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Fasciola gigantica Parasitic Infection in Slaughtered Cows and Buffaloes

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Abstract | Fasciolosis is a parasitic disease of livestock and is widespread throughout the world. As a neglected tropical disease, fasciolosis can spread from animal to human raising zoonotic public health implications. In order to ascertain the prevalence of *Fasciola gigantica*, causative agent of fasciolosis, we investigated routinely slaughtered animals (cows and buffaloes) in Iraq. In the central slaughterhouse of Nasiriyah, 58 *F. gigantica* adults were collected from the livers of cows and buffaloes. We observed that buffaloes were infected with fