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Low prevalence of lymphatic filariasis infection among adults in a post-mass drug administration setting in Lira District, Northern Uganda: a cross-sectional study

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Abstract

Background

Lymphatic filariasis (LF) is a mosquito-borne neglected tropical disease targeted for elimination as a public health problem. Uganda has implemented LF elimination activities, including mass drug administration (MDA), morbidity management, and post-intervention surveillance. Local evidence remains important for guiding surveillance and community-level prevention in previously endemic districts. This study estimated LF prevalence and examined individual, socioeconomic, and health-system factors among adults in Lira District, northern Uganda.

Methods

A cross-sectional study was conducted using structured questionnaire data and Ministry of Health Vector Control Division screening records for 150 adults from selected communities in Lira District. The questionnaire was developed specifically for this study and is provided as Additional file 4. LF infection status was abstracted from laboratory screening records. Data were analysed using IBM SPSS Statistics Version 25-compatible procedures. Prevalence was estimated with an exact binomial 95% confidence interval. Because only two participants were LF-positive, multivariable logistic regression was not fitted; bivariate analyses used Fisher exact or Fisher-Freeman-Halton exact tests and were interpreted as exploratory.

Results

Most participants were male (107/150, 71.3%), aged 35–44 years (64/150, 42.7%), farmers (139/150, 92.7%), and rural residents (150/150, 100.0%). Overall, 2 of 150 participants were LF-positive, yielding a prevalence of 1.33% (exact 95% CI 0.16–4.73). Exact bivariate tests did not provide statistical evidence of associations between LF infection and measured demographic, knowledge, prevention, or health-system variables. Descriptive findings showed high general awareness of LF (92.7%), but limited prioritization of prevention (77.3% disagreed that LF prevention was a personal priority) and weak reported communication from health workers about LF (77.3% strongly disagreed that healthcare professionals provided LF information).

Conclusions

Detectable LF infection prevalence among adults in this Lira District sample was low, consistent with a post-MDA setting. However, low prevalence in a small cross-sectional sample should not be interpreted as proof of the complete absence of residual transmission. Continued post-MDA surveillance, targeted

health education, community engagement, morbidity detection, and integration of LF activities within routine health services remain important for protecting elimination gains.

Background

Lymphatic filariasis (LF) is a mosquito-borne neglected tropical disease caused by filarial nematodes, predominantly *Wuchereria bancrofti* in Africa, with *Brugia malayi* and *Brugia timori* contributing to transmission in some Asian and Pacific settings [1, 2]. Infection is often acquired early in life, may remain subclinical for long periods, and can damage the lymphatic system before overt disease becomes apparent [1, 3]. Chronic manifestations, including lymphoedema, elephantiasis, and hydrocele, cause disability, stigma, social exclusion, and loss of productivity, reinforcing the link between LF and poverty [1, 4, 5].

The Global Programme to Eliminate Lymphatic Filariasis (GPELF) is built on two complementary pillars: interrupting transmission through preventive chemotherapy, mainly mass drug administration (MDA), and providing morbidity management and disability prevention for people already affected [3, 6–8]. The World Health Organization (WHO) reported that in 2023, 657 million people in 39 countries still required preventive chemotherapy for LF, showing that elimination progress is substantial but incomplete [1, 2]. The 2021–2030 neglected tropical diseases road map further emphasizes country ownership, integration, surveillance, equity, and sustainability after intervention scale-down [3].

The post-MDA phase is epidemiologically challenging. As infection prevalence declines, surveys may identify few positive individuals, making routine risk-factor analysis statistically unstable and increasing the risk of false or exaggerated associations [9–14]. Transmission assessment surveys (TAS), pre-TAS assessments, targeted surveillance of hotspots, household contact approaches, xenomonitoring, and improved diagnostics have all been proposed to strengthen confidence that transmission has been interrupted or to detect residual foci [9–15]. Thus, low prevalence should be interpreted in relation to sampling design, diagnostic method, age group, historical endemicity, and MDA coverage, rather than as standalone proof that transmission has ceased.

