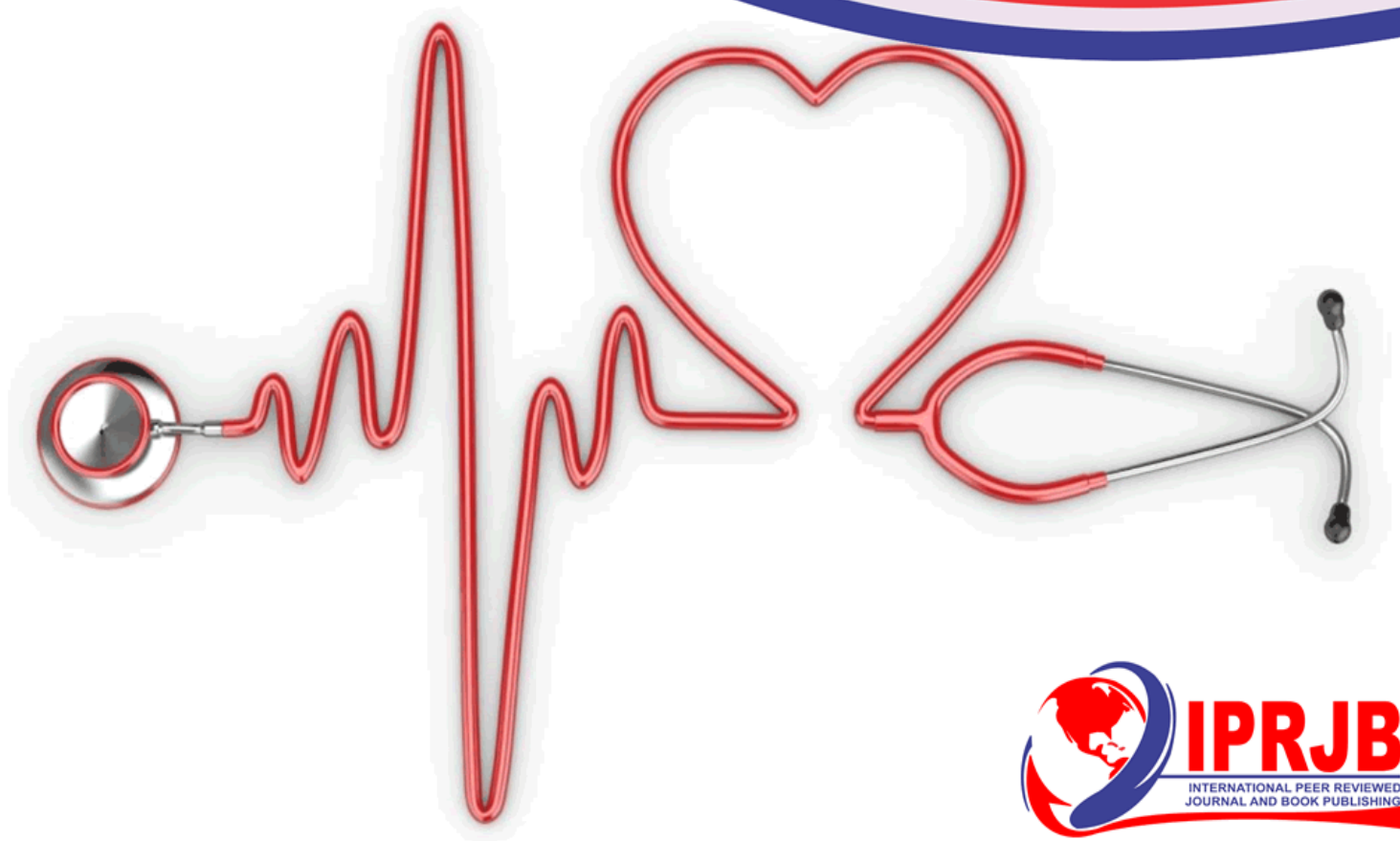


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ENVIRONMENTAL FACTORS PREDISPOSING RURAL COMMUNITY MEMBERS TO TUNGIASIS IN MURANG'A EAST SUB COUNTY, MURANG'A COUNTY

Zablon Wambani, Jackim Nyamari and Harun Kimani



ENVIRONMENTAL FACTORS PREDISPOSING RURAL COMMUNITY MEMBERS TO TUNGIASIS IN MURANG'A EAST SUB COUNTY, MURANG'A COUNTY

^{1*}Zablon Wambani

¹Murang'a County Government, Department of Health
*Corresponding Author's E-mail: zwambani@yahoo.com

²Jackim Nyamari

Lecturer: School of Public Health Kenyatta University

³Harun Kimani

Lecturer: School of Public Health Kenyatta University

Abstract

Purpose: To determine environmental factors predisposing rural community members to tungiasis in Murang'a East Sub County, Murang'a County.

