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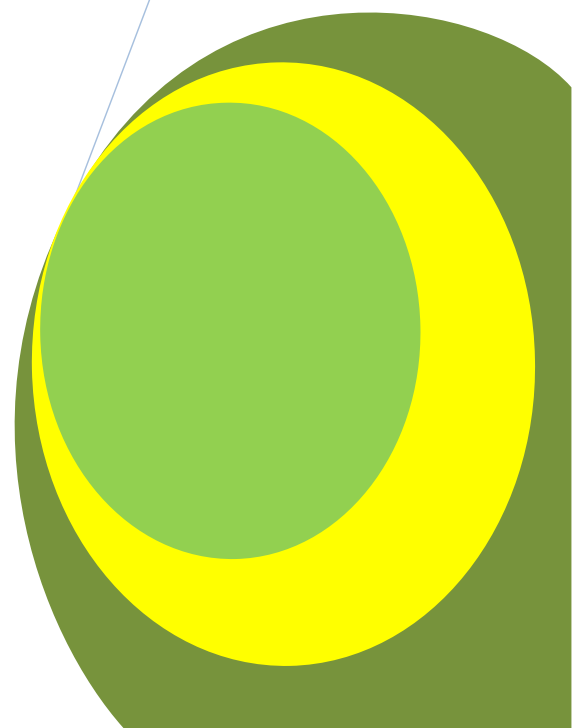
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Prevalence of Malaria and Typhoid Co-Infections among Patients who Attended State Specialist Hospital Gombe from May to August 2015 for Malaria and Widal Tests

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ABSTRACT

Malaria and Typhoid fever are two of the leading febrile illness common in sub-Saharan Africa and remain the disease of major public health importance in causing morbidity and mortality especially in countries where poor sanitary habit, poverty and ignorance exist. This study carried out among 627 patients diagnosed for malaria (MP) and Widal test (Typhoid fever) in Gombe State Specialist Hospital (GSSH) between May – August, 2015, shows that the prevalence rate of malaria and typhoid fever co-infection is very high. 136 patients (21.7%) of the study population were discovered to have co-infection, showing a high prevalence rate when compared with the report of Agwu, E. *et al* (2008) who reported overall co-infection of 5.0% in Ekwulimili in Anambra state. Of the 136 examined, 60.3% are male while 39.7% are female. The study also shows that the prevalence rate of malaria in the study area is higher in male than in female. Male had 60.0% while female had 59.1% confirming the report of Njoku, O. O. *et al*, 2003 who reported the rate of 76% for male and 62% for female in Azia and Umudioka communities in Anambra state. 196 (52.3%) male reacted positive for typhoid while female is 129 (51.1%). This is in contrast to the work of Onyido, A. E. *et al*, 2014 who reported 18.2% male and 81.8% females in Ekwulimili community in Anambra state. These observations can be attributed to wrong perceptions about the causes of malaria and typhoid fever in the study area.

KEY WORDS: Febrile, Morbidity, Mortality, Prevalence and Co-infection.

INTRODUCTION

Typhoid and malaria fever are two leading febrile illness affecting humans, especially in sub-Saharan Africa. They remain the diseases of major public health importance and the cause of morbidity and mortality. Both diseases are common in many countries of the world where poor sanitary habit, poverty and ignorance exist.

Typhoid fever is a systemic bacterial infection caused by *Salmonella enterica* serotype Typhi (*S. typhi*). It is characterized by acute illness. The first non-specific manifestations include fever, headache, abdominal pain and vomiting. On the other hand, malaria is a protozoan infection caused by *Plasmodium* species. It is transmitted by female Anopheles mosquito and characterized by intermittent fever, headache, abdominal pain, weakness and vomiting. It could be complicated or uncomplicated.

