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Co-infection of schistosomiasis, malaria, HBV and HIV among adults living in Eggua Community, Ogun State, Nigeria

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Abstract

Schistosomiasis is a parasitic disease caused by the blood fluke that continues to plague many developing countries in the tropics. The goal of this study was to determine the occurrence of schistosomiasis, malaria, HBV and HIV co-infection among adults in some villages of Eggua Community, Nigeria (Tata, Imoto, Orile and Ebute Igbooro). In cross-sectional surveys, 240 participants were recruited from Orile and Ebute Igbooro and 207 from Tata and Imoto. Urine samples were collected and tested for urinary schistosomiasis by conventional microscopy; blood samples were tested for HBV, HIV and malaria using standard RDTs and microscopy respectively. Prevalence and co-infection of the diseases was analyzed by *chi*-squared (x^2) test. The prevalence of schistosomiasis and malaria was 21.3% and 11.1% in Tata and Imoto respectively; and 14.5% and 19.1% in Orile and Ebute Igbooro, respectively. The overall prevalence of co-infection of urinary schistosomiasis with malaria was 2.5% and 0.4% each with HIV and HBV in the study areas. *Schistosoma haematobium* and *Plasmodium falciparum* are prevalent in the study-area, and an integrated control approach directed against the two parasites should be carried out.

Keywords: Schistosomiasis; malaria; co-infection; HBV and HIV.

Introduction

Tropical areas of the world, especially Africa, have a huge burden of infectious diseases and consequently high levels of morbidity and mortality. It has been estimated that the disease burden implies 1.9 million Disability Adjusted Life Years for African population, with serious economic and social effects. A growing body of evidence suggests that a pre-existing infection can modulate the effect of a second infection within the human host [1]. Therefore, it is important to conduct studies on co-infection of diseases so as to provide information necessary to plan for integrated control measures in endemic areas.

Schistosomiasis is a neglected tropical disease characterized by chronic infections with significant residual morbidity. It is of considerable public health importance with substantial socio-economic impact on impoverished communities [2]. In 2012 there were still 240 million patients with schistosomiasis globally, of which 45.8 % were children aged between 5 and 14 years, and estimates show that at least 206.4 million people require preventive treatment for schistosomiasis in 2016 with 91.4% % of sufferers living in Africa [3]. These statistics show little change from those reported previously [4], indicating that schistosomiasis has not yet been effectively controlled. Human schistosomiasis is mainly caused by three species of schistosomes: *Schistosoma japonicum*, *S. mansoni, and S. haematobium*.

The World Health Organization set targets to

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control, eliminate and eradicate 10 specific Neglected Tropical Diseases (NTDs) by 2020, including urinary schistosomiasis [5] as endorsed in the London Declaration on NTDs in January 2012. Control efforts have increased mainly by Mass Drug Administration (MDA) with drug donations increased from 20 million tablets in 2012 to 250 million annually for an unlimited period [4]. Hence there is a need to continuously carry out epidemiological studies in order to monitor the successes of such efforts. Such surveillance is more important, given that MDA programmes are mainly operated in resource-limited settings.

Malaria is a life-threatening disease caused by five species of protozoan parasites of the genus *Plasmodium* (*P. falciparum*, *P. vivax*, *P. malariae*, *P. ovale* and *P. knowlesi*) that is transmitted to humans through the bite of an infected anopheles mosquito [6]. Sub-Saharan Africa records 90% of more than the 400,000 deaths attributed to malaria yearly, and prevalence rates in Nigeria may be up to 60% or more in some localities within the country [7]. It has been suggested that *P. falciparum* and *Schistosoma* species are co-endemic parasites with worldwide distribution [1].

Viral infections also constitute a huge burden in the developing world, where many viral epidemics have been recorded in the past. Human immunodeficiency virus (HIV) and Hepatitis B virus (HBV), transmitted mainly through exchange of body fluids, have considerable prevalence in Nigeria and Africa. About 25 million persons were believed to have HIV in sub-Saharan Africa in 2014 and 3 million of them lived in Nigeria, making up 3.2% of Nigeria's population [8]. HBV, a leading cause of chronic hepatitis, accounts for about 600,000 deaths per year worldwide and in Nigeria, prevalence estimates indicate that 13.6% of the population including blood donors, pregnant women and infants are affected [9]. This occurs despite availability of HBV vaccines in the country.

