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: malaria is caused by parasitic agents from Plasmodium species; typhoid 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 typehi, 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.
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 typhoid 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 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](image)

Table 1: The coinfection among participants with respect to age

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>No. Examined</th>
<th>No. Positive (%)</th>
<th>X²</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-12</td>
<td>47</td>
<td>5 (10.6)</td>
<td>24.56</td>
<td>0.019</td>
</tr>
<tr>
<td>13-18</td>
<td>7</td>
<td>1 (14.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19-59</td>
<td>68</td>
<td>13 (19.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;60</td>
<td>12</td>
<td>9 (75.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>134</td>
<td>28 (20.9)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: The coinfection among participants based on gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>No. Examined</th>
<th>Positive (%)</th>
<th>Negative (%)</th>
<th>X²</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>47</td>
<td>13 (46.4)</td>
<td>34 (31.2)</td>
<td>2.004</td>
<td>0.16</td>
</tr>
<tr>
<td>Female</td>
<td>87</td>
<td>15 (53.6)</td>
<td>72 (67.9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>134</td>
<td>28 (100)</td>
<td>106 (100)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>No. Examined</th>
<th>Total Positive (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E</td>
<td>M(P)</td>
</tr>
<tr>
<td>1-12</td>
<td>47</td>
<td>20 (2)</td>
</tr>
<tr>
<td>13-18</td>
<td>7</td>
<td>3 (0)</td>
</tr>
<tr>
<td>19-59</td>
<td>68</td>
<td>32 (5)</td>
</tr>
<tr>
<td>&gt;60</td>
<td>12</td>
<td>5 (4)</td>
</tr>
<tr>
<td>Total</td>
<td>134</td>
<td>60</td>
</tr>
</tbody>
</table>

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


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