International Journal of Healthcare and Medical Sciences
ISSN(e): 2414-2999, ISSN(p): 2415-5233
Vol. 7, Issue. 2, pp: 13-17, 2021
URL: https://arpgweb.com/journal/journal/13
DOI: https://doi.org/10.32861/ijhms.72.13.17

Academic Research Publishing Group

Original Research Open Access

Assessment of the Prevalence of Malaria and Typhoid Fever among Apparently Healthy Undergraduates

Iyevhobu Kenneth Oshiokhayamhe (Corresponding Author)
Irrua Specialist Teaching Hospital (ISTH), Irrua, Edo State, Nigeria
Email: kennylamai@yahoo.com

Obodo Basil Nnaemeka
Department of Medical Laboratory Science, Ambrose Alli University, Ekpoma, Edo State, Nigeria

Irobonosen Osaze Israel
Center for Infectious Disease Control, 161 Nigerian Airforce Hospital, Makurdi, Benue State, Nigeria

Ken-Iyevhobu Benedicta Agumeile
Department of Microbiology, Ambrose Alli University, Ekpoma, Edo State, Nigeria

Article History
Received: February 8, 2021
Revised: March 19, 2021
Accepted: March 24, 2021
Published: March 29, 2021

Abstract

Malaria is a mosquito-borne infectious disease of humans and other animals caused by parasitic protozoans (a type of unicellular microorganism) of the genus *Plasmodium*. Commonly, the disease is transmitted via a bite from an infected female *Anopheles* mosquito, which introduces the organisms from its saliva into a person's circulatory system. In the blood, the protists travel to the liver to mature and reproduce. Malaria causes symptoms that typically include fever and headache which in severe cases can progress to coma or death. The disease is widespread in tropical and subtropical regions in a broad band around the equator, including much of Sub-Saharan Africa, Asia and the Americans Five species of *Plasmodium* can infect and be transmitted by humans. The vast majority of deaths are caused by *Plasmodium falciparum* and *Plasmodium vivax*, while *Plasmodium ovale* and *Plasmodium malariae* cause a generally milder form of malaria that is rarely fatal. The result showed that prevalence of typhoid fever in both male and female are 9 (%) and 21 (21%) respectively. The distribution of this result was statistically significant ($p<0.05$; X2=4.745). The result showed that prevalence of typhoid fever in both male and female are 6 (6%) and 4 (4%) respectively. The distribution of this result was not statistically significant ($p>0.05$; X2=0.105). The result showed that prevalence of the co-infection in both male and female are 3 (3%) and 2 (2%) respectively. The distribution of this result was not statistically significant ($p>0.05$; X2=0.205). The result showed that co-infection was negatively correlated with typhoid fever in both male ($r=-0.055$) and female ($r=-0.074$) subjects. Also co infection was negatively correlated with malaria for male subjects ($r=-0.044$) while it is positively correlated with the female subjects ($r=0.335$). Similarly typhoid fever was negatively correlated with malaria in both male ($r=-0.079$) and females ($r=-0.105$) subjects. Conclusively, the results in this study showed that the prevalence of malaria and typhoid co-infections are low which means the no association was found between malaria and typhoid fever infections within the study area. Hence one cannot actually say that malaria may predispose to typhoid fever. Also cross reacting antigens are widely distributed in the microbial world and since there will always be repeated exposures to salmonella species in endemic regions, increased efforts should be made to find a better, more rapid, sensitive and specific clinical and cultural methods.

Keywords: Malaria; Typhoid; Pregnant; Parasite; Plasmodium.