Eggua Ward, comprising several settlements in Yewa North Local Government Area is an endemic community for *S. haematobium* in Ogun State, Nigeria [10]. Studies conducted more recently in the area revealed a prevalence of 27% in adults [11]. The endemicity of the disease in this region is aided by the non-availability of potable water sources, appropriate hosts, poor knowledge of the cause of the disease and other socio-economic factors [12]. The aim of this study was to determine the co-infection of schistosomiasis, malaria, HIV and HBV co-infections in Eggua community, Nigeria.

Materials and methods

Study design and study area

A cross-sectional design was used to recruit 447 adults aged 20 to above 60 years old into the study. The sample size was determined using previously described methods [13]. The study was carried out in four communities Tata, Imoto, Orile and Ebute Igbooro in Eggua, Yewa North Local Government Area, Ogun State, Nigeria (Figure 1). Their major occupations are farming, fishing and trading; and their water sources are rivers, streams and ponds. The snail intermediate hosts of *S. haematobium* have been found in the river bodies in the area [14]. This study was conducted between December 2015 and March 2017.

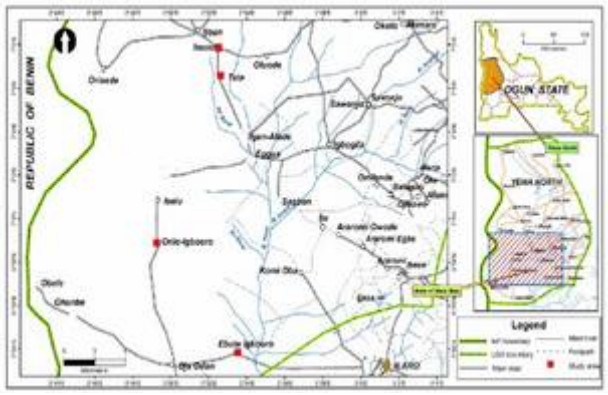

Figure 1. Map of Eggua Community, showing the study-areas.

Ethical approval

The study protocol was approved by the Ogun State Ministry of Health and the University of Ibadan/ University College Hospital Ethical Review Committee. Written and informed consents were obtained from participants after a detailed explanation of the objectives of the study.

Parasitological investigation

Midstream urine collected from participants were examined for *S. haematobium* infection microscopically using the conventional centrifugation method [25]. Blood samples (2 ml) were collected by venepuncture into EDTA specimen bottles. Thick and thin blood films were made on grease-free well labelled slides, air dried and thin films were fixed with 70% methanol, stained with 10% Giemsa solution for 10 minutes. Slides were viewed microscopically for the presence and absence of *Plasmodium* parasites.

Rapid Diagnostic Test (RDT) for HBV and HIV

The samples were examined for Hepatitis B virus using commercial Agary Rapid Diagnostic Test HBsAg Test kit (Nantong Egens Biotechnology Co. Limited) and for Human Immunodeficiency Virus (HIV) using commercial Alere Determine HIV 1/2 Diagnostic Test

kits. The test procedure for the diagnosis of HBV and HIV was followed as recommended by the manufacturers.

Data analysis

Descriptive statistics, frequencies and percentages were used to analyse the prevalence data.

Results

Gender-related prevalence of urinary schistosomiasis and malaria in the study areas

The gender-specific prevalence showed that schistosomiasis was more prevalent among females 26 (15.3%) than males 9(12.9%) although statistical analysis indicated no significant difference between the sexes $p>0.05$. Likewise, females were slightly more heavily infected, mean eggs intensity of 7.4 eggs/10 ml of urine than males with an intensity of 5.5 eggs/10 ml of urine. The prevalence of schistosomiasis was higher in Tata and Imoto than in the Igbooro. Conversely, malaria prevalence was higher in Igbooro than in Tata and Imoto.

Prevalence of schistosomiasis, HIV, HBV and malaria

The prevalence of schistosomiasis, HIV, HBV and malaria in the Igbooro is shown in (Table 2). HIV and HBV prevalence were generally low (below 5%) and were not significantly different among men and women.

Co-infection of schistosomiasis with HIV, HBV and malaria

Co-infection of schistosomiasis with HIV, HBV and malaria is represented in (Table 3). The highest prevalence of co-infection was observed between schistosomiasis and malaria 12 (2.1%) while co-infection of schistosomiasis with HIV in the two communities was 1(0.4%).

