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Sero–Prevalence of Filariasis and Associated Risk Factors among Apparently Healthy Undergraduate Students of a Private University in South–West Nigeria

Research Article

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Abstract

The parasitic disease called filariasis caused by thread–like microscopic worms called filarial worms, is largely found in Africa, Asia, the Pacific Islands and South America (especially in regions with high temperature). Filariasis is one of the world's neglected tropical diseases (NTDs) that mostly affect people from the poorest regions of the world; unfortunately are given less public health attention unlike COVID–19, HIV and Tuberculosis. The aim of this study is to determine the sero–prevalence of filarial IgM and IgG antibodies among apparently healthy undergraduate students of Babcock University in Ilishan–Remo, Ogun State. Using a one–step JusChek Filariasis IgG/IgM Rapid Antibody Test Cassette supplied by Huachenyang Technology Co., Ltd, Shenzhen, China, the blood samples of 100 participants—50 men and 50 women—were tested. A systematic questionnaire was used to gather the participants' demographic and clinical information. Out of the 100 participants that were screened, 4 (4%) individuals tested positive for filarial IgG antibodies, no one tested positive for filarial IgM antibodies (0%), and no one (0%) tested positive for both filarial IgG and IgM antibodies. Only three (3%) of the 50 examined male students tested positive to the filarial IgG antibody, compared to just one (1%) of the screened female students. The sero–prevalence of filarial antibodies did not differ significantly ($P>0.05$) among research participants based on gender or age. Of all the risk factors considered, the awareness of mosquito as etiology of filariasis ($\chi2=18.199$, $p=0.000$), environment of hall of residence characterized with high mosquito population density ($\chi2=5.754$, $p=0.016$) and subsequent exposure to mosquito bite ($\chi2=8.088$, $p=0.004$) were found to be significantly associated with the occurrence of anti–filarial IgG antibody among the study participants. The results of this study demonstrate that Babcock University undergraduate students had filarial IgG antibody, not IgM antibody. It is important to establish public health education and proper public awareness of the method of transmission and risk factors for filariasis.

Keywords: Filariasis; Risk Factors; Sero–Prevalence; Students; South–West Nigeria.

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Introduction

Filariasis is the medical name for infection with a filarial worm. The superfamily Filarioidea includes thread–like tiny worms known as filarial worms (Knopp et al., 2012). Three members of the subfamily Filarioidea, notably *Brugia malayi*, *B. timori*, and *Wuchereria bancrofti*, are of significant medical importance. These parasites have been implicated in lymphatic and the cutaneous infections. Other species of less medical importance include: *Dirofilaria tenuis* (raccon heartworm), *Dirofilaria immitis* (dog heartworm) and *Dirofilaria repens* (Nochetiella) amongst others. They cause incomplete infection because they are unable to get the adult phase in definitive host (man) and develop into microfilariae which is first–stage larva [1,2].

Infection with filarial worms is common in about 120 million people in at least 80 countries around the world, with an estimated 1.2 billion people (20 percent of the worldwide population) at risk of developing it. Nigeria, after India and Indonesia, is the world's third most endemic country, with 22.1 percent of the population considered to be infected. Despite its low fatality rate, filariasis affecting the lymphatic system is the fourth leading cause of persistent long–term disability. In most parts of Africa, *W. bancrofti* is the etiological agent of lymphatic filariasis [3].

The parasitic disease called filariasis, is largely found in Africa, Asia, the Pacific Islands and South America (especially in regions with high temperature). Filariasis is one of the world's neglected tropical diseases (NTDs) that mostly affect people from the poorest regions of the world; unfortunately are given less public health attention unlike COVID–19, HIV and Tuberculosis. For decades, these diseases have been ignored as part of a broader neglect of the poor world. Despite the fact that several NTDs can be controlled and prevented, they continue to pose a significant morbidity burden. As a result, countries and international agencies must invest more in research, medicine development, and vaccine development [4].

Anopheles and Culex mosquitoes are the natural vectors of lymphatic filariasis. Humans act as the disease's reservoir host. There are three different species of filarial nematodes, and different mosquito species act as carriers for them (Eigege *et al.,* 2002). In addition, there are nine species of Anopheles that function as filariasis vectors in tropical Africa alone. *Aedes pseudoscutellaris, Culex quinquefasciatus, Aedes scapularis, Anopheles funestus, Aedes samoanus, Anopheles gambiae* and *Aedes polynesienis* are the most important *Wuchereria bancrofti* vectors. *Anopheles barbirostris*, *Anopheles sinensis, Anopheles donaldi*, and numerous *Aedes* and *Mansonia* species are among the vectors of *Brugia malayi*. *Anopheles barbiostris* is the vector for *Brugia timori* [5,6].