Uganda has a documented history of LF transmission, particularly in the northern and eastern regions. Baseline investigations in the Lira, Soroti, and Katakwi districts confirmed bancroftian filariasis and identified Anopheles vectors as important in transmission [16]. National mapping using circulating filarial antigen (CFA) tests among schoolchildren found antigen-positive cases in 31 of 76 sites, with prevalence ranging from 0.4% to 30.7% and stronger signals in parts of northern Uganda [17]. Subsequent work in northern Uganda reported substantial reductions in W. bancrofti infection in humans and mosquitoes following integrated MDA and long-lasting insecticidal net distribution [18, 19].

Uganda's Neglected Tropical Diseases Master Plan 2023–2027 prioritizes sustainability, the integration of NTD services into routine health systems, surveillance, case management, and community engagement [20]. These priorities are particularly relevant for formerly endemic communities where MDA has been stopped or scaled down, as residual infections, gaps in health education, limited

morbidity reporting, and complacency may threaten elimination gains [3, 9, 13, 14, 20]. Community acceptance of MDA and prevention messages is shaped by knowledge, risk perception, communication, trust in health workers, access to drugs, and the motivation of community drug distributors [21–25].

The present manuscript reports a dissertation-derived analysis of LF infection among adults in Lira District, northern Uganda. The analysis is intentionally conservative because only two LF-positive individuals were identified in the dataset. The objectives were to estimate LF prevalence and to describe individual, socioeconomic, and health-system characteristics relevant to post-MDA surveillance, health education, mosquito-net promotion, community engagement, and morbidity detection.

Methods

Study design and setting

This cross-sectional analytical study was conducted in Lira District, northern Uganda, from February to September 2024. Participants were adults from selected communities served by the Ministry of Health Vector Control Division screening system. Study locations included Erute North and Erute South, specifically the sub-counties of Ogur, Ngetta, Agali, Amach, and Adekokwok. Lira District is a historically significant LF area in northern Uganda, where earlier studies informed the national understanding of LF distribution and elimination needs [16–20].

Study population and eligibility

The study population comprised adults aged 18 years and over whose information was captured in the Ministry of Health Vector Control Division's primary data tools and who had been screened for LF. Participants with severe illness or comorbidities that could compromise reliable testing or data collection were excluded. The original sample size target was 169, but complete, analyzable records were available for 150 adults, yielding an achieved response rate of 88.7% of the planned sample.

Sampling procedures

The sampling frame consisted of adults listed in LF screening records. Systematic random sampling was employed from the screening list. Because the final analysis included only two LF-positive participants, the manuscript focuses on prevalence estimation and descriptive public-health interpretation rather than on causal modelling.

Data sources and study variables

Data were collected using a structured questionnaire developed specifically for this study (see Additional file 4). The questionnaire covered sociodemographic characteristics, knowledge and perceptions of LF,

prevention-related factors, health-system factors, and sociodemographic factors. Data were drawn from responses to a structured questionnaire and Vector Control Division screening records. Variables included LF infection status, sex, age group, educational level, occupation, marital status, residence, family size, religion, awareness of LF, knowledge of LF prevention, MDA-related treatment concepts, perceptions of LF threat and prevention, health-worker communication, mosquito-net advice, and perceived role of insecticide-treated nets in LF prevention.

LF diagnostic method and case definition

LF infection status was abstracted from the Ministry of Health Vector Control Division screening records. The study used circulating filarial antigen (CFA) as the diagnostic marker. CFA is a marker of active or recent *Wuchereria bancrofti* infection because the antigen is released by adult worms. CFA-based rapid immunochromatographic tests, including the immunochromatographic card test and the Filariasis Test Strip, have been used in LF elimination programmes for mapping endemic areas, monitoring programme impact, and supporting post-MDA surveillance [26–30].

Statistical analysis

Data were analysed using IBM SPSS Statistics Version 25-compatible procedures. Frequencies and percentages were used for categorical variables. LF prevalence was calculated as the number of LF-positive participants divided by the number screened, with an exact binomial 95% confidence interval [31]. Because only two LF-positive cases were identified, multivariable logistic regression was not fitted to avoid sparse-data bias, model non-convergence, inflated standard errors, and misleading adjusted odds ratios. The minimum events-per-variable problem and sparse-outcome bias are well recognized in logistic modelling [32, 33].

Bivariate comparisons were performed using Fisher exact tests for 2 x 2 tables and Fisher-Freeman-Halton exact tests for larger contingency tables [34, 35]. Results were interpreted as exploratory rather than confirmatory. A two-sided p-value < 0.05 was considered statistically significant, but emphasis was placed on prevalence, exact confidence intervals, descriptive patterns, and public-health relevance rather than hypothesis testing.