Table 1. Gender-related prevalence of schistosomiasis and malaria in Tata, Imoto, Orile and Ebute Igbooro.

Gender	No. examined	Schistosomiasis *n* (%)	Malaria *n* (%)
Tata and Imoto			
Male	97	28(28.7%)	14(14.4)
Female	110	16(14.6)	9(8.2)
Total	207	44(21.3)	23(11.1)
Orile and Ebute			
Male	70	9(12.9)	13(18.6)
Female	170	26(15.3)	33(19.4)
Total	240	35(14.5)	46(19.1)

Table 2. Gender-related prevalence of HBV and HIV in Orile and Ebute Igbooro.

Gender	No. examined	HBV *n* (%)	HIV *n* (%)
Orile and Ebute Igbooro			
Male	97	28(28.7%)	14(14.4)
Male	70	1(1.4)	5(7.1)
Female	170	3(1.8)	4(2.4)
Total	240	4(1.7)	9(3.8)

Table 3. Overall prevalence of co-infection of schistosoma with malaria, HBV and HIV.

	No. examined	Infected (%)
Schistosomiasis + Malaria	447	11(2.5)
Schistosomiasis + HBV	240	1(0.4)
Schistosomiasis + HIV	240	1(0.4)

Discussion

Infectious diseases constitute a major public health problem in many developing countries including Nigeria. This study was conducted to determine the prevalence of co-infection of schistosomiasis, HBV, HIV and malaria among adults living in Eggua. These findings have added to the growing body of evidence that indicate that urinary schistosomiasis is still prevalent in this area [11, 15].

The overall prevalence (14.3%) of urinary schistosomiasis in Orile and Ebute Igbooro and (21.3%) in Tata and Imoto reflects the level of exposure of the inhabitants of the studied communities. In Orile and Ebute Igbooro, both males and females are equally at risk of getting infected, shown by the lack of a significant difference in prevalence ($p>0.05$) between the two sexes, contrary to the observations [16] in Osun and [17] in Gusau. However, males in Tata and Imoto were more infected as in other studies [16, 17]. The difference in the gender prevalence of urinary schistosomiasis, which was higher among males than female in Tata and Imoto (Table 1), could be attributed to frequency of contact with contaminated water, which is an important factor in schistosomiasis prevalence. With limited sources of clean water in the community, it is difficult if not impossible to prevent the people from going to the Rivers Yewa and Idi every day for various activities. The study-areas are rural communities that are wholly dependent on these rivers for their water needs and livelihoods: farming and irrigation, bathing, and other domestic uses. These water-bodies are well distributed within the area, providing natural meeting points for people for

social interaction during the day, and also serving as niches for the schistosome parasites and snail intermediate hosts. In this regard, community awareness and better understanding of the social, cultural and behavioural determinants are imperative for designing effective control strategies.

Malaria control still remains a challenge in Africa where 45 countries including Nigeria are endemic for malaria and about 588 million people are at risk [5]. The overall malaria prevalence of 19% reported in Orile and Ebute is lower than the prevalence obtained in Plateau and Abia States (north-central and south-east) of Nigeria with prevalence of 36.6% and 36.1% respectively [18]. The prevalence is however higher than 14.7% reported for Ibeshe community in Ikorodu, Lagos State [19]. The difference in the prevalence and endemicity of malaria in Orile and Ebute and the previously mentioned locations in Plateau, Abia and Ikorodu could be explained by the ecological factors in the areas as well as the socio-economic condition of the people. The overall prevalence of (11.1%) observed in Tata and Imoto is within the values (7-54%) reported in both urban areas of Nigeria and other African countries [20]. Schistosomiasis is endemic in the study-area with more than a quarter of the sampled population of this study harbouring single infection due to either *S. haematobium* and a much-reduced number infected with *P. falciparum*. The overall prevalence of HBV and HIV in study was 1.7% and 3.8% respectively (Table 2). In a meta-analysis of HBV infections in Nigeria, the prevalence of HBV reportedly ranged from 0.5-46.8% and the pooled prevalence estimate was 13.6% [9]. In 2012, the Nigeria National Agency for Control of AIDS (NACA) reported relatively low HIV prevalence in Nigeria, with the prevalence in Ogun State ranging from 2.1-4.0% [8].

