PREVALENCE OF HUMAN ONCHOCERCIASIS AND TRANSMISSION POTENTIAL OF BLACK FLIES IN UBA COMMUNITY OF HONG LOCAL GOVERNMENT ADAMAWA STATE

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Abstract

Onchocerciasis remains a significant public health concern in rural Nigeria, particularly where black fly vectors are prevalent along rivers. This study assessed the potential black fly transmission and the prevalence of human onchocerciasis in the Uba community, Hong LGA, Adamawa State. From April to May 2023, 1209 *Simulium* flies collected from three settlements (A, B, C), spanning 9 km along River Yedzaram at Uba community were dissected and observed for microfilaria under the microscope. Additionally, 678 residents provided demographic data, underwent skin examination for onchocerciasis lesions, and had skin snips tested for microfilariae. Of the dissected flies, 14.64% (177/1209) harbored microfilariae, with higher rates in May compared to April, and heads were the primary infection site. Monthly transmission potential rose from 187.50 L3/person/month in April to 310 L3/person/month in May, signaling wet-season escalation. Overall prevalence in human is 11.06%, highest among males, those aged ≥35 years, and farmers. The study highlights ongoing transmission risk in Uba, underscoring the need for targeted ivermectin distribution and vector control during peak biting months to curb this neglected tropical disease.

Keywords: Onchocerciasis, Transmission potential, Prevalence, Black flies, *Simulium*.

Introduction

Onchocerciasis, widely known as river blindness, presents a major public health challenge with substantial economic consequences. The name ‘river blindness’ comes from the fact that blackflies, which transmit the disease, are abundant at riverside areas, and the disease could lead to blindness (WHO 2025). The disease is a chronic, non-fatal filarial infection that can result in lifelong suffering for those affected (WHO 2025). It is caused by a parasite called *Onchocerca volvulus* and transmitted by blackflies of the species *Simulium damnosum* complex. The disease impacts millions globally, primarily in sub-Saharan Africa (Moya *et al*., 2017). Approximately 31 African countries, including Nigeria, remain endemic for onchocerciasis (WHO, 2010).

The socio-cultural consequences of onchocerciasis skin disease (OSD) profoundly affect patients. These include social isolation, fears of remaining unmarried, school disruptions from constant itching, and children dropping out to care for blind relatives (Danjuma Foundation, 2024). Young individuals with OSD endure discrimination, peer humiliation, friend avoidance, and societal stigma. Married women with skin lesions often lose spousal affection, while marriage prospects for those infected dwindle dramatically. Psychologically, onchodermatitis fosters withdrawal, isolation, and poor societal adjustment (Evans, 2014).

Individuals who settle or work along riverbanks where *Simulium* vectors breed, such as those involved in domestic, recreational, or occupational activities, face significantly higher risks of onchocerciasis infection (Ferrari *et al*., 2013). Endemic foci are primarily determined by suitable vector breeding sites in fast-flowing rivers or smaller riverine habitats, exacerbated by heightened human activity (WHO, 2016). Koala *et al*. (2019) demonstrated that entomological indicators such as parous rate, biting rate, and transmission potential of the *Simulium* vector effectively estimate transmission rates. In their study on onchocerciasis control, these metrics reliably identified endemic foci in West Africa's savanna regions, even when annual biting rates (ABR) fell below 1000 bites per person per year.

The Global Burden of Disease Study estimates that 220 million people required preventive chemotherapy for onchocerciasis worldwide in 2024 (WHO, 2025). In Africa, over 123 million individuals remain at risk, with 987,000 blinded by the disease, creating substantial health and economic burdens (WHO, 2024).

Year-round water flow in the River Yedzaram and surrounding vegetation create ideal blackfly breeding conditions, sustaining onchocerciasis transmission in the Uba community. Many residents show skin manifestations, with some blind and begging. This study assesses *O. volvulus* infestation rates and blackfly transmission potential among Uba dwellers, as well as deliver evidence-based data for control strategies and educates residents on prevalence, blackfly transmission, and prevention methods. The disease's vision impairment, blindness, and debility hinder the local economy, and unless it is controlled, the disease will perpetuate into future generations.

Materials and Methods

Study Area

This study was conducted in the Uba community of Hong Local Government, Adamawa State. Uba town is located between latitudes 10°25'00" N and 10°32'00"N of the Equator and between longitudes 13°12'00"E and 13°16'00"E of the Prime Meridian. The town is bounded to the east by Mayo Bani, to the South by Hildi, and to the north by Kuzum Settlements. The vegetation of the area is characterized by short, scattered woody plants with grasses forming the predominant plant cover. The major source of water in the area is the river Yedzaram, which flows throughout the year, and a few streams that flow into Yedzaram, only during the wet season. River Yedzaram is covered by thick streamside vegetation that is made up of tall evergreen grasses (Gandapa, 2018). Livelihoods of the residents mainly depend on cultivated crops, with very few livestock being raised and fishing activities.

