

Review

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Review

# One Health Scoping Review of the Epidemiology of Human Fascioliasis across Africa for the Period 2000–2022

Moses Adriko <sup>1,2,3,\*</sup>, Edridah M.Tukahebwa <sup>2</sup>, Miph B. Musoke <sup>3</sup>, David Muwanguzi <sup>4</sup>, Stellah Nambuya <sup>5,6</sup>, Patrick Vudriko <sup>6,7</sup>, Kalinda Chester <sup>8</sup>, Samson Mukaratirwa <sup>9,10</sup>, Moses J.Chimbari <sup>11</sup>, Anna-Sofie Stensgaard <sup>12</sup>, Birgitte Vennervald <sup>12</sup> and Lawrence Mugisha <sup>7</sup>

<sup>1</sup> Ministry of Health, Plot 6 Laudel Road, Nakasero, P.O Box 7272, Kampala, Uganda

<sup>2</sup> Vector Borne & NTD Control Division, Plot15 Bombo Road, P.O Box 1661, Kampala, Uganda

<sup>3</sup> NkumbaUniversity (NU), School of Sciences, Nkumba University-Main Campus, Entebbe, P.O. Box 237, Entebbe, Uganda

<sup>4</sup> One Health Division, Department for National Disease Control & Prevention, Ministry of Health, Plot 6 Laudel Road, Nakasero, P.O Box 7272, Kampala, Uganda

<sup>5</sup> National Animal Genetic Resource Centre and Data Bank, Plot 96-108, Nsamizi Road, P.O. BOX 183, Entebbe, Uganda

<sup>6</sup> Research Centre for Tropical Diseases and Vector Control (RTC), Department of Veterinary Pharmacy, Clinic and Comparative Medicine, School of Veterinary Medicine and Animal Resources, College of Veterinary Medicine, Animal Resources and Biosecurity, Makerere University, P.O. Box 7062, Kampala, Uganda

<sup>7</sup> Department of Wildlife and Aquatic Resources, School of Veterinary Medicine and Animal Resources, College of Veterinary Medicine, Animal Resources and Biosecurity, Makerere University, P.O. Box 7062, Kampala, Uganda

<sup>8</sup> University of Global Health Equity (UGHE), Kigali Heights, Plot 772. KG 7 Ave., 5th Floor, P.O. Box 6955

<sup>9</sup> Department of Public Health, College of Health Sciences, School of Nursing and Public Health, University of Kwazulu-Natal, Durban, South Africa

<sup>10</sup> Ross University School of Veterinary Medicine (RUSVM), One Health Center for Zoonoses and Tropical Veterinary Medicine, Ross University School of Veterinary Medicine PO Box 334 Basseterre St Kitts

<sup>11</sup> University of KwaZulu-Natal (UKZN), Durban, Westville, Pinetown and Pietermaritzburg, KwaZulu-Natal, South Africa

<sup>12</sup> University of Copenhagen, Nørregade 10, 1172 København, Denmark

\* Correspondence: adrikomoses@gmail.com; Tel.: +256-778939303

**Abstract: (1)Background:** Fascioliasis is considered a neglected tropical disease affecting an estimated 17 million people in more than 70 countries worldwide. The highest prevalence of human fascioliasis is found in regions where livestock farming and consumption of raw or undercooked freshwater plants are common, such as parts of Africa, Asia, Europe, and Latin America. It is responsible for over 90,000 disability-adjusted years of life due to associated abdominal complications. We conducted a study to investigate the prevalence of human fascioliasis through a systematic review and meta-analysis of all available literature in Sun-Saharan Africa. **(2). Methods:** We screened a total of 126 publications using pubmed online search engine databases; Web of Science and CAB for articles published within a 20-year period between 2000 and 2022. We used a comprehensive search method using a combination of terms, parasite and disease names. The initial search resulted in a screening of articles by title, abstracts and full texts. The relevant information on the prevalence of human fascioliasis in Africa was extracted. Of the 126 publications, 33 articles were selected for meta-analysis. The essential information required was extracted from these documents and determined through statistical analysis in Microsoft Excel for calculating the prevalence of human fascioliasis in sub-Saharan Africa. The variance of each study was assessed using a bimodal distribution and heterogeneity assessment using a I2 index. Analysis was performed using random effects models. **(3)Results:** A total of 271 articles were searched through the database search and 33 articles were eligible studies that provided qualitative information on the prevalence of human fascioliasis in Africa. These make up 12.17% (n=33). The pooled prevalence estimates for human fascioliasis are 0.032% (IVhet PPE: 0.032% (95%CI 1.4-6.53). The highest prevalence rate was observed in Egypt with a prevalence of 100%. The prevalence of human fascioliasis is very high in some sub-Saharan

countries, partly due to neglect of diagnostics, demonstrating the bias of available information for decision-making in human fascioliasis across Africa, given the spatial presence, scarcity and incompleteness are region.(4)**Conclusions:** The prevalence of Human fascioliasis is very high in some Sub-Saharan Countries partly due to neglect in diagnostics. This presents how highly focal with spatial occurrences, scarcity and patchy the available information for decision making is on Human fascioliasis across the Sub-Saharan African region.

