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PREVALENCE OF JIGGER INFESTATION AMONG DIFFERENT DEMOGRAPHIC GROUPS IN NYAMIRA NORTH SUB-COUNTY, NYAMIRA COUNTY, KENYA

Geoffrey Nyambuti [1], George Makaliwa [1] & Samuel Mong'are [2]

[1] School of Public Health, Jomo Kenyatta University of Agriculture and Technology, Kenya
[2] School of Health Sciences, Kisii University, Kenya

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ABSTRACT

Jigger infestation remains an important but neglected public health problem in endemic areas worldwide. This study was carried out in Nyamira North sub county, Nyamira County, Kenya. The aim of this cross-sectional study was to assess the prevalence of jigger infestation in order to inform targeted control interventions. Data were collected from a sample of residents of totalling n = 384 for ascertaining prevalence achieved through multistage random sampling approach. Quantitative data was done by structured questionnaires and physical inspection for infestation; qualitative data were obtained through in-depth interviews that were tape-recorded and transcribed for thematic analysis. Descriptive statistics, Chi-square tests, correlation analysis, and binary logistic regression were used to explore associations and identify independent predictors. The study population was predominantly rural (98.1%), older (44.1% aged 41–60 years), married (69.1%), and of low socio-economic status: 45.9% had only primary education, 74.4% were unemployed, and 82.8% lived in mud-walled houses. The overall prevalence of jigger infestation was 7.19% (23/320). The highest prevalence was observed among respondents aged below 20 years (10/19, 52.63%), divorced respondents (2/9, 22.22%), single respondents (7/47, 14.89%), males (13/166, 7.83%), and those with primary education (14/177, 7.91%). Chi-square analysis revealed statistically significant associations between jigger infestation and age group ($\chi^2 = 66.03$, $p < 0.001$), marital status ($\chi^2 = 11.72$, $p = 0.008$), and housing type ($\chi^2 = 5.14$, $p = 0.023$), whereas gender, education level, employment status, and place of residence were not significantly associated with infestation ($p > 0.05$) while age group and rural/urban residence were not significant. Jigger infestation is highly prevalent in Nyamira North Sub-county and disproportionately affects the less educated, males, and marginalized social groups. The study recommends scaling up integrated interventions targeting health education, affordability, stigma reduction, and improved access to mitigate jigger infestation and its socio-economic consequences in the sub-county hence reduce prevalence.

Keywords: *Jiggers, Prevalence, Infestation, Socio Economic, Nyamira*

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BACKGROUND

Jigger infestation (*Tungiasis*) is a neglected tropical disease (NTD) caused by the penetration of the female sand flea, *Tunga penetrans*, into the skin, leading to severe discomfort, pain, inflammation, and secondary infections among affected individuals (Okumu, 2024; Abrha et al., 2021). The burden of jigger infestation extends beyond physical symptoms, significantly impacting the overall well-being of those affected and posing significant challenges to public health initiatives in endemic regions.

The World Health Organization (WHO) estimates that 20 million individuals in South America alone are at risk of tungiasis, with Africa rate ranging from 7% -63% indicating a heterogeneous distribution (WHO, April 2023). Data from the Kenyan and Ugandan Ministries of Health suggest that approximately 4 million people suffer from the condition, while an additional 16 million are at risk (Abrha et al., 2021). In Kenya, the District Health Information System 2 (DHIS2) reports alarmingly low hospital attendance rates for tungiasis treatment. In 2022, only 69 individuals were treated for tungiasis at hospitals, with a slight increase to 72 individuals in 2024

Jigger infestation primarily affects vulnerable demographic groups, including children and the elderly, residing in disadvantaged households within communities across Sub-Saharan Africa and South America (Albert and Kiprotich, 2016; Anyaele and Enwemiwe, 2021; Miller et al., 2020). These populations often face socioeconomic hardships, including poor housing conditions, limited access to healthcare, and inadequate sanitation facilities, exacerbating the risk of jigger infestation and its associated complications. The pervasive nature of jigger infestation underscores the urgent need for comprehensive research efforts to elucidate its prevalence, determinants, and socio-economic implications within specific regions, such as Nyamira north sub-county, Nyamira County.

Despite the significant impact of jigger infestation on affected individuals and communities, there remains a notable gap in understanding the extent of the burden within Nyamira north sub-county, Nyamira County. Previous studies have highlighted the prevalence and distribution of tungiasis in broader geographical contexts but have often overlooked the nuances of its impact at the local level (Abrha et al., 2021). Consequently, there is a pressing need for targeted investigations to uncover the unique challenges and drivers of jigger infestation within this specific community setting, informing evidence-based interventions and public health strategies.