Microscopic examination of blood is one of the methods for the laboratory diagnosis of filariasis. A thick blood smear is made on a glass slide which is then stained with Giemsa or Haematoxylin and Eosin. This is done to check for the appearance of microfilaria. In some cases where adult worms are not seen in the blood, they can be found in the lymph nodes. Serologically, the presence of immunoglobin M and G aids in the detection of antibodies against the specific antigen in the patient's serum which is discovered by the use of rapid diagnostic test kit specific for the detection of filarial worms. The serological method has a great advantage because it can be used any time of the day unlike the usual time for the collection of blood which is done at night [7].

Vectors for filaria (mosquitoes) and malaria (mosquitoes) are the same. Because the first signs and symptoms of both parasite diseases are similar, a diagnosis based just on symptoms might be misleading, necessitating the use of differential diagnosis.

In different sections of the country, the prevalence of lymphatic filariasis has been determined. Data on the prevalence of anti–filarial antibodies among young adults in Ogun State is scarce, and research that explore the prevalence of anti–filarial antibodies among young adults would be beneficial. According to a review of the literature, no work has been done to determine the prevalence of lymphatic filariasis in this region of the country (Ogun State, South–West, Nigeria). The aim of this study was to ascertain the sero–prevalence of filarial IgM and IgG antibodies and related risk factors among otherwise healthy undergraduate students of Babcock University in Ilishan–Remo, Ogun State.

Materials and Methods

Study Design

This is a prospective institutional–based study designed to investigate the sero–prevalence of filariasis among undergraduate students of Babcock University, Ilishan–Remo, Ogun State.

Study Area

This study was conducted among undergraduates of Babcock University in Ilishan–Remo, Ogun State, South–Western Nigeria (coordinates: 6.89460N, 3.71740E), with an estimated student population of about 13,000.

Study Duration

The research took place over the course of two months. (May–June, 2022)

Study population

This cross–sectional institutional study was conducted among Babcock University undergraduates having a history of filariasis in Ilishan–Remo, Ogun State. Male and female participants of diverse ages, religions, cultural and ethnic backgrounds were were recruited for the study.

Sample size calculation

The single population proportion formula, developed by Pourhoseingholi et al., [8] was used to estimate the sample size (N) for the study.

Using the single population proportion formula,

$n=Z^2PQ/d^2$

Where;

n = Minimum sample size required.

Z = Standard normal variant at 5% ($p<0.05$) error or 95% confidence interval is 1.96.

P = Proportion of apparently healthy individuals with *Wuchereria bancrofti* sero–prevalence from previous study (1–P) and

d = Desired level of significance (0.05)

For the calculation, a 95% confidence interval was used, the error margin used was set at 0.05 and a P–value of 0.053 that is, a prevalence rate of 5.3% for the sero–prevalence of lymphatic filariasis from previous study by Eneanya et al., [9]. To reduce errors arising from the likelihood of non–compliance, 10% of the sample size was added giving a final sample size of 87.

Using the formula,

$n= Z^2PQ/d^2$

where;

Z=1.96, P=0.053, Q= (1–0.053), d=0.05

$=1.96^2\times0.053\times (1–0.053)/(0.05)^2$

$=3.84\times0.053\times0.947/0.0025$

=77

10% of the sample size was added to reduce errors = 77+10 = 87.

To make our work robust, we round up the sample size to 100.

Sample size

A total of 100 blood specimens was collected at random from 100 consenting undergraduate students (50 males and 50 females) of Babcock University, Ilishan–Remo, Ogun State.

Eligibility of subjects

Inclusion Criteria

Consenting apparently healthy undergraduate students of Babcock University, Ogun State with no history of recent use of antibiotics, anti–parasitic medications, or herbal therapies were included in the study.

Exclusion Criteria

Undergraduate students of Babcock University, Ogun State with history of antibiotics, anti–parasitic medications, or herbal therapies in the previous two (2) weeks were excluded from the study.

Consent

Each willing participant whose blood was collected for the study were asked to give their informed consent. Participants were informed about the study's goals, advantages, and procedures, as well as the studies confidentiality.

Data Collection

Prior to the collection of specimens, participants were asked to provide demographic and clinical information via personal interviews and prepared questionnaires. A unique identification number of the participant was assigned to each questionnaire (PIDN). The biodata of the patients were included in the first section of the questionnaires, which included their age, religion, name, educational level, marital status and sex. The second section comprised of clinical data from the individuals relating to a brief history of symptoms of filarial infections, such as fever, swellings under the skin, muscle soreness, itchy skin, lymph node inflammation etc.

The participants were divided into groups based on their age, academic level, gender, and residence hall. All completed questionnaires were checked for accuracy and stored in a secure locker each day, with data input taking place the next day. For the sake of secrecy, only the PIDN numbers were recorded on the specimen bottles and result sheet.