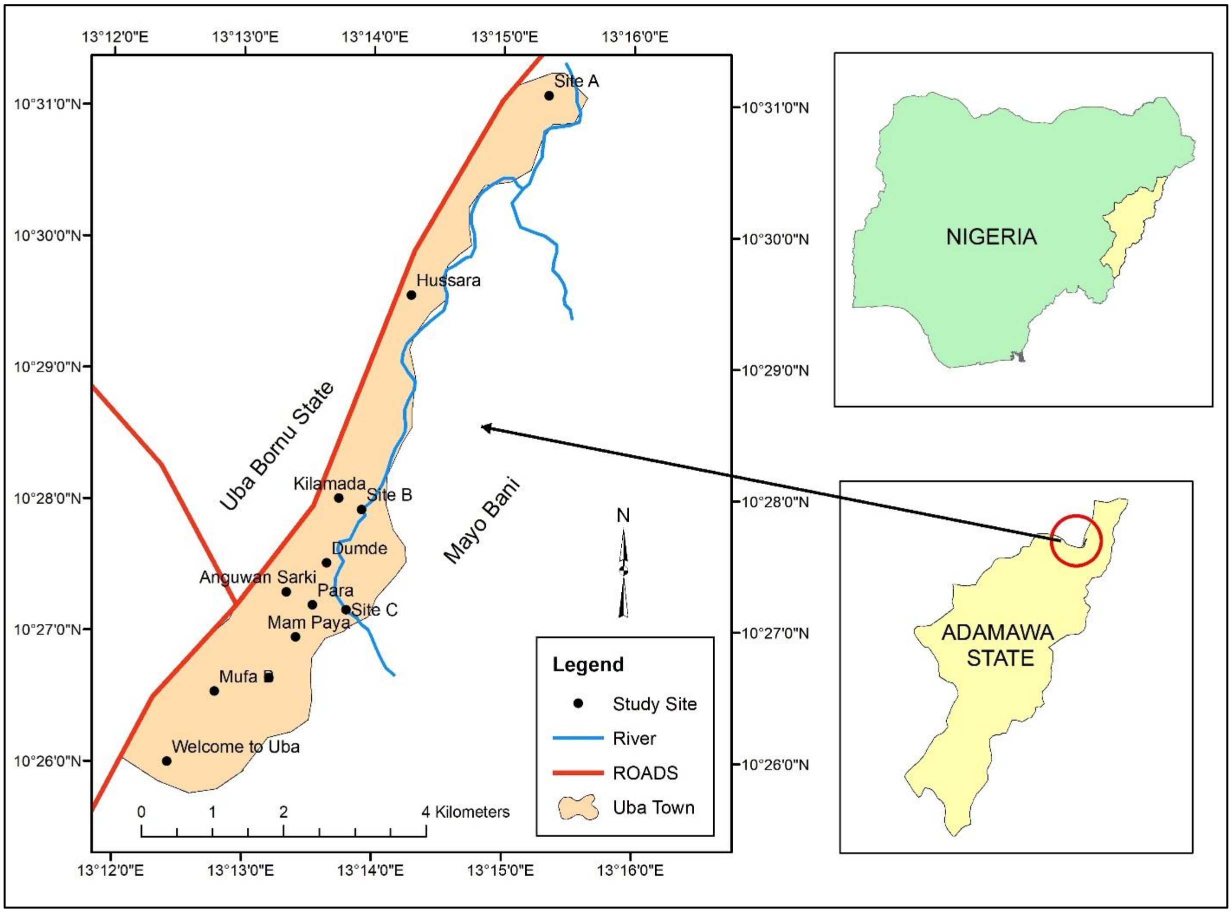

Figure 1: Map showing Uba town (the Study Area). Source: GIS.

Study Design and Sample Size Determination

Insect samples were collected randomly along the river Yedzaram by using handheld scooping nets. The choice of insect capture point was made purposively due to the area's black fly infestation and intensified human activities along the same riverbank.

A sample size of 385 was determined using Andrew Fisher's formula (Bedilu *et al*., 2019) :

$N = Z^2 \times P(1 - P) / E^2$

The insect sample site covering a stretch of 9km in length (i.e., from Kuzum to Drisal community), was stratified into three sampling sites (A, B, and C) based on the type of human activities and vegetation along the sites. Site A covers a stretch of 4km i.e., from Kuzum to Giwadi and characterized by farming and fishing activities, Site B (river Kilamada) covers a stretch of 3km and characterized by cattle grazing with abundant grasses along the riverbank, Site C'(river Drisal) covers a stretch of 2km and characterized by domestic activities such as washing and swimming.