**Keywords:** human-fascioliasis; prevalence; epidemiology; africa; one-health

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### The Scoping Review and Analysis Has Observed the Following Strengths and Limitations

The rigorous and comprehensiveness search methodology of existing studies provided large datasets for standardized statistical pool analysis where a robust conclusion was drawn.

The review highlighted the current burden of fascioliasis in humans in Africa.

There is increased generalizability as datasets were derived from a collection of multiple African countries and longer identification of trends over time (2000-2022). This increased the statistical power and reduced bias.

There shortcomings to this review by the impossibility of disaggregating the datasets relating to sample sizes, diagnostic methods, data scarcity from African Countries, heterogeneity due to environmental, cultural and socioeconomic factors of the disease that affect drawing conclusions.

### Introduction

Fascioliasis is a parasitic zoonosis caused by liver flukes of the genus *Fasciola* that infects both humans and ruminants worldwide [1–3]. Human fascioliasis infection causes significant liver obstruction and biliary inflammation in affected patients [1–3]. The disease occurs in travelers and immigrants from endemic areas and in sporadic outbreaks due to environmental or social changes. Worldwide, over 17 million people are infected and 180 million are at risk of infection, from over 70 countries including Europe, Asia, Africa, Oceania and the Americas worldwide [1–3]. The global burden is underestimated due to the lack of reliable diagnostic tools and monitoring systems as well as low awareness and recognition among health professionals and the general public [4–6]. This parasite has a complex life cycle involving an intermediate host of the family Lymnaeidae [1–3], an aquatic freshwater plant that acts as a carrier, and a mammalian host like Sheep, goats, cattle and humans [1–3]. The infection is responsible for the development of symptoms such as urticaria, eosinophilia and malaise and can also lead to chronic diseases in humans and ruminants [1–3]. Human fascioliasis infections are becoming a neglected zoonotic disease across Africa [1–3] and are responsible for over 90,000 disability adjusted life years (DALYS) lost associated abdominal complications [1–3].

The prevalence of human fascioliasis infections has been reported in over 17 African countries, including Algeria [7], Angola [7], Cape Verde Islands [7], Chad, Egypt, Ethiopia, Djibouti [7], Ghana [7], Libya [8], 1998), Morocco [8], Nigeria, Senegal [9], South Africa [10], Swaziland [10], Tunisia [11], the United Republic Tanzania [12] and Zimbabwe [13] in Africa [1–3], which negatively affects the good health of the human and animal population [14]. The Epidemiology of fascioliasis depends on the intermediate host snails of the family Lymnaeidae. Diagnosis relies on a number of techniques; using the standard sedimentation method of stool samples for egg concentration, followed by microscopy [15], coproantigen testing using stool samples [16] and antibody detection in blood serum using ELISA [17,18], meat inspections [19] through morphological identification of the adult *Fasciola* parasites with *F. gigantica* with a typical, leaf-shaped, dorsoventrally flattened, longer, narrower body of 28–52mm, while *F. hepatica* is significantly shorter at 12–29mm [20,21]. PCR-based tools provide the best molecular markers for diagnosing and distinguishing the two types of *Fasciola* infections [22–24] in Lymnaeid Snails [25].

The prevention and control of fascioliasis in both animals and humans depends heavily on the use of antihelmintic, with the following approved for regular deworming of animals: triclabendazole, closantel or nitroxylin and the use of triclabendazole in both chronic and acute forms of human infections [26,27]. In addition, health education campaigns aimed at empowering farmers to practice animal hygiene and ensure regular deworming are crucial, alongside established surveillance systems to detect, monitor and report outbreaks. Freshwater snails of the Lymnaeid group play an important role in the maintenance and transmission of fascioliasis [25,28], which has a significant economic impact [29] and biomedical burden [13] worldwide, especially in bovine fascioliasis [30,31]. The transmission potentials are favored by the local tolerance of Lymnaeid snails [32], which therefore requires a precise localization of their epidemiological distribution and identification, which is crucial to combat the infections.

In animals, the infection tends to show a notable reduction in milk production as well as weak reproductive rates [33] with significant associated costs of treatment and meat condemnation, which represent a very large economic loss to the farmer [34–36]. While human infections are reported as symptomatic, more non-specific symptoms such as fever, abdominal pain, diarrhea and nausea are reported in individuals during the acute or chronic form of the infections [37,38]. Many studies have documented the prevalence of the infection in domestic and wild populations throughout Africa [39]. However, there is little data on its prevalence in humans across the African region.