Materials and Methods: The study utilized cross sectional descriptive study design. The research adopted systematic random sampling design to identify the households to be studied where a total of 334 households were selected to participate in the study as determined by Fisher *et al* 1998 formula. The study was carried out in Murang'a East Sub county where household heads or their representatives were interviewed using interview schedule and observation checklist gathered data on environmental factors related to tungiasis. Both descriptive and inferential statistics were used to analyze the collected data.

Results: The study found out that Majority of those who had tungiasis were living in temporary houses which had earthen floors. Majority (21%) of the respondents were aged between 20 to 29 years followed by those aged between 30 to 39 years that accounted for 19.2%. Majority (71.3%) of respondents were females while 28.7% were males. 39.5% of them were living in semi-permanent houses, 37.1% were living in temporary houses while 23.4% were living in permanent houses. However, for those who were jigger infested, 83.3% were living in temporary houses and 16.7% were living in semi-permanent houses. 88.6% of households had domestic animals (chicken) out of which 57.7% reported that the chicken slept next to the living house while 36.6% reported that their chicken slept away from the living house. 68.9% of the households' surrounding was clean.

Unique contribution to theory, practice and policy: The study recommends that the county government of Murang'a should consider subsidizing house improvement particularly for those households that experience persistent tungiasis cases.

Key words: *Environmental factors, rural community, tungiasis, Murang'a East Sub county*

1.0 INTRODUCTION

Tungiasis is highly prevalent in many resource-poor communities in sub-Saharan Africa, Latin America and the Caribbean (Winter, Oliveira, Wilcke, Heukelbach, & Feldmeier, 2009). *Tunga penetrans* is an ecto-parasite which is mostly found in dusty and dirty places. It causes a skin disease called tungiasis. Signs associated with the disease include severe local itching, pain and sensation of a foreign body in the skin (Heukelbach, Oliveira, Hesse & Feldmeier, 2001). The parasite is common in urban slums, traditional fishing communities and rural communities (Ugbomoiko, Ofoezie, & Heukelbach, 2007). Diagnosis involves identification of the parasite especially through mechanical removal using a sharp pointed object such as a needle (Mwangi, Ozwara & Gicheru, 2015). The importance of tungiasis is localization in the foot causing serious difficulty in walking and reducing the infected person's ability to work normally. In endemic areas, prevalence ranges from 15-40% (Julian, Fioravanti, Onore, Mantovani, & Trentini, 2009).

Direct transmission of *Tunga penetrans* from one person to another is not possible but it occurs through the insanitary environment. Humans become infested when walking in sandy soil in which female fleas are present. Infestation tends to involve the ankles and feet, particularly between the toes. It can also occur anywhere in the body, including the head if the individual lies on the infested ground. In small children, lesions can occur at ectopic sites as far as the hands, elbows, neck, anus and the genitals (Veraldi & Schianchi 1999). Tungiasis has a high number of hosts including pigs, dogs, cats, rats, sheep, cattle, donkeys, monkeys, elephants and other mammals. However, human is an accidental host (Nagy *et al.*, 2007). Tungiasis causes debility in resource-poor communities of developing countries where it is usually considered an entomologic nuisance and has not received much attention and therefore remains an important public health problem for the poor (Kimani, Nyagero, & Ikamari, 2012).

Ahadi Kenya Trust, a Non Governmental Organization working to eradicate tungiasis in Kenya has registered over 2.6 million people suffering from tungiasis and over 10 million are at risk of infection in Kenya (Ahadi Kenya Trust, 2010). Grouped by regions, Central region had the highest infection rate followed by Coast region. In Murang'a County, Ahadi Kenya Trust (2010) reported more than 1,358 people who were suffering from tungiasis in just one Division. In 2010, the prevalence of tungiasis in Murang'a south, an endemic area, was suggested to be 57 % in children of 5–12 years (Ngomi, 2010). According to the Ministry of Health, Murang'a East Sub county is one of the 20 Sub counties in Kenya which are considered to have the highest prevalence of tungiasis (Ministry of Public Health and Sanitation [MOPHS], 2012).

The first case of tungiasis was described in 1526 by Gonzalo Fernández de Oviedo Valdés, (Gordon, 1941). Through ship routes, *Tunga penetrans* was spread to the rest of the world (Hoepli, 1963). The spread to greater Africa occurred throughout the 17th and 19th centuries, specifically in 1873 when the infected crewmen of the ship Thomas Mitchell introduced it into Angola (Gordon, 1941). From Angola, *Tunga penetrans* spread to other parts of sub-Saharan Africa (Hicks, 1930; Sachse, 2007). The ectoparasite followed trade routes and was propagated through military expeditions and within 20 years reached East Africa including Kenya (Hoepli, 1963).

