

# A Literature Survey of Common Parasitic Zoonoses Encountered at Post-Mortem Examination in Slaughter Stocks in Tanzania: Economic and Public Health Implications

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## Abstract

Zoonoses caused by parasites constitute a large group of infectious diseases with varying host ranges and patterns of transmission. Their distribution, prevalence and transmission patterns are affected by the influence of both human and environmental factors. The economic and public health impact of such zoonoses warrants appropriate surveillance to obtain enough information that will provide inputs in the design and implementation of control strategies. A need therefore arises to regularly re-evaluate the current status of zoonotic diseases, particularly in view of new data available as a result of surveillance activities and the application of new technologies. Consequently this paper summarizes available information in Tanzania on parasitic zoonoses encountered in slaughter stocks during post-mortem examination at slaughter facilities. The occurrence, in slaughter stocks, of fasciola spp, Echinococcus granulosus (hydatid) cysts, Taenia saginata Cysts, Taenia solium Cysts and ascaris spp. have been reported by various researchers. Information on these parasitic diseases is presented in this paper as they are the most important ones encountered in slaughter stocks in the country.

**Keywords:** Parasitic Zoonoses; Slaughter Stocks; Post-Mortem Examination; Traditional Sector

**Abbreviations:** MAFS: Ministry of Agriculture and Food security; CE: Cystic Echinococcosis; NCC: Neurocysticercosis

## Introduction

In Tanzania slaughter stocks are mainly composed of cattle, pigs, goats and sheep. Most of these are supplied to the slaughter facilities by the rural based traditional livestock sector which constitutes more than 98% of the total livestock population in the country [1]. Apart from poor animal genetic makeup and poor management, the traditional livestock sector suffers high disease burden due to lack/inadequacy of veterinary services attributable to shortage of veterinary staff, poor infrastructure especially transport facilities and lack of diagnostic facilities and drugs [2-6]. As a result animals brought for slaughter into urban areas from the rural traditional sector may harbor chronic or subclinical infections some of which have zoonotic implication. Such diseases are rarely detected during ante-mortem examination and hence infected animals proceed into slaughter.

Zoonoses have been defined as diseases and infections that are naturally transmitted between vertebrate animals and humans

[7,8]. They are among the most important animal and public health problems that affect the well being of societies worldwide; and yet most of them go unrecorded and are often neglected [9]. Most zoonoses are maintained in the animal reservoir but can cross over to humans as a result of different risk factors and behavioral traits. Zoonoses caused by parasites have recently assumed an important role in public health with some of them being involved in opportunistic infections [10]. They are an important cause of human parasitic diseases worldwide and a major threat to the socio-economic development of especially developing countries [11]. The migration of humans and their domestic animals has been the pathway for disseminating parasitic zoonoses throughout recorded history and will continue to have an impact on emergency, frequency and spread of infections [12].

A slaughterhouse or abattoir refers to the premises approved and registered by the controlling authority used in the slaughter

of animals for human consumption [13]. For a long period abattoirs have played an important role in the surveillance of various diseases of human and animal health importance [14-16]. Surveillance at the abattoir is known to allow for all animals passing into the human food chain to be examined for unusual signs, lesions or specific diseases. Abattoir data are useful as they can provide a rough picture of emerging diseases [17]. As a result this paper summarizes common zoonoses encountered in slaughter stocks at abattoir during post-mortem meat inspection. It focuses on those zoonotic parasites transmitted from animals to humans. The described prevalence and distribution of various parasitic zoonoses in this paper will help responsible public health authorities in targeting of control measures and monitoring of the progress of food-safety policies.

## Method

### Literature Search

A literature search was conducted using the Pubmed database which comprises citations for biomedical literature from Medline, life science journals and online books. Various combinations of the following terms were used: 'Zoonotic parasites', 'Parasitic infections', 'Zoonotic, Helminths', and 'Slaughterstocks', 'cattle', 'goats', 'sheep', 'pigs', and 'abattoir', 'slaughter facility', 'slaughter house', 'postmortem inspection', and 'Tanzania'. Articles mentioned in the reference lists of the initially obtained articles were also screened to get additional articles. From the several articles detailed review of the abstracts identified 14 most relevant and representative studies of zoonotic parasitic infections encountered in slaughter stocks in the country, and these were chosen for the present paper.