Ethical considerations

Ethical approval

was obtained from the Lira University Research Ethics Committee (LUREC; approval number LUREC-2024-211). Administrative clearance was granted by Lira District authorities and relevant health facility administrators. The study was conducted in accordance with the Declaration of Helsinki. All participants provided written informed consent prior to participation. Participant identifiers were omitted from the analysis files, and data were coded and securely stored.

Reporting guidelines

The manuscript was prepared in accordance with the STROBE guidance for cross-sectional observational studies (see Additional file 1) [36].

Results

Participant characteristics

A total of 150 adult records were analysed. Most participants were male (107/150, 71.3%), aged 35–44 years (64/150, 42.7%), had secondary education (139/150, 92.7%), were farmers (139/150, 92.7%), and lived in rural areas (150/150, 100.0%). Married participants accounted for 78 (52.0%), 61 (40.7%) were divorced, and 11 (7.3%) were single. Christians constituted 103 (68.7%) and Muslims 47 (31.3%) of the participants (Table 1).

Table 1
Sociodemographic characteristics of adults included in the analysis (N = 150)

Characteristic	Category	n (%)
Sex	Male	107 (71.3)
	Female	43 (28.7)
Age group	18–34 years	38 (25.3)
	35–44 years	64 (42.7)
	≥ 45 years	48 (32.0)
Education level	Primary	11 (7.3)
	Secondary	139 (92.7)
Occupation	Business	11 (7.3)
	Farmer	139 (92.7)
Marital status	Single	11 (7.3)
	Married	78 (52.0)
	Divorced	61 (40.7)
Residence	Rural	150 (100.0)
Family size	1–4	75 (50.0)
	5–8	50 (33.3)
	9–10	25 (16.7)
Religion	Christian	103 (68.7)
	Muslim	47 (31.3)

Prevalence of lymphatic filariasis infection

Overall, 2 of 150 participants were recorded as LF-positive, giving a prevalence of 1.33% (exact 95% CI 0.16–4.73). The remaining 148 participants (98.67%) were LF-negative. This low prevalence is consistent with a post-MDA setting, but the wide exact confidence interval reflects the small number of positive cases (Fig. 1).

Exploratory associations with sociodemographic factors

Because only two LF-positive participants were identified, associated-factor analysis was exploratory. Exact tests did not show statistical evidence of association between LF infection and sex, age group,

education, occupation, marital status, family size, or religion. Residence could not be tested because all participants in the analysis dataset were rural residents (Table 2).

Table 2
Exploratory bivariate analysis of sociodemographic characteristics and LF infection status

Variable	Category	LF-positive/total (%)	Exact p-value	Exact test
Sex	Female	1/43 (2.3)	0.493	Fisher exact
	Male	1/107 (0.9)		
Age group	18–34 years	0/38 (0.0)	1.000	Fisher-Freeman-Halton exact
	35–44 years	1/64 (1.6)		
	≥ 45 years	1/48 (2.1)		
Education level	Primary	0/11 (0.0)	1.000	Fisher exact
	Secondary	2/139 (1.4)		
Occupation	Business	0/11 (0.0)	1.000	Fisher exact
	Farmer	2/139 (1.4)		
Marital status	Single	0/11 (0.0)	1.000	Fisher-Freeman-Halton exact
	Married	1/78 (1.3)		
	Divorced	1/61 (1.6)		
Family size	1–4	1/75 (1.3)	1.000	Fisher-Freeman-Halton exact
	5–8	1/50 (2.0)		
	9–10	0/25 (0.0)		
Religion	Christian	1/103 (1.0)	0.530	Fisher exact
	Muslim	1/47 (2.1)		

Knowledge, perceptions and prevention-related factors

Most participants had heard of LF (139/150, 92.7%). However, 78 (52.0%) reported not knowing that LF can be prevented, 116 (77.3%) disagreed that LF prevention was a personal priority, and 116 (77.3%) strongly disagreed that they knew of various LF preventive measures. Similarly, 116 (77.3%) strongly disagreed that healthcare professionals had provided information on LF infection in the community.