1. Introduction

Malaria may be a mosquito-borne communicable disease of humans and other animals caused by parasitic protozoans (a sort of unicellular microorganism) of the genus Plasmodium [1]. Normally, the illness is communicated through a chomp from a tainted female Anopheles mosquito, which presents the life forms from its spit into a person's cardiovascular framework. In the blood, the protists travel to the liver to mature and reproduce [2]. Malaria causes symptoms that typically include fever and headache which in severe cases can progress to coma or death [3]. The illness is far and wide in tropical and subtropical locales during an expansive band round the equator, including quite a bit of Sub-Saharan Africa, Asia and accordingly the Americans Five types of Plasmodium can contaminate and be sent by people [4]. The vast majority of deaths are caused by Plasmodium falciparum and Plasmodium vivax, while Plasmodium ovale and Plasmodium malariae cause a generally milder form of malaria that is rarely fatal [5]. The zoonotic species Plasmodium Knowlesi, prevalent in Southeast Asia, causes malaria in macaques but can also cause severe infections in humans. Intestinal sickness (like malaria) is predominant in tropical and subtropical districts since precipitation, warm temperatures and stale water give environments ideal to mosquito hatchlings [6]. Disease transmission can be reduced by preventing mosquito bites by using mosquito insecticide treated nets and insect repellents, or with mosquito-control measures such as spraying insecticides and draining stagnant water [7]. Malaria is usually diagnosed by the microscopic examination of blood using blood films or with antigen-based rapid diagnostic tests [8]. Modern techniques that use the polymerase chain reaction to detect the parasite's DNA have also been developed, but these aren't widely utilized in malaria-endemic areas thanks to their cost and complexity [9]. The World Health Organization has estimated that in 2010, there have been 219 million documented cases of malaria. That year, the disease killed between 660,000 and 1.2 million people, many of whom were children in Africa [10]. The actual number of deaths is not known with certainty, as accurate data is unavailable in many rural areas and many cases are undocumented [11].

Typhoid fever additionally referred to just as typhoid might be a typical overall bacterial illness communicated by the ingestion of food or water polluted with the dung of a tainted individual, which contain the bacterium Salmonella enterica subsp. enterica, serovar Typhi [12]. The disease has received various names, like gastric fever, typhoi, abdominal typhus, infantile remittant fever, slow fever, nervous fever and pythogenic fever. The name typhoid means "resembling typhus" and comes from the neuropsychiatric symptoms common to typhoid and typhus [12]. The occurrence of this disease fell sharply in the developed world with the rise of 20th-century sanitation techniques and antibiotics [13].

Malaria poses a serious public health problem in most tropical and subtropical countries of the world. About 40% of the world's population in over 100 countries are at risk of malarial infection. Sub-Saharan Africa has about 90% of the world's burden of malaria [14]. The main burden of malaria in these areas results from infection with *Plasmodium falciparum* [15-17].

Also, lack of laboratory facilities usually poses problem in the treatment of malaria. Also, typhoid fever is an acute systemic infection caused by the bacterium Salmonella enterica sub-sp enterica serotype Typhi (or simply Salmonella Typhi). Typhoid is transmitted by the fecal-oral route via contaminated food and water. An estimated 17 million cases of typhoid are reported worldwide each year, resulting in 0.6 million deaths [18]. This is exacerbated by the emergence and spread of multidrug-resistant strains of Salmonella Typhi, and further complication by malaria co-infection [18-20]. This study is limited to evaluating the prevalence rate of malaria and typhoid fever among apparently healthy undergraduates of Ambrose Alli University, Ekpoma, Edo State.

2. Materials and Methods

This study was carried out in the Ambrose Alli University, Ekpoma. The study population of this study comprises of undergraduates students of Ambrose Alli University, Ekpoma. The students were within the age range of 18 years to 30 years. The study also comprise of 100 level to final year students of the University.

A total of two hundred (200) students were recruited for this study. The sample size (N) is calculated from the formula below using prevalence from previous studies (Ekejindu *et al.*, 2002).

Ethical approval was obtained from the Management of the University schools and informed consent was sought from the students.

Sample Selection/Collection: Samples were collected in ethylenediaminetetraacetic acid (EDTA) bottles.

2.1. Methods of Analysis

Malaria Parasite Density Determination: The malaria parasite density was determined by examining a thick blood film stained by Giemsa method [21]. The blood was mixed by inversion. A clean grease free slide was taken. A drop of the blood was placed on the slide using pasture pipette and a thick film smear was made. It was allow to dried. It was flooded with diluted Giemsa stain (1:10) and allow to stay for 45minutes. It was rinsed after 45 minutes with buffered distilled water pH 7.0. The back of the slide was wiped dried with cotton wool and allow to dried. It was then examined under the microscope using X10 and X40 objective with immersion oil.