Salmonellae are Gram-negative, motile, non-spore, non-capsulate bacilli which exist in nature primarily as parasites of the intestinal tract of man and other animals. On the basis of their pathogenicity the *Salmonellae* may be divided into two groups:

- (i) The enteric fever group comprises the organisms capable of causing enteric fever in man, *Salmonella typhi* and the paratyphoid bacilli, found only in the intestinal tract of man for whom they have a high degree of pathogenicity and in which they frequently cause invasive disease.
- (ii) The food poisoning groups which are essentially parasites of animals from whom man is occasionally infected. Their pathogenicity for man is relatively low, the usual result of infection being the production of gastroenteritis. In this condition they penetrate to the sub-epithelial tissues but rarely invade the blood streams.

Malaria is the most important parasitic diseases of people, affecting over 200 million people and causing more than one million deaths each year. Because of its dependence upon human/vector (mosquito) contact, malaria is considered to be a disease of poverty. Malaria is an important potentially deadly mosquito-borne disease characterized by cyclical bouts of fever with muscle stiffness, shaking and sweating.

Despite decades of control success and a competent network of country-wide health infrastructure, malaria remains an important health threat in rural areas in the tropics. It causes economic loss and impacts social functions. Four *Plasmodium* species are responsible for human malaria. These are *P. falciparum*, *P. vivax*, *P. malariae*, *P. ovale* and *P. knowlesi*. *Plasmodium falciparum* which causes malignant tertian malaria and *P. malariae* which causes quartan malaria are the most common species of malaria parasites and are found in Asia and Africa.

The symptomatology of malaria depends on the parasitaemia, the presence of the organism in different organs and the parasite burden. The incubation period varies generally between 10 – 30 days. As the parasite load becomes significant, the patient develops headache, lassitude, vague pains in the bones and joints, chilly sensations and fever. As the disease progress, the chill and fever become more prominent, follows a cyclic pattern (paroxysm) with the symptomatic period lasting 8 – 12 hours. In between the symptomatic periods, there is a period of relative normalcy, the duration of which depends upon the species of the infecting parasite, but classical tertian paroxysm is rarely seen in *P. falciparum*.

LITERATURE REVIEW

Malaria is a mosquito-borne infectious disease affecting humans and other animals caused by parasitic protozoans (a group of single-celled microorganisms) belonging to the *Plasmodium* type ("Malaria Fact sheet N°94). Malaria causes symptoms that typically include fever, feeling tired, vomiting, and headaches. In severe cases it can cause yellow skin, seizures, coma, or death (Caraballo H, 2014). The disease is most commonly transmitted by an infected female *Anopheles* mosquito. The mosquito bite introduces the parasites from the mosquito's saliva into a person's blood ("Malaria Fact sheet N°94) The parasites travel to the liver where they mature and reproduce. Five species of *Plasmodium* can infect and be spread by humans (Caraballo H, 2014). Most deaths are caused by *P. falciparum* because *P. vivax*, *P. ovale*, and *P. malariae* generally cause a milder form of malaria ("Malaria Fact sheet N°94). The species *P. knowlesi* rarely causes disease in humans ("Malaria Fact sheet N°94). Malaria is typically diagnosed by the microscopic examination of blood using blood films, or with antigen-based rapid diagnostic tests (Caraballo H, 2014). Methods that use the polymerase chain reaction to detect the parasite's DNA have been developed, but are not widely used in areas where malaria is common due to their cost and complexity (Nadjm B and Behrens RH, 2012). The disease is widespread in the tropical and subtropical regions that exist in a broad band around the equator (Caraballo H, 2014). This includes much of Sub-Saharan Africa, Asia, and Latin America ("Malaria Fact sheet N°94).

In 2015, there were 296 million cases of malaria worldwide resulting in an estimated 731,000 deaths (GBD 2015). Approximately 90% of both cases and deaths occurred in Africa ("Malaria Fact sheet N°94", 2016). Rates of disease have decreased from 2000 to 2015 by 37%, ("Malaria Fact sheet N°94", 2016). But increased from 2014 during which there were 198 million cases WHO, 2014). Malaria is commonly associated with poverty and has a major negative effect on economic development (Gollin D et al, 2007). In Africa, it is estimated to result in losses of US\$12 billion a year due to increased healthcare costs, lost ability to work, and negative effects on tourism (Greenwood BM et al, 2005).