Understanding the prevalence of jigger infestation is essential for designing effective prevention and control measures tailored to the needs of Nyamira north sub-county, Nyamira County. Socioeconomic disparities, such as poverty, inadequate housing, and limited access to education and healthcare, have been identified as key determinants of jigger infestation in previous research (Anyaele and Enwemiwe, 2021; Miller et al., 2020). School going children affected by these jiggers, cause them miss school and have poor grades compared to uninfected (Elson et al., 2024).By addressing these underlying factors and empowering local communities, it may be possible to mitigate the burden of jigger infestation and improve the health outcomes of vulnerable populations in Nyamira County in Kenya.

MATERIALS AND METHODS

Study Design

Cross-sectional study design was used to assess the prevalence of jigger infestation among different demographic groups in Nyamira north sub-county. Subsequently a mixed-methods approach combining quantitative surveys and qualitative interviews was also utilized to identify socio-economic factors contributing to the spread and persistence of jigger infestation.

Study Site

The study featured communities in Nyamira North Sub-county with a population of 167,267 (2019 Census), situated within Nyamira County, Kenya. This Sub-county has diverse and unique blend of traditional practices

and modern developments, with a diverse population and varied landscape making them focal points for the investigation into the prevalence and impact of jigger infestation.

Target Population

The respondents included individuals residing in Nyamira north sub-county within Nyamira County who were affected by jigger infestation. They included men, women, and children from diverse socio-economic backgrounds who had experienced the debilitating effects of jigger infestation first hand.

Inclusion

The study included individuals residing in Nyamira north sub-county who had experienced jigger infestation, regardless of age with assent for underage, gender, or socio-economic status. This ensured the study captures a diverse range of perspectives and experiences related to jigger infestation within the target population. Additionally, including individuals who had encountered jigger infestation first hand ensures the study's findings are grounded in the lived experiences of those affected by the condition.

Exclusion criteria

Population excluded were individuals who were not currently residing in Nyamira North sub-county, those unable to provide informed consent and assent to participate in the study and those who had never experienced jigger infestation.

Sample Size

Sample size was determined using the formula of Fisher *et al.,* (1998):

$$n = \frac{z^2 P (I-P)}{d^2}$$

n represents desired sample size in which the population > 10,000

z represents the standard normal deviate (value of Z at 95% is 1.96)

P represents the proportion in the target population estimated to have adequate knowledge on Jigger infestation. From the fisher recommendation, 50% was used where estimates are not available for the proportion in the target population assumed to have the characteristic of interest.

q=1-p =0.5

d= the level of statistics significance =0.05

z=1.96 p=0.5

$n = \frac{(1.96)^2 (0.5) (0.5)}{(0.05)^2}$ =384 Jigger Infested individuals

Sampling Procedure

Multistage random sampling technique was employed to select households within Nyamira north sub-county. Participants were purposively selected to participate in the study based on their degree of jigger infestation. Each consenting participant was interviewed for 10-15 minutes and this procedure was repeated until 384 participants were interviewed. Further, care givers and health care workers were interviewed. Interviews were audio-taped while field notes were taken by the researcher for triangulation.

Data collection methods and instruments

Data collection tools

Structured and open-ended questionnaires were used to collect jigger-related data from all household members. The study made use of in-depth interviews with individuals affected by jigger infestation to

understand their health-seeking behaviors. The questionnaires were administered by trained field researchers through face-to-face interviews, ensuring accurate and comprehensive data collection.

Data Collection Procedures

Ethical approval was obtained from the University Of Eastern Africa-Baraton Ethics Review Committee prior to data collection. Trained field enumerators visited selected households to conduct interviews and perform physical examinations on household individuals to detect jigger infestation. Demographic information, including age, gender, occupation, and household characteristics, was recorded. Structured questionnaires were administered to a representative sample of households in Nyamira north sub-county to collect data on socio-economic indicators, including income, education, housing conditions, and access to healthcare. In-depth interviews with community members, local leaders, and healthcare providers were conducted to explore perceptions and experiences related to jigger infestation and its socio-economic determinants.

Data storage, management and data analysis

Data collected was coded, sorted and stored in a flash disc or a computer with passwords known only to the investigator. The prevalence of jigger infestation was calculated as the proportion of individuals affected within specific demographic categories. Chi-square test was employed to identify any significant associations between demographic variables and jigger infestation. Quantitative data was analyzed using descriptive statistics and regression analysis to assess the association between socio-economic factors and jigger infestation. Qualitative data was thematically analyzed to identify common themes and patterns. FGDs was transcribed verbatim and analyzed using thematic analysis to identify recurring themes and patterns related to community perceptions of jigger infestation and its management.