Classification of the Degree of Parasitaemia: The malaria parasite density was graded as follows: 1 parasite/field: low density (+), 2-9 parasites/field: medium density (++) and More than 20 parasites/field: high density [21].

Typhoid Fever Determination: Patient serum is doubly diluted by mixing and transferring from 1:10 to 1:640 in three-four rows. First row usually comprises of Khan tubes, where somatic *S.typhi* O antigen is added. For all the remaining rows, test tubes are taken; where different flagellar H antigens are added. Each tube must contain 0.5ml of diluted serum. A test tube with just saline is kept in each column as control. All the cylinders (counting control) straight are blended in with 0.5ml of antigen suspension. The primary column is treated with *S.typhi* O antigen, the second line with *S.typhi* H antigen, the third line with *S.paratyphi* AH antigen and the fourth line with *S. paratyphi* BH antigen. Since contaminations by *S. paratyphi* B are uncommon, this antigen is typically overlooked in the test. After all the cylinders have been treated with explicit antigen suspensions, the widal rack is put in a thermostatically controlled water shower kept up at 50-55^{o}C for 2 hours [21].

The collected data expressed as Frequency and percentage. Comparison of qualitative variables was made using chi-square test. In all cases studied, the difference having $p \leq 0.05$ were considered statistically significant using SPSS software (version 21).

3. Results

This study was carried out to investigate the prevalence of co-infection in apparently healthy individuals. The study employed a total of 200 samples comprising of 100 male and 100 female apparently healthy subjects.

The results in table 1 present the prevalence of typhoid fever in apparently healthy individuals. The result showed that prevalence of typhoid fever in both male and female are 9 (%) and 21 (21%) respectively. The distribution of this result was statistically significant ($p<0.05$; $X^2=4.745$).

The results in table 2 present the prevalence of malaria in apparently healthy individuals. The result showed that prevalence of typhoid fever in both male and female are 6 (6%) and 4 (4%) respectively. The distribution of this result was not statistically significant ($p>0.05$; $X^2=0.105$).

The results in table 3 present the prevalence of typhoid fever and malaria co-infection in apparently healthy individuals. The result showed that prevalence of the co-infection in both male and female are 3 (3%) and 2 (2%) respectively. The distribution of this result was not statistically significant ($p>0.05$; $X^2=0.205$).

Table 4 presents the correlations of co-infection, malaria and typhoid fever in apparently healthy individuals. The result showed that co-infection was negatively correlated with typhoid fever in both male ($r=-0.055$) and female ($r=-0.074$) subjects. Also co infection was negatively correlated with malaria for male subjects ($r=-0.044$) while it is positively correlated with the female subjects ($r=0.335$). Similarly typhoid fever was negatively correlated with malaria in both male ($r=-0.079$) and females ($r=-0.105$) subjects.

Table-1. Prevalence of Typhoid fever in apparently healthy individuals

Sex	No Examined	No Infected	Prevalence (%)	X^2 cal
Male	100	9	9	
Female	100	21	21	
TOTAL	200	30	15	4.745

(α = 0.05, p value = 0.029; df =1)

Key: X^2cal = chi-square calculated; D.f. =Degree of freedom; No=Number

Table-2. Prevalence of Malaria in apparently healthy individuals

Sex	No Examined	No Infected	Prevalence (%)	X^2 cal
Male	100	6	6	
Female	100	4	4	
TOTAL	200	10	5	0.105

(α = 0.05, p value = 0.746; df =1)

Table-3. Prevalence of malaria and Typhoid fever co-infection in apparently healthy individuals

Sex	No Examined	No Infected	Prevalence (%)	X^2 cal
Male	100	3	3	
Female	100	2	2	
TOTAL	200	5	2.5	0.205

(α = 0.05, p value = 0.651; df =1)

Table-4. Correlations of co-infection, malaria and typhoid fever in apparently healthy individuals

Infections		Male (r)	Female (r)
Co infection	Typhoid fever	-0.055	-0.074
Co infection	Malaria	-0.044	0.335
Typhoid	Malaria	-0.079	-0.105

Key:
r = correlation coefficient

4. Discussion

This examination was completed to decide the predominance of typhoid and malaria co-contamination in obviously solid people. Co-disease is the concurrent contamination of a host by different microbe species. Worldwide predominance or frequency of co-contamination among people is obscure, yet it is believed to be normal spot, some of the time more normal than single disease [22, 23]. Co-disease is of specific human wellbeing significance since microbe species can collaborate inside the host. The net impact of co-contamination on human wellbeing is believed to be negative [24]. Cooperations can have either certain or negative impacts on different parasites.