## Methods and Methods

This study aimed to investigate the prevalence of human fascioliasis through a systematic review and meta-analysis of all available literature in the African region during 2000–2022. The primary outcome of the systematic review and meta-analysis should be available datasets on the prevalence of human fascioliasis in Africa. Secondary outcomes included reviewing available diagnostic methods to estimate the prevalence of infections across the African region.

**Information sources and searching approach:** A systematic review was performed with the objective of mapping out all the relevant literature needed for the study on Human fascioliasis and intermediate vector snails across Africa. All the publications relevant over 20 year period between 2000–2022 were searched using the databases from pubmed, web of science and CAB. The study conducted an online search using the following words “fascioliasis,” “human fascioliasis,” “zoonosis,” “Fasciola liverfluke,” “Fasciola hepatica,” “Fasciola gigantica,” “human fascioliasis epidemiology,” “human fascioliasis distribution,” “research trends in “human fascioliasis,” and “fascioliasis outbreaks in Africa”

**Study Materials and Eligibility:** All the datasets required for this review were generated from the various databases and later merged into a single one. This helped remove and eliminate duplicate downloads from the records. The reviews were sorted by title and abstract. All articles that focused on non-human fascioliasis and Lymnaeid datasets will be removed from the analysis. The full texts of the remaining study texts follow the admission criteria. The following criteria were used to exclude the reviewed studies:

Reporting parasites other than *F.gigantica* or *F.hepatica* across Africa.

Duplicate datasets were removed from the analysis.

All of these followed the PRISMA guideline for reporting systematic and meta-analysis reviews as previously described [40].

**Data processing and quality assessments:** All retrieved articles were classified based on the following characteristics: study period, population, prevalence, diagnostics used, observed outcomes, and risk factors associated with human fascioliasis. While species identified in the Lymnaeid snails are included in the study, the numbers infected with *Fasciola* infections are checked. This study also considered article publication years for impact factor and index citations. All records were entered into preformatted tables. The study also conducted quality assessments for all population-based human fascioliasis surveys using the Prevalence Critical Appraisal Tool [41].

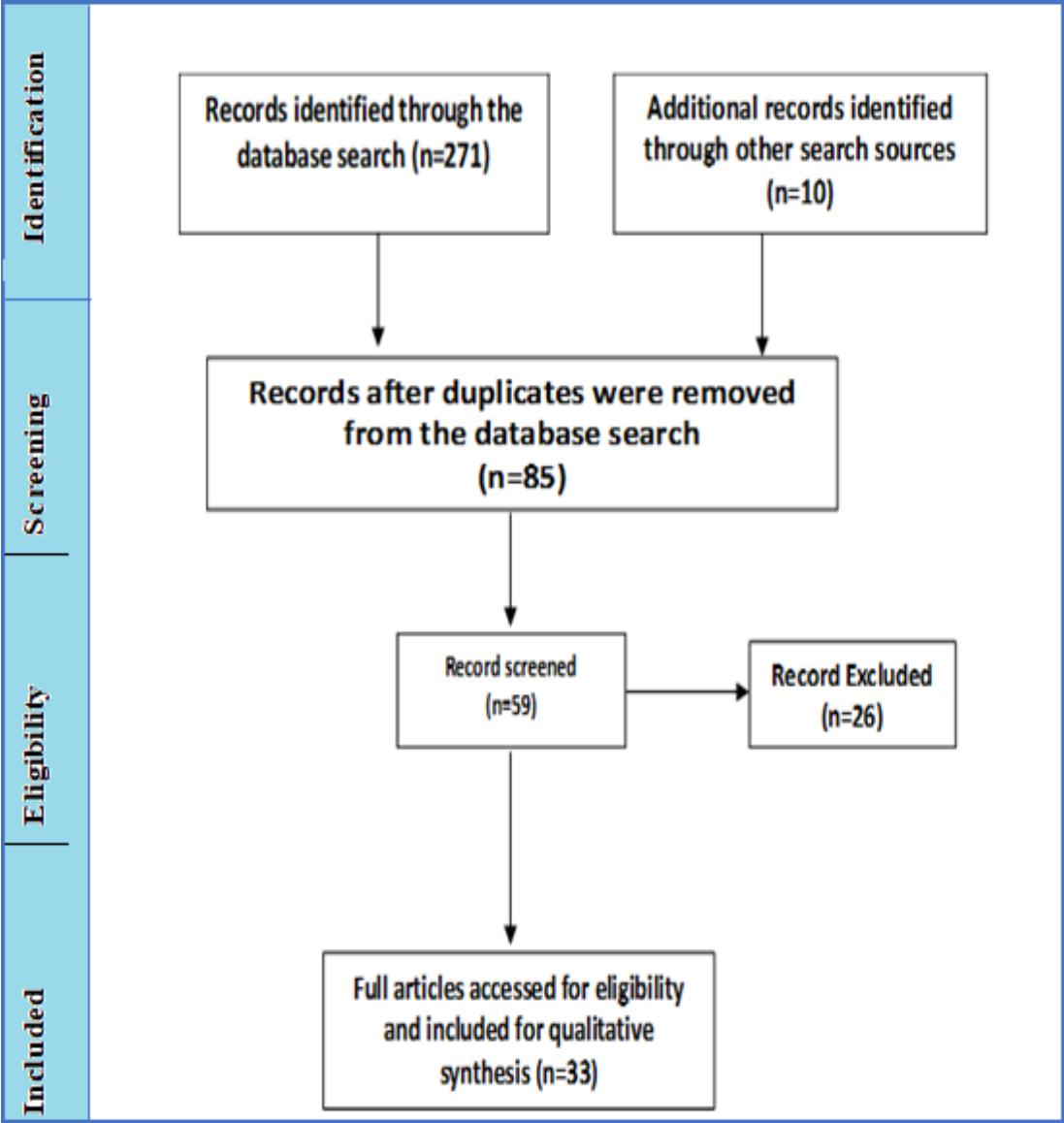
**Summary measures and synthesis of results:** The study examined a total of 126 publications. All populations based on the studies were screened for a descriptive analysis of the populations infected with human fascioliasis to determine the proportion of infected individuals. The magnitude of