Specimen Collection and storage

Two (2) mls of venous blood was collected from each participant' into sample bottles and allowed to clot in order to acquire the sera. The storage of the sera was kept at a temperature of 2–80^{0}C for three days if the samples were not processed at that time. Before testing, the specimens which are frozen was thoroughly thawed and combined. The sera were not thawed and frozen multiple times. Prior to testing, frozen samples were gradually brought to room temperature and gently mixed. Before testing, any specimens that include visible particle matter was cleared by centrifugation. To prevent interfering with the interpretation of results, samples displaying turbidity, gross lipemia, or gross haemolysis were not used.

Laboratory analysis

Detection of serum filarial IgG and IgM antibodies

The detection of filarial IgG and IgM antibodies was done with the use of a one–step JusChek Filariasis IgG/IgM Rapid Antibody Test Cassette (*Relative Sensitivity: 95.8%; Relative Specificity: 100%; Overall agreement: 99.6%*) supplied by Huachenyang Technology Co., Ltd, Shenzhen, China according to the manufacturer's instruction.

Principle

The JusChek Filariasis IgG/IgM Rapid Test is an *in vitro* immunodiagnostic test used to detect filarial antigen in whole blood, serum or plasma. The test cassette includes: 1) A membrane strip of nitrocellulose with two test bands (M and G bands) and a control band (C band). 2) A burgundy colored conjugate pad containing recombinant. Anti–human IgG is immobilized on the test's IgG line region, whereas anti–human IgM is immobilized on the test's IgM line region in this process. The specimen with the filarial antibodies reacts after being placed in the specimen well of the cassette. This mixture migrates throughout the length of the test chromatographically and interacts with the immobilized anti–human IgG/anti–human IgM in each line. A coloured line will show if the samples contains Filariasis antibodies, indicating a positive result. The migration of specimen dispensed into the well of the test cassette is through capillary action. Filarial IgM will bind to *Wuchereria bancrofti* conjugates if present in the specimen. The membrane captures the immunocomplex by the pre–coated anti–human IgM antibody, forming a pink M line, indicating a positive or reactive test result for *Wuchereria bancrofti* IgM. Anti–*Wuchereria bancrofti* IgG will bind to *Wuchereria bancrofti* conjugates if present in the specimen. The immunocomplex is subsequently trapped on the membrane by the pre–coated anti–human IgG antibody generating a pink coloured G line, signifying a *Wuchereria bancrofti* IgG positive or reactive test result. A non–reactive or negative result is seen by no reaction on any T lines (M and G). A reaction (pink coloured line) on the C band which indicates the internal control should be seen regardless of reactions on the T lines. If such happens, the result of the test will be invalid, and the specimen will need to be tested again using a different cassette.

Procedure

Briefly, before testing, the specimen was warmed to room temperature (15–30^{0}C) by thawing. The test cassette was opened from the pack and placed on a clean area. The specimen's ID number was accurately labeled on the test cassette. About 30–45µl (1 drop) of serum from the specimen was collected by the use of a plastic dropper and dropped into the well of the sample on the cassette. Then, 1 drop of buffer (sample diluent) was added. The test samples were run alongside external positive and negative controls provided by the manufacturer. The results were read after 15 minutes with the aid of a timer.

Interpretation of Results

Positive Result

If 'M' line for IgM is produced, test confirms the presence of filarial IgM in the specimen, in addition to the presence of the 'C' line (control). The outcome is either positive or negative. If just the IgG "G" line is produced, test confirms the presence of filarial IgG in the specimen, in addition to the presence of the C line. The outcome is either negative or positive. In addition to the presence of the C line, the test confirms the presence of both filarial IgG and IgM in the samples if both the "M" and "G" lines are formed. The outcome can be either positive or negative.

Negative Result

If just the C line is present, the absence of any pink hue in both test lines (M and G) suggests that filarial antibodies are absent. The outcome is either unfavorable or non–responsive.

Invalid Result

The assay is inaccurate if no control "C" line develops, regardless of any pink hue in the test bands as shown. A complete lack of color in either region or the appearance of only one color band on the test region suggests a technique error and/or deterioration of the test reagent. If this happens, the assay will be redone using a different device.

General Precaution

All blood samples were handled as though they might be infectious. All test procedures that involved handling test samples and related test components adhered to the US–CDC Universal Precautions for the prevention of transmission of HIV, HBV, and other blood–borne viruses in order to prevent self–and cross–contamination. The filariasis test kits and used clinical specimens were discarded as biohazardous trash. First and foremost, they were autoclaved at 121^{0}C for 15 minutes before being appropriately destroyed by incineration at the conclusion of the screening process.

Data Analysis

Microsoft Excel was used to enter the data received from the questionnaires and the blood antibody testing. Statistical analysis was performed using SPSS–18.0. A one–way analysis of variance (ANOVA) and Turkey–Kramer Multiple Comparisons Test were performed to examine any differences between the sero–prevalence rates of filarial IgG and IgM antibodies as well as the percentage prevalence of previous and present filarial infection.