The aftereffects of the this examination demonstrated that out of the all out 200 examples analyzed, typhoid fever was pervasive in of 15% out of which 9% was for males and 21% for females. This was factually critical ($P<0.05$). Likewise intestinal sickness was common in 5% out of which 6% was for maless and 4% for females. Besides, the outcomes on co-disease indicated that 2.5% of the complete example was common for co-contamination which contained 3% for males and 2% for females.

The outcome demonstrated that co-disease was adversely related with typhoid fever in both male and female subjects. Additionally co disease was adversely connected with intestinal sickness for male subjects while it is emphatically related with the female subjects. Additionally typhoid fever was contrarily corresponded with intestinal sickness in both male and female subjects.

The commonness of co-disease with malaria parasites and salmonella life forms recognized in this examination was low which is in concurrence with the investigation of Isibor, *et al.* [25]. The aftereffect of this investigation is likewise upheld with the investigation of Afoakwah, *et al.* [26] which additionally detailed a predominance of 4.65%. The recorded commonness of 5% and 15% individually for intestinal sickness and typhoid fever are low, consequently comparing with different works in other endemic districts [27-29]. Mbuh, *et al.* [30], affirmed this finding that the vast majority of the co-contaminations treated depend on techniques for conclusion tormented with suspicion which presumably overstates the circumstance, since clinicians are frequently constrained by patients' practices to endorse antimalarial medications or against typhoidal tranquilizes in any event, when malaria parasites or serological test outcomes are not reminiscent of the infections. The exact instrument fundamental the relationship among malaria and salmonellosis is as yet not completely comprehended. In any case, it has been indicated that haemolysis, which happens in intestinal sickness, may incline to typhoid fever [31]. It has likewise been demonstrated that intense malaria decreases counter acting agent reaction to the physical (O) antigen of *S. typhi* [32].

Likewise, the consequence of this examination could be ascribed to the time of the year during which testing was finished. Water shortage inside the region of study zone could likewise be a factor that might have influenced the aftereffect of this examination. Henceforth, there is no amassing of water in canals, bowls, leaves and the encompassing which fill in as rearing destinations for these parasites, subsequently making it outlandish for malaria parasites to raise. Likewise, Buck, *et al.* [33] detailed an estimation of single pretreatment widal agglutination test in the finding of typhoid and paratyphoid fevers helpful.

What's more, report shows that the presence of widal agglutinins under states of negative malaria smear, proposes that different irresistible specialists, notwithstanding salmonella and intestinal sickness parasites, may likewise impart normal antigenic determinants to Salmonella typhi. Different reports from India, Canada and Baltimore are likewise in concurrence with the discoveries in this examination [34-36].

5. Conclusion

Conclusively, the results in this study showed that the prevalence of malaria and typhoid co-infections are low which means the no association was found between malaria and typhoid fever infections within the study area. Hence one cannot actually say that malaria may predispose to typhoid fever. Also cross reacting antigens are widely distributed in the microbial world and since there will always be repeated exposures to salmonella species in endemic regions, increased efforts should be made to find a better, more rapid, sensitive and specific clinical and cultural methods. Based on the results obtained in this study, the following are hereby recommended; Researchers should develop vaccines that will be used to treat and monitor malaria and typhoid co-infections, Appropriate food, water handling and personal hygiene should be implemented and reinforced at homes and public places, There should adequate provisions for mosquito preventive facilities such as mosquito nets, Proper sanitation and appropriate facilities for human waste disposal should be made available for all the community, Health education is paramount to raise public awareness on all the mentioned prevention measures and Methods for screening and monitoring of typhoid and malaria should be adopted in order to reduce morbidity.

Conflict of Interest

The authors declare no conflicts of interest. The authors alone are responsible for the content and the writing of the paper.

Funding

This research did not receive any grant from funding agencies in the public, commercial, or not-for-profit sectors.

