International Journal of TROPICAL DISEASE & Health

Volume 45, Issue 4, Page 46-52, 2024; Article no.IJTDH.113998
ISSN: 2278–1005, NLM ID: 101632866

The Burden of Tungiasis (Jiggers' Infestation) and Its Impact on Rural Vulnerable Populations in Kenya: A Comprehensive Health Assessment on Muranga County, Kenya

Thomas Opiyo Okumu [a++*]

[a] Independent Researcher, P.O BOX 7340 – 30100, Eldoret, 254, Kenya.

Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

Article Information

DOI: 10.9734/IJTDH/2024/v45i41527

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/113998

Review Article

Received: 05/01/2024
Accepted: 09/03/2024
Published: 12/03/2024

ABSTRACT

Tungiasis, commonly known as jiggers' infestation, poses significant health challenges within the vulnerable rural population in Kenya. This parasitic skin disease is caused by the female sand flea *Tunga penetrans* and primarily affects individuals living in impoverished and overcrowded conditions. The infestation leads to severe discomfort, pain, inflammation, and secondary infections, impacting the physical and mental well-being of those affected. This abstract aims to assess the health challenges brought by tungiasis in rural Kenya and especially in Muranga County, highlighting the need for effective prevention strategies, treatment interventions, and public health education to combat this neglected tropical disease. It will also aim at providing an overview of a study conducted to assess the health challenges associated with tungiasis in Muranga County, Kenya. It will also explore the significant health challenges and effects of tungiasis which is also

**Corresponding author: Email: opiyothomas@gmail.com, opiyothomas@googlemail.com;*

known as jigger's infestation on rural population in Kenya and provide recommendations on means and measures that should be taken by the department of public health within the ministry of health of Kenya and other stakeholders in improving healthcare conditions for the focus population and transform the plea of this rural population and other rural populations affected within Kenya.

Keywords: Tungiasis; prevalence; risk factors; epidemiology; prevention.

1. INTRODUCTION

Tungiasis is a neglected tropical disease prevalent in many rural areas of sub-Saharan Africa, including Muranga County in Kenya. The infestation occurs when the female sand flea burrows into the skin of its host, typically targeting the feet but can also affect other parts of the body. The condition is characterized by intense itching, pain, inflammation, and the formation of nodules that can lead to secondary bacterial infections if left untreated. In addition to the physical symptoms, tungiasis can have profound social and psychological effects on individuals, often leading to stigma and social exclusion. The burden of tungiasis disproportionately affects rural vulnerable populations, particularly in developing countries like Kenya. This comprehensive health assessment focuses on Muranga County in Kenya, where tungiasis is prevalent and poses significant challenges to the affected communities.

Tungiasis also known as jiggers' infestation is a parasitic skin or infestation with the digging female sand flea *or jigger flea Tunga penetrans* or related species into the skin [1]. After the penetration which mostly is seen on the feet, the flea undertakes an amazing enlargement which takes some days to grow up to about 1 cm [2]. This flea has many common names including, *chigoe flea, jigger, nigua, pico, sand flea, and bicho de pie (bug of the foot)* [3]. The lacerations caused by the flea are characterized by a white patch with a black dot in the center.

In as much as there is growth of rural settings that have been transformed into urban areas, tungiasis still seems to be an emerging neglected disease found in Africa, and in Latin America and is commonly associated with poverty and affecting the less fortunate and the resource poor communities within the mentioned regions [4]. In Kenya, it is a highly endemic disease commonly found in rural and poor areas such as rural Central Kenya where Muranga is one of the counties and is associated with considerable morbidity.

