to scarce resource and limited laboratory capacity to diagnose the disease accurately, most data on typhoid fever are not credible. A survey conducted in Egypt found an incidence of 59 cases per 100,000 persons per year for typhoid fever (Srikantiah *et al*., 2006). Malaria and typhoid fever remain the disease of major public health importance and cause of morbidity and mortality in tropical Africa. 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 (Orok et al, 2016). The first case of co-infection was described during the American civil war by Woodward in 1862 amongst young soldiers presenting with intermittent pyrexia. It was suggested that it could be a mixed infections (Smith, 1981). Subsequently, many studies have long established the association (Ammah *et al.,* 1999; Gopinath *et al.,* 1995). Patients with co-infection mostly associated with nausea, vomiting, abdominal pain, diarrhea and continuous fever (Khan et *al.,* 2005). Anaemia due to massive haemolysis or dyserythropoiesis can occur during malaria infection which can lead to increase iron in the liver and which support the growth of Salmonella (Bashyam, 2007). Like malaria, there is a popular belief that typhoid fever is endemic and quite prevalent in Nigeria (Ohanu *et al*., 2003).

Malaria and typhoid usually present similar symptoms particularly at the beginning of typhoid fever (Nsutebu *e tal*., 2001). Owing to the fact that it is sometimes very difficult to differentiate clinically, the presentation of typhoid fever from that of malaria without laboratory support (Rooth and Bjorkman, 1992). Malaria and typhoid fever are well known undifferentiated febrile illnesses which may be responsible for varying degrees of morbidity and mortality in developing and middle income countries including Nigeria. Due to lack of availability of diagnostics in low and middle income countries, most cases of acute febrile illnesses are diagnosed as malaria (Stoler and Awandare, 2016). Due to their similar clinical presentations and the likelihood of a misdiagnosis and mistreatment of febrile patients, it has been suggested that malaria and typhoid fever should be treated

concurrently in endemic communities (Uneke, 2008; Iheukwumere *et al*., 2013). However, concurrent treatment may have some public health implications in the sense that, irrational use of antibiotic or antimalarial may result in increasing surge of drug resistance, unnecessary cost and exposure of patients to side effects of antibiotic (Sharma *et al*., 2016).

People living in endemic areas have been reported to be at risk of contracting both infections concurrently (Uneke, 2008; Nsutebu *et al*., 2003). Predisposition to co-infection was found to be influenced by some epidemiological factors such as dense population, poor hygiene, and sanitation practices (Iheukwumere *et al*., 2013; Sharma *et al*., 2016). Based on available data, no investigation was conducted to determine the prevalence of malaria or its co-infection with typhoid fever among students or staff living in Gombe State University. This study aims to determine the incidence of Malaria and Typhoid fevers co-infection among patients attending Gombe State University Clinic.

MATERIALS AND METHODS

Study Site

The study area is Gombe State University Clinic, Gombe Metropolis. Gombe is a commercial, administrative town and the capital of Gombe State (Gombe State Ministry of Land and Survey, 2003). The metropolis is approximately located at latitude 10^0 15^1N to 10^0 17^1 N and longitude 11^0 0^1 E to 11^0 19 ^{1} E and altitude 500 meters above the sea level. The total population of Gombe Metropolis was 266,844 in 2006 and increased to almost double 400,000 in 2010 (Mbaya, 2013).

Study Design

A Spatio – Temporal cross- sectional study was conducted to collect both qualitative and quantitative data on patients aged between 1-70 years whose temperature reading > 37.5^{o}C at the outpatient department between the months of September to October 2019 in Gombe State University Clinic. Blood samples were taken from these febrile patients suspected to have Malaria or Typhoid fever to determine the proportion of Malaria and Typhoid fever co-infection.

Sampling

Study population

A total of 500 participants aged 1-70years old who reported at the outpatient department, Gombe state University Clinic between September and October, 2019 were randomly selected for the study. Body temperature was determined using the infrared thermometer, those whose reading was >37.5 ^{o}C, suspected of Malaria and Typhoid and have met the inclusion criteria were recruited.

Inclusion criteria

The inclusion criteria involved;
1. Patients with fever >37.5 ^{o}C, presented to the health facility at the outpatients department.
2. Patients who have volunteered to the study.

Exclusion criteria

The study excluded;
1. Patients who were on antibiotics and anti-malarial therapy.
2. Patients below 1 year.
3. Those who did not volunteered to the study.
4. Patients in critical conditions such as convulsion.

Sampling method

Patients aged 1 – 70 years presenting with febrile illnesses at the out-patient department between the months of September to October, 2019 in Gombe State University Clinic and consented to participate were selected for the study. Body temperature of the participants was measured using infrared thermometer.

Sample Collection and Processing

Data on the socio-demographic and clinical characteristics of the study participants were collected through an oral interview. For each patient, 5 mL of venous blood sample was collected aseptically and transferred into a sterile EDTA tube for laboratory procedures. The collection tubes were labeled with unique identification numbers and names.