Acknowledgements

The authors would like to thank all the Laboratory and technical staffs of the department of Medical Laboratory Science and Microbiology, Ambrose Alli University Ekpoma, Edo State for their excellent assistance and St Kenny Research Consult, Ekpoma, Edo State for providing medical writing support/editorial support in accordance with Good Publication Practice (GPP3) guidelines.

References

[1] Nayyar, G. M. L., Breman, J. G., Newton, P. N., and Herrington, J., 2012. "Poor-quality antimalarial drugs in southeast Asia and sub-Saharan Africa." *Lancet Infectious Diseases*, vol. 12, pp. 488-496.

[2] Fairhurst, R. M. and Wellems, T. E., 2010. *Chapter 275. Plasmodium species (malaria). In . Mandell, douglas, and bennett's principles and practice of infectious diseases 2*. 7th ed. Churchill Livingstone/Elsevier: Mandell GL, Bennett JE, Dolin R (eds), Philadelphia, Pennsylvania. pp. 3437–3462.

[3] Nadjm, B. and Behrens, R. H., 2012. "Malaria: An update for physicians." *Infectious Disease Clinics of North America*, vol. 26, pp. 243-259.

[4] Bartoloni, A. and Zammarchi, L., 2012. "Clinical aspects of uncomplicated and severe malaria." *Mediterranean Journal of Hematology and Infectious Diseases*, vol. 4, pp. 20-26.

[5] Beare, N. A., Taylor, T. E., Harding, S. P., Lewallen, S., and Molyneux, M. E., 2006. "Malarial retinopathy: A newly established diagnostic sign in severe malaria." *American Journal of Tropical Medicine and Hygiene*, vol. 75, pp. 790-797.

[6] Ferri, F. F., 2009. *Chapter 332. Protozoal infections. Ferri's color atlas and text of clinical medicine*. Elsevier Health Sciences, p. 1159.

[7] Korenromp, E., Williams, B., de Vlas, S., and Gouws, E., 2005. "Malaria attributable to the HIV-1 epidemic, sub-Saharan Africa." *Emerging Infectious Diseases*, vol. 11, pp. 1410-1419.

[8] Taylor, W. R., Hanson, J., Turner, G. D., White, N. J., and Dondorp, A. M., 2012. "Respiratory manifestations of malaria." *Chest,* vol. 142, pp. 492-505.

[9] Beare, N. A., Lewallen, S., Taylor, T. E., and Molyneux, M. E., 2011. "Redefining cerebral malaria by including malaria retinopathy." *Future Microbiology,* vol. 6, pp. 349-355.

[10] Hartman, T. K., Rogerson, S. J., and Fischer, P. R., 2010. "The impact of maternal malaria on newborns." *Annals of Tropical Paediatrics,* vol. 30, pp. 271-282.

[11] Rijken, M. J., McGready, R., Boel, M. E., and Poespoprodjo, R., 2012. "Malaria in pregnancy in the Asia-Pacific region." *Lancet Infectious Diseases,* vol. 12, pp. 75-88.

[12] Cunha, B. A., 2004. "Osler on typhoid fever: differentiating typhoid from typhus and malaria." *Infect. Dis. Clin. North Am.,* vol. 18, pp. 111-25.

[13] Brusch, B., 2014. *Typhoid fever*. Medscape.

[14] World Health Organization, 1999. "Practical chemotherapy of malaria. Report of a WHO scientific group, Geneva. World Health Organization Technical Report Series. No. 805."

[15] WHO, 2003. "Reproductive Risk Assessment of Antimalaria Therapy with Artemisinin Compounds - Reports of an Informal Consultation Convened by WHO Geneva, 2002 May 29-30."

[16] Al-Hajjaj, D., 2005. "Malaria in pregnancy." *PostGrad Doct Africa,* vol. 3, pp. 50-60.

[17] Gravett, M. G. and Sampson, J. E., 1994. *Malaria in high-risk pregnancy. High-risk pregnancies*. Mosby: James DK, Steer PJ, Weiner CP Churchill Livingstone, Saunder's Company Ltd. pp. 541-550.

[18] Keong, B. C. and Sulaiman, W., 2006. "Typhoid and malaria co-infection—an interesting finding in the investigation of a tropical fever." *The Malaysian Journal of Medical Sciences,* vol. 13, pp. 74-75.