Typhoid fever, also known simply as **typhoid**, is a bacterial infection due to *Salmonella typhi* that causes symptoms (Wain, J et al . 2015) which may vary from mild to severe and usually begin six to thirty days after exposure ("Malaria Fact sheet N°94) . Often there is a gradual onset of a high fever over several days (Anna E .

Newton, 2014). Weakness, abdominal pain, constipation, and headaches also commonly occur (cdc.gov. 2013). Diarrhea is uncommon and vomiting is not usually severe (cdc.gov. 2013). Some people develop a skin rash with rose colored spots (cdc.gov. 2013). In severe cases there may be confusion (cdc.gov. 2013). Without treatment symptoms may last weeks or months (cdc.gov. 2013). Other people may carry the bacterium without being affected; however, they are still able to spread the disease to others (WHO, 2008). Typhoid fever is a type of enteric fever along with paratyphoid fever (Wain, J et al, 2015). The cause is the bacterium *Salmonella typhi*, also known as *Salmonella enterica* serotype Typhi, growing in the intestines and blood (cdc.gov. 2013). Typhoid is spread by eating or drinking food or water contaminated with the feces of an infected person (WHO, 2008). Risk factors include poor sanitation and poor hygiene (Wain, J et al, 2015). Those who travel to the developing world are also at risk (CDC, 2013) and only humans can be infected (WHO, 2008). Diagnosis is by either culturing the bacteria or detecting the bacterium's DNA in the blood, stool, or bone marrow (Crump, JA and Mintz, ED, 2010). Culturing the bacterium can be difficult (Cunha BA, 2004). Bone marrow testing is the most accurate (Crump, JA and Mintz, ED, 2010). Symptoms are similar to that of many other infectious diseases (cdc.gov. 2013).

MATERIALS AND METHODS

STUDY AREA

The findings were conducted in the Microbiology/Parasitology Unit of Gombe State Specialist Hospital (GSSH) Laboratory, between May – August, 2015. Data was obtained from the record of Malaria and Widal test registers. Permission was obtained from head of Microbiology/Parasitology unit and confirmed by the Medical Laboratory Scientists in-charge of the benches.

STUDY POPULATION

Of 3, 133 patients who attended the GSSH for malaria (MP) and Widal tests from May – August 2015, 627 patients were selected using systematic and stratified sampling method.

LABORATORY ANALYSIS

Microscopic examinations of stained thick and thin blood films for malaria diagnosis were prepared according to technique. Typhoid infection was diagnosed using the patient's serum and Widal test kits, which contained reactants with attenuated typhoid antigen that reacted specifically with the antibody.

PROCEDURE FOR MP TEST

Thick and thin blood films made from patients' blood were stained with 10% Giemsa's stain for 10 minutes. The slides were viewed under x100 oil immersion objective lens to identify the parasites. Positive slides identified on the basis of microscopic examination for the presence of ring forms in the erythrocytic stage of malaria parasite (Cheesbrough, M. 2000).

WIDAL TEST PROCEDURE

Tile Method:

Sample collected by venepuncture in an EDTA container. A drop of antigen is placed in 8-squares of the tile. A drop of the patient's serum then added and mixed using applicator stick. The tile was then rocked gently for mixing. Observation of agglutination in form of visible crumbs was observed. An agglutination reaction in any of the reactants indicates the presence of *Salmonella*. The degree of agglutination are recorded in titres as 1:40, 1:80, 1:160, 1:320, etc. (Cheesbrough, M. 2000).

DATA ANALYSIS

The data were analyzed using descriptive statistics into percentages, mean and standard deviation.

RESULTS AND DISCUSSION.

A total of 627 data were selected for malaria and typhoid. Out of the number 375 (59.8%) are male while 252 (40.2%) are female (Table I), within the age range of 1 year and 75 years. The mean age of the patients was 30.6 ± 15.2 (SD) years. Patients' age 20 -39 years accounted for significantly highest percentage while age >60 accounted for least percentage.

Table I: Showing number and percentage of male and female

Gender	No. of patients	%
Male	375	59.8
Female	252	40.2
Total	627	100

Table II: Showing number and percentage of patients based on age limit

Age	No. of patients	%
1 – 5	32	5.10
6 – 10	36	5.74
11 – 15	60	9.57
16 – 20	55	8.77
21 – 25	31	4.94
26 – 30	35	5.58
31 – 35	71	11.32
36 – 40	73	11.64
41 – 45	54	8.61
46 – 50	38	6.06
51 – 60	22	3.51
61 – 65	48	7.66
66 – 70	42	6.69
71 – 75	30	4.78

Of the number, 233 (37.2%), 185 (29.5%) and 136 (21.7%) were tentatively diagnosed for malaria, typhoid and co-infections respectively. While 63 (11.6%) were negative to both typhoid and malaria (Table III)

Table III: Showing number and percentage of patients based on Test

Tests	No. of patients	%
Malaria	233	37.2
Typhoid	185	29.5
Co-infection	136	21.7
Negative	63	11.6
Total	627	100

Of the 375 males, 225 (60.0%) are malaria positive while of the 252 females, 149 (59.1%) are malaria positive. The age group <5 years had the highest malaria prevalence rate while group >50 years had low malaria prevalence rate. 196 (52.3%) of the male and 129 (51.1%) of female were positive typhoid. Age group 41 – 60 years had the highest typhoid prevalence rate. Of the 136 examined for co-infection, 82 (60.3%) are male while 54 (39.7%) were female.

Table IV: Malaria positive

Gender	Total no.	No. +ve	%	No. -ve	%
Male	375	225	60.0	150	40.0
Female	252	149	59.1	103	40.9
Total	627	374	59.6	253	40.4

Table V: Typhoid reactive

Gender	Total no.	No. reactive	%	No. non-reactive	%
Male	375	196	52.3	179	47.7
Female	252	129	51.1	123	48.9
Total	627	325	51.8	302	48.2

Table VI: co-infection

Gender	No. examined	No. co-infection	%
Male	375	82	60.3
Female	252	54	39.7
Total	627	136	100

Table VII: Malaria

Age group	No. examined	%
1 – 5	40	6.38
6 – 10	44	7.02
11 – 15	36	5.74
16 – 20	81	12.92
21 – 25	60	9.57
26 – 30	45	7.18
31 – 35	70	11.16
36 – 40	60	9.57
41 – 45	42	6.70
46 – 50	28	4.47
51 – 55	15	2.39
56 – 60	10	1.59
61 – 65	30	4.78
66 – 70	50	7.97
71 – 75	21	3.35
Total	627	100

Table VIII: Malaria and Typhoid

Malaria Positive	%	Typhoid Reactive	%
56	14.97	10	3.08
49	13.10	20	6.15
36	9.63	15	4.62
26	6.95	18	5.54
28	7.49	24	7.38
20	5.35	27	8.31
33	8.82	41	13.85
25	6.68	38	11.69
18	4.81	40	12.31
19	5.08	46	14.15
18	4.81	42	12.92
16	4.29	-	-
10	2.67	-	-
20	5.35	-	-
Total = 374	100	Total = 325	100

This study carried out among 627 patients diagnosed for malaria (MP) and Widal test (Typhoid fever) in Gombe State Specialist Hospital (GSSH) shows that the prevalence rate of malaria and typhoid fever co-infection is very high. 136 patients (21.7%) of the study population were discovered to have co-infection, showing a high prevalence rate when compared with the report of Agwu, E. *et al* (2008) who reported overall co-infection of 5.0% in Ekwulimili in Anambra state. Of the 136 examined, 60.3% are male while 39.7% are female. The study also shows that the prevalence rate of malaria in the study area is higher in male than in female. Male had 60.0% while female had 59.1% confirming the report of Njoku, O. O. *et al*, 2003 who reported the rate of 76% for male and 62% for female in Azia and Umudioka communities in Anambra state. 196 (52.3%) male reacted positive for typhoid while female is 129 (51.1%). This is in contrast to the work of Onyido, A. E. *et al*, 2014 who reported 18.2% male and 81.8% females in Ekwulimili community in Anambra state. These observations can be attributed to wrong perceptions about the causes of malaria and typhoid fever in the study area.

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