Laboratory Analysis

Thick and thin films were prepared to examine malaria parasites. The slides were stained using Giemsa stain and observed microscopically under 100X (oil immersion) objective. Parasite density was determined by counting the number of parasites against 200 white blood cells on thick films multiplied by the total leucocyte count of the patient. At least 100 high power microscopic fields would have to be examined before declaring a slide negative (Cheesebrough, 2005).

Widal agglutination test was performed on all blood samples by the rapid slide titration method using commercial antigen suspension for the somatic (O) and flagella (H) antigens (Pro-Med Biomedicals, India). Antibody titration was performed for slide reactive samples using the tube technique. Antibody titer of >1: 80, was considered to be significant and usually suggestive of infection according to the manufacturer's instruction.

RESULTS

Prevalence for malaria, typhoid fevers and co-infections among the patients were found to be 88%, 76% and 76% respectively as shown in table 1.

Table 1: Overall incidence of malaria and typhoid fever amongst the febrile patients.

Illness	Number examined	Number Infected	Percentage (%)
Malaria	500	440	88
Typhoid	500	380	76
Co –infection	500	380	76

Prevalence of malaria and typhoid fever among men were 92 and 80% compared to 84 and 72% found among women as shown below in Table 2.

Table 2: Gender-based frequency distribution of malaria parasite and typhoid fever amongst the febrile patients.

Sex	Number Tested	Infected with malaria (%)	Infected with typhoid (%)	Co– infection (%)
Male	250	230 (92)	200(80)	200(80)
Female	250	210(84)	180(72)	180(72)
Total	500	440 (88)	380 (76)	380 (76)

The prevalence for malaria typhoid fever co-infection was 80% and 20% among patients within the age of 11-20 and 41-5% respectively as shown below in Table 3.

Table 3: Age-based frequency distribution of malaria parasite and typhoid fever amongst febrile patients.

Age Group	Number Tested	Infected with Malaria (%)	Infected with Typhoid (%)	Co-infection (%)
1-10	0	0	0	0
11-20	130	100 (22.7)	80 (21.1)	80 (21.1)
21-30	270	240 (54.6)	230 (60.5)	230 (60.5)
31-40	50	50 (11.36)	40 (10.5)	40 (10.5)
41-50	30	30 (6.8)	20 (5.3)	20 (5.3)
51-60	0	0	0	0
61-70	20	20(4.54)	10 (2.6)	10 (2.6)
Total	500	440 (100)	380 (100)	380 (100)

DISCUSSION

Prevalence for malaria, typhoid fevers and co-infections among the patients were found to be 88%, 76% and 76% respectively as shown in table 1. The high prevalence of malaria/typhoid fevers and co-infections recorded in the study area corresponds with many studies conducted in Nigeria and Africa. Concurrent infection of typhoid fever and malaria has been reported by studies from Africa and Asia (Ohanu *et al*., 2003; Kanjilal *et al.,* 2006). The prevalence of typhoid fever reported by other investigators ranged from 4.4% to 70% (Ibadin and Ogbimi, 2004). Prevalence of malaria-typhoid fever co-infection recorded by Afoakwah*et al*., 2011 from Ghana was found to be significantly lower than the figure (4.65% vs 76%) reported by this study.

Similarly, Nwuzo *et al*., (2009), Ekesiobi *et al*., 2008 and Archibong *et al*., 2016 reported a co-infection of 10% and 58% in Nigeria. Numerous factors may be associated with the variations. Some of these factors include socio-economic variations, sanitary conditions, overcrowding and health care systems. Poverty, uncontrolled urbanization and inadequate infrastructure do contribute to the contamination of water supplies. Usually, transmission is through poor hygiene and sewage contamination of water (Bhutta, 2006) Furthermore, climate change may also play a key role in limiting or acceleration of pandemics caused by plasmodium spp and *Salmonella typhi* ((Bhan *et al.,* 2005).

The incidence of Malaria and Typhoid fevers between genders is shown in Table 2. Out of the 500 febrile patients examined, 92% and 84% were positive for Malaria amongst male and female patients, respectively. In addition, typhoid fever prevalence of 80% and 72% for male and female gender, respectively were recorded by this study.The incidence of malaria and typhoid fever based on age groups amongst febrile patients is shown in Table 3. The participants were aged between 1-70 years. No subject was obtained below the age of one during the time of the study, which may be due to the nature of the study area, children aged 11 – 20 were found to be more vulnerable while the older participants less susceptible. This may be due to the low immunity level of children to various infections. A study in Pakistan showed that children are usually burdened with Typhoid fever (Graham, 2002; Siddiqui *et al*., 2006). Another study has also revealed that incidence of Typhoid fever was highest in children of less than 5 years, with higher complications (Bhutta, 2006).

CONCLUSION AND RECOMMENDATIONS

High prevalence of malaria-typhoid fever co-infection was found by this study. Variability in prevalence among different

age groups and gender were observed. Further studies need to be performed to explore more on the causative agents found in the study area. Good sanitary procedures, proper waste disposal and public health awareness are some of the option through which the prevalence of malaria-typhoid fever co-infections may be minimized.

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