A community-based cross-sectional study was conducted by sampling individuals aged 10 years and above who have lived in the community for at least a year. Study participants were selected by systematic random sampling. The independent variables considered in the study include age, sex, and occupation (Hudu *et al.,* 2013). The participants were adequately informed about the purpose of the study, and informed consent was obtained from each participant before enrolment in the study. Each participant has the right to withdraw at any stage of the research.

Insect Sample Collection and Microscopic Examination for Microfilaria

A total of one thousand, two hundred and nine (1209) insect samples were collected once a week for eight weeks, in April and May 2023, along the river Yedzaram in Uba, Hong L.G.A, Adamawa State. Adult flies were captured along the stream side vegetation by using handheld scooping nets according to Terra *et al.* (2019). The samples were preserved in 80% ethanol in specimen bottles and placed in a cooler with an ice block, and transported to Zoology laboratory, Adamawa State University, Mubi, where they were kept in a refrigerator at 4^0C (Maikaje *et al.,* 2008). Each fly sample was dissected by teasing the head, thorax, and abdomen with dissecting pins. The dissected flies were mounted on glass slides and examined for larvae of *O. volvulus* under a dissecting microscope using an x10 objective lens (Terra *et al.,* 2019)

Skin Snip Sampling and Administration of Questionnaire

Six hundred and seventy-eight (678) participants who were residents of the area were enrolled in the study. The participants were physically examined, and skin snip samples from both sides of the upper iliac crest of the body parts were collected, with the assistance of male and female health workers from Uba B Primary Health care Centre, Adamawa, and General Hospital Uba, Borno. Each skin snip sample was placed in a round bottom micro titer plate containing normal saline and labeled appropriately (Traore *et al.*, 2018). The plates were covered to prevent evaporation and contamination, and the samples were transported to the hospital laboratory for examination (Lagatie *et al.,* 2016). The fluid in each sample plate was thoroughly mixed and pipetted into a microscopic slide and examined for the presence of microfilaria of *O. volvulus* (Bedilu *et al.,* 2019). Non-specimen data were collected using a structured questionnaire and verbal discussion (Naphtali *et al.,* 2008; Traore *et al*., 2018). The Clinical manifestation of onchocerciasis was observed in the participants as described by Lagatie *et al.* (2016).

Estimation of Onchocerciasis Transmission Potential of Black Flies

Entomological indices were used in determining microfilaria density in flies and in estimating onchocerciasis transmissions potential. The prevalence of infection is expressed as a percentage of positive samples, while the Infective rate of flies is equal to the parasite load of dissected flies. The parasite load, monthly biting rate, and monthly transmission potential were calculated as follows (Dadzie 2003);

Parasite load of dissected flies = $\frac{\text{No. of L3H}}{\text{Parous rate}} X\ 100$

Monthly biting rate (MBR) = $\frac{\text{No. sampled}}{\text{Days of Sampling}} X$ days of the month

Monthly transmission potential (MTP) = $\frac{\text{MBR X L3H}}{\text{Total No. Dissected}}$

Data Processing and Analysis

An independent t–test was used to determine the significant difference in prevalence of *Onchocerca volvulus* between the insect samples collected in April and those collected in May, at P=0.05. ANOVA was used to calculate the statistical differences in the number of microfilariae between the various anatomical (Head, Thorax, and Abdominal) parts of the insects' sample, at a confidence level of α = 0.05. Epidata version 3.1 and SPSS version 21 were used for statistical analysis of the human sample. Descriptive statistics, including frequency count, were carried out to determine the prevalence of the disease in humans and to summarize other predictor variables.

RESULTS

A total of 1209 flies were caught on streamside vegetation along the river Yedzaram by using a hand-held scooping net in April and May 2023. The microscopic examination of 1209 black flies revealed that 177 (14.64%) flies were found with microfilariae of *O. volvulus* (Table 1). The table also indicated the total number of flies caught in April (559) and May

(650). The percentage of flies' positive for microfilaria in April was 74 (13.24%) and 103 (15.85%) in May.

Table 1: Prevalence of Microfilariae in black flies caught along the river Yedzaram, Uba, Hong L.G.A., Adamawa State.

Month of Sampling	No. examined	No. Positive	% Positive
April	559	74	13.24
May	650	103	15.85
Total	**1209**	**177**	**14.64**

X^2 = 302.184, 303.286: P = 0.01

Table 2 shows the flies caught at different sampling sites during the period of the survey, with the distribution of microfilariae in black flies caught at each site. The percentage concentration of microfilariae in the flies sampled at site B is relatively low, 40(10.10%), compared to those caught at site A, 60(14.96%), and site C, 77(18.87%). The major differences in these three sites of sampling are their vegetation cover and human activities.

Table 2: Distribution of microfilariae in black flies per sampling site.