significance associations was determined using Wilson's score at 95%CI for subjects infected with fascioliasis. We performed chi-square tests to determine associations between risk factors for fascioliasis infections in humans and their presence. Odds ratios and associated Wilsons score at 95%CI were also determined.

## Results

A total of 271 articles were searched through the database search. An additional 10 records were identified from other sources and 33 articles were eligible studies that provided qualitative information on the prevalence of human fascioliasis in Africa (Figure 1). After duplicate records were deleted from the system database, a total of 85 records were retained and subjected to a further verification process. At this point, we determined that 26 datasets were ineligible based on the exclusion criteria and were excluded from the final qualitative review and analysis. The final database contained a total of 33 articles that were considered for further synthesis. In total, a total of 33 (n=33) articles were included for full review in the systematic and meta-analytic review of human fascioliasis. Of 26 (n=26) studies, 78.8% were from Egypt, seven were from Nigeria (n=07), which 21.2%, while a single study was conducted in the remaining countries where studies on human fascioliasis were conducted including Angola (n=01), Ethiopia (n=01), Ghana (n=01), South Africa (n=01), Tanzania (n=01) and Tunisia (n=01).





**Figure 1.** Showing PRISMA Flow of Study Selection. Studies were assessed using a 10-point Quality Index scorecard (Qi). Results were rated on a scale of 1-4 as low, 5-6 as moderate and 7-10 as high. The final analysis revealed that 9 studies from Egypt (n=06), Nigeria (n=02) and Tunisia (n=01) were rated as high. The majority (n=20) of studies from Egypt (n=14), Nigeria (n=02), South Africa (n=03) were rated as low and thirteen from Angola (n=01) were rated as moderate. Egypt (n=06), Ethiopia (n=01), Ghana (n=01), Nigeria (n=01) and Tanzania (n=01).