Despite these gaps, most respondents reported that LF patients are advised to sleep under mosquito nets (146/150, 97.3%) and that regular use of insecticide-treated nets (ITNs) prevents LF transmission (121/150, 80.7%). Knowledge of ivermectin/albendazole dosing varied: 88 (58.7%) reported once, 57 (38.0%) reported thrice, and 5 (3.3%) reported twice. Exact bivariate tests did not provide statistical evidence of an association between these factors and LF infection status in this small dataset (Table 3).

Table 3
Knowledge, perception and prevention-related factors, with exploratory exact tests

Variable	Category	Total n (%)	LF-positive/total (%)	Exact p-value
Heard of lymphatic filariasis	No	11 (7.3)	0/11 (0.0)	1.000
	Yes	139 (92.7)	2/139 (1.4)	
Knows LF can be prevented	No	78 (52.0)	1/78 (1.3)	1.000
	Yes	72 (48.0)	1/72 (1.4)	
LF prevention is a personal priority	Agree	15 (10.0)	0/15 (0.0)	1.000
	Disagree	116 (77.3)	2/116 (1.7)	
	Neutral	5 (3.3)	0/5 (0.0)	
	Strongly agree	14 (9.3)	0/14 (0.0)	
Knowledge of preventive measures	Agree	5 (3.3)	0/5 (0.0)	1.000
	Neutral	4 (2.7)	0/4 (0.0)	
	Strongly agree	25 (16.7)	0/25 (0.0)	
	Strongly disagree	116 (77.3)	2/116 (1.7)	
Health workers provide LF information	Disagree	11 (7.3)	0/11 (0.0)	1.000
	Neutral	5 (3.3)	0/5 (0.0)	
	Strongly agree	18 (12.0)	0/18 (0.0)	
	Strongly disagree	116 (77.3)	2/116 (1.7)	
LF patients advised to sleep under mosquito net	No	4 (2.7)	0/4 (0.0)	1.000
	Yes	146 (97.3)	2/146 (1.4)	
Regular ITN use prevents LF spread	No	29 (19.3)	0/29 (0.0)	1.000

Variable	Category	Total n (%)	LF-positive/total (%)	Exact p-value
	Yes	121 (80.7)	2/121 (1.7)	

Discussion

Principal findings

This cross-sectional study found a low detectable LF prevalence of 1.33% among adults in Lira District. The finding is consistent with a post-MDA environment in which active infection has declined substantially, but the confidence interval (0.16–4.73%) and the small number of positive cases warrant cautious interpretation. No measured individual, socioeconomic, or health-system factor showed a statistically significant association with LF infection after exact testing. The main contribution of this study is therefore the documentation of low detectable prevalence in a historically endemic district, together with evidence of persistent health-education and surveillance needs.

Interpretation in relation to Uganda and regional elimination efforts

Historical studies in northern Uganda documented LF transmission in the Lira, Soroti, and Katakwi districts, and national mapping identified CFA-positive schoolchildren at multiple sites, with higher infection signals in northern Uganda [16, 17]. Later intervention studies in northern Uganda observed marked reductions in *W. bancrofti* infection following MDA and long-lasting insecticide-treated net distribution [18, 19]. The low prevalence observed in the present adult dataset is therefore plausible in the context of long-term elimination activities. However, it should be interpreted as evidence supporting continued surveillance rather than as proof that transmission has been fully interrupted.

WHO guidance emphasizes that stopping MDA and validating elimination require ongoing epidemiological monitoring, including TAS, post-MDA surveillance, and attention to morbidity management [3, 9–11, 37]. In low-prevalence settings, targeted approaches may improve efficiency, such as surveillance in historical hotspots, older age groups, households of detected positives, and areas with ecological conditions favorable for mosquito vectors [13, 14]. These approaches are relevant to Lira District because earlier data documented northern Uganda as an LF focus, while the current dataset detected only two positives, limiting the ability to identify statistically robust predictors of residual infection.

Health education, mosquito nets, and community engagement

The study found high reported general awareness of LF (92.7%) but weaker prioritization of prevention (77.3% disagreed LF prevention was a personal priority) and limited reported health-worker

communication (77.3% strongly disagreed that healthcare professionals provided LF information). This distinction is programmatically important: having heard of LF is not equivalent to understanding mosquito transmission, MDA eligibility, the importance of swallowing medicines during campaigns, or when and where to seek care for chronic complications.