Site of Sampling	No. examined	No. Positive	% Positive
A'	401	60	14.96
B'	400	40	10.10
C'	408	77	18.87
Total	**1209**	**177**	**14.64**

X^2 = 83.047, 146.685, and 80.041: P = 0.01

The total concentration of microfilariae found during the eight weeks of sampling is shown in Table 3. Variations in the prevalence of microfilaria were observed across the different weeks of sampling. The 4th week has the fewest positive flies with 15 (8.47%) microfilariae, and the 8th week has the highest positive flies with 31 (17.51%) microfilariae.

Table 3: Weekly distribution of microfilariae in Black Flies**.**

Week of Sampling	No. examined	No. Positive	% Positive
1st Week/April	120	16	9.04
2nd Week/April	138	19	10.73
3rd Week/April	151	24	13,56
4th Week/April	150	15	8.47
5th Week/May	150	22	12.43
6th Week/May	150	24	13.56
7th Week/May	167	26	14.67
8th Week/May	183	31	17.51
Total	**1209**	**177**	**116.17**

X^2 = 64.533, 72.464, 70.285, 96.000, 74.907, 84.796, 79.192, and 80.005: P = 0.01

The results for the anatomical concentration of microfilaria revealed a slight difference in microfilaria concentration in the various anatomical sites. The head (H) has 63 (35.59%), the thorax (T) has 59 (33.33%), and the abdomen (A) has 55 (31.07%) of all the positive flies (Table 4).

Table 4: Microfilariae at different anatomical parts of Black Flies sampled.

Week /Month	Head (H)	Thorax (T)	Abdomen(A)	Total
1st Week/ April	4(25.00%)	6(37.50%)	6(37.50%)	16(9.04%)
2nd Week/ April	4(21.05%)	8(42.11%)	7(36.84%)	19(10.73%)
3rd Week/ April	7(29.17%)	8(33.33%)	9(37.50%)	24(13.56%)
4th Week/ April	8(53.33%0	4(26.67%)	3(20.00%)	15(8.47%)
5th Week/May	9(40.91%)	7(31.82%)	6(27.27%)	22(12.43%)
6th Week/May	10(41.67%)	6(25.00%)	8(33.33%)	24(13.56%)
7th Week/May	9(34.62%)	9(34.62%)	8(30.77%)	26(14.69%)
8th Week/May	12(38.71%)	11(35.48%)	8(25.81%)	31(17.51%)
Total	**63(35.59%)**	**59(33.33%)**	**55(31.07%)**	**177(100.00%)**

F = 7.839, 4.554, 3.554: P = 0.05

Transmission Potential of Black Flies

The entomological indicators used to estimate onchocerciasis transmission are the parous rate, parasite load of dissected flies, biting rate, and transmission potential. The parous rate is the proportion of dissected flies that were infested. The biting rate refers to the number of bites an exposed individual receives within a specified period. The parasite load of dissected flies, monthly biting rate (MBR), and MTP are shown below.

Parasite load of dissected flies = $\frac{\text{No. of L3H}}{\text{Parous rate}} X\ 100 = \frac{63}{177} X\ 100 = \mathbf{35.59}\%$

Monthly biting rate (MBR) = $\frac{\text{No. sampled}}{\text{Days of Sampling}} X$ days of the month

MBR of April = $\frac{559}{4} X\ 30 = \mathbf{4192.50}$

MBR of May = $\frac{650}{4} X\ 31 = \mathbf{5037.50}$

Monthly transmission potential (MTP) = $\frac{\text{MBR X L3H}}{\text{Total No. of Dissected flies}}$

MTP of April = $\frac{4192.50}{559} X\ 23 = \mathbf{187.50}$ L_3H/human/month

MTP of May = $\frac{5037.50}{650} X\ 40 = \mathbf{310}$ L_3H/human/month

Transmission potential = Average mean of MTPs = $\frac{187.50 + 310}{2} = \mathbf{249}$.

The parous rate of black flies in the study area in April and May 2023 was 177 (Table 1), while the parasite load of dissected flies was found to be 35.59%. The monthly biting rates (MBRs) for April and May were 4192.50 and 5037.50, respectively, while the monthly transmission potential (MTPs) was 187.50 (infective larvae/human/month) for April and 310.00(infective larvae/human/month) for May. The higher MTP (310.00 infective larvae/human/month) was recorded in May, compared to 187.50 infective larvae/human/month in April.

Of the dissected flies, 177 were infected with microfilaria. Of these, 63 (35.59%) had the larvae of *O. volvulus* in the head, 59 (33.33%) in the thorax, and 55 (31.07%) in the abdomen (Table 4). The mean square (MS) values for larvae are isolated from the head, thorax, or abdominal segment of infective flies were 7.839, 4.554, and 3.554, respectively.