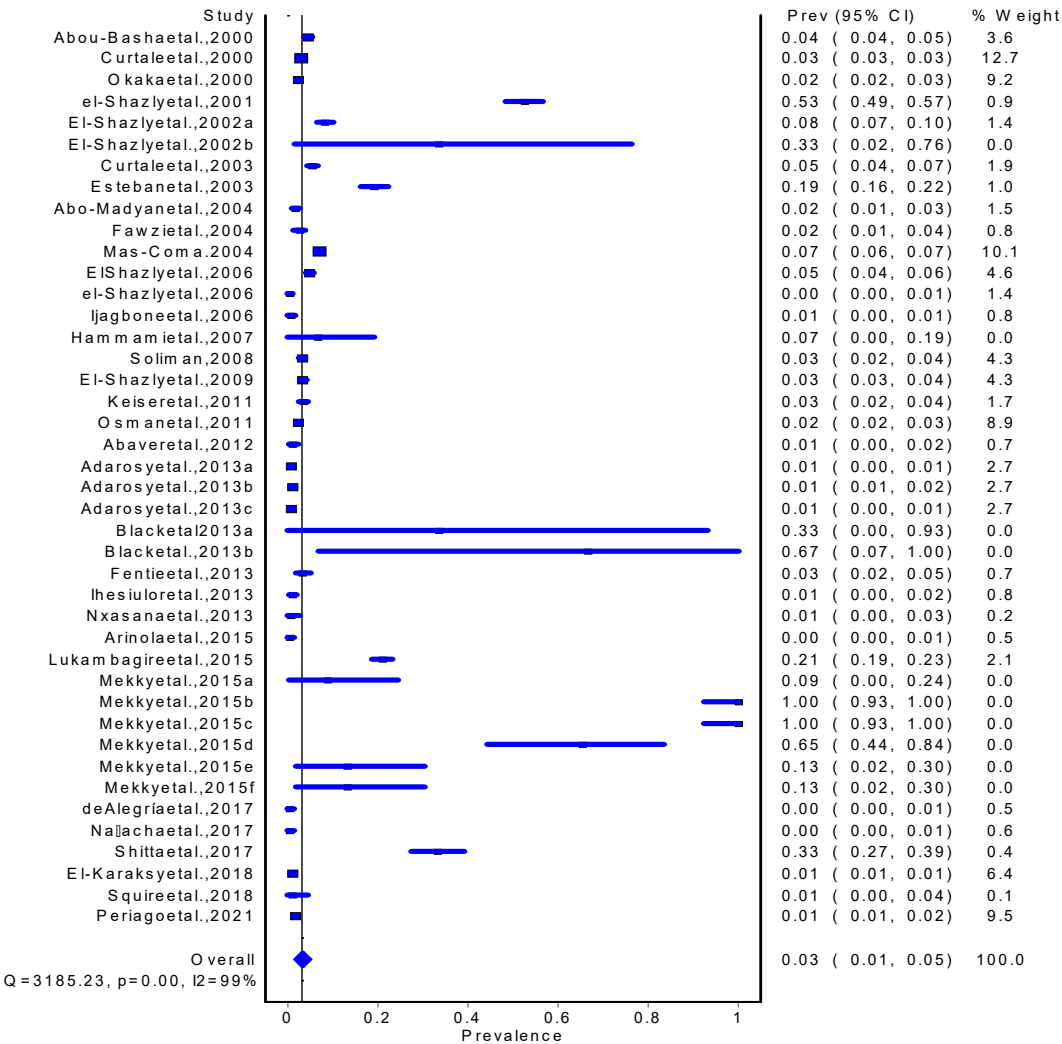
**Table 1.** Showing characteristics of the Studies included in the Qi Analysis on human Fascioliasis across Africa 2000-2022.

Author Name	Sample Size & (%)	Country	Year	Article type	%QiEvaluation	Citation
Abaver et al.,2012	480(1.04)	Nigeria	2012	Clinical Reviews	50.0 low	[42]
Abo-Madyan et al.,2004	1,019(1.67)	Egypt	2004	clinical trial	50.0 low	[43]
Abou-Basha et al.,2000	2,492(4.45)	Egypt	2000	Clinical Reviews	40.0 low	[44]
Adarosy et al.,2013a	1,868(0.59)	Egypt	2013	clinical trial	30.0 low	[45]