Evidence from systematic reviews shows that knowledge, trust, perceived risk, drug-delivery strategy, access, communication, and community engagement influence compliance and acceptability of MDA [21–24]. Community drug distributors and health workers therefore remain central to sustaining LF elimination, even after routine MDA is stopped [25]. The finding that 77.3% of participants reported no LF information from health workers represents a modifiable gap that district health teams can address through enhanced health education integrated into routine outpatient services and community health-worker visits.

Mosquito nets remain relevant where LF and malaria share *Anopheles* vectors. Integrated vector management has been proposed where malaria and LF vectors overlap, and evidence from northern Uganda suggests that MDA combined with LLIN distribution can contribute to reductions in *W. bancrofti* infection [18, 19]. In Lira District, LF messages can be integrated into malaria prevention and environmental sanitation education, while clearly communicating that mosquito nets are part of a broader package that includes surveillance, treatment, morbidity management, disability prevention, and referral for hydrocele or lymphoedema care [7, 18, 37].

Programmatic implications

The findings support five programme priorities. First, routine post-MDA surveillance should continue in Lira District, particularly in historically endemic communities and areas with vector-breeding conditions [9–15, 20]. Second, LF messages should be reinforced through community health workers, facility health talks, integrated NTD/malaria activities, and local leaders [21–25]. Third, health systems should maintain capacity for morbidity identification and referral, including lymphoedema care and hydrocele management where relevant [4, 5, 7]. Fourth, future surveys should document the specific diagnostic test, manufacturer, testing procedure, timing, and quality-control measures [26–30]. Fifth, future analyses should be powered for low-prevalence settings and use methods appropriate for sparse data, including exact statistics, Bayesian or penalized methods, or targeted surveillance designs where appropriate [13, 14, 32, 33].

Strengths and limitations

The study used field data linked to Vector Control Division screening records, providing local evidence from a historically significant LF area in northern Uganda. Reanalysis using exact methods strengthened the manuscript by preventing overinterpretation of sparse data. The manuscript also aligns the interpretation with the post-MDA context and current elimination priorities.

However, several limitations should be considered. The analytically usable sample was small, with only two positive cases, limiting statistical power. Residence showed no variation in the supplied dataset,

precluding a rural-urban comparison. The diagnostic method was described as laboratory-confirmed LF/CFA-based screening, but the commercial CFA test kit, blood specimen type, timing of specimen collection, reader training, and quality-control procedures were not specified in the source documents. The cross-sectional design precludes causal inference, and self-reported knowledge and prevention variables may be affected by recall or social-desirability bias. Finally, because the study was based on adults in selected communities, results should not be generalized to all age groups or all formerly endemic areas without additional surveillance data.

Conclusions

LF infection prevalence among adults in this Lira District sample was low, with only two positive cases detected (1.33%, exact 95% CI 0.16–4.73). The results are consistent with a post-MDA setting but do not prove complete interruption of transmission. Due to the very small number of positive cases, associated-factor findings should be interpreted descriptively and not as evidence of independent risk or protection. Continued post-MDA surveillance, targeted health education, sustained mosquito-net promotion, community engagement, and integration of LF morbidity management into routine health services are recommended to protect elimination gains in northern Uganda.

Abbreviations

CFA	Circulating filarial antigen
CI	Confidence interval
GPELF	Global Programme to Eliminate Lymphatic Filariasis
ITN	Insecticide-treated net
LF	Lymphatic filariasis
LLIN	Long-lasting insecticidal net
LUREC	Lira University Research Ethics Committee
MDA	Mass drug administration
MMDP	Morbidity management and disability prevention
MOH	Ministry of Health
NTD	Neglected tropical disease
SPSS	Statistical Package for the Social Sciences
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
TAS	Transmission assessment survey
WHO	World Health Organization

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Lira University Research Ethics Committee (LUREC; approval number LUREC-2024-211). Administrative clearance was obtained from Lira District authorities and relevant health facility administrators. The study was conducted in accordance with the Declaration of Helsinki. All participants provided written informed consent prior to participating in the study. Participant identifiers were omitted from analysis files, and data were coded and stored securely.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

FHA conceived the study, collected and managed the data, and analysed the dataset. FHA and JPB prepared the manuscript. DO and RO reviewed the manuscript. MSO supervised the study and critically reviewed the scientific content. All authors read and approved the final manuscript.

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Data Availability

All data generated or analysed during this study are included in this manuscript (and its supplementary information files).