Sociodemographic Characteristics of the Participants: A total of six hundred and seventy-eight (678) human subjects participated in the study, with the participants from Mampaya presenting the highest compliance with 102(15.04%), while the least compliance, 46(6.78%), was from Anguwan Sarki. More than half of the participants were female, 383(56.49%). Two hundred and fifty-five (37.61%) of the participants were within the age range of 10 – 24 years, 104(15.34%) were within the range of 25 – 34 years, while 319(47.05%) were ≥ 35 years. Concerning their occupation, 208(30.68%) participants were farmers; 52(7.67%) were civil servants and 418(61.65%) had other occupation (Table 5).

Table 5: Prevalence of onchocerciasis in the Uba community area of Hong Local Government, Adamawa State.

Variables	Study population	Number examined (%)	Number positive	Percentage positive
Gender	Male	295 (43.51)	38	12.88
	Female	383 (56.49)	37	09.66
	Total	**678**	**75**	**11.06**
Age Group	10 – 24 years	255 (37.61)	09	03.53
	25 – 34 years	104 (15.34)	10	09.62
	≥ 35 years	319 (47.05)	56	17.55
	Total	**678**	**75**	**11.06**
Occupation	Farmer	208 (30.68)	53	25.48
	Civil servants	52 (7.67)	05	09.62
	Others	418 (61.65)	17	04.07
	Total	**678**	**75**	**11.06**
Community	Mufa B	98	11	11.22
	Sabon Anguwa	90	09	10.00
	Mampaya	102	13	12.75
	Para	100	11	11.00
	Anguwan Sarki	46	03	6.52
	Dumde	80	04	5.00
	Kilamada	63	08	12.70
	Husara	99	16	16.16
	Total	**678**	**75**	**11.06**

Gender: X^2 = 162.580, 249.298: P = 0.01 Occupation: X^2 = 50.019, 33.923: P = 0.01 Quarter: X^2 = 58.939, 57.6000, 56.627, 60.840, 34.783, 64.800, 35.063, and 45.343: P = 0.01

Clinical Manifestation of Onchocerciasis:

Participants were examined for the presence of intense itching, hanging groin, nodules formation, swelling of legs, leopard skin, lizard skin, redness and dryness of the eye, visual impairment, and total blindness (Table 6). All participants with other clinical manifestations have intense itching. The overall prevalence of the clinical manifestation of onchocerciasis in the study area was 527 (77.73%). The clinical manifestation with the highest prevalence was intense itching, 527(77.73%). While 205(30.24%) present redness of the eyes, only one of the participants was observed with complete blindness, and none had a hanging groin.

Table 6: Prevalence of clinical presentation of onchocerciasis in various quarters in the Uba community area of Hong Local Government, Adamawa State.

Quarters	No of participant	Participants presented with symptoms of onchocerciasis.								
		Intense itching	Hanging groin	Nodules formation	Swelling of legs	Leopard skin	Lizard skin	Redness of eye	Visual impairment	Blindness
Mufa B.	98	71	0	17	16	0	10	35	9	0
Sabon Anguwa	90	69	0	7	7	20	2	31	8	0
Mampaya	102	79	0	2	8	8	25	35	7	0
Para	100	78	0	5	12	14	15	31	15	0
Anguwan Sarki	46	31	0	0	6	1	1	10	8	0
Dumde	80	66	0	1	11	5	4	20	8	0
Kilamada	63	49	0	4	9	6	9	10	3	1
Husara	99	84	0	8	16	2	22	33	7	0
Total	**678**	**527**	**0**	**44**	**85**	**56**	**88**	**205**	**65**	**1**

X^2 = 153.60, 5.33, 17.42, 64.80, 31.94, 8.87, 16.20, 35.063, and 85.40: P = 0.01

Discussion

Onchocerciasis constitutes a major public health challenge, especially in rural areas where continuous human contact with vector breeding sites leads to increased parasite transmission. This study provides insights into the transmission dynamics of *Onchocerca volvulus* by black flies along the River Yedzaram, and the prevalence of onchocerciasis among inhabitants of some communities in Uba, Hong LGA, Adamawa State. The positive report of *O. volvulus* microfilaria, particularly in the head of black flies, suggests the occurrence of active transmission in the study area. Findings from this study revealed a rise in positivity rate among black flies with microfilaria from the month of April to May, suggesting an increase in transmission potential because of an increase in vector activities as the rainy season intensifies. A chi-square analysis indicates a statistically significant difference between the microfilariae prevalence in black flies in April and May at (P = 0.01). This result aligns with similar studies conducted by Maikaje *et al.,* (2008), Adeleke *et al.* (2010), and Katabarwa and Richards (2014) on parasitological and entomological profiles and showed the presence of microfilaria of *O. volvulus* in different foci. In contrast to our findings, Onah *et al.* (2020) reported zero infective rate of black flies after 15 years of Ivermectin distribution at Adani community in Enugu state, Nigeria. According to Remme (1990), such an observation where the infective rate of flies in an existing focus is zero is only expected in an area where the distribution of ivermectin has been extensive for a long period.