## Results and Discussion

### Fasciolosis

Fasciolosis is a parasitic zoonosis caused by liver flukes, *Fasciola gigantica* and *F. hepatica*, belonging to the genus *fasciola* [18]. *F. hepatica* has been known to be the main causal agent as it assumes a worldwide distribution [19]. In Tanzania the disease has been reported to be among the major constraints to ruminant production in different regions [20]. Though liver fluke infestation rarely causes mortalities in cattle, much of the economic importance of the disease is due to its effect on production and economic losses owing to condemnations of the livers. Studies involving live animals have reported high prevalence rates in traditional cattle stocks in the country [20-22]. Abattoir surveys in the country have found the disease to be the commonest and a leading cause of liver condemnations in slaughter cattle [2,3,5,20,23,24]. A study by Keyyu et al. [21] reported up to 100% liver condemnation rates in some slaughter slabs in rural areas in Iringa region due to liver flukes in cattle.

Reports also exist on detection of the disease in small ruminants during post-mortem inspection [3,5], prevalence rates ranging from 3.1% to 17.1% (Sheep) and 3.1% to 18.5% (Goats). However, small ruminants suffer from an acute form of the disease which is normally associated with high mortalities [25,26]. The

proportion contributions of fasciolosis to total liver condemnations in the reported studies may not be a true reflection of infections in slaughter stocks since there are many light infections in which affected parts are trimmed and the remaining portion passed for human consumption and these are not recorded [2,5,6]. Apart from its importance in veterinary and economic terms, fasciolosis has been shown to be a reemerging and widespread zoonosis affecting a number of human populations throughout the world [27,28]. According to Mas Coma et al. [28] emergence/re-emergence of the disease in many countries is an attribute of many phenomena related to environmental changes and manmade modifications. Together with other trematodiasis the disease is included in a list of important helminthiasis with a great impact on human development.

### Cystic Echinococcosis /Hydatid Disease

Cystic Echinococcosis (CE) is a zoonotic disease caused by larval stage of the tape worm, *Echinococcus granulosus*, whose adult forms are seen in carnivores [29,30]. Ungulates and humans act as intermediate hosts for the parasite with human infections being caused by ingestion of the tapeworm eggs while playing with infected dogs containing eggs in the fur or through consumption of garden vegetables or water contaminated by dog feces [31]. The organism assumes a cosmopolitan distribution but is endemic in the Mediterranean, Africa, Middle East, South America, Australia, Russia, and China where livestock, mainly sheep and cattle, are raised with dogs who harbor the adult phase of the tapeworm [29-35]. *Echinococcus granulosus* causes serious lung and liver disease [36-40] and less frequently affects the kidney, peritoneum, spleen [31]. Maintenance and spread of the disease in endemic areas are known to be influenced by the diversity of livestock production systems, poor and unsupervised slaughter-houses, illegal and family slaughtering, low public awareness of the disease, and a large stray dog population [35].

Apart from exerting health effects to both humans and animals, hydatid cysts have important economic consequences [41]. On the human side economic losses arise through diagnostic cost, treatment cost, hospitalization, convalescence, life impairment and fatal outcomes. In animals economic losses are observed in decreased carcass weight, milk production and fertility rates, and from increased rate of condemnation of affected organs. In intermediate hosts (ungulates), cysts of *E. granulosus* are usually detected at post-mortem abattoir examination of the viscera [42], providing important epidemiological data, which can be used to define likely Echinococcal infection pressure [43-45]. Abattoir based studies in the country (Tanzania) have revealed that the disease is prevalent among slaughter stocks particularly cattle [2,4-6,46,47] as well as sheep and goats [4-6,48]. A study by Braae et al. [48] also detected the parasites in 6.6% of the slaughter pigs they examined (n=243). Some other studies reported occurrence of the disease in humans more so in pastoral communities [49,50]. Studies elsewhere in pastoralist communities in other African countries [51-60] and other continents [61,62] also showed evidence of existence of the disease in humans and domestic animals particularly cattle, sheep and goats. Poor sanitation and hygiene, and unrestricted disposal

of animal viscera post-slaughter may be responsible for the high prevalence Echinococcosis.

