

### Short communication

## Liver fluke infection in a one-humped camel from Nigeria

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### Abstract

Fasciolosis is a globally re-emerging and under-reported food-borne animal disease of public health concern. *Fasciola gigantica* and *Fasciola hepatica* cause infection in domestic ruminants (except dromedary camels before this report) in Nigeria. This paper describes the first liver fluke infection in a Nigerian dromedary camel, identified as *F. gigantica* by morphology. Multidisciplinary research to determine liver fluke transmission patterns is recommended in formulating appropriate control measures.

**Keywords:** camel, fasciolosis, liver fluke, Nigeria, zoonosis

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### Introduction

Fasciolosis, caused by the digenetic trematodes *Fasciola gigantica* and *Fasciola hepatica*, is a re-emerging and neglected disease of livestock and humans worldwide. *Fasciola gigantica* is restricted to some parts of Africa and Asia, while *Fasciola hepatica* is widely distributed in Oceania, the Americas, Europe, temperate Africa and Asia (Ashrafi et al., 2014). In some African countries, such as Nigeria and South Africa, concomitant infections with these two species have been recorded (Mucheka et al., 2015; de Agüero et al., 2020). Due to impaired liver function in infected animals, the disease causes substantial economic losses, involving decreased livestock meat/milk production, morbidity, and mortality (Beesley et al., 2018). Herbivores, mammals,

and omnivores are the definitive hosts for liver fluke, and they can become infected after ingesting vegetation (raw consumable vegetables in humans) or natural water containing infective *Fasciola* metacercariae (Beckham et al., 2009; Mas-Coma et al., 2018). Furthermore, humans may become infected by eating raw meat dishes made from fresh livers infected with immature flukes, since early migrating flukes present in the consumed affected liver can retain the ability to re-start intra-organic migration (Mas-Coma et al., 2018). Human fasciolosis is isolated to developing countries with a higher chance of exposure to the infective fluke stage during food preparation, predominantly in Africa, China, Korea, South America, North and South Asia (Zerna et al., 2021).

In recent years, there has been a substantial rise in cases of liver fluke infection across all continents (WHO, 2021). According to anecdotal data, *F. gigantica* is the most common liver fluke observed in ruminants during slaughter in Nigeria, namely cattle, sheep, and goats, posing a severe threat to animal and public health. To an extent, Haridwal *et al.* (2021) showed that analysis of morphological characteristics of fluke could distinguish between *Fasciola* species detected post-mortem. We herein report the occurrence of liver fluke infection in a one-humped camel, also known as dromedary (*Camelus dromedarius*), slaughtered at an abattoir in Zamfara, Nigeria.

## Materials and methods

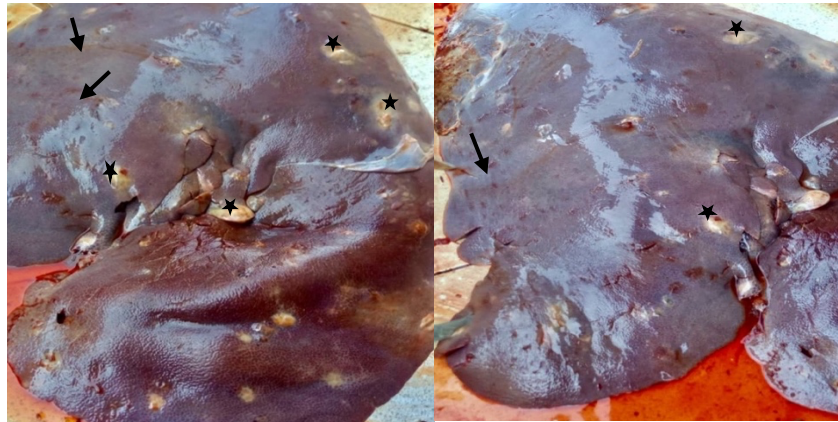
Zamfara (latitude 10°N and 14°N and longitude 04°E and 8°E), located in Nigeria's north western region, has 38 418 km<sup>2</sup>. The average annual temperature in this area is 27 °C, with a relative humidity of nearly 20%. Long periods of rainfall (676 to 1507 mm) occur from May to September, followed by a cold-dry cycle from October to January, with the lowest temperatures recorded in November and February, and a hot-dry season from February to April, with the highest temperatures usually recorded in March and April. Livestock in this region are raised by extensively mixed and transhumant production systems, with most grazing fields and watersheds shared by cattle, goats, sheep, and dromedary camels.

During routine meat inspection at a slaughterhouse in Zamfara, a liver of a male dromedary camel, older than ten years, was discovered to have deeply rooted gross lesions. The organ was inspected externally before being dissected in the parenchyma and primary bile ducts. Adult flukes were recovered from several incised greyish-white raised foci on the hepatic parietal surface using fine-tipped forceps. The parasites were placed in a beaker

and washed in physiological distilled water for morphological analysis. Based on the severity of the pathology found during the post-mortem examination, the dromedary was assessed to be severely infected, with the whole liver tissues (weighed 5.8 kg) being overwhelmed with fluke-caused lesions. Furthermore, the liver revealed migratory lesions with widespread haemorrhagic patches and greyish-white soft abscesses on the parietal surface (Figure 1). Adult flukes (ranging in size from 4.3 to 5.5 cm), with the long-tapered outline of body shape, the position of the suction cups, and the narrow shoulders characteristic of *F. gigantica*, were found in the lanced liver abscesses (Figure 2).