2. BACKGROUND AND EPIDEMIOLOGY

Tungiasis is endemic in tropical and subtropical regions, with approximately 500 million people at risk of infection. Tungiasis or Jigger infestation has been found to be affecting majority of the rural poor population and the urban slum dwellers because of the state of their houses such as earthen floors [5]. "In Kenya, the disease is prevalent in rural areas, where people live in close proximity to animals and lack access to proper footwear and healthcare services. A study conducted in the rural villages of Muranga County showed that poor and temporary living conditions attributed to 39.5% living in semi-permanent houses, 37.1% were living in temporary houses and only 23.4% were living in permanent houses. As compared to urban setting where 98% of the houses were permanent. Out of the sampled group, 83.3% of those who were tungiasis/jigger infested were living in temporary houses, and only 16.7% were living in permanent houses. While 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" [6]. The assessment aims to provide a detailed understanding of the epidemiology, risk factors, and socio-economic impact of tungiasis on vulnerable populations in Muranga County.

3. HEALTH IMPACT AND SOCIO-ECONOMIC CONSEQUENCES

Tungiasis can lead to severe health complications, including chronic pain, disability, and secondary infections. The disease has a significant impact on the affected individuals' quality of life, as well as on their families and communities. The assessment explores the health impact of tungiasis on rural vulnerable populations in Muranga County and examines the socio-economic consequences of the disease, such as reduced productivity, increased healthcare costs, and social stigma [7].

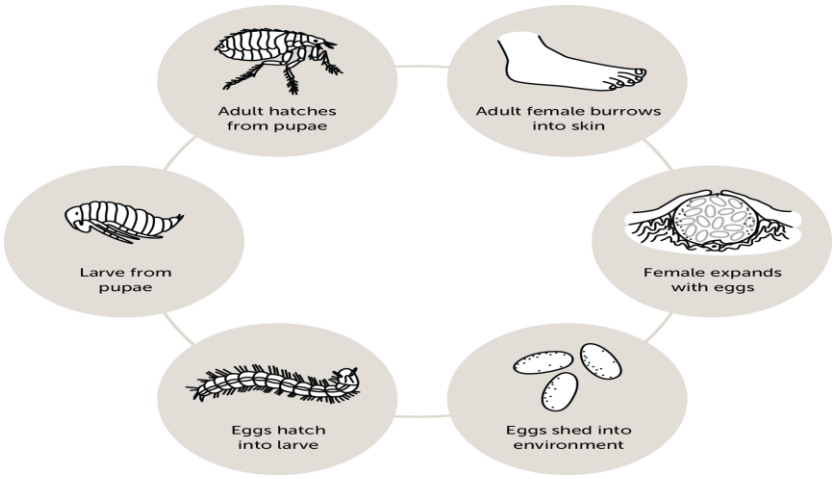

Fig. 1. Life cycle of a Tungiasis (Give feet a fighting chance – Kenyan Children's Project)