Results

This study investigated filariasis sero–prevalence and risk variables among Babcock University undergraduate students in Ilishan–Remo, Ogun State, Nigeria. Using rapid diagnostic test (RDT) kits, 100 pupils were screened (50 males and 50 females). The sociodemographic details of the study participants are shown in Table 1. According to the table, most participants were between the ages of 16–20 (63%), followed by 21–25 (36%), and 26–30 (1%). All screened participants were single (100%) and none of them were married (0%). Based on tribal affiliation, the majority (80%) belonged to the Yoruba tribe, then the Igbo tribes (20%). Most of the students were at the 100–level (41%), followed by those at the 500–level (24%), 400–level (13%), 300–level (12%) and 200–level (10%).

Furthermore, the study participants were stratified according to their halls of residence. Based on the gender of the students, five male and female halls each were selected for the study. Female halls of residence include: Felicia Adebisi Dada hall, Havilah Gold hall, Ogden hall, Platinum hall and White hall; while the male halls include: Bethel hall, Nelson Mandela hall, Samuel Akande hall, Topaz hall, Welch hall. On the basis of their religion, majority of them were Christians (96%), followed by Muslims (4%).

Table 4.1: Demographic characteristics of the study participants

Variable	Category	Frequency (N)	Percent (%)
Gender	Female	50	50.0
	Male	50	50.0
Age group (Years)	16-20	63	63.0
	21-25	36	36.0
	26-30	1	1.0
	≥30	0	0
Marital Status	Single	100	100.0
	Married	0	0
Tribe	Igbo	20	20.0
	Yoruba	80	80.0
	Hausa	0	0
	Others	0	0
Study Level	100	41	41.0
	200	10	10.0
	300	12	12.0
	400	13	13.0
	500	24	24.0
	600	0	0
Religion	Christianity	96	96.0
	Islam	4	4.0
	Traditional	0	0
	Others	0	0

The sero–prevalence of anti–filarial antibodies among the study participants is presented using a histogram (Figure 1). Out of the 100 participants screened, only 4 (4%) tested positive for anti–filarial IgG antibody only, none tested positive for anti–anti–filarial IgG and IgM antibody only (0%) and also, none 0%) tested positive for both anti–filarial IgG and IgM antibodies.

The distribution of anti–filarial IgG antibody frequency by sex is shown in Table 2. Only 1 (%) of the participants who were female tested positive for anti–filarial IgG antibody, compared to 3 (3%) of the participants who were male. The proportion of participants who tested positive for filarial IgG alone did not differ significantly between male and female participants (P>0.05).

The frequency of anti–filarial IgG antibodies by age distribution is shown in Table 3. Only participants between the ages of 16 and 20 had anti–filarial IgG antibody levels as high as 3.0%, while participants between the ages of 21 and 25 had the lowest levels

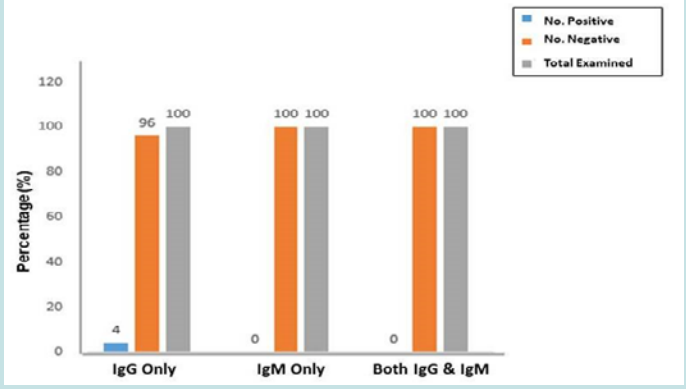

Figure 1: Sero–prevalence of filarial antibodies among the study participants.

(1.0%). There was no record of the presence of anti–filarial IgG antibodies among other age groups (0%). Between and within the various age groups, there were no significant differences (P>0.05) in the prevalence of anti–filarial IgG antibodies.

The frequency of anti–filarial IgG antibodies among the study participants by hall of residence is shown in Table.4. Two male residents of Topaz hall (2%), one male of Bethel hall (1%) and one female of Havilah Gold hall had the highest prevalence of anti–filarial IgG antibodies (1%). Anti–filarial IgG antibody prevalence did not differ significantly (P>0.05) by participants' hall of residence.