Data across the different sampling sites (A, B, and C) showed variation in black fly infection rates across these locations along the riverbank. Site C revealed the highest prevalence (18.87%), compared to site A (14.96) and site B, the lowest (10.10%). This geographic variation in infection rates is not uncommon and has been documented in similar studies. For instance, Cantey *et al.* (2018) and Raphael *et al. (*2013) observed varying rates of infection in fly populations relative to characteristics of the breeding sites. These differences can be explained by variations in environmental factors, such as vegetation type, water quality, and human activity, which can influence the breeding and biting patterns of black flies. The result of a chi-square analysis conducted on the infection rate of the insect collected from different sites indicated a statistically significant difference in microfilariae concentrations between the flies from different sites at P = 0.01, implying that differences exist in infection rates across sites, which may be substantial enough to indicate a geographically driven transmission gradient.

The presence of thick evergreen streamside vegetation and rocky substrates of the 'Drisal' tributary along site C' provides a fertile breeding ground for the *Simulium* vector. Site C is also dominated by human activities, including washing, swimming, and commercial activities. This, according to Young *et al.,* (2021), provides the vehicle required for the disease transmission. Thus, the highest prevalence observed at Site C may be attributed to environmental factors that favour black fly breeding, coupled with increased human activities, both of which enhance human–fly interactions. However, the disproportionately sparse vegetation of site B' and its higher cattle stock density could result in a relatively low number of flies infected. According to Katabarwa *et al*. (2014), host selection by certain *Simulium* species plays a crucial role in regulating infection and transmission efficiency. Studies by Evans (2014), Cupp *et al.* (2019), and Toe *et al. (*2014), agree that many vector species of *S. damnosum* complexes are zoophilic and may indiscriminately feed on the blood of humans and ungulates. This process may result in transmission of L3s to cattle, which according to Crump *et al.* (2021), is a dead-end host of the parasite. This diminishes the rate of transmission of this parasite to humans (Remme, 2004). Consequently, the relatively low prevalence of 10.10% microfilaria in flies caught at site 'B' could be a result of zooprophylaxis.

The weekly distribution of microfilaria infective flies demonstrates temporal variation in the infection rates within the eight weeks of sampling. A gradual increase in microfilaria positivity rates in the flies was observed over the weeks, peaking in the eighth week, while the lowest infection rate occurred in week 4. This gradual increase aligns with seasonal patterns where vector activity heightens towards the end of the dry season and into the wet season. The chi-square test results indicated statistically significant weekly differences at P = 0.01, with the rising trend of prevalence that suggests a potential increase in transmission risk towards the end of May. The odds of acquiring *O. volvulus* by an individual exposed to black fly bites during the 8th week of sampling are almost two times as likely compared to those exposed in early April [X^2 = 64.533, 80.005. P = 0.01].

The distribution of microfilariae across the anatomical segments of the flies (head, thorax, and abdomen) showed that the highest concentration of larvae was found in the head, followed by the thorax and abdomen, (Table 4). This is consistent with the known biology of *O. volvulus*, where the larvae migrate from the abdomen to the head as it develops and to facilitate transmission during feeding. This emphasizes a higher potential for transmission of *O volvulus.* The analysis of variants (ANOVA) test result demonstrates statistical significant differences in larval distribution across the anatomical parts, F (7, 0) = 178.61, with the head segment having significantly higher concentration of microfilariae: (M = 7.84, SS = 54.88) at P = 0.01, compared to thorax and the abdomen; (M = 4.55, SS = 31.88) at P = 0.01 and (M = 3.55, SS = 24.88) at P = 0.05, respectively. This suggests that flies harboring a high concentration of infective microfilarial larvae in their heads have a greater potential to transmit the disease to humans.

The entomological indices further highlight the potential for disease transmission, with the combined monthly transmission potential of 497.50 infective larvae per human over the two months. The higher monthly transmission potential (MTP) observed in May (310.00 infective larvae/human/month) compared to April (187.50 infective larvae/human/month) confirmed the earlier findings of increased transmission risk in the later weeks of the study. This reflects the growing biting rate and the transmission dynamics of the disease as environmental conditions become more favorable for the vector's activities, as well as the increased human activities around the foci.

The sociodemographic data (Table 5) collected from human participants in this study further highlights the risk factors associated with onchocerciasis in the study area. The overall prevalence of onchocerciasis in the human population in this study was 11.06%, this agrees with the findings of a study by Kamalu and Nwakwe (2014) in Imo state, Nigeria, who reported a prevalence of 18%, and Njim and Aminde (2017) in Cameroon, who reported a prevalence of 11.40%. A higher prevalence of the disease was observed among male participants (12.88%) compared with females (9.66%) (Table 5). This gender difference is consistent with findings from Bedilu *et al.* (2019) in Ethiopia, who observed that males, particularly those involved in outdoor occupations like farming and fishing, are more frequently exposed to black fly bites. It was also observed during this study that male usually remove their clothing while fishing and during other farming activities compared to their female counterparts. Such body exposure as commonly practiced by males, increases human-fly interactions, thereby leading to a higher prevalence of the disease among males.