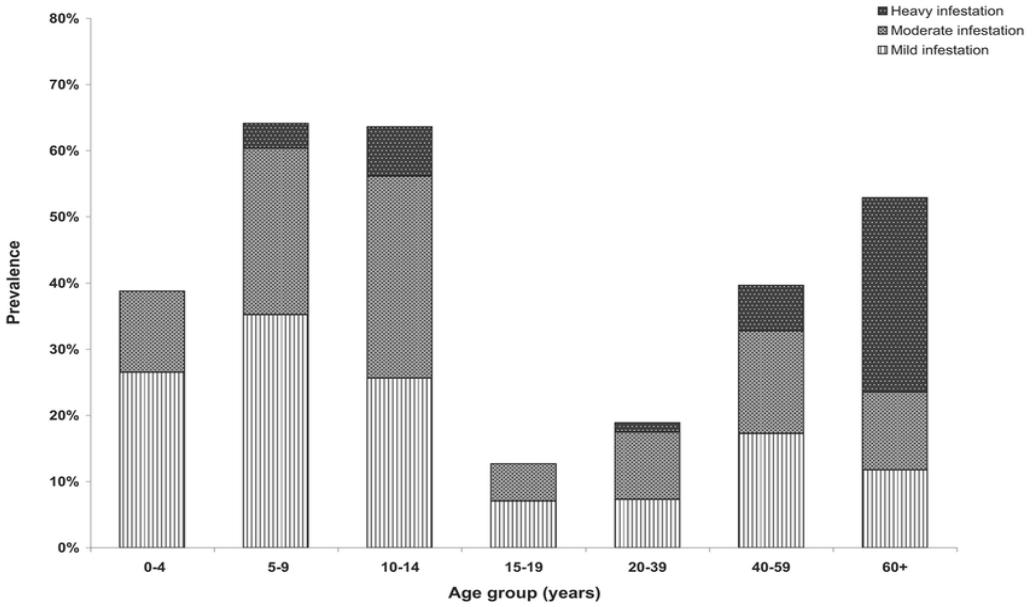

Fig. 2. Prevalence of tungiasis stratified by age group and severity of infestation

4. PUBLIC HEALTH EFFORTS TO ERADICATE TUNGIASIS IN MURANGA COUNTY, KENYA

"The effects of Tungiasis have been felt by two levels of population. In endemic communities' children (aged 5–14 years), and older people (60 years old and above) are most affected. The prevalence has also shown to grow to 85% in these groups compared with 50% in the general population" [8]. The research done and reported by Ahadi Kenya, a non-governmental organization has estimated that 2.6 million Kenyans (about 4.8% of the total population) had the condition, over 10 million (18.5% of the total population) are at risk of getting the condition and another 265 were reported to have lost their lives reported due to tungiasis, possibly because of complications from blood poisoning (septicemia) or tetanus. So far, there is no drug treatment that has been found to be effective against burrowed sand fleas in humans [9] and so prevention is therefore the only available means to control morbidity. However, in resource-poor communities, this method is frequently done using unsafe procedures as a quicker mechanical treatment of tungiasis by immediately removing the embedded fleas using sharp pointed objects which destroys the flea before laying eggs and thus breaking the life cycle and to prevent secondary infections.

"Sometimes involving sharing of sharp instruments such as pins, needles, thorns, and sharpened wood pieces to extract the flea, often leading to bacterial superinfections, increased inflammatory response, and potential transmission of viral pathogens such as HIV, hepatitis B, and hepatitis C" [10]. This has been a traditional practice since the days of old and even though still encouraged by the public health to be carried out in masses in schools within the affected counties, this can encourage the spreading of blood related diseases such as HIV and hepatitis due to the usage of contaminated sharp objects among these children/pupils.

"Another public health effort to prevent against Tungiasis is control by regular use of closed footwear. This is believed to be protective against tungiasis because shoes can prevent infestation and re-infestation of feet by fleas from the ground or from one person to another. The shoe program is important however the exposure frequently happens inside houses where shoes are not usually worn. Shoes are also considered an asset and very expensive especially for a poor and struggling family and therefore will often not be used in schools, for walks, or playing around the house. Shoes tend to perish rapidly, and sand fleas can easily reach the skin through cracks and holes" [11].

"The parasiticides such as oral thiabendazole and ivermectin, and topical benzyl benzoate and disinfectant (e.g., hydrogen peroxide), have been used to investigate the treatment of tungiasis in non-randomized, non-regulated studies which showed comparatively little convincing information available on their protection or efficacy. Additionally, to our understanding, there has been no methodical synthesis of proof on randomized controlled trials (RCTs) exploring tungiasis preventive and treatment interventions so far" [12]. "These findings confirm the presence of resistant bacteria in tungiasis lesions hence highlighting the significance of secondary infection of the lesions in endemic communities. This therefore implies that the research for treating regimen for tungiasis especially in severe cases should be expanded to include antibiotics. Antimicrobial susceptibility testing may be considered to guide in identification of appropriate antibiotics. Norfloxacin and gentamicin have shown to be very effective against both Gram negative and Gram-positive bacteria. In severe tungiasis where sepsis is observed, a broad-spectrum drug may be considered at the onset to avoid delay in starting treatment as results from cultures are awaited" [13]. To eradicate tungiasis within the rural population of Muranga County, various public health efforts are essential;

4.1 Awareness Campaigns and Education

One of the primary strategies to combat tungiasis in Muranga County is through awareness campaigns and education. Public health officials can work with local community leaders, schools, and healthcare providers to educate the population about the causes of tungiasis, its symptoms, and preventive measures [14]. By raising awareness about the importance of personal hygiene, wearing protective footwear, and seeking treatment early, the spread of tungiasis can be significantly reduced.