### **Taenia saginata Cysticercosis**

*Taenia saginata* is a two host parasite whose larval stage, known as *Cysticercus bovis*, is found in cattle, and the adult tapeworm, *Taenia saginata*, is found in intestines of man [63,64]. The cycle is completed when eggs in gravid proglottids shed from the human tapeworm are ingested by cattle, and viable cysts in undercooked beef are consumed by man [63,65]. The public health and economic consequences of infection of cattle with metacestodes of this worldwide occurring human tapeworm are considerable [66]. In humans infected individuals may remain asymptomatic for years, and the only symptom may be the spontaneous passage of proglottids. However, non-specific symptoms, such as vague abdominal pain, vomiting, nausea, diarrhea and weight loss can be present [67]. Although the tapeworm seems to be a benign parasitic disease, it can lead to serious surgical Gastrointestinal System (GIS) complications that are seldom reported in the medical literature [67-69]. In Tanzania a number of works have reported occurrence of the parasite in slaughter cattle [2,4-6,47]. Though the prevalence rates were fairly small (less than 2%) the implication thereof is significant. Low prevalence rates of the parasite in slaughter cattle have also been reported in other countries [70].

### **Taenia solium Cysticercosis**

Porcine cysticercosis is a parasitic zoonosis caused by the larval stage of a tapeworm *Taenia solium* [71]. The disease is endemic in most developing countries of Latin America, Asia and sub-Saharan Africa where pork is consumed causing serious public health and agricultural consequences [72-76]. While pigs are the intermediate hosts, man is the only natural definitive host. Pigs usually get infected by eating infected human feces or by consuming feed or water contaminated with human feces. Humans can also become accidental intermediate hosts upon ingestion of *T. solium* eggs [77,78]. In both humans and pigs, the larval stage of *T. solium* can establish in the muscles and/or in the brain, the latter resulting in Neurocysticercosis (NCC), which is the most common cause of human acquired epilepsy in many developing countries and accounts for over 20 million cases and 50 000 deaths each year [73,79]. NCC is a neglected disease, and its prevalence is largely underestimated [80]. Human NCC may lead to acute seizures, epilepsy and other neurological manifestations [81]. Ingestion of larvae (*Cysticerci*) present in raw or under-cooked pork may result in human tapeworm infection.

In Tanzania several abattoir surveys have been conducted to establish the existence of porcine Cysticercosis in slaughter pigs [6,82-85]. Prevalence rates as high as 24.4% [83] have been reported in slaughter pigs. The detection of the parasites in live animals has also been attempted [83,85-88] revealing high prevalence of the disease in rural communities where traditional pig husbandry is practiced. Studies in slaughter and live animals in other countries in the East and central African region have also found the disease to be prevalent in the traditional pig husbandry [89-96]. Several studies

in endemic areas have associated the disease with free ranging pig husbandry, poor sanitary practices and lack of veterinary control, all related to poverty [77,86,97,98].

### **Ascariasis**

*Ascaris suum* is a nematode found in pigs causing a disease known as ascariasis [99]. Human infections with *Ascaris suum* such as cases with larva migrans and eosinophilic pneumonia have been reported [100-105]. In some molecular studies carried out in some regions on human intestines, *Ascaris suum* infections were determined to be prevalent [99]. Infections in humans and other mammals result from the ingestion of food and water contaminated by *A. suum* eggs. Several studies have investigated occurrence of ascariasis in slaughter pigs in Tanzania [6,84,86], reporting different rates. A low rate of 4.03% was reported by Mellau et al. [6] in a record based study in northern part of the country whereas Ngowi et al. [86] reported the highest rate of 44.3% in a different location of the same part of the country. A lower rate of ascariasis (4.1%) has been reported in Turkey [99] whereas rates as higher as 54.5% and 36.7% have been reported in Botswana [106] and in China [107]. According to Olson and Guselle [103], 50% to 70% of pigs are estimated to be infected by *A. suum* in the world. Differences in reported prevalence may be attributable to limitations of abattoir records (record based studies), pig management systems, diagnosis methods used [6] and differences in levels of anthelmintic use among pig producers [84]. The observed prevalence of the condition in slaughter pigs in the country is of economic and public health importance due to zoonotic nature of the disease [108]. Some further work is however needed to establish factors responsible for transmission and maintenance of ascariasis and to evaluate the implication of the parasite in economic and public health terms.

### **Conclusion**

Parasitic zoonoses are prevalent among livestock destined for human consumption in Tanzania. Reported prevalence rates of these conditions have enormous economic and public health implications. As revealed by large quantities of condemned organs and/or carcasses, post mortem meat inspection is playing an outstanding role in safeguarding consumers' health in Tanzania. Sadly, such large quantities of condemned organs and/or carcasses have a huge negative impact on the economy of farmers and the country at large. Although the abattoir survey reports collated and availed in this review are not juxtaposing true estimates of the prevalence of parasitic zoonoses in Tanzania, they still provide good overview of the trend and status of these zoonoses in the country; and can therefore guide in planning future co-ordinated researches and control programs.

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