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Figures

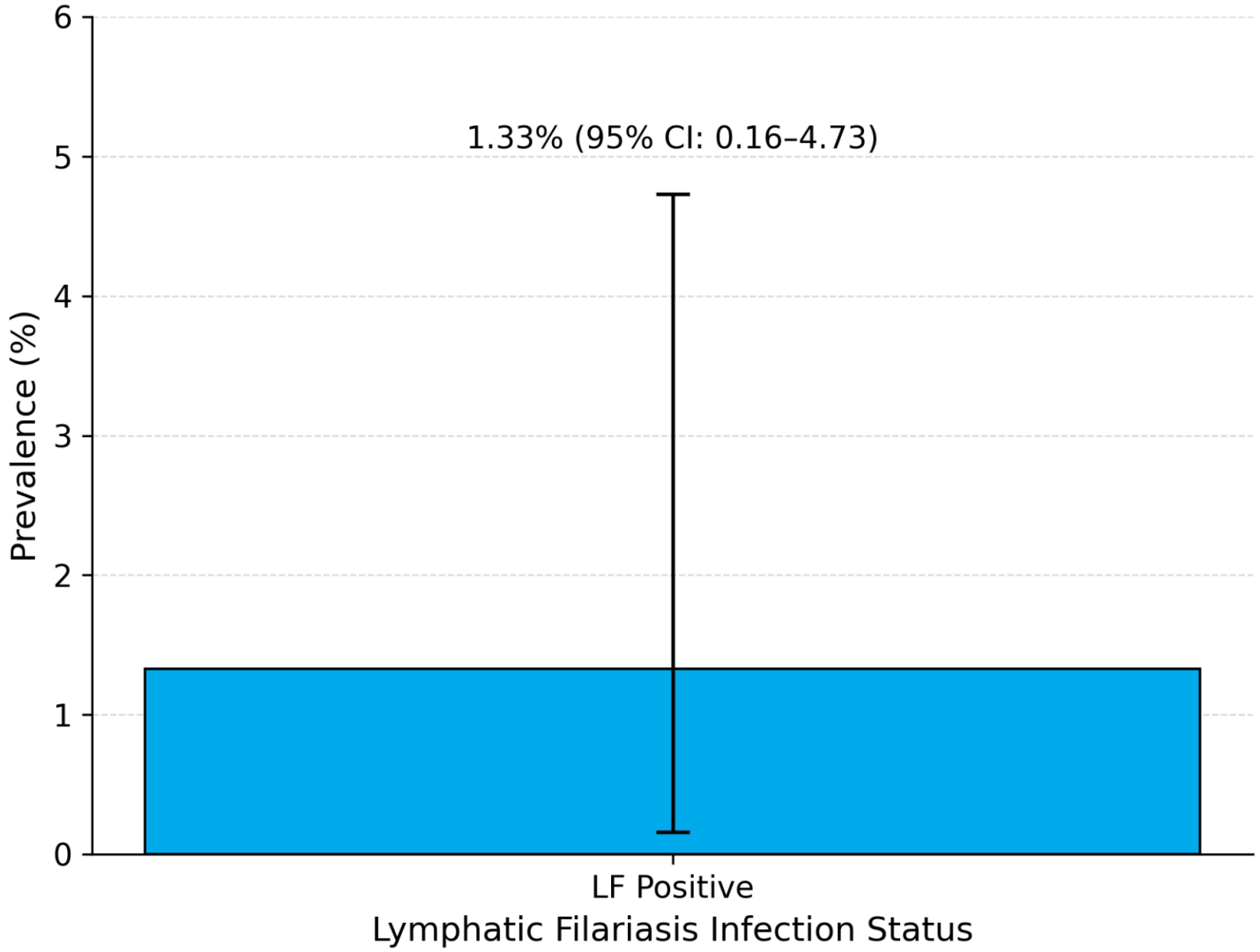


Figure 1

Prevalence of lymphatic filariasis infection among adults in Lira District, northern Uganda. Error bar shows exact binomial 95% confidence interval (0.16-4.73%), calculated using the Clopper-Pearson method.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Additionalfile1STROBECHECKLIST.docx
- Additionalfile2deidentifiedanalysisdataset.csv
- Additionalfile3SPSSsyntax.sps
- Additionalfile4studyquestionnaire.pdf