4.2 Provision of Treatment and Healthcare Services

Another crucial aspect of eradicating tungiasis in Muranga County is ensuring access to treatment and healthcare services. This includes providing affected individuals with medical care to remove the embedded sand fleas safely and treat any resulting infections [15]. Health facilities in the region should be equipped with the necessary supplies and trained personnel to manage tungiasis cases effectively [16].

4.3 Environmental Sanitation

Improving environmental sanitation is vital in preventing tungiasis infestations. Public health authorities can collaborate with local authorities and communities to implement measures such as regular cleaning of living spaces, proper waste disposal, and maintaining clean water sources. By reducing the breeding grounds for sand fleas, the risk of tungiasis transmission can be minimized [17].

4.4 Community Engagement and Empowerment

Engaging with the local community and empowering individuals to take ownership of their health is key to eradicating tungiasis in Muranga County [18]. Community health workers can play a significant role in conducting door-to-door screenings, providing health education sessions, and encouraging community members to adopt preventive behaviors. Empowering individuals to protect themselves against tungiasis can lead to sustainable long-term results. The challenge lies

in ensuring that community views are responded to by the health system [19].

4.5 Monitoring and Evaluation

Regular monitoring and evaluation of public health interventions are essential to assess the progress made in eradicating tungiasis in Muranga County. By collecting data on disease prevalence, treatment coverage, and community engagement levels, public health officials can identify areas that require additional attention and adjust their strategies accordingly [20]. The recommendations will also help the victims and community which has frequently mentioned withdrawal tactics and engaged in refutation strategies to deny responsibility for their condition [21].

4.6 Diagnosis, Treatment and Prevention

Early diagnosis and treatment of tungiasis are crucial to prevent severe health complications. The assessment reviews the available diagnostic tools, treatment options, and prevention strategies for tungiasis. It also highlights the challenges faced in implementing effective control measures in resource-limited settings [22]. Some victims have been branded with curses and witchcraft as the reason why they suffer from tungiasis. Sufferers of severe infestations were stereotyped as lazy and unhygienic, and as possessing “jigger-attracting blood.” Both physical deformity and moral stigma were associated with tungiasis [23].

5. CONCLUSION, RECOMMENDATIONS AND FUTURE DIRECTIONS

5.1 Conclusion

In conclusion, tungiasis (jiggers’ infestation) presents substantial health challenges to the rural population of Muranga County in Kenya. The study emphasizes the need for a multi-sectoral approach to address this public health issue, with a focus on education, prevention, and treatment. Based on the findings of the comprehensive health assessment, the assessment provides recommendations for improving the diagnosis, treatment, and prevention of tungiasis in Muranga County. It emphasizes the need for intersectoral collaboration, community engagement, and sustainable funding to address the burden of tungiasis and improve the health and well-being of rural vulnerable populations. As we have learnt and studied that Tungiasis disproportionately affects the elderly, homeless, displaced people, and is more common among the impoverished communities. The present scrutiny has identified some of the key issues as well as emerging opportunities to control and eliminate tungiasis successfully in the future.

5.2 Recommendations

The problem of jigger infestation is not merely a medical issue. As much as a medical intervention is needed, it is also a public health issue that requires an approach that addresses the underlying factors influencing jigger infestation with the goal of prevention. Clearly, jigger infestation is influenced by sociodemographic characteristics such as age, level of education, geographical location and environment and socio-economic status. There should be;

1. Multi-sectorial approach may be the most appropriate way to address each of the core factors such as poor housing, illiteracy, age, and geographical locations.
2. Community partnership with health sector’s wide approach for permanent health remedy, such as

    i. Means and ways to increase income to household,
    ii. Capacity building of community via health education and promotion using appropriate technology which can be done through the ministry of health in Kenya and by pulling together resources to help the poor community.
    iii. Resources can be pulled together by the government and non-governmental organizations supporting rural and community health to help the affected families and individuals especially where majority (80%) of infestation are due to enhanced poverty, going to school bare feet, live in grass thatched or uncemented floors, rarely smeared with cow dung.