Adarosy et al.,2013b	1,868(1.07)	Egypt	2013	clinical trial	30.0 low	[45]
Adarosy et al.,2013c	1,868(0.75)	Egypt	2013	clinical trial	30.0 low	[45]
Arinola et al.,2015	349(0.29)	Nigeria	2015	Impact Evaluation	37.5 high	[46]
Black et al. 2013a	3(33.33)	South Africa	2013	Case report article	30.0 low	[47]
Black et al.,2013b	3(66.67)	South Africa	2013	Case report article	30.0 low	[47]
Curtale et al.,2000	8,854(2.88)	Egypt	2000	Parasitological Reviews	62.5 moderate	[48]
Curtale et al.,2003	1,331(5.41)	Egypt	2003	Crossectional Survey	80.0 low	[49]
de Alegria et al.,2017	372(0.27)	Angola	2017	Crossectional Survey	100.0 moderate	[50]
El Shazly et al.,2006	3,180(4.78)	Egypt	2006	Parasitological Survey	12.5 high	[51]
El-Karakasy et al.,2018	4,475(0.85)	Egypt	2018	Clinical Reviews	37.5 high	[52]
el-Shazly et al.,2001	605(52.56)	Egypt	2001	clinical trial	37.5 moderate	[53]
El-Shazly et al.,2002a	1,000(8.20)	Egypt	2002	Serological Evaluation	50.0 moderate	[54]
El-Shazly et al.,2002b	6(33.33)	Egypt	2002	Rectal Biospy	50.0 moderate	[55]
el-Shazly et al.,2006	1,000(0.40)	Egypt	2006	Clinical Reviews	37.5 low	[54]
El-Shazly et al.,2009	3,000(3.27)	Egypt	2009	Clinical Reviews	33.3 low	[53]
Esteban et al.,2003	678(19.03)	Egypt	2003	Clinical Reviews	70.0 low	[56]
Fawzi et al.,2004	575(2.43)	Egypt	2004	Public Health Reviews	55.6 moderate	[57]
Fawzi et al.,2004	575	Egypt	2004	Crossectional Survey	50.0 high	[57]
Fentie et al.,2013	520(3.27)	Ethiopia	2013	Crossectional Survey	90.0 moderate	[58]
Hammami et al.,2007	30(6.67)	Tunisia	2007	Crossectional Survey	25.0 high	[59]
Ihesiulor et al.,2013	570(0.88)	Nigeria	2013	Parasitological Reviews	37.5 moderate	[60]
Ijagbone et al.,2006	533(0.56)	Nigeria	2006	Parasitological Survey	44.4 moderate	[61]
Keiser et al.,2011	1,215(3.37)	Egypt	2011	clinical trial	62.5 moderate	[62]
Lukambagire et al.,2015	1,460(20.89)	Tanzania	2015	Crossectional Survey	55.6 moderate	[12]
Mas-Coma.2004	7,071(6.84)	Africa	2004	research article	30.0 low	[39]
Mekky et al.,2015a	23(8.70)	Egypt	2015	research article	25.0 low	[63]
Mekky et al.,2015b	23(100)	Egypt	2015	research article	80.0 high	[63]
Mekky et al.,2015c	23(100)	Egypt	2015	research article	80.0 high	[63]
Mekky et al.,2015d	23(65.22)	Egypt	2015	research article	80.0 high	[63]
Mekky et al.,2015e	23(13.04)	Egypt	2015	research article	37.5 low	[63]
Mekky et al.,2015f	23(13.04)	Egypt	2015	research article	37.5 low	[63]
Na'acha et al.,2017	438(0.46)	Nigeria	2017	Crossectional Survey	50.0 high	[64]
Nxasana et al.,2013	162(0.62)	South Africa	2013	Crossectional Survey	87.5 low	[65]
Okaka et al.,2000	6,430(2.32)	Nigeria	2000	Public Health Reviews	25.0 moderate	[66]
Osman et al.,2011	6,214(2.29)	Egypt	2011	Impact Evaluation	62.5 low	[67]

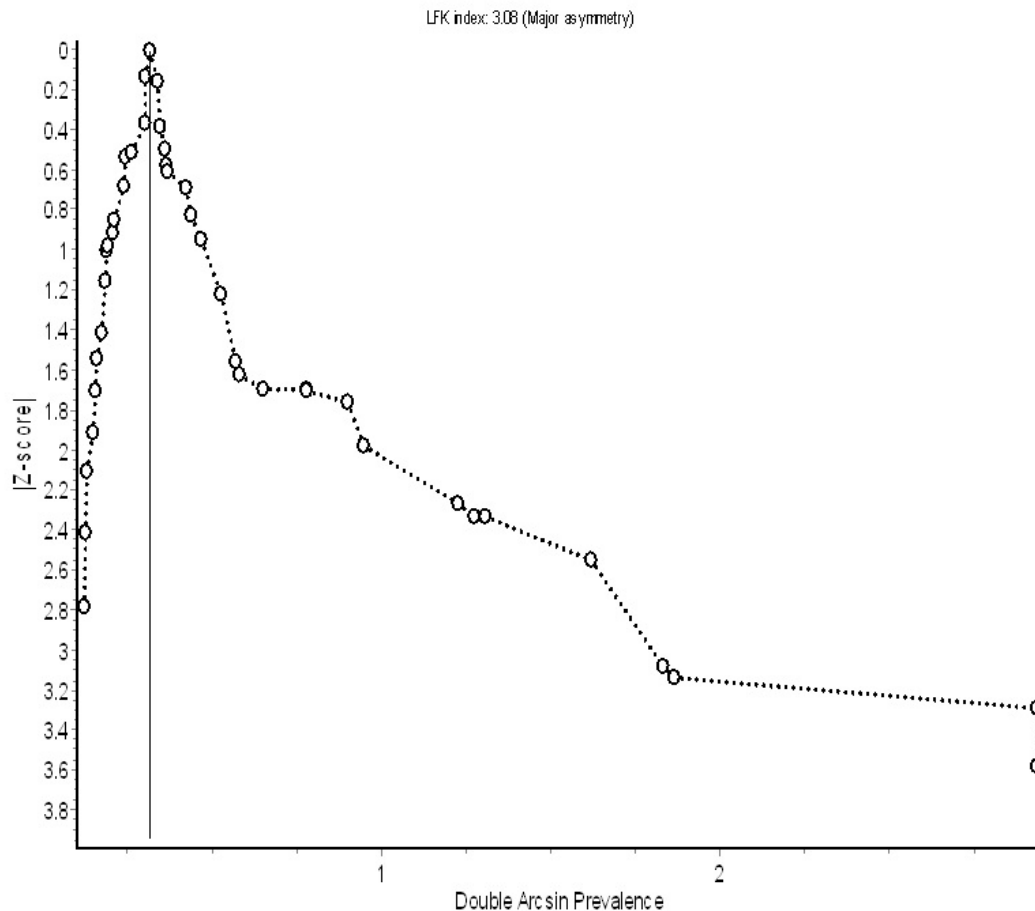
Periago et al.,2021	6,657(1.44)	Egypt	2021	Crossectional Survey	12.5 high	[68]
Shitta et al.,2017	254(33.07)	Nigeria	2017	Crossectional Survey	50.0 low	[69]
Soliman,2008	3,000(3.0)	Egypt	2008	research article	30.0 low	[70]
Squire et al.,2018	95(1.05)	Ghana	2018	Parasitological Survey	50.0 moderate	[71]