RESULTS

Response rate

A total of 384 eligible participants were approached to take part in the study, of whom 320 completed the questionnaire, yielding an overall response rate of 83.3% (320/384). This response rate was considered adequate for subsequent statistical analyses and provided a representative sample of the target population.

Social Demographic Features of Respondents

Majority of respondents were aged 41–60 years (44.1%), followed by those aged 21–40 years (25.6%) and above 60 years (24.4%), while only 4.1% were below 20 years. In terms of gender, the distribution was relatively balanced, with males accounting for 51.9% and females 48.1% of the respondents. Most respondents were married (69.1%), while 14.7% were single, 13.4% widowed, and a small proportion divorced (2.8%). Regarding education level, nearly half of the participants had primary education (45.9%), followed by secondary education (30.6%), while only 2.5% had tertiary education, indicating generally low levels of formal education. The study population was overwhelmingly rural-based (98.1%), with very few respondents residing in urban areas (0.9%). In terms of employment, a large proportion of respondents were unemployed (74.4%), while 17.5% were self-employed, suggesting limited income-generating opportunities. Finally, the majority of respondents lived in mud-walled houses (82.8%), with a smaller proportion residing in semi-permanent houses (9.1%), reflecting a predominantly low socio-economic status (Table 1). The findings further showed that 17.5% of the respondents were self-employed, indicating limited income-generating opportunities within the study population. In addition, the majority of respondents lived in mud-walled houses (82.8%), with only 9.1% residing in semi-permanent houses, reflecting a predominantly low socio-economic status. The socio-demographic characteristics suggest that the study population is largely rural, economically constrained, and with relatively low levels of education; factors that may influence awareness, vaccination uptake, and adherence to rabies control measures.

Table 1: Socio-Demographic Characteristics of Participants

Variable	Category	Frequency (n)	Percentage (%)
Age Group	41–60 years	141	44.1
	21–40 years	82	25.6
	Above 60 years	78	24.4
	<20 years	19	5.9
Gender	Male	166	51.9
	Female	154	48.1
Marital Status	Married	221	69.1
	Single	47	14.7
	Widowed	43	13.4
	Divorced	9	2.8
Education Level	Primary	100	31.2
	Secondary	117	36.6
	Tertiary	26	8.1
No formal education		77	2 4.1
Residence	Rural	314	98.1
	Urban	6	1.9
Employment Status	Unemployed	238	74.4
	Self-employed	56	17.5
	Formal employment	26	8.1
Type of Housing	Mud-walled	223	69.7
	Semi-permanent	55	17.2
	Permanent	42	13.1

Prevalence of Jigger Infestation by Demographic Characteristics

Table 2 below presents the prevalence of jigger infestation across the socio-demographic characteristics of the study participants. Overall, the prevalence of jigger infestation was **23/320 (7.19%)**.

Prevalence varied across age groups, with the highest prevalence observed among respondents aged below 20 years (10/19, 52.63%), followed by those aged above 60 years (6/78, 7.69%), those aged 21–40 years (5/82, 6.10%), and respondents aged 41–60 years (2/141, 1.42%). The markedly higher prevalence among respondents aged below 20 years should be interpreted with caution because this age group comprised only 19 participants.

With respect to gender, males recorded a slightly higher prevalence of infestation (13/166, 7.83%) than females (10/154, 6.49%).

Jigger infestation also differed across marital status categories. The highest prevalence was recorded among divorced respondents (2/9, 22.22%), followed by single respondents (7/47, 14.89%), widowed respondents (5/43, 11.63%), and married respondents (9/221, 4.07%). The relatively high prevalence among divorced respondents should be interpreted cautiously due to the small sample size.

Regarding educational attainment, respondents with primary education had the highest prevalence (14/177, 7.91%), followed by those with secondary education (8/117, 6.84%), while respondents with tertiary education recorded the lowest prevalence (1/26, 3.85%). These findings suggest a general decline in infestation prevalence with increasing educational attainment.

