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Short communication

Co-infection of *Plasmodium falciparum* and *Wuchereria bancrofti* in an irrigated farming community, North Central Nigeria

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Abstract

Background*: Plasmodium falciparum* and *Wuchereria bancrofti* infections have similar geographical distribution and co-infection is a common-place. Risk is generally elevated for residents living in and around stagnant water bodies such as dams and irrigated farming projects. This study was aimed at establishing the current status of malaria and Lymphatic filariasis (LF) in Omi-a rural irrigated farming community located in north central Nigeria. **Methods**: Five hundred and thirty nine (539) individuals were examined. Their blood samples subjected to microscopic examination and immunochromatographic test, for identification of *Plasmodium falciparum* and *Wuchereria bancrofti* parasites respectively. **Results**: Out of the 539 blood samples examined, 332 (61.6%) were positive for malaria parasite and 17 (3.2%) were positive for *Wuchereria bancrofti*, while 10(1.9%) were positive for both malaria and *W. bancrofti*. However, prevalence of malaria parasite was not statistically significant in relation to sex ($P > 0.05$).The prevalence of Lymphatic filariasis was statistically higher in males (3.5%) than in females (2. 8%).Concerning overall prevalence of concomitant infections, 10 (1.9%) were infected with more males 6 (2.4%) infected than females 4 (1.4%). **Conclusion**: The result of this study reveals a low concurrent transmission of both infections. An integrated control strategy for malaria and LF should be adopted in this area and also the need to educate the populace on measures of reducing vector-human contact is advocated.

Keywords: Lymphatic filariasis, Malaria, Coinfection, Irrigated area, *Plasmodium falciparum, Wuchereria bancrofti*.

Introduction

Several millions of the world's population mainly in developing countries is infected with parasitic infection such as malaria and lymphatic filariasis (LF). Malaria and bancroftian filariasis are mosquito-borne water-related disease resulting from infection with *Plasmodium* and *Wuchereria bancrofti*. Both infections persist as public health problem in developing countries (Muturi *et al.*, 2006, 2008; Udujih *et al.*, 2012). Malaria, a leading cause of death in developing countries accounts for 27% of the total African malaria burden (WHO, 2017). Within Nigeria, malaria causes illness, death and a major drain on the country's economy. Nigeria is estimated to have the highest burden of Lymphatic filariasis a disease also known as elephantiasis. In Nigeria with an estimated population of 170 million people, 80 to 120 million people are at risk of the infection (Eneanya *et al.*, 2019). A lot of these affected populations suffer from one or more clinical manifestations such as lymphedema and elephantiasis of the limbs or genitals, hydrocele, chyluria and other infections associated with damaged lymphatic's (Amaechi *et al.*, 2016, 2017) Their distribution is influenced by

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population movement and the availability of water bodies suitable for vector breeding. Many of the countries in developing world depend on agriculture for their economy where water projects such as dams are used for irrigation purposes. These dams are also effective in hydroelectric power for the production of electricity. The adverse effects of these projects have been observed to threaten human health. Mosquito-borne water-related disease persists in conducive environment, where conditions that favor parasite development and transmission exist (Chadee *et al.*, 2003). Concomitant occurrence of malaria and bancroftian filariasis has been reported in other study areas (Chadee *et al*., 2003; Muturi *et al*., 2006, 2008; Manguin *et al*., 2010). This paper reports the parasitological observationin residents of Omi dam irrigation area and surrounding communities where the infection has been established (Amaechi *et al*., 2016, 2017, 2018). However, there has been no documented record of the level of infection in the study area thus the need for the present study.

Material and methods

Study area and population

Five communities of Omi dam irrigation project and surrounding communities namely Omi, Ogga, Iddo, Ogbo and Ejiba located in Yabga West Local Government Area of Kogi State, north central Nigeria formed the study area. The ecological and geographical features of the area have been described in detail previously (Amaechi *et al*., 2016, 2017, 2018). The most remarkable features of the study communities are the numerous water bodies which form breeding grounds for potential arthropod vectors.

Ethical consideration

Permission to conduct the study was obtained from authorities of Lower Niger River Basin Authority, Ilorin. Approval was granted by the Kogi State Ministry of Health and the local government health authority. Meetings were held in the villages to explain the purpose of the study to the inhabitants. It was made clear that participation in the study was voluntary and that all members of the household across all ages were eligible for enrolment in the study. Before commencing the collection of blood, census of all people was done by house-to-house visits, during which personal information was taken for each individual. Individual consent was obtained from each participant or (if < 18 years) from one of their parents or guardian. Individuals found positive for malaria, filarial or both parasites were advised to seek treatment.