Co-infection of malaria with schistosomiasis has been related with subtle morbidity that includes mortality, malnutrition, cognitive development, reproduction and physical work capacity. 2.5% of the participants had concurrent infection with schistosomiasis and malaria in this study (Table 3). This is in close agreement with 2.84% [21] in Ethiopia, less than 16% prevalence [22] and 55.1% recorded [23] in Rivers State. The combined effect of malaria and urinary schistosomiasis on the affected persons could be devastating since there was little or no access to good health services. The occupational practices of the those living in these communities such as fishing and farming, in addition to the clustered arrange-ment of mud houses, lack of hygiene and indiscriminate littering of human wastes around living places and water bodies, create a powerful enabling environment for the transmission of the infections.

There were very low levels of co-infection of urinary schistosomiasis with Hepatitis B (HBV) and Human Immunodeficiency Virus (HIV) in this study. Thus, HBV and HIV may or may not necessarily co-exist with schistosomiasis [24].

In this study, we have found co-occurrence of *S. haematobium* and *P. falciparum* in the locality; therefore, an integrated control approach against the two parasites could be advocated which would deliver multiple treatment against urinary schistosomiasis and malaria simultaneously. Mass treatment programmes and health education campaign should be considered imperative, along with safe treatment guidelines for these communities in order to significantly reduce the transmission and morbidity of schistosomiasis and malaria.

Conclusion

Co-infection of schistosomiasis and malaria in Eggua among adults is prevalent, though at low levels/ prevalence 2.5%, and 0.4% each with HBV and HIV at this time.

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References

1. Lyke, K. E., Dabo, A., Arama, C., Diarra, I., Plowe, C. V., Doumbo, O. K. and Sztein, M. B. 2018. Long-term Maintenance of CD4 T cell Memory responses to Malaria antigens in Malian children coinfected with *Schistosoma haematobium*. *Frontiers in Immunology*, *8*, 1995.
2. Weerakoon, K. G., Gobert, G. N., Cai, P. and McManus, D. P. 2015. Advances in the diagnosis of human schistosomiasis. *Clinical Microbiology Reviews*, *28(4)*: 939-967.
3. WHO. 2018. *Schistosomiasis fact sheet;* 2014. Accessed 25 March 2017 from http://www.who.int/mediacentre/factsheets/fs115/en/
4. WHO. 2013. *Schistosomiasis: Progress report 2001-2011 and strategic plan 2012-2020*. Geneva: World Health Organization, pp. 1-80.
5. WHO. 2012. Accelerating work to overcome the global impact of neglected tropical diseases: a roadmap for implementation, WHO, Geneva, Switzerland. http://www.who.int/neglected_diseases/NTD_RoadMap_ Date accessed 19th January, 2016.
6. Iwuafor, A. A., Egwuatu, C. C., Nnachi, A. U., Ita, I. O., Ogban, G. I., Akujobi, C. N. and Egwuatu, T. O. 2016. Malaria Parasitaemia and the use of insecticide-treated nets (INTs) for malaria control amongst under-5 year old children in Calabar, Nigeria. *BMC Infectious Diseases*, *16(1)*: 151.