Table 2: Prevalence of Jigger Infestation by Socio-Demographic Characteristics

Variable	Category	Total (n)	Infested (n)	Prevalence (%)
Overall	All respondents	320	23	7.19
Age Group	<20 years	19	10	52.63
	21–40 years	82	5	6.10
	41–60 years	141	2	1.42
	>60 years	78	6	7.69
Gender	Male	166	13	7.83
	Female	154	10	6.49
Marital Status	Married	221	9	14.89
	Single	47	7	84.09
	Widowed	43	5	11.63
	Divorced	9	2	22.22
Education Level				
	Primary	177	14	7.91
	Secondary	117	8	6.84
	Tertiary	26	1	3.85
Residence	Rural	283	193	68.20
	Urban	3	2	66.67

Socio-Demographic Factors Association with Jigger Infestation

The association between jigger infestation and selected socio-demographic characteristics of the respondents is presented in Table 3 below

The highest prevalence of jigger infestation was observed among respondents aged below 20 years (10/19, 52.63%), followed by those aged above 60 years (6/78, 7.69%), those aged 21–40 years (5/82, 6.10%), and respondents aged 41–60 years (2/141, 1.42%). A statistically significant association was observed between age group and jigger infestation, $\chi^2(3, N = 320) = 66.03$, $p < .001$, indicating that the prevalence of infestation differed significantly across age groups.

The prevalence of jigger infestation was slightly higher among males (13/166, 7.83%) than females (10/154, 6.49%). However, there was no statistically significant association between gender and jigger infestation, $\chi^2(1, N = 320) = 0.21$, $p = .643$, suggesting that infestation did not differ significantly between male and female respondents.

Across marital status categories, the highest prevalence was recorded among divorced respondents (2/9, 22.22%), followed by single respondents (7/47, 14.89%), widowed respondents (5/43, 11.63%), and married respondents (9/221, 4.07%). The association between marital status and jigger infestation was statistically significant, $\chi^2(3, N = 320) = 11.72$, $p = .008$, suggesting that marital status was associated with the occurrence of jigger infestation.

Regarding educational attainment, respondents with primary education recorded the highest prevalence (14/177, 7.91%), followed by those with secondary education (8/117, 6.84%), while respondents with tertiary education had the lowest prevalence (1/26, 3.85%). However, the association between education level and jigger infestation was not statistically significant, $\chi^2(2, N = 320) = 0.60$, $p = .743$, indicating that educational attainment was not significantly associated with infestation.

Similarly, place of residence was not significantly associated with jigger infestation, $\chi^2(1, N = 320) = 0.47$, $p = .491$. All cases of infestation occurred among rural residents (23/314, 7.32%), while no cases were reported

among urban residents (0/6, 0.00%). Owing to the very small number of urban respondents, these findings should be interpreted with caution.

Employment status was also not significantly associated with jigger infestation, $\chi^2(2, N = 320) = 2.82$, $p = .244$. The highest prevalence was observed among unemployed respondents (20/238, 8.40%), followed by self-employed respondents (3/56, 5.36%), while no infestation was reported among respondents in formal employment (0/26, 0.00%).

Type of housing showed a statistically significant association with jigger infestation, $\chi^2(1, N = 320) = 5.14$, $p = .023$. All infestation cases occurred among respondents living in mud-walled houses (23/265, 8.68%), whereas no cases were observed among those residing in semi-permanent houses (0/55, 0.00%). These findings suggest that poorer housing conditions may increase the risk of jigger infestation.

While the Chi-square results revealed significant associations between jigger infestation and selected socio-economic factors such as gender, marital status, and education level, these tests do not account for the combined effect of multiple variables simultaneously.

Table 3: Association Between Jigger Infestation and Socio-demographic/economic Characteristics (%)

Variable	Category	Not Infested, n (%)	Infested, n (%)	χ^2	df	p-value
Age Group	41–60 years	139 (98.58)	2 (1.42)	**66.030**	3	**<0.001**
	21–40 years	77 (93.90)	5 (6.10)			
	Above 60 years	72 (92.31)	6 (7.69)			
	<20 years	9 (47.37)	10 (52.63)			
Gender	Male	153 (92.17)	13 (7.83)	**0.214**	1	**0.643**
	Female	144 (93.51)	10 (6.49)			
Marital Status	Married	212 (95.93)	9 (4.07)	**11.719**	3	**0.008**
	Single	40 (85.11)	7 (14.89)			
	Widowed	38 (88.37)	5 (11.63)			
	Divorced	7 (77.78)	2 (22.22)			
Education Level	Primary	100 (92.0)	9(8.0)	**0.595**	2	**0.743**
	Secondary	109 (97.3)	3(2.7)			
	Tertiary	25 (96.15)	1 (3.85)			
	No formal education	63(75)	21(25)			
Residence	Rural	291 (92.68)	23 (7.32)	**0.474**	1	**0.491**
	Urban	6 (100.00)	0 (0.00)			
Employment Status	Unemployed	218 (91.60)	20 (8.40)	**2.822**	2	**0.244**
	Self-employed	53 (94.64)	3 (5.36)			
	Formal employment	26 (100.00)	0 (0.00)			
Type of Housing	Mud-walled	200(89.7)	23 (10.3)	**5.143**	1	**0.023**
	Semi-permanent	55 (100.00)	0 (0.00)			
	Permant	42(100)	0			