The pooled prevalence estimates (PPE) for human fascioliasis were 0.032% and the inverse variance quasi likelihood based alternative pooled prevalence estimates (IVhet PPE) at 0.032% (95% CI 1.4-5.3) and the statistic meta-analysis of prevalence worthwhile or worthless (I2) estimated at 98.7% (95% CI; 98.548-98.859) with Chi2, *p*=0.000.



**Figure 2.** Showing Forest Plot for PPE Analysis for Human Fascioliasis in Africa for period 2000-2022.





**Figure 3.** Showing Funnel plot of the double arcsine transformed prevalence estimates of for Human Fascioliasis in Africa for period 2000-2022.

## Discussions

Human fascioliasis is a parasitic disease caused by the liver fluke *Fasciola hepatica* or *Fasciola gigantica*. The disease affects people in over 70 countries worldwide, with an estimated 2.4 million people infected worldwide. In Africa, fascioliasis occurs primarily in areas where livestock grazing is common, such as the Nile Valley, the Ethiopian Highlands, and South Africa. The epidemiology of human fascioliasis in Africa is influenced by several environmental, ecological and climatic factors that influence the growth, development and survival of the parasite and its intermediate host. The disease has been shown to be a major plant-borne zoonosis in the high-altitude Andean rural regions of Bolivia and Peru [72], in the northern provinces of Iran bordering the Caspian Sea [73,74], Nile Delta region of Egypt [75] and Central provinces of Vietnam [76].

The results of our analysis and review suggest that several epidemiological studies on the transmission of human fascioliasis have been conducted in Africa [7,77]. This adds to the growing evidence that human fascioliasis infections are becoming a problem Across Africa as described in Egypt [70,72,78], Ethiopia [79–81], South Africa [47], Tanzania [82], Angola [83], Nigeria [7,84], Senegal [7], Ghana [7,85], Morocco [7,8], Algeria [7,86] and Tunisia [7,79,87]. This increase trend of infections and spread across African region could be due to a shift in consumption of raw vegetables and raw or partially cooked liver [88] and also the presence of available intermediate hosts of snails. The analysis further indicates that the trend of human fascioliasis in Africa varies depending on local conditions and transmission patterns; this has been observed to spread across the African region with significant adaptations by the intermediate Vector snails as previously described [89,90]. The

transmission of the disease is primarily zoonotic, with people becoming infected through consumption of contaminated watercress or other vegetables [79].

Our analysis and reviews have further pointed that transmission is predominantly described as zoonotic and anthroponotic [79,91]. The overall trend analysis across Africa indicated a generally low and stable transition between 2-5 publications reported on Human Fascioliasis from 2000-2012 and a significant swift upto 10 publications from 2012-2015 and steady drop to 2 publications in 2021. For example, in Egypt over twenty six publications on human fascioliasis reported and Nigeria with seven on human fascioliasis reported publications which correspond to the Fascioliasis outbreaks. The epidemiology is also influenced by socioeconomic factors and public health interventions. Indeed our analysis revealed that Poverty, poor sanitation and lack of access to clean water is major driver to increased risk of infection with the parasite across all observed countries with reported cases [7,39].

**One Health epidemiological underpinning for this scoping review in Africa:** This study has highlighted epidemiological setting categorization into rural, urban, or rural-urban that drives the emergent zoonosis [92]. The people from the low- to middle-income countries are more likely to suffer from fascioliasis whereas those residents from developed countries are likely to become infected if they feed on imported infested vegetable plants that evade quarantine measures [92,93]. Similar observation have been reported in this scoping review especially during field trips to endemic countries, city dwellers were at high risk of infection due to fascioliasis [93,94]. The human feeding and dietary habits are also another cause to weary especially when the source of food and water consumed are linked to marsh vegetations with open and free range animal husbandry practices [94], this scoping review has highlighted this an important epidemiological factor of human fascioliasis. The unregulated and uncontrolled supplies of vegetable products (such as carrots, cucumbers, cabbage, onions, tomatoes, spinach, etc.) to markets coupled with drinking contaminated water and fruit drinks/juices made from local plants make humans vulnerable to infection as previously documented [94].