3. Exploring other effective ways of treating tungiasis without actual mechanical removal, such as washing with disinfectant, topographic application of anti-parasitic agents, use of anti-inflammatory creams and use of repellants should be preferred. In areas with Tungiasis prevalence, endemic settings, a One Health approach, integrating public

health, animal health, biological and entomological sciences, and the environment, is likely to be an effective measure to control tungiasis. However, this approach would require a comprehensive process involving;

i. Integrated preventive and treatment measures for humans who are infected and infected animals;
ii. Public health education and training, focusing on tungiasis prevention and control; and
iii. Improving environmental risk factors and reducing the number of parasites in off-host stages.

4. The elimination cannot be achieved without environmental interventions, use of repellants, vaccines and ultimately a fight against poverty. A multidisciplinary approach is needed to understand and sustainably resolve the problems. Important disciplines for this public health endeavor are epidemiology, sociology, and ethics.
5. The above recommendations can only be achieved through a united workforce of the government's ministry of health and ministry of education, through a set board that will specifically address the issue of tungiasis/jigger infestation. There is also a need for donor funding.

5.3 Future Directions

The rapid assessment method is one of the best strategies to estimate the prevalence and to identify the risk population. It can be extremely useful to plan as well as monitor the tungiasis prevention and control interventions strategies effectively. The appropriate tungiasis control policy needs to be tailored according to the local conditions, and this scrutiny recommends the following as regional, national, and international agendas concerning tungiasis control priorities:

- In the tungiasis endemic settings, the major risk factors must be identified.
- Since deficient sanitation is a significant risk factor, it must be addressed by providing appropriate urban services like paved road, electricity, water supply, and healthcare facilities.
- Free supply of skin disinfectant and hypodermic needles with proper health education to remove the sand fleas at the initial stage.
- Since poverty is one of the major driving forces for prevalence of tungiasis in the endemic settings, poverty alleviation programs must be initiated not only to minimize the burden of tungiasis but also other poverty-associated parasitic and infectious diseases.
- Besides, it could also pave the way to enhance the socioeconomic and health status of the marginalized population of the society considerably.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. Heukelbach J, Harvey TV, Calheiros CML. Tunga Spp, Tungiasis in Latin America. In: Mehlhorn H, Heukelbach J. (eds) Infectious Tropical Diseases and One Health in Latin America. Parasitology Research Monographs. Springer, Cham. 2022;16. Available:https://doi.org/10.1007/978-3-030-99712-0_8
2. Heukelbach J. Tungiasis. Revista do Instituto de Medicina Tropical de São Paulo. 2005;47(6):307-313.
3. Kaimbo DKW, Bifuko A, Parys-Van Ginderdeuren R. Upper eyelid localisation of Tunga penetrans. Ophthalmologica. 2007;221(6):439-442.
4. Heukelbach J, De Oliveira FAS, Hesse G, Feldmeier H. Tungiasis: A neglected health problem of poor communities. Tropical Medicine & International Health. 2001; 6(4):267-272.
5. Oluwasola OO, Olufemi OO. Epidemiology of tungiasis in sub-Saharan Africa: a systematic review and meta-analysis, Pathogens and Global Health. 2020; 114(7):360-369. DOI:10.1080/20477724.2020.1813489
6. Wambani Z, Nyamari J, Kimani H. Environmental Factors Predisposing Rural Community Members to Tungiasis in Murang'a East Sub County, Murang'a County. Journal of Health, Medicine and Nursing. 2018;3(2):90-97.
7. Elson L, Nyawa SM, Matharu A. et al. Developing low-cost house floors to control tungiasis in Kenya – A feasibility