2.0 MATERIALS AND METHODS

This was a cross sectional descriptive study designed to survey a sample of population elements at one point in time. The research was carried out in Mbiri Division of Murang'a East Sub county. Murang'a East Sub county is one of the eight Sub counties in Murang'a County. The Sub county total area is approximately 110 square kilometers. Murang'a East Sub county was chosen for this study because it is one of the twenty Sub counties in the country which the Ministry of Health considers to have the highest tungiasis prevalence (MOPHS, 2012). The Division was randomly chosen among other Divisions in the Sub county and it has two Locations namely Muchungucha and Gikandu. The study targeted household heads living in Gikandu and Muchungucha Locations of Mbiri Division. A total of 334 households participated in the study from the two Locations as determined by Fisher *et al.* (1998) formula ($n=Z^2pq/d^2$).

Where n = the desired sample size (if the target population is greater than 10,000).

Z = the standard normal deviate at the required confidence level, 95% (1.96).

p = the proportion in the target population estimated to have tungiasis.

q = $1-p$ (the proportion without tungiasis).

d = the level of statistical significance (0.05).

$$n = (1.96)^2 (0.5) (0.5) / (0.05)^2$$

$$= 384$$

For 2,569 households, $nf = n/(1+n/N)$ was used to calculate sample size,

where nf = the desired sample size and

N = the estimated total population less than 10,000

n = the estimated sample when the estimated total population is greater or equal to 10,000.

$$384 / (1 + 384 / 2569)$$

$$= 384 / 1.149 = 334$$

Structured interview schedule and observation checklist were used for data collection and five research assistants were recruited and trained on how to administer the instruments. Prior to data collection, pre-testing was conducted in 33 selected households in the neighboring Njogu-ini Location.

Data collected was coded and statistically analyzed using statistical package for social sciences version 20. Descriptive statistics; mean, percentages and frequencies were useful in ensuring that the large amount of numerical data was organized and summarized in such a way that it was meaningfully understood and communicated. Chi-square Test of independence and Fisher's Exact Test were used to draw generalization and inferences. The researchers sought approval to conduct the study from Kenyatta University Graduate School and clearance from Kenyatta University Ethics Review Committee. Research permit was obtained from the National Commission for Science, Technology and Innovation. At the county level, the County Commissioner and the County Public Health Officer for Murang'a County as well as the County Director of Education were consulted and they gave their written permission before the research started. Signed consent was sought from participants after explaining and describing to them

pertinent information about the study. Confidentiality and privacy of the respondents were ensured through the use of codes on the interview schedule.

3.0 RESULTS

3.1 Demographic characteristics

17.3% of the respondents were aged 19 years and below while those in the age bracket of 20 to 29 years were 21%. Those respondents aged between 30 to 39 years accounted for 19.2% while those aged between 40 to 49 years were 17.7%. The least (7.5%) were in the age bracket of 50 to 59 years and those 60 years and above were 17.3%. Majority (71.3%) of the respondents were females while 28.7% were males.

Table 1: Demographic characteristics

Characteristic	Frequencies (n=334)	Percentage
Age		
≤ 19 years	58	17.3
20 - 29 years	70	21.0
30 - 39 years	64	19.2
40 - 49 years	59	17.7
50 - 59 years	25	7.5
≥ 60 years	58	17.3
Sex		
Male	96	28.7
Female	238	71.3

3.2 Type of house occupied

Majority (39.5%) of the respondents were living in semi-permanent houses followed by 37.1% who were living in temporary houses. Only 23.4% were living in permanent houses. However, for those who were jigger infested, 83.3% were living in temporary houses compared to 16.7% who were living in semi-permanent houses. Out of the 334 households visited, 6.9% reported at least one case of tungiasis. The total tungiasis cases were 35.

Table 2: Type of house occupied by respondents

Type of house occupied	Frequency (n= 334)	Percent
Temporary	124	37.1
Semi-permanent	132	39.5
Permanent	78	23.4
For those who were jigger infested (n= 35)		
Temporary	29	83.3
Semi-permanent	6	16.7

3.3 Presence of domestic animals

88.6% of households had domestic animals (chicken) and 11.4% reported not having domestic animals. Those with chicken, 57.7% reported that the chicken slept next to the living house while

36.6% reported that their chicken slept away from the living house whereas 5.7% shared their living houses with chicken.