Parasitological survey

Malaria

Thin blood smear was prepared as described by Cheesbrough (2005). Thelabeled films were then air dried with the slides in a horizontal position. The thin smears were laterfixed with ethanol for 2 minutes, before staining all the smears with 10% Giemsa for 45 min, and then examined microscopically under oil immersion for *Plasmodium* species.The thin smears were used for *Plasmodium* species identification. A slide was considered negative if no parasites were observed after counting 100 fields.

Lymphatic Filariasis

Thick blood films and immunochromatographic test were performed on each participant between the hours of 9 and 12pm.The first sample was drawn onto a microscope slide and the second was dropped onto an ICT card according to the manufacturer's instructions. For the thick blood film, a rectangular smear covering an area of approximately 80% of the slide was left to dry overnight at room temperature and read the next day. The slides were dehaemoglobinized in water, fixed in methanol for 3 min and stained with

haematoxylin and later examined microscopically (Carrazi method) (Cheesbrough, 2005).

Using the ICT card test (AMRAD ICT, New South Wales, Australia), the test uses paired antibodies (polyclonal and monoclonal antibodies) that recognizes filarial antigen in the blood of infected humans. The cards were stored in a refrigerator at 8°C and carried to the field in polystyrene foam boxes. The reading and interpretation of the tests was performed the next day. Cards exhibiting the control line were considered valid. The reading and interpretation of the results followed the manufacturers' instructions that states, 'Any visible line in the T area (test line) indicates a positive result'. The test is positive even when the T-line appears lighter or darker than C (control) line.

Statistical analysis

Statistical analysis was performed using SPSS version 16 (SPSS Inc., Chicago, IL, USA). Chi-squared test were used to determine level of differences in the prevalence.

Results

Five hundred and thirty nine (539) persons were examined for malaria and LF parasites. Out of this number, 255(47.3%) were males while 284(52.7%) were females. Of the number infected, 10 (1.9%) of the individuals harbored microfilariae and *P. falciparum* (Table 1).

Table 1. Prevalence of malaria and Lymphatic filariasis (LF) co-infections among subjects in the studied area (n=539).

	No. Examined		Co-infection		Chi-square	P-value
	No	%	Prevalence	(%)		
Age groups					8.721	0.2880
0–9	188	34.9	0	0		
10–19	66	12.2	1	1.5		
20–29	65	12.1	0	0		
30–39	56	10.4	2	3.6		
40–49	49	9.1	3	6.1		
50–59	53	9.8	2	3.8		
60–69	42	7.8	5	11.9		
70+	20	3.7	4	20.0		
Sex				2.4	0.1120	0.7491
Male	255	47.3	6	1.4		
Female	284	52.7	4			

Discussion

The prevalence of parasitic infections in most developing countries is still a major health issue. Malaria and lymphatic filariasis are two of the most common mosquito-borne parasitic diseases worldwide which can occur as concomitant human infections while also sharing common mosquito vectors.

The present study has shown that some individuals (1.9%) harbor both *Plasmodium falciparum* and *Wuchereria bancrofti*parasites. This is consistent with the findings of Muturi et al. (2006) who recorded a 2.0% prevalence of concomitant infection of *Plasmodium falciparum* and *Wuchereria bancrofti* in Kenya. Concomitant infections of malaria and bancroftian filariasis were observed in persons aged between 30-49 years.Chadee et al. (2003) and Muturi et al. (2006) also reported the absence of such infections in children below 10 years in South America and Kenya respectively. The differences in behavior and occupations of people in different age groups may account for the distribution of concomitant infections.The

30-49 years age group is composed of energetic working individuals. The working individuals may be exposed to infective bites while working. Farmingand fishing activities which are usually done early in the morning and later in the evening may expose people to mosquitoes. The presence of breeding sources might have led to the abundance of mosquitoes. Mosquito species use different natural and artificial habitats as sources of water for oviposition and breeding. These breeding sites were numerous in villages surrounding Omi dam irrigation area of Yagba West, Kogi State, and north central Nigeria. This was due to varied human activities, poor economic conditions, construction of dam and irrigation projects, poor sanitation level and indiscriminate disposal of discarded household materials. The resultant effect is abundance of gutters, refuse dump, used tyres and domestic containers amongst others.

Conclusion

Concurrent transmission of *Plasmodium falciparum* and *Wuchereria bancrofti* was rare in the study area. An integrated control strategy for both infections should be adopted.

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