study. BMC Public Health. 2023;23: 2483.
Available:https://doi.org/10.1186/s12889-023-17427-4
8. Ugbomoiko US, Ofoezie IE, Heukelbach J. Tungiasis: high prevalence, parasite load, and morbidity in a rural community in Lagos State, Nigeria. International Journal of Dermatology. 2007;46(5):475-481.
9. Heukelbach J, Franck S, Feldmeier H. Therapy of tungiasis: A double-blinded randomized controlled trial with oral ivermectin. Memórias do Instituto Oswaldo Cruz. 2004;99(8):873-876.
10. Mwangi JN, Ozwara HS, Gicheru MM. Epidemiology of tunga penetrans infestation in selected areas in Kiharu constituency, Murang'a County, Kenya. Tropical Diseases, Travel Medicine and Vaccines. 2015;1(1):1-6.
11. Feldmeier H, Heukelbach J, Ugbomoiko US, Sentongo E, Mbabazi P, von Samson-Himmelstjerna G, International Expert Group for Tungiasis. Tungiasis—a neglected disease with many challenges for global public health. PLoS Neglected Tropical Diseases. 2014;8(10):e3133.
12. Abrha S, Heukelbach J, Peterson GM, Christenson JK, Carroll S, Kosari S, Thomas J. Clinical interventions for tungiasis (sand flea disease): A systematic review. The Lancet Infectious Diseases. 2021;21(8):e234-e245.
13. Nyangacha RM, Odongo D, Oyieke F, Ochwoto M, Korir R, Ngetich RK, Tolo F. Secondary bacterial infections and antibiotic resistance among tungiasis patients in Western, Kenya. PLoS Neglected Tropical Diseases. 2017;11(9) :e0005901.
14. O'Meara WP, Tsofa B, Molyneux S, Goodman C, McKenzie FE. Community and facility-level engagement in planning and budgeting for the government health sector–A district perspective from Kenya. Health Policy. 2011;99(3):234-243.
15. Elson L, Kamau C, Koech S. et al. National prevalence and risk factors for tungiasis in Kenya. Infect Dis Poverty. 2023;12:85.
Available:https://doi.org/10.1186/s40249-023-01131-x
16. Mørkve ÅW, Sitienei J, Van den Bergh G. A qualitative case study of community experiences with Tungiasis in high prevalence villages of Bungoma County, Kenya: The whole-body aches and the jiggers are torturing me!. PLoS Negl Trop Dis. 2023;17(4):e0011304.
Available:https://doi.org/10.1371/journal.pntd.0011304
17. Mwai J, Abdi MH, Githinji E. Factors Associated with Tungiasis Infestation among School age Children in Ugenya Sub-County, Siaya County, Kenya. African Journal of Health Sciences. 2020;*33*(4):80-91.
18. Gitau AK, Oyieke FO, Richard W. Assessment of tungiasis management knowledge in Kandara sub county, Kenya; 2021.
19. Kimotho S, Miller AN, Ngure P. Managing communication surrounding tungiasis stigma in Kenya. Communicatio. 2015; 41(4):523-542.
20. Kimotho S, Miller A. Stigmatizing beliefs, stereotypes and communication surrounding tungiasis in Kenya. 2016.
21. Karunamoorthi K. Tungiasis: A neglected epidermal parasitic skin disease of marginalized populations—a call for global science and policy. Parasitology Research. 2013;112(10):3635-3643.
22. Kamau TM, Ngechu RN, Haile ZT, Mwitari J. An exploration of factors associated with jigger infestation (Tungiasis) among residents of Muranga North District, Kenya. International Journal of Health Sciences and Research. 2014;4(3):1-8.
23. Wanzala M, Silali MB. Factors influencing prevention of Tungiasis infestation in Tshiatsala division of Butere Sub County–Kenya. SMU Medical Journal. 2016;3(1): 410-431.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/113998