Table 3: Presence of domestic animals

Presence of domestic animals	Frequencies (n=334)	Percentage (%)
Present	296	88.6
Absent	38	11.4
For those with chicken (n= 296)		
Where chicken slept	Frequencies	Percentage
Next to the living house	171	57.8
Away from the living house	108	36.5
Living house	17	5.7

3.4 Sanitary state of household compound

Majority of the respondents 68.9% of the households' surrounding was clean, 13.8% was dusty, 13.4% was dirty and 3.9% was bushy.

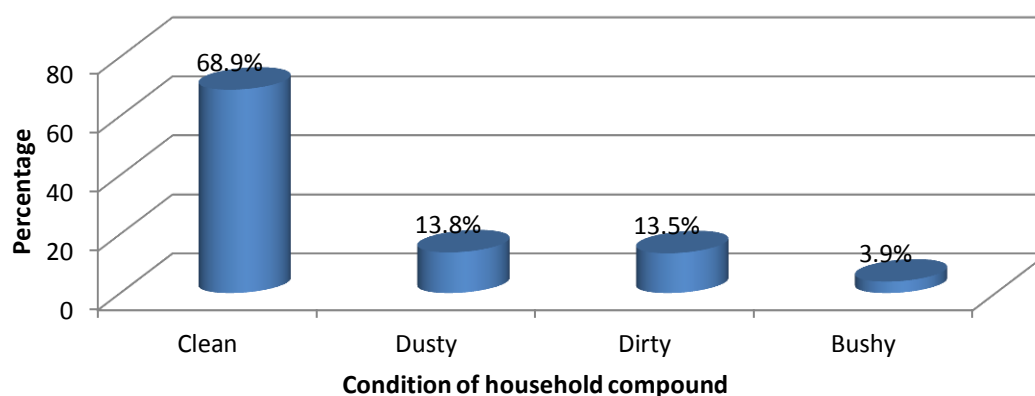


Figure 1: Sanitary state of household compound

4.0 DISCUSSION

All those who were suffering from tungiasis were living in temporary and semi-permanent houses. Most (68.9%) household compounds were well maintained with exceptions which were dusty, dirty or bushy. A study conducted in Kiharu constituency (Mwangi *et al* (2015) established association between poor housing and tungiasis. Maintaining high standard of cleanliness in poor houses is a challenge and this could increase the flea population thus high attack rate. Dusty surfaces, cracks and crevices in the walls and floors harbour *Tunga penetrans* and therefore should be avoided (Kimani, Nyagero & Ikamari, 2012). Therefore, hygiene is important in order to control pests and provide pleasant atmosphere to the household members (Kimani, Nyagero & Ikamari, 2012). It speculated that dirty and poorly maintained environment is a preferred breeding site for the flea, as there is abundant organic material for the larvae to feed on (Chelimo, 2013). Heukelbach *et al.*, (2002) reported that improving sanitation and waste collection reduced the incidence of tungiasis.

According to Mwangi *et al* (2015), domestic animals in the home such as cats, dogs, chicken and goats is an important factor associated with tungiasis, perhaps because they harbor *Tunga penetrans* fleas. Chicken and dogs in close vicinity to living quarters may harbour and transfer *Tunga penetrans* to man due to their domesticated nature and interactions with people, including sharing of common resting places. These domestic animals are invariably available in many households and even children find it enjoyable to play with them thus making it possible for the helpless children to come into contact with *Tunga penetrans* (Ugbomoiko, Ariza, & Heukelbach, 2008). When humans live in close contact with infested animals, the risk of infestation is high. Domestic animals live on compounds and in close proximity to homes either because of lack of adequate land to shelter animals, fear of theft or cultural practices. A study on tungiasis risk factors conducted in Nigeria indicated that co-habitation with pigs and dogs and poor housing condition played a pivotal role in the transmission of *Tunga penetrans* in the community (Ugbomoiko, Ariza, Ofoezie, & Heukelbach, 2007a). Another study conducted in North East Brazil revealed that occupants of households with infested pets and domestic animals had tungiasis that correlated to infestation in the animals (Pilger *et al*, 2008).

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The study concluded that 6.9% of the households sampled had at least one or more members who were suffering from tungiasis with a total of 35 cases. Majority of those who had tungiasis lived in temporary houses which had earthen floors.

5.2 Recommendations

The county government of Murang'a should consider subsidizing house improvement (compacting earthen floors or cementing them) particularly for those households that experience persistent tungiasis cases.

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Competing interests

The authors declare no competing interests.

Authors' contributions

The three authors helped to conceptualize the ideas, review drafts, read and approved final manuscript. Zablon Wambani designed the methodology, collected data, undertook statistical analysis, synthesized the findings and wrote the draft and the final article. Jackim Nyamari, supervised the study, reviewed the methodology, read the drafts and approved the final manuscript. Harun Kimani also supervised the study, reviewed the methodology, read the drafts and approved the final manuscript.

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