Table 2: Frequency of occurrence of anti-filarial IgG antibody by sex distribution

Gender	No. Positive N (%)	No. Negative N (%)	Total Examined N (%)	Pearson Chi-Square (χ^2)	P-Value
Male	3(3.0)	47(47.0)	50(50.0)	1.042[a]	0.307
Female	1(1.0)	49(49.0)	50(50.0)		
Total	4(4.0)	96(96.0)	100(100.0)		

Table 3: Frequency of occurrence of anti-filarial IgG antibody by age distribution

Age Group (Years)	No. Positive N (%)	No. Negative N (%)	Total Examined N (%)	Pearson Chi-Square (χ^2)	*P-Value*
16-20	3(3.0)	60(60.0)	63(63.0)	.277[a]	0.871
21-25	1(1.0)	35(35.0)	36(36.0)		
26-30	0(0)	1(1.0)	1(1.0)		
>31	0(0)	0(0)	0(0)		
Total	4(4.0)	96(96.0)	100(100.0)		

P value >0.05 is considered statistically non-significant

Table 4: Frequency of occurrence of anti-filarial IgG antibody among the study participants by hall of residence

Hall of residence		Positive N (%)	Negative N (%)	Total N (%)	Pearson Chi-Square (χ^2)	P-value
Female	FAD	0(0.0)	10(10.0)	10(10.0)	4.082[b]	0.395
	Havilah	1(1.0)	9(9.0)	10(10.0)		
	Ogden	0(0.0)	10(10.0)	10(10.0)		
	Platinum	0(0.0)	10(10.0)	10(10.0)		
	White	0(0.0)	10(10.0)	10(10.0)		
Male	Bethel	1(1.0)	9(9.0)	10(10.0)	5.674[c]	0.225
	N. Mandela	0(0.0)	10(10.0)	10(10.0)		
	S. Akande	0(0.0)	10(10.0)	10(10.0)		
	Topaz	2(2.0)	8(8.0)	10(10.0)		
	Welch	0(0.0)	10(10.0)	10(10.0)		
	Total	4(4.0)	96(96.0)	100(100.0)		

P value >0.05 is considered statistically non-significant.

The relationship between occurrence of anti–filarial IgG antibody and indications for filariasis among the study participants is presented using a histogram (Figure 2). None of the four (4%) participants who tested positive to anti–filarial IgG antibody had any indication for filariasis.

Table 5 shows the relationship between occurrence of anti–filarial IgG antibody and associated risk factors. Out of the 100 study participants examined, 71 (71%) of them indicated that they have not heard of filariasis, among which 4% tested positive for anti–filarial IgG antibody. It appears that majority of the study participants have no knowledge of the etiology of filariasis. 56%, 7%, 32% and 5% of them indicated that bacteria, fungi, parasite and virus are the etiologic agent of filariasis, respectively. Out of the 56 (56%) individuals who indicated bacteria, 3(3%) were positive for anti–filarial IgG antibody, whereas among the 32(32%) participants who indicated parasite, only 1 (1%) person was positive for anti–filarial IgG antibody. Thirty–one percent (31%) of the participants indicated that the bite of infected mosquito is the mode of transmission of filariasis; however, none (0%) of them tested positive for anti–filarial IgG antibody. None

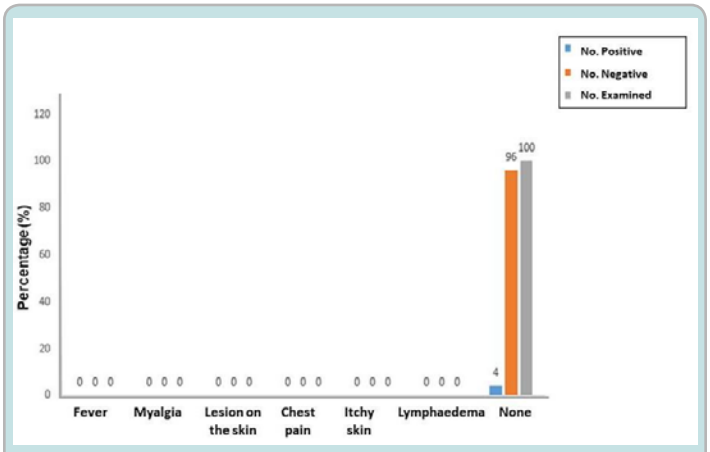

Figure 2: The relationship between occurrence of anti–filarial IgG antibody and indications for filariasis among the study participants.

of the participants (0%) had history of filariasis. Amidst the high mosquito population density in the environment of their hall of residence, characterized with bushy and overgrown vegetation, none of the 4 (4.0%) who tested positive for anti–filarial IgG antibody are aware that mosquito is the vector for filariasis, even though they are often bitten by mosquitoes because most of them stayed outside late at night (3.0%) . Unfortunately 4 of them who tested positive for anti–filarial IgG antibody indicated that they less often go for medical check–up and laboratory test.

Of all the risk factors considered, the awareness of mosquito as etiology of filariasis (χ^2=*18.199, p=0.000*), environment of hall of residence characterized with high mosquito population density (χ^2=*5.754, p=0.016*) and subsequent exposure to mosquito bite (χ^2=8.088, p=0.004) were found to be significantly associated with the occurrence of anti–filarial IgG antibody among the study participants.

The percentage distribution of symptomatic and asymptomatic filariasis among the study participants is presented using a histogram (Figure 3). Similarly, none of the four (4%) participants who tested positive to anti–filarial IgG antibodies were symptomatic for filariasis (Table 5).