[19] Gupta, A., 1994. "Multidrug-resistant typhoid fever in children: epidemiology and therapeutic approach." *Pediatr. Infect. Dis. J.,* vol. 13, pp. 134-140.

[20] Siddiquia, F. J., Rabbania, F., Hasanb, R., Nizamic, S. O., and Bhuttac, Z. A., 2006. *International Society for Infectious Diseases,* vol. 10, p. 1016.

[21] Cheesbrough, M., 1998. *District laboratory practice in tropical countries, part 1*. Cambridge: Cambridge University Press. pp. 355-358.

[22] Petney, T. N. and Andrews, R. H., 1998. "Multiparasite communities in animals and humans: frequency, structure and pathogenic significance." *International Journal for Parasitology,* vol. 28, pp. 377-393.

[23] Cox, F. E., 2001. "Concomitant infections, parasites and immune responses." *Parasitology,* vol. 122, pp. 23-38.

[24] Griffiths, E. C., Pedersen, A. B. P., Fenton, A., and Petchey, O. P., 2011. "The nature and consequences of coinfection in humans." *Journal of Infection,* vol. 63, pp. 200-206.

[25] Isibor, J. O., Eghe, I., Okodua, M. A., Akhere, O. A., Efosa, I., and Emwionmwan, A., 2011. "Co-infection with malaria parasites and salmonella typhi in patients in Benin City, Nigeria." *Annals of Biological Research,* vol. 2, pp. 361-365.

[26] Afoakwah, R., Desmond, O. A., Johnson, N. B., Margaret, S., Ekene, K. N., and Patience, S. T., 2011. "Typhoid-Malaria Co-Infection in Ghana." *European Journal of Experimental Biology,* vol. 1, pp. 1-6.

[27] Ammah, A., Nkujo-Akenji, T., Ndip, R., and Deas, J. E., 1999. "An update on concurrent malaria and typhoid fever in Cameroon." *Trans. R. Soc. Trop. Med. Hyg.,* vol. 2, pp. 127-129.

[28] Ohanu, M. E., Mbah, A. U., Okonkwo, P. O., and Nwagbo, F. S., 2003. "Interference by malaria in the diagnosis of typhoid using Widal test alone." *West Afr. J. Med.,* vol. 22, pp. 250-252.

[29] Agwu, E., Ihongbe, J. C., Okogun, G. R., and Inyang, N. J., 2009. "High incidence of co-infection with malaria and typhoid in febrile HIV infected and AIDS patients in Ekpoma, Edo state, Nigeria." *Braz. J. Microbiol.,* vol. 40, pp. 329-332.

[30] Mbuh, F. A., Galadima, M., and Ogbadu, L., 2003. "Measures for treating fever in malaria." *Annals. Afr. Med.,* vol. 2, pp. 64-67.

[31] Kaye, D. and Hook, E. W., 1963. "Malaria in adolescence: Burden of disease, consequences, and opportunities for intervention." *J. Immunol.,* vol. 91, pp. 65-75.

[32] Greenwood, B. M., Bradley-Moore, A. M., Palit, A., and Bryceson, A. D. M., 1972. "Immunosuppression in children with malaria." *Lancet,* vol. 1, pp. 169-172.

[33] Buck, R., Escanilla, J., Sangalang, R. P., Cabangan, A. B., and Santiago, L. T., 1987. "Diagnostic value of single, pre-treatment Widal test in suspected enteric fever cases in the Philippines." *Trans. Roy. Soc. Trop. Med. Hyg.,* vol. 81, pp. 871-873.

[34] Gopinath, R., Keystone, J. S., and Kain, K. C., 1995. "Chronic and acute infection of the gall bladder by Salmonella Typhi: understanding the carrier state." *Clin infect. Dis.,* vol. 20, pp. 706-708.

[35] Khubnani, H., Phalke, D., Khubani, A. H., and Jain, R. C., 1995. "Management of malaria." *J. Assoc. Phys. India.,* vol. 2, pp. 583-586.

[36] Zenilman, J. M., 1997. "Typhoid fever." *The Journal of the American Medical Association,* vol. 278, pp. 847-850.