7. Dawaki, S., Al-Mekhlafi, H. M., Ithoi, I., Ibrahim, J., Atroosh, W. M., Abdulsalam, A. M., Sady, H., Elyana, F. N., Adamu, A. U., Yelwa, S. I. and Ahmed, A. 2016. Is Nigeria winning the battle against malaria? Prevalence, risk factors and KAP assessment among Hausa communities in Kano State. *Malaria Journal, 15(1):* 351.
8. Awofala, A. A. and Ogundele, O. E. 2018. HIV epidemiology in Nigeria. *Saudi Journal of Biological Sciences, 25(4):* 697-703.
9. Musa, B. M., Bussell, S., Borodo, M. M., Samaila, A. A. and Femi, O. L. 2015. Prevalence of hepatitis B virus infection in Nigeria, 2000-2013: A systematic review and meta-analysis. *Nigerian Journal of Clinical Practice, 18(2):* 163-172.
10. Mafiana, C. F., Ekpo, U. F. and Ojo, D. A. 2003. Urinary schistosomiasis in preschool children in settlements around Oyan Reservoir in Ogun State, Nigeria: implications for control. *Tropical Medicine and International Health, 8(1):* 78-82.
11. Onile, O. S., Awobode, H. O., Oladele, V. S., Agunloye, A. M. and Anumudu, C. I. 2016. Detection of urinary tract pathology in some *Schistosoma haematobium* infected Nigerian adults. *Journal of Tropical Medicine*, 5405207.
12. Anumudu, C., Onile, O., Oladele, V., Adebayo, A. and Awobode, H. 2017. Determining the environmental, social and cultural contexts of a proposed schistosomiasis health education intervention in Eggua, Yewa North Local Government area, Ogun State Nigeria. *BMJ Global Health, 2(Suppl 2):* A65-A65.
13. Naing, L., Winn, T. and Rusli, B. N. 2006. Practical issues in calculating the sample size for prevalence studies. *Archives of Orofacial Sciences, 1:* 9-14.
14. Salawu, O. T. and Odaibo, A. B. 2013. Schistosomiasis among pregnant women in rural communities in Nigeria. *International Journal of Gynecology and Obstetrics, 122(1):* 1-4.
15. Salawu, O. T. and Odaibo, A. B. 2014. Urinary schistosomiasis and urological assessment of hematuria in preschool-aged children in rural communities of Nigeria. *Journal of Pediatric Urology, 10(1):* 88-93.
16. Ugbomoiko, U. S., Ofoezie, I. E., Okoye, I. C. and Heukelbach, J. 2010. Factors associated with urinary schistosomiasis in two peri-urban communities in south-western Nigeria. *Annals of Tropical Medicine and Parasitology, 104(5):* 409-419.
17. Ladan, M. U., Abubakar, U., Abdullahi, K., Bunza, M. D. A., Nasiru, M. and Ladan, M. J. 2011. Gender and age-specific prevalence of urinary schistosomiasis in selected villages near a dam site in Gusau Local Government Area, Zamfara State, Nigeria. *Nigerian Journal of Parasitology, 32(1).*
18. Noland, G. S., Graves, P. M., Sallau, A., Eigege, A., Emukah, E., Patterson, A. E., Ajiji, J., Okorofor, I., Oji, O.U., Umar, M. and Alphonsus, K. 2014. Malaria prevalence, anemia and baseline intervention coverage prior to mass net distributions in Abia and Plateau States, Nigeria. *BMC Infectious Diseases, 14(1):* 168.
19. Aina, O. O., Agomo, C. O., Olukosi, Y. A., Okoh, H. I., Iwalokun, B. A., Egbuna, K. N., Orok, A.B., Ajibaye, O., Enya, V.N., Akindele, S.K. and Akinyele, M. O. 2013. Malariometric survey of Ibeshe Community in Ikorodu, Lagos State: Dry season. *Malaria Research and Treatment, Volume 2013*, Article ID 487250, 7 pages http://dx.doi.org/10.1155/2013/487250
20. Adedotun, A. A., Salawu, O. T. and Odaibo, A. B. 2013. Plasmodial infection and haematological parameters in febrile patients in a hospital in Oyo Town, south-western Nigeria. *Journal of Public Health and Epidemiology, 5(3):* 144-148.
21. Deribew, K., Tekeste, Z. and Petros, B. 2013. Urinary schistosomiasis and malaria associated anemia in Ethiopia. *Asian Pacific Journal of Tropical Biomedicine, 3(4):* 307-310.
22. Oladele, V. S., Awobode, H. O. and Anumudu, C. I. 2014. Subtle morbidities associated with malaria co-infection with schistosomiasis among children in south-west Nigeria. *African Journal of Medicine and Medical Sciences, 43 suppl:* 125-35.
23. Okafor-Elenwo, E. J. and Elenwo, A. C. 2014. Assessment of Morbidity in Malaria and Urinary Schistosomiasis using Some Specifi Indicators. *Assessment, 4*(1). *Journal of Natural Sciences, 4(1):* 7-13.
24. Al-Shamiri, A. H., Al-Taj, M. A. and Ahmed, A. S. 2011. Prevalence and co-infections of schistosomiasis/ hepatitis B and C viruses among school children in an endemic areas in Taiz, Yemen. *Asian Pacific Journal of Tropical Medicine, 4(5):* 404-408.

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