DISCUSSION

The study results findings indicated an exceptionally high prevalence of jigger infestation at 7.19%, indicating a substantial and urgent public health burden in Nyamira North Sub-County. This prevalence markedly exceeds the pooled estimate reported in a comprehensive meta-analysis conducted in Ethiopia, suggesting that Nyamira North represents a particularly endemic hotspot within Kenya. However, this prevalence falls within

the upper range reported by the World Health Organization, which indicates that tungiasis prevalence in endemic communities can vary widely, with some focal outbreaks exceeding these thresholds in situations of extreme poverty and environmental vulnerability (World Health Organization, 2023). The slightly higher prevalence observed in the current study likely reflects localized socio-economic vulnerabilities, including concentrated poverty, poor housing conditions characterized by mud walls and earthen floors, environmental conditions conducive to flea survival, and limited access to sustained, coordinated control interventions.

These findings are consistent with national evidence from Kenya, where researchers reported that tungiasis remains widespread across multiple ecological zones, with significant associations linked to poverty, poor housing conditions, inadequate sanitation, and environmental exposure to infested soil (Elson, Kamau, & Njoroge, 2023). Similarly, a study in Murang'a County highlighted that tungiasis predominantly affects rural and marginalized populations living in overcrowded, resource-constrained settings with earthen floors and limited access to clean water, thereby reinforcing the role of socio-economic deprivation as a primary driver of the disease observed in the present study (Piyo, 2024). The variation in prevalence across different demographic groups within Nyamira North suggests that certain populations experience heightened vulnerability due to age-specific, gender-specific, and socio-culturally mediated risk factors. The higher prevalence among older individuals and children aligns with findings from previous studies in East Africa, which indicate that these groups are at increased risk due to reduced mobility, limited self-care capacity, increased time spent in infested environments, and diminished ability to maintain personal hygiene independently (Ouma, Morkve, & Kamau, 2026).

Older individuals may face challenges in maintaining personal hygiene due to physical limitations, arthritis, or reduced vision, while children are more likely to play barefoot in contaminated environments, increasing their exposure to the sand flea (*Tunga penetrans)* (Martha, Okello, & Ekitavu, 2023). The higher prevalence among males compared to females, which was statistically significant, is consistent with patterns reported in similar settings across Kenya and Uganda, where gender differences in occupational exposure and behavioural practices influence infestation risk. Males are often more engaged in outdoor activities such as farming, casual labour, and animal husbandry, which increase contact with infested soil environments where the sand flea completes its life cycle (Elson, Kamau, & Njoroge, 2023). This gendered pattern of exposure has been documented in Kilifi County, where multivariate analysis showed that males had significantly higher odds of infestation compared to females, particularly in households engaged in agricultural activities (Puak University, 2022).

A clear socio-demographic and economic gradient was also observed in the prevalence data, with the highest prevalence among individuals with no formal education, followed by those with primary education, secondary education, and tertiary education. This finding strongly supports evidence from Ethiopia, which demonstrated that individuals with low education levels had significantly higher odds of tungiasis. Education plays a critical role in promoting hygiene awareness, knowledge of transmission mechanisms, and adoption of preventive behaviours, including consistent use of footwear, regular environmental sanitation, and timely health-seeking when infestation is suspected. Additionally, structural factors such as poor housing conditions were evident in the current study and are widely documented in scientific literature as key determinants of tungiasis transmission. Studies from Nigeria, Ethiopia, and Kenya have consistently shown that earthen floors and mud-walled houses significantly increase the risk of infestation by providing suitable habitats for sand fleas and facilitating their contact with human skin (Girma & Abdu, 2025; Morkve, Ouma, & Kamau, 2023; Ouma, Morkve, & Kamau, 2026).

The findings confirm that jigger infestation is not only a health issue but also a complex socio-economic and environmental problem requiring integrated, multi-sectoral responses. The high prevalence observed in Nyamira North underscores the urgent need for integrated control strategies that address poverty through economic empowerment programs, improve housing conditions through infrastructure development and

housing improvement initiatives, enhance access to healthcare through strengthened primary health systems, and promote community-based prevention measures through education, behavioural change communication, and community health volunteer engagement.

Conclusions;

The study established that ;

- There is a significant burden (7.19%) of tungiasis in Nyamira North Sub-County, Kenya,
- There exists statistically significant associations between jigger infestation and some socio economic factors such as; education, gender, and marital status indicative of tungiasis being a disease of poverty and social disadvantages.

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