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Malaria and Typhoid Fever Coinfection among Febrile Patients Attending Kafin-Maiyaki Primary Health Centre

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Abstract

Malaria and typhoid fever are two symptomatically similar but aetiologically dissimilar diseases: mala ria is caused by parasitic agents from Plasmodium species; ty phoid fever, on the other hand, is caused by Salmonella typhi. They both have no gender distinction in terms of their effect, but malaria appears to be more severe among children. The study aimed to determine the burden of these two diseases among febrile patients in the study area by collecting four (4) mL of blood from each participant, 2 mL of which were dispensed into EDTA bottles for use to detect microscopic parasites. The harvested serum from the remainder was used for the Widal agglutination test to detect the presence of antibodies to Salmonella species. Based on the results, malaria and typhoid fever co-existence was found to be 20.9%. The findings with respect to age group revealed that patients >60 years had a higher coinfection rate of 75% while the 1-12 years age group had the least coinfection (10.6%). There was a significant association between coinfection and age groups (p = 0.019). With respect to gender, females were more prone to be co-infected (53.6%) compared to their male counterparts (46.4%) out of the total positive cases (28) obtained, but the observed difference was not statistically significant (p = 0.016). We therefore recommend concurrent screening of these diseases in all febrile cases in the study area.

Keywords: Coinfection, Malaria, Plasmodium species, Salmonella species, Typhoid fever

INTRODUCTION

As a life-threatening disease, malaria is caused by the genus *Plasmodium*, which is transmitted when an infected female *Anopheles* mosquito bites a susceptible human host (Antonio-Nkondjio *et al.*, 2019; Mohammed *et al.*, 2020). Usually, fever and vomiting are the two known primary symptoms of malaria, which, in severe cases, can easily lead to the death of the host (Mohammed *et al.*, 2020). Based on known reported data, there are up to 228 million cases of malaria, leading to 405,000 deaths. However, 93.8% of these deaths trace their routes to sub-Saharan African regions (Sale *et al.*, 2020). The most commonly encountered malarial parasite is *Plasmodium falciparum* and it causes the most severe form of the disease (Simon-Oke and Akinbote, 2020).

On the other hand, Typhoid fever is an acute blood-borne infection caused by *Bacilli* (*Salmonella typhi*) and, to some extent, the *para typhi*, which are non-lactose fermenters and Gram-negative in nature. They are usually transmitted via the faeco-oral route through contaminated food and/or drinks. In terms of intensity, there exist up to 33 million cases of typhoid fever across the globe, leading to about 216,000 human deaths, mostly in the endemic regions of the world (Mohammed *et al.*, 2020).

In the most affected regions (sub-Saharan Africa and countries in Southeast Asia), frequent outbreaks of typhoid fever are reported annually, and because of the effect of this disease on human health, WHO identifies typhoid fever among the diseases of significant public health concern in developing countries, which mostly affecting children and young adults as well as women in pregnancy (WHO, 2016). A gradually rising fever, poor appetite, and abdominal pain, occasionally with diarrhoea are some of the common features of the disease (Ubengama *et al.*, 2019).

The causative agents of malaria (the Plasmodium species) are single-celled protozoan parasites with complex life cycles involving man and arthropods (mosquitoes) as vectors (Birhanie *et al.*, 2014). The agent of typhoid fever is

Salmonella typhi, which is rod-like Gram-negative bacilli naturally predominant in human and animal GIT. The Somatic antigen (O), which is a polysaccharide, and flagella antigen (H), which is a protein, serve as Serologic markers to differentiate *Salmonella* sub-specie types (Anand and Anand, 2019).

Salmonella typhi and *paratyphi* are normal inhabitants of the intestines of humans, but they still exhibit high levels of pathogenicity, which leads to frequent invasive diseases, including typhoid fever (Dinah *et al.*, 2016).

In developing countries with largely resource-limited settings, co-morbidity of these important diseases (malaria and typhoid) is common and mostly linked to poverty and underdevelopment, leading to increased unnecessary mortality, especially in areas with warm, humid climates and poor sanitary conditions and habits (Chilongola *et al.*, 2018).

It is believed that malaria and typhoid fever remain a major cause of acute febrile illness that leads to high morbidity and mortality in developing countries of the world (Zerfu *et al.*, 2018). They are caused by different types of organisms, protozoa (for malaria) and Gram-negative *bacilli* (for typhoid fever), with different modes of transmission (Kaboré *et al.*, 2021).

With regards to signs and symptoms, malaria and typhoid fever have a great deal in common, as such many patients with febrile conditions are frequently misdiagnosed due to regular overlaps of the same signs and symptoms from different diseases, which eventually leads to incorrect treatment and poor patient management (Zerfu *et al.*, 2018).

Therefore, this study highlights the burden of coinfection of these diseases in a resource-limited setting of a local government in Kano State, Nigeria.

MATERIALS AND METHODS

Study area

This study was carried out in Kafin-Maiyaki Primary Health Centre. The hospital is situated within Kafin-Maiyaki town, Kiru Local Government Area of Kano State.

Sample size determination

The sample size was determined using Cochran's formula $n = z^2p\ (1\text{-}p) / d^2$

Where:
n = the minimum sample size,
z = standard score for the 95% confidence limit = 1.96
p = prevalence from the past study 22.7 (Cochran, 1963)
d = precision =5%
The sample size determined was 134.

Sample collection and processing

A 5 mL syringe collected 4mL of blood sample from each study participant. Two (2 mL) of the blood were dispensed into an Ethylene Diamine Tetra-acetic Acid (EDTA) container for malaria parasite determination, and the remaining 2 mL were placed in the plain container, and serum was obtained for Widal test in accordance with Wasihun et al., (2015).

Detection of malarial parasites

Thick films were prepared by placing a drop of blood at the centre of grease-free glass slides and spreading (circular movement) using a spreader to make a smear of about 12 mm. The blood films were allowed to air-dry and then stained with 10% Giemsa stain for 10 minutes to detect *Plasmodium* parasites. The slides were examined microscopically under 100x (oil immersion) objective, according to Iwuafor (2016).

Widal screening test for typhoid fever

The 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. About fifty microliter (50 µL) of test serum were placed in 8 circles on a plastic slide, and equal volumes of positive control and normal saline (as negative control) were placed in each of the last two circles, respectively. A drop each of O, H, A(H), B(H), C(H), C(O), B(O) and A(O) antigens were added to the test serum in each circle and then to the negative and positive controls. The content of each circle were mixed and spread, after which it was rocked gently for 5 minutes and observed for agglutination (Buckle *et al.*, 2012).

RESULTS

A total of one hundred and thirty-four (134) patients with febrile illness were enrolled, out of which 47(35%) were males while 87(65 %) were females. The prevalence of malaria and typho id fever coinfection was 20.9%. (Figure 1). On the malaria-typhoid fever coinfection among participants with respect to age, those in the age bracket > 60 years had a higher coinfection rate of 75% while the age group 1-12 years had the least infection (10.6%) (Table 1). The observed differences are statistically significant (p = 0.019). With respect to gender, females were more prone to co-infected (53.6%) compared to their male counterparts (46.4%), but the observation was not statistically significant (p = 0.16) (Table 2). With respect to age and gender, males had 5 positive cases as against 8 cases for females in the age bracket of 19-59 (Table 3)

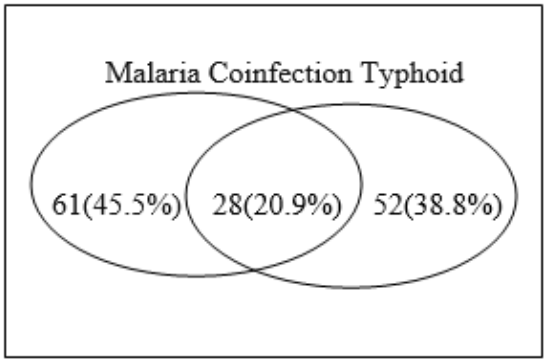

Figure 1: Malaria and typhoid fever infection rates among the participants

Table 1: The coinfection among participants with respect to age

Age group (years)	No. Examined	No. Positive (%)	X^2	p-value
1-12	47	5(10.6)	24.56	0.019
13-18	7	1(14.3)		
19-59	68	13(19.1)		
>60	12	9(75.0)		
Total	**134**	**28(20.9)**		

Table 2: The coinfection among participants based on gender

Gender	No. Examined	Positive (%)	Negative (%)	X^2	p-value
Male	47	13 (46.4)	34(32.1)	2.004	0.16
Female	87	15 (53.6)	72(67.9)		
Total	**134**	**28 (100)**	**106(100)**		

Table 3: The coinfection among participants with respect to age and gender

Age group (years)	No. Examined (E)			Total Positive (%)
	E	M(P)	F(P)	
1-12	47	20(2)	27(3)	5(10.6)
13-18	7	3(0)	4(1)	1(14.3)
19-59	68	32(5)	36(8)	13(19.1)
>60	12	5(4)	7(5)	9(75.0)
Total	**134**	**60**	**74**	**28(20.9)**

Key: E = E umber examined, M = Male, F = Female, P = Positive

DISCUSSION

The findings of this research highlight the significance of coinfection among the study population and underscore the importance of public health education and the degree of public health concern.

In this study, the malaria and typhoid fever coinfection was 20.9%. This agrees with the findings of Igiri and colleagues in 2018, who reported a 22.7% coinfection rate of malaria and typhoid fever (Igiri *et al.*, 2018). But this is in contrast to the findings of Odikamnoro *et al.* (2017), which have a higher prevalence rate of 36.2% for the coinfection (Odikamnoro *et al.*, 2017) and 34.3% according to (Sangaré *et al.* 2021). However, a lower prevalence of 14.36% was obtained in a similar research involving 256 subjects (Ekesiobi *et al.*, 2008).

On the malaria-typhoid fever coinfection among participants with respect to age group, those in the age bracket > 60 years had a higher coinfection rate of 75% while the age group 1-12 years had the lowest prevalence of 10.6%. In contrast, a similar study in 2015 on coinfection of malaria and typhoid fever showed age group of 16-30 years with 83.33% had the highest infection rate (Okore *et al.*, 2015). However, in

2020, other researchers reported a lower prevalence of 31% among the age group of 21-25 years old as the age group with the highest coinfection (Simon-Oke *et al.*, 2020).

Findings with respect to gender revealed that females were more prone to coinfection, with 53.6% compared to their male counterparts at 46.4%. This could be because many women normally attend hospital while they are pregnant, in which state they have weak immunity. A similar finding was also reported in which females were found to be the most affected with coinfection 53.6% compared to that found in males 46.4% as the least affected (Odikamnoro *et al.*, 2017). In another study on gender-related typhoid-malaria coinfection, almost the same infection rate was reported for females and males, with 37% and 35% respectively (Odikamnoro *et al.*, 2017). However, a contrasting result revealed males as the most infected by typhoid/malaria fever coinfection than females, with 43% and 40.5% as their respective prevalence rates (Simon-Oke et al., 2021). It was also reported in one study that 38.78% tested positive for malaria, 42.86% positive for typhoid fever, while 37.50% were the total prevalence for typhoid/malaria coinfection, and it was found that males were the most affected with 44.00% infection rate in the study (Okore *et al.*, 2015).

CONCLUSION

The coinfection prevalence of 20.9% obtained in the study indicated a significant burden of these two related diseases in the study area. Females had a higher vulnerability (53.6%) for coinfection compared to males (46.4%).

RECOMMENDATION

Giving health education to the populace could be a vital tool for understanding the different causative agents of these seemingly similar diseases. Screening for the different agents in each patient who complains of fever is recommended for successful differential diagnosis.

REFERENCE

Anand, N., & Anand, N. (2018). Incidence of coinfection of malaria and typhoid and their diagnostic dilemmas. *RAPL*, *4*(4), 10-12. **[Crossref]**

Antonio-Nkondjio, C., Cyrille, N. & Flobert, N. (2019). "Review of malaria situation in Cameroon: technical viewpoint on challenges and prospects for disease elimination. *Parasites and Vectors*, *12*(1), 501–523. **[Crossref]**

Birhanie, M., Tessema B., Ferede G., Endris M., & Enawgaw, B. (2014). Malaria, typhoid fever, and their coinfection among febrile patients at a rural health center in Northwest Ethiopia: a cross-sectional study. *Advances in medicine*, *8*, 2014. **[Crossref]**

Buckle, G. C., Walker, C. L. & Black, R. E. (2012). "Typhoid fever and paratyphoid fever: systematic review to estimate global morbidity and mortality for 2010. *Journal of Global Health*, *2*, 1. **[Crossref]**

Chilongola, J. Kombe, S. & Horumpende, P. (2018). "Prevalence of *Plasmodium falciparum* and *Salmonella typhi* infection and coinfection and their association with fever in Northern Tanzania. *East African Health Research Commission*, *2*(2), 147-155. **[Crossref]**

Cochran, W. G. (1963). Sampling techniques, (3rd edition).Wiley. *New York. John Wiley and Sons*, Inc. *p.75*, 124-125.

Dinah K., Tonny A., & Moses, O. (2016). Prevalence of Plasmodium and salmonella coinfection among febrile patients attending outpatient department of Lira Regional Referral Hospital in Northern Uganda: a cross-sectional study. *Journal of Disease and Global Health*, *7*(4), 183-187.

Ekesiobi, A. O., Igbodika, M. C. & Njoku, O. O. (2008). Coinfection of malaria and typhoid fever in a tropical community; *Animal Research International*, *5*(3), 888-891. **[Crossref]**

Igiri, B. E., Ejezie, G. C., Inyang-Etoh, P. C., Jimoh, O., & Okoduwa, S. I. R. Otu-Bassey, I. B. & Ogba, O. M. (2018). Incidence of malaria and salmonellosis coinfection in Ahmadu Bello University Teaching Hospital, Zaria, North-West Nigeria. *ClinSci Res Rep*, *1*(2), 1-5. **[Crossref]**

Iwuafor, A. A., Egwuatu, C. C., Nnachi, A. U., Akujobi, C. N., & Ita, I. O. (2016). Malaria-related febrile illness and the use of Insecticide-Treated Nets (INTs) for malaria control amongst under-5 year old children in Calabar, Nigeria. *BMC Infect Dis*, *16*, 151-160. **[Crossref]**

Kaboré, B., Post, A., & Lompo, P. (2021). Aetiology of acute febrile illness in children in a high malaria transmission area in West Africa. *Clinical*

Microbiology and Infections, 27(4), 590-596. [Crossref]

Mohammed, H. I., Mukhtar, I. M. & Sadiq, H. A. (2020). Malaria and typhoid fever: prevalence, coinfection and socio-demographic determinants among pregnant women attending antenatal care at a primary healthcare facility in Central Nigeria. *International Journal of Pathogen Research*, *5*(4), 17–24. [Crossref]

Odikamnoro, O.O., Ikeh, I. M., Okoh, F. N., Ebiriekwe, S. C., Nnadozie, I. A., Nkwuda, J. O. & Asobie, G. C. (2018). Incidence of malaria/typhoid coinfection among adult population inunwana community, afikpo north local government area, ebonyistate, southeastern nigeria. *Afr J Infect Dis*, *12*(1), 33-38.

Okore, O. O., Ubiaru, P. C., & Nwaogwugwu, U. G. (2015). Prevalence of Malaria and Typhoid Fever Coinfection: Knowledge, Attitude and Management Practices among Residents of Obuda-Aba, Abia State, Nigeria. *American Journal of Public Health Research, 3*(4), 162-166

Sale, M. Pukuma, M. Adedeji, B. & Shehu, A. (2020). "Prevalence of typhoid and malaria coinfection among patients attending a public hospital in Yola, Nigeria," *International Journal of Mosquito Research*, *7*(3), 42-47.

Sangaré, I. S. Yacouba, B. Wifried, W. S. Constant, D. F., Sanou, S. Z. Jacques, P. A. Ouédraogo, A. S. & Bamba, S. (2021). Institut Supérieur des Sciences de la Santé, Université Nazi BONI, Bobo-Dioulasso, Burkina Faso (2021). Malaria and Typhoid Fever Coinfection in the Hospital University of Bobo-Dioulasso, Burkina Faso. *Journal of Parasite Research, 1*(1), 21-25

Simon-Oke L. A. & Akinbote, M. O. (2020). Prevalence of Malaria and Typhoid Coinfection in Relation to Haematological Profile of University Students in Akure, Nigeria. *Journal of Infectious Diseases and Epidemiology*, *6*(5), 166. [Crossref]

Ubengama, N. Useh, M. & Ben, S. (2019). "High occurrence of typhoid fever and malaria coinfection among patients clinically diagnosed of malaria and or typhoid infection in Calabar, Nigeria," *Journal of Medical Laboratory Science*, *29(*2), 1-9

Wasihun, A. G., Wlekidan, L. N., Gebremariam, S. A., Welderufael, A. L., Muthupandian, S., & Haile, T. D., (2015). Diagnosis and treatment of typhoid fever and associated prevailing drug resistance in northernEthiopia. *Int J Infect Dis, 35*, 96–102. [Crossref]

World Health Organization, (2016). *World Malaria Report,* Geneva, World Heal the Organ.

Zerfu B., Medhin G., Mamo G., Getahun G., Tschopp R., & Legesse, M. (2018). Community-based prevalence of typhoid fever, typhus, brucellosis and malaria among symptomatic individuals in Afar Region, Ethiopia. *PLoS Neglected Tropical Diseases*; *12*(10), e0006749. [Crossref]