## Results and discussions

The gross pathology typical of fasciolosis includes flukes in the parenchyma, surface fibrinous tags/abscesses, extensive migratory tunnels associated with several haemorrhagic dark-red spots, and visible fibrotic hepatic tracts. The multifocal abscesses found in this case might have developed due to the host's immune reaction to fluke by-products, eggs, and dead larvae stuck in the liver parenchyma concurrent with the secondary bacterial infection, while the haemorrhagic streaks on the parenchyma are post-necrotic scars resulting from direct trauma at the entry points into the liver by early migrating immature flukes. In ruminant livestock, *Fasciola* species in Nigeria have been confirmed by molecular and morphological characteristics studies (Ahmad *et al.*, 2020; de Agüero *et al.*, 2020). Conversely, this is the first report to note a *Fasciola gigantica* infection in dromedary camels in Nigeria. Previous studies conducted in other countries have reported liver fluke infections in camels (Haridy and Morsy, 2000; Eslami *et al.*, 2003; Khalil, 2011; Nourani and Salimi, 2013; Nakayima *et al.*, 2017; Ijaz *et al.*, 2018).



**Figure 1.** Liver of a dromedary camel showing multiple greyish-white abscesses (starred black) and haemorrhagic streaks (arrowed black) on the parietal surface. Lanced abscesses revealed fibrinous to mucoid exudate and mature *Fasciola gigantica*.



**Figure 2.** Macro-photograph of adult flukes (*Fasciola gigantica*) obtained from the liver of a dromedary camel in Zamfara, northwestern Nigeria.

Dromedaries can play a role in maintaining and transmitting several gastropod-borne trematodes, including *Fasciola* species, in areas where both hosts and parasites are present (Sazmand *et al.*, 2019).

*F. gigantica* and *F. hepatica* both have a typical life cycle. The development of these parasites passes through aquatic environments, intermediate hosts, and into definitive hosts, including animals and humans, often exposed to infection by the ingestion of metacercariae – the infectious stage (Mas-Coma *et al.*, 2018). Free-

released newly hatched juvenile flukes emerge from their cysts in the small intestine within an hour of ingestion, traverse the gut wall and peritoneal cavity, and migrate to the liver within six days after encystment (Mas-Coma *et al.*, 2018; John *et al.*, 2019). The juvenile flukes feed on and pass through the hepatic parenchyma for 5-6 weeks, causing tissue damage and haemorrhage, before subsequently migrating into the bile ducts for maturation, replication, and egg-laying in at least 3-4 months to re-start the life cycle (Valero *et al.*,

2016; Mas-Coma et al., 2018; John et al., 2019). These result in severe hepatic consequences, leading to a range of pathological changes such as hepatitis, cholelithiasis, liver fibrosis, and cirrhosis. The number of ingested metacercariae usually determines the magnitude of the infection, with *F. gigantica* being more extensive and more pathogenic than *F. hepatica* (Valero et al., 2016). Due to the larger size, spines present all over the tegument, and with a longer migration duration in hepatic parenchyma than *F. hepatica*, *F. gigantica* has been demonstrated to cause more severe lesions even with fewer fluke exposure. However, the prepatent period varies, depending on the number of adult flukes in the liver and the host (Valero et al., 2016).

The emergence of new camel diseases in sub-Saharan countries has been attributed to changes in camel population dynamics associated with the progressive expansion of herders, as a result of climate change and indirect effects caused by interactions between the environment and epizootic risks of infection (Faye et al., 2012). The incidence of animal fasciolosis in Nigeria can be influenced by the presence of the *F. gigantica* intermediate host, the aquatic snail species *Lymnaea (Radix) natalensis*, and expanding livestock movements in the commonly practised pastoral system. Recent research identified an overlap infection with *F. hepatica* and *F. gigantica* in domestic ruminants, indicating the coexistence of both intermediate hosts, snails from *Radix* and *Galba* genera, in the same locality in Nigeria (de Agüero et al., 2020). Local farming practises in developing regions can facilitate parasite transmission since untreated livestock manure is widely used as fertilizer, increasing the risk of fluke eggs being dispersed into otherwise uncontaminated vegetations (John et al., 2019). The transmission rate of human fasciolosis can be estimated based on local prevalence and intensities of infection among livestock in the region (Mas-Coma et al., 2018). Anti-*Fasciola*

antibodies have been found in individuals regularly in contact with domestic ruminants in certain countries, suggesting an increased risk of occupational exposure to *Fasciola* infection in areas of extensive livestock farming (Javanmard et al., 2020; Najib et al., 2020). As a constraint, the morphological criteria used in this report to describe the fluke is only valuable for the initial differentiation of *Fasciola* species. Thus, specific differentiation between *F. gigantica* and *F. hepatica* using molecular and morphological techniques is essential, especially in regions where both species overlap (Haridwal et al., 2021). It is also crucial due to substantial differences in control methods, and pathogenic and epidemiological aspects between *Fasciola* species (de Agüero et al., 2020).

This report describes the first liver fluke infection in a dromedary camel in Nigeria, suggesting a higher risk of *Fasciola* parasite exposure in a predominantly mixed free-range production system. Given the increasing importance of camels as livestock animals in marginal and desert areas of developing countries, their role as hosts for zoonotic *Fasciola* spp. and in infection dynamics needs to be investigated further. The One Health-guided approach to fasciolosis, led by veterinary and biomedical scientists, will define the disease transmission patterns and characteristics, allowing for the development of effective control measures.

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## Conflict of interest

The authors have no conflicts of interest to declare relevant to this article's content.

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### Ethics approval

Not applicable, as the report does not involve clinical trials or animal experiments.

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