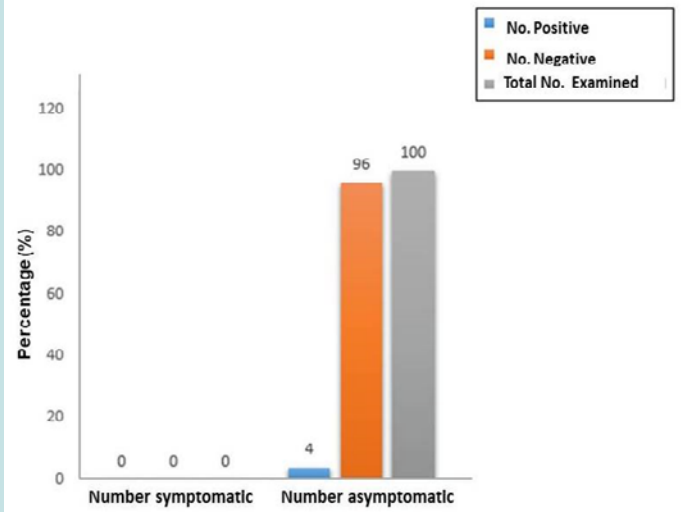

Figure 3: The percentage distribution of symptomatic and asymptomatic filariasis among the study participants.

Table 5: Relationship between occurrence of anti-filarial IgG antibody and associated risk factors

Characteristics	Responses	No. Positive N (%)	No. Negative N (%)	Total Number Examined N (%)	Pearson Chi-Square (χ^2)	P-Value
Have you heard of Filariasis?	No	4(4.0)	67(67.0)	71(71.0)	2.390[a]	0.303
	Yes	0(0.0)	29(29.0)	29(29.0)		
What do you think is the etiologic agent of filariasis?	Bacteria	3(3.0)	53(53.0)	56(56.0)	.832[a]	0.842
	Fungi	0(0.0)	7(7.0)	7(7.0)		
	Parasite	1(1.0)	31(31.0)	32(32.0)		
	Virus	0(0.0)	5(5.0)	5(5.0)		
	No Idea	0(0.0)	0(0.0)	0(0.0)		
What is the mode of transmission of filariasis?	Bite of infected mosquito	0(0.0)	31(31.0)	31(31.0)	7.555[a]	0.182
	Ingestion	1(1.0)	16(16.0)	17(17.0)		
	Inhalation	0(0.0)	11(11.0)	11(11.0)		
	Sexual intercourse	0(0.0)	1(1.0)	1(1.0)		
	Skin contact	3(3.0)	20(20.0)	23(23.0)		
	No idea	0(0.0)	17(17.0)	17(17.0)		
Do you have any history of filariasis?	No	4(4.0)	96(96.0)	100(100.0)		
	Yes	0(0)	0(0)	0(0)		
Are you aware that mosquito is the vector for filariasis?	Yes	0(0.0)	27(27.0)	27(27.0)	18.199[a]	0.000*
	No	4(4.0)	69(69.0)	73(73.0)		
Is the environment of your hall characterized with high mosquito population density?	No	0(0.0)	58(58.0)	58(58.0)	5.754[a]	0.016*
	Yes	4(4.0)	38(38.0)	42(42.0)		

If yes, which of the following environmental features may be responsible for the high mosquito population density in your hall of residence and its environs?	Abandoned water tanks	0(0.0)	3(3.0)	3(3.0)	1.541[a]	0.673
	Bushy/Overgrown vegetation	4(4.0)	69(69.0)	73(73.0)		
	Leaking sewage	0(0.0)	9(9.0)	9(9.0)		
	Presence of stagnant water	0(0.0)	15(15.0)	15(15.0)		
How often do you get bitten by mosquitoes?	Much often	4(4.0)	30(30.0)	34(34.0)	8.088[a]	0.004*
	Often	0(0.0)	66(66.0)	66(66.0)		
Do you stay outside late at night?	No	1(1.0)	19(19.0)	20(20.0)	.065[a]	0.799
	Yes	3(3.0)	77(77.0)	80(80.0)		
If yes, how often do you stay outside late at night?	Less often	0(0.0)	15(15.0)	15(15.0)	3.971[a]	0.137
	Never	3(3.0)	77(77.0)	80(80.0)		
	Often	1(1.0)	4(4.0)	5(5.0)		
How often do you go for medical check-up/laboratory test?	Less often	4(4.0)	91(91.0)	95(95.0)	.219[a]	0.640
	Often	0(0.0)	5(5.0)	5(5.0)		

**P value <0.05 is considered statistically significant.*

The relationship between occurrence of anti–filarial IgG antibody and pathologies associated with filariasis among the study participants is presented using a histogram (Figure 4). None of the four (4%) participants who tested positive for anti–filarial IgG antibody had any pathology (Elephantiasis, Hydrocele and Mastitis) associated with filariasis (Figures 5–7).