**One Health Concept of the Fascioliasis Prevention and Control in Africa:** One Health approach recognizes the interconnections between human health, animal health, and the environment, emphasizing the need for collaborative efforts across disciplines to address complex health issues like fascioliasis [95,96]. The diagnosis relies on a number of techniques; with the standard sedimentation method of faecal samples for eggs concentration followed by microscopy [15], coproantigen tests using faecal samples [16] and antibody detections in blood serum by ELISA [17,18], Meat inspections [19] by morphological identifications of the adult *Fasciola* parasites with *Fasciola hepatica* with a typical leafy shaped dorso-ventrally flattened longer-narrower body measuring 28-52mm whilst *Fasciola hepatica* shorter measuring 12-29mm [20,21]. PCR based tools provide the best molecular markers for diagnosing and differentiating the two species of *Fasciola* infections [22–24] in Lymnaeid snails [25]. The prevention and control of Fascioliasis in both animal and human populations relies heavily on the use of antihelmintic drugs with the following approved for regular deworming of animals: triclabendazole, closantel or nitroxylin and use of triclabendazole in both chronic and acute forms of human infections [26,27]. Additionally, health education campaigns geared at equipping farmers to practice animal hygiene and ensure regular deworming alongside established surveillance systems to detect, monitor and report outbreaks are key and vital.

**Observed theoretical Gap:** Fascioliasis is an emerging neglected zoonotic disease [13,97] affecting the health and wellbeing of humans and animals [97,98]. The burden of the infection is not well defined with studies showing geographical expansion of the disease in human-animal population due to climate change [99–102]. This is likely to be uncovered through increase awareness and continued surveillance systems [103]. There is need for research in new adjuvants/therapeutic agents to tackle the challenges of emerging resistance to triclabendazole treatment. Future research into genomics and molecular biology could be a fruitful area of investigations to bridge the theoretical gap in treatments.

**Observed methodological Gap:** There are studies that have assessed the global linkage of climate change [97] and annual prevalence of Fascioliasis at 0.45% (95%CL: 0.35-0.56) [104]. Other studies by [105] were able to highlight the significant role played by bibliometric document visualization and

analysis where reporting steady increases in publications which corresponds to the Fascioliasis outbreaks between 1913 to 2021 although there was a sharp increase reported between 1965 to 1985 that explains the deadly outbreak in Britain and Europe at the time [105]. These findings are similar to trends observed in our analysis reported here. There is lack of a standardized diagnostic tool as many diagnostics are reportedly used in different scenarios ranging from microscopy, serological tests and ELISA each with varying degrees of sensitivities and specificities. There are challenges in the differential assessments of acute versus chronic infections as well as differentiating a symptomatic and subclinical form of the disease which are missed during the surveys [106]. There are gaps in the reliability of data collection systems that incorrectly capture and report data often siloed to veterinary level reporting.

## Conclusion

In summary, the epidemiology of human fascioliasis in Africa is complex and influenced by various factors. A better understanding of the epidemiology of the disease is critical to developing effective control strategies and reducing the burden of disease in affected communities. Mass administrations of drugs, improved sanitation, and health education programs have been effective in reducing the prevalence of human fascioliasis in some countries. However, sustained efforts are needed to control the disease in areas where it remains a public health problem. The results suggest that the burden of disease is underestimated due to a number of factors; Lack of reliable diagnostic tools, adequate surveillance systems, lack of denominator for cases tracked, low awareness and recognition among health professionals and the general public. This requires increased multispectral collaboration using a One Health approach.

Fascioliasis has emerged as an important foodborne disease with human and zoonotic importance. Climate change together with emerging drug resistance and development of new parasite strains through hybridization are becoming serious threats and challenges likely to impact and potentially change the climate driven epidemiology of Fascioliasis disease in years to come. Therefore, it is prudent that researchers must double the synergies towards research and innovations to develop promising vaccines that will be the margin bullet to provide the maximum required protection to livestock and humans.

**Author Contributions:** MA: EMT,MBM, DM,SN,PV,LM, MP, TM, KC, Conceptualized and designed the study, MA, EMT,MBM, DM, SN,PV,LM, MP, TM, KC, SM, MJC, ASS and BV, MA, EMT,MBM, DM, SN,PV,LM, MP, TM, collected the data, prepared it and proposed an analysis plan and interpreted the results. MA, EMT,MBM, DM, SN, PV and LM wrote the first drafted the manuscript. All the authors read, revised and approved the final manuscript.

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