The highest prevalence among farmers also reflects occupational exposure as a key risk factor for onchocerciasis, given their proximity to fly breeding sites and higher exposure to vector bites. This finding corroborates the results of the study by Naphtali *et al.* (2008), which show the prevalence of onchocerciasis to be highest (28.8%) among farmers in Garaha – Dutse. This study's participant whose occupations involved farming, showed a higher prevalence of the disease. This group is disproportionately affected by onchocerciasis because of their frequent exposure to riverine breeding sites of black flies.

This study found a higher prevalence of onchocerciasis in individuals aged ≥35 years compared to younger age groups (χ^2 = 220.271, 67.846; P = 0.01). This observation is likely due to cumulative exposure to infected black flies and chronic uncured infections. Similar age-related patterns were observed by Ikpo *et al*. (2016) in Nigeria, Kamga *et al*. (2016) in Cameroon, and Wilson *et al*. (2016) in Senegal.

Conclusion

This study underscores the ongoing public health burden of *Onchocerca volvulus* in the Uba community, Adamawa State. The recorded human prevalence of 11.06% confirms hypoendemic status, while microfilariae, especially infective L3 larvae in dissected black flies, signify active transmission. High infection rates among farmers, as well as those of age ≥35 years, reflect cumulative occupational and longevity risks. Persistence of clinical signs (itching, eye lesions) among infected individuals within the community demands targeted interventions. To mitigate infection risk, annual ivermectin mass drug administration targeting at least 80% population coverage should be prioritized, alongside robust community sensitization programs.

Ethical Approval and Consent

Ethical approval was obtained from the Primary Health Care Authority, Hong LGA, Adamawa State. Permissions were secured from respective community heads to conduct the study in the Uba settlements. Informed consent was individually obtained after participants fully understood the study details and prior to data collection.

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Reference

Adeleke, M.A., Mafiana, C.F., Sam-Wobo, S.O., Olatunde, G.O., Ekpo, U.F. and Akinwale, O.P. (2010). Biting behaviour of *Simulium* damnosum complex and *Onchocerca volvulus* infection along the Osun River, Southwest Nigeria. *Parasit. Vectors*. **3**: 93

Bedilu, K., Kifle, W. And Mamo N. (2019). Prevalence of Onchocerciasis and Associated Factors among adult aged ≥ 15 years in Semen Bench District, Bench Maji Zone, South Ethiopia: Community Based Cross – sectional study. *Hundawai Advances in Public Health.***1**: 1 – 9.

Cantey, P.T., Roy, S.L. and Boakye, D. (2018). Transitioning from river blindness control to elimination: steps towards stoping treatment. *Int. Health*. **10**: 7 – 13.

Danjuma Foundation (2024). Vision for a Brighter Future: Combatting Preventable Blindness. https://tydanjumafoundation.org. 5 – 12.

Evans, T.G. (2014). Socio-economic consequences of blinding onchocercaisis in West Africa. *Parasitology Today*. **73:** 459 - 506.

Ferrari, A.J., Charlson, F.J. and Norman, R.E. (2013). Burden depressive disorder by country, sex, age and year: Findings from the global burden of disease study. *Medical Parasitology*. **10:** 47.

Gandapa, E.N. (2018). Spatio – temporal Change Detection of Land – use Cover of Hong Local Government, Adamawa State. *Journal of Environmental Technology*. **11**(1): 6 – 19.

Hudu, O.O., Helen, I., Sabo, E.Y., Patrick, A.A., Musa, G., Lillian, E.O., Danjuma, M., Sale, A.D. and Mamman, M. (2013). Impact of Eighteen years Varied Compliance to Onchocerciasis Treatment with Ivermectin in Sentinel Savannah Agrarian Community in Kaduna State of Nigeria. *International Scholarly Research Notice.* **2**: 8 – 34

Ikpo, A. U., Mbanugo, J., Anukwuorji, C. A. and Ugwuanyi, I. K. (2016) Study on the prevalence of *onchocerca volvulus* infection among the inhabitants of Awgu, Oji - River Local Government Areas of Enugu State, Nigeria. *International Journal of Tropical Disease & Health*. **18**(1): 1 – 9.

Kamga, G.R., Dissak-Delon, F. N. and Nana-Djeunga, H. C. (2016). Still mesoendemic onchocerciasis in two Cameroonian community: directed treatment with ivermectin projects despite more than 15 years of mass treatment. *Parasites & Vectors*. **9**(1): 1–12.

Katabarwa M., Lakwo T., Habomugisha P., Agunyo S., Byamukama E., Oguttu D., (2014) Transmission of *Onchocerca volvulus* by *Simulium neavei* in Mount Elgon focus of Eastern Uganda has been interrupted *Am. J. Trop. Med Hyg.* **90** (6): 1158 – 1167.

Katabarwa, M. and Richards, F. (2014). Twice-yearly ivermectin for onchocerciasis: the time is now. *Lancet. Infect. Dis.* **14**: 373–374.

Koala, A., Achille, S. and Alain, B. (2019). Entamological assessment of the transmission following recrudences of onchocerciasis in the Como Valley, Burkina Faso. *Parasite and vectors.* **12**: 34.

Lagatie, O., Merino, M., Debrah, L.B., Debrah, A.Y. and Stuyver, L.J. (2016). An isothermal DNA amplification method for detection of *Onchocerca volvulus* infection in skin biopsies. *Parasites Vector.* **62**(4):3 – 7.

Maikaje, D.B., Danguma, P.G., Domo, A., Malgwi, M.M., Mbinkar, D.L. and Elihu, A. (2008). Investigating suspected human onchocerciasis endemic foci in Mubi North and Hong local government areas of Adamawa State. *Nigerian Journal of Parasitology*. **29** (2): 72 – 76

Moya, L., Nguema, J., Aparicio, P., Mignetoteo, M., Cenzual, G., Canorea, J., Lanza, M., Bemto, A., Crainey, J.L. and Rubro, J.M. (2017). Geographic distribution and species identification of human filariasis and onchocerciasis in Bioko Island, Equatorial Guinea. *Acta Trop*. **180**: 12 – 17.

Naphtali, R.S., Akinboye, D.O. and Abdulazeez, A.A. (2008). Onchocerciasis and Plasmodiasis: Concurrent infection in Garaha – Dutse community, Adamawa State, Nigeria. *Biomedical Research.* **19**(2)**:** 107 - 111.

Njim, T. and Aminde, L. N. (2017). An appraisal of the neglected tropical diseases control program in Cameroon: the case of the national program against onchocerciasis. *Public Health*. **17**(103): 1–5.

Onah, I. E., Ubachukwu, P. O. and Eyo, J. E. (2020). Status of *Onchocerca volvulus* infection and transmission by blackflies after 15 years of ivermectin distribution at Adani, Nigeria. *Trop Biomed.* **37**(1): 174–185.

Raphael, N.U., Ikechuku, C.N., Aduk, G.M. and Joel, A.Y. (2013). Substrate colonization and relative abundance of immature forms of black flies (Diptera: *Samuliidae*) in river Mada, Nasarawa State, Nigeria. *Journal of Parasitology.* **1**(2): 10 – 63.

Remme, J.H.F. (1990). The African Programme for Onchocerciasis Control: Preparing to Launch. *Parasitol. Today.* **11**: 403 – 406.

Remme, J.H.F. (2004). Research for control: the onchocerciasis experience. *Trop. Med. Int. Health.* **9**: 243 – 253.

Terra, W.R., Barroso, L.G., Dias, R.O. and Ferreira, C. (2019). Molecular physiology of insect midgut. *Advances in insect physiology.* 56: 117 – 160.

Toé, L.D., Koala, L., Burkett-Cadena, N.D., Traoré, B.M., Sanfo, M. and Kambiré, S.R. (2014). Transmission by blackflies after 15 years of ivermectin distribution at Adani, Nigeria. *Tropical Biomedcine*. **37**: 22 – 54.

Traore, M.O., Sarr, M.D., Badji, A., Bissan, Y.,Diawara, L., Doumbia, K., Goita, S.F., Unnasch T.R. and Golden, A. (2018) Diagnostics for onchocerciasis in the era of elimination. *Int Health*. **10**(1): 20 – 26.

WHO (2010). Conceptual and Operational Framework of Onchocerciasis Elimination with Ivermectin Treatment. African Programme for Onchocerciasis Control

WHO (2016). The World Health Organization/Department of Control of Neglected Tropical Disease. Guidelines for Stopping Mass Drug Administration and Verifying Elimination of Human Onchocerciasis Criteria and Procedure.

Wilson, N.O., Badara ly, A., Cama, V.A., Cantey, P.T., Cohn, D., Diawara, L., Direny, A., Fall, M., Feeser, K.R., Fox, L.M., Kabore, A., Seck, A.F., Sy, N., Ndiaye, N. and Dubray, C. (2016). Evaluation of lymphatic Filariasis in three Senegalese District treated for Onchocerciasis with Ivermectin. *PLOS Neglected Tropical Disease.* **10**(12): 1 – 14.

Young, K.I., Valdez, F., Vaquera, C., Campos, C., Zhou, L. and Vessels, H.K. (2021). Surveillance along dynamics of viral RNA detection in black flies. *Pathogens.* **10**: 1264