Discussion

Filariasis is one of the world's neglected tropical diseases (NTDs) that mostly affect people from the poorest regions of the world; unfortunately is given less public health attention unlike HIV and Tuberculosis [4]. Three species of the superfamily *Filarioidea* are of serious medical importance namely: *Brugia malayi (B. malayi), Brugia timori (B. timori)* and *Wuchereria bancrofti (W. bancrofi)*. These parasites have been implicated in lymphatic and the cutaneous infections [1]. Anopheles and

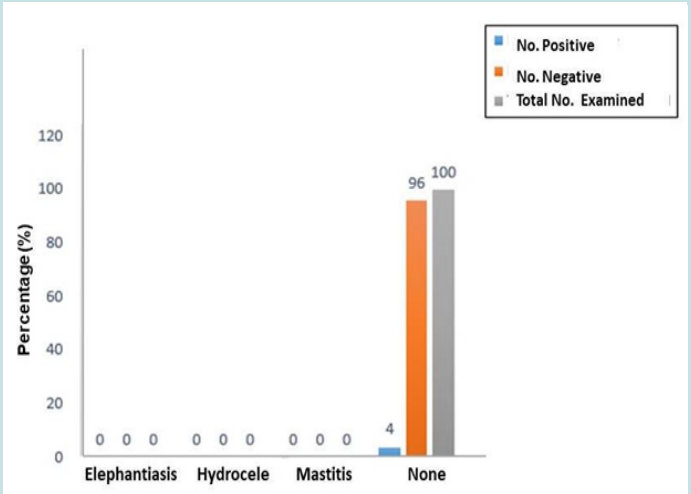

Figure 4: Relationship between occurrence of anti–filarial IgG antibody and pathologies associated with filariasis among the study participants.

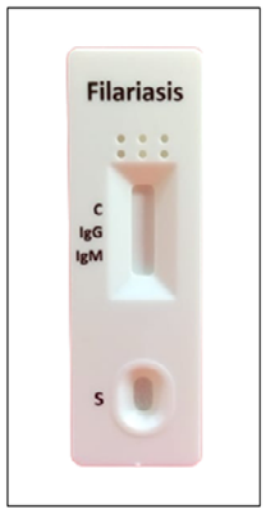

Figure 5: Picture showing unused JusChek filariasis IgG/IgM antibody Test Cassette.

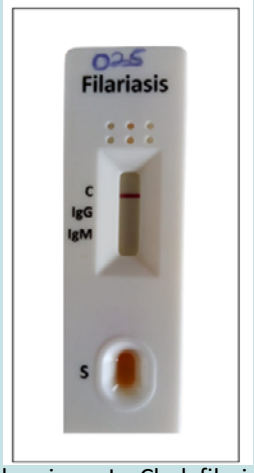

Figure 6: Picture showing a JusChek filariasis IgG/IgM antibody Test Cassette negative for both anti–filarial IgG and IgM antibodies.

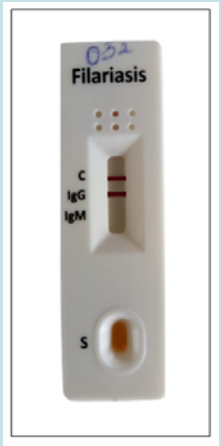

Figure 7: Picture showing a JusChek filariasis IgG/IgM antibody Test Cassette positive for only anti–filarial IgG antibody.

Culex mosquitoes are the natural vectors of lymphatic filariasis. Humans act as the disease's reservoir host [10].

The sero–prevalence of filariasis among Babcock University undergraduate students has not, as far as we are aware, been studied. Therefore, the purpose of the current study was to use rapid diagnostic test (RDT) kits to ascertain the sero–prevalence of filariasis and associated risk factors among seemingly healthy undergraduate students of Babcock University in Ilishan–Remo, Ogun State, Nigeria.

The results of this study demonstrate that, of the 100 persons screened, 4% tested positive for anti–filarial IgG antibodies alone, 0% for IgM antibodies alone, and 0% for both IgG and IgM antibodies. The outcome of the present study is somewhat different from that of earlier investigations. A study conducted in different communities of the six geo–political zones, Ota, Ogun State, and Ukwa–East LGA, Abia State, all in Nigeria, found that the 4 percent IgG sero–positivity observed in this current study was lower than the 5.3 percent, 21 percent, and 22.3 percent prevalence rates reported by Eneanya et al. [9], Okonufua et al. [11] and Amaechi et al. [12]. However, compared to studies conducted in Mandalay Region, Myanmar and Andhra Pradesh, India, Dickson et al. [13] and Upadhyayula et al. [14] discovered that the 4 percent IgG sero–positivity recorded in this current study was greater than the 2.63 percent and 3.7 percent reported by those studies. The low prevalence rate revealed in this study compared to that of other studies may be because of the screening methods used, the geography, and the type of study population.

With regard to sex distribution, in this current study, more male participants tested positive to anti–filarial IgG antibodies (3%) than their female counterparts (1%). This study agrees with that of Okonofua et al. [11] that reported a higher occurrence in males (27.1%) compared to their female counterpart (16%). This current study also agrees with the study of Amaechi et al. [12] who reported a higher occurrence in males (26.4%) than their female counterparts (17.2%). This higher occurrence in males may be because males tend more to stay outside late at night compared to females, which makes them more vulnerable to mosquito bites.

Based on the distribution of participants' ages, our study's findings demonstrate that individuals between the ages of 16 and 20 had greater sero–positivity levels of anti–filarial IgG antibodies than participants in other age groups. Amaechi et al. [12] found that the age group of 31 to 40 years had the highest prevalence rate (54.3%) compared to other age groups. Additionally, Upadhyayula et al. [14] noted a high frequency among people above 61 years old (8.2%). Additionally, Dickson et al. [13] showed a high level of prevalence among participants aged 60 and beyond. The high prevalence rates reported among the elderly in these previous community–based studies was expected because of their low level hygiene practices and decline in their immune function, unlike the low prevalence rate reported in this current study carried out among apparently healthy students with a robust immune system and exhibiting high level of hygienic practices.

Furthermore, even though the percentage of sero–positivity of anti–anti–filarial IgG antibody is low in this current study, majority of the participants had no knowledge of filariasis, nor its etiology. Similarly, majority of them were not aware that mosquito is the vector for filariasis. Information and knowledge is very important in disease prevention and control in epidemiology. Since the percentage of the participants with no knowledge and awareness of filariasis and the etiologic agent was high in this study, there is need for urgent public enlightenment to fill the gap in knowledge.

According to the present study, of all the risk factors considered, there is significant association ($P<0.05$) between sero–positivity of anti–anti–filarial IgG antibody and awareness of mosquito as a vector of filariasis, environment of hall of residence characterized with high mosquito population density and subsequent high exposure to mosquito bite in this study.

In addition, unlike the work of Okonofua et al. [11] which reported hydrocele (16.9%), limb (4.6%) and breast (5.1%) elephantiasis among the study participants; none of the four (4%) participants who tested positive for anti–filarial IgG antibody in this current study indicated any symptom of filariasis or had any pathology associated with filariasis. This is not surprising since this study was carried out among apparently healthy subjects.

Even though this current study did not employ microscopy in the detection of filariasis, the works of Eneanya et al. [9] and Dickson et al. [13] show that serological method is more sensitive (5.3% and 2.63%, respectively) in the diagnosis of filariasis compared to microscopy (2.0% and 1.3%, respectively). Some advantages and shortcomings of these methods are related to its specificity, sensitivity, precision, time, cost–effectiveness and skill/experience. Rapid diagnostic tests (RDTs) are frequently thought to be more accurate than microscopic methods, however they have limitations in terms of sensitivity and specificity, which rely on the manufacturer, manufacturing process, as well as product storage temperature and shelf life. However, RDT has the potential to provide accurate diagnosis to all populations at risk, including those who cannot access high–quality microscopy services in endemic areas because they require no capital investment, electricity investment, are straightforward to carry out, and are easy to interpret [15,16].

The body's immune reaction to the presence of infectious pathogens, such as filarial worms, includes the development of antibodies. The presence of filarial antibodies in the patient's serum is a sign that they must have been exposed to the parasite at some point or another. In general, initial (first 1–7 days) and secondary (first 7–21 days) immune responses to infectious pathogens result in the production of IgG and IgM antibodies,

respectively. After 2–3 weeks of infection, IgM vanishes and is replaced by IgG, which tends to stay in the patient's blood longer and provide long–lasting immunity. While the presence of only anti–anti–filarial IgG and IgM antibodies indicates that the person has a current case of filarial infection, the presence of only anti–filarial IgG antibody indicates recent or prior infection (Unfortunately, none was detected in this study). On the other hand, the presence of anti–filarial IgG and IgM antibodies indicates both recent and past infection in addition to current illness. The absence of anti–filarial IgG and IgM antibodies, however, indicates that there has not been a filarial infection. This means that the person is susceptible to infection and should take the required precautions to avoid future exposure.

Conclusion

Undergraduate students of Babcock University, Ogun State had a prevalence rate of 4.0% for anti–filarial IgG antibodies. The results of this study demonstrate that study participants have a history of infection with filariasis (prior exposure). Additionally, the majority of study participants are ignorant of the causes, modes of transmission, and epidemiology of filariasis. To stop the spread of illness among the study population, it is crucial to increase public health education, awareness, and regular screening to find new cases.

Ethical Approval

Ethical approval for the study was obtained from the Babcock University Health Research Ethics Committee (BUHREC) with ethical approval registration number: BUHREC 410/22.

Disclosure statement

The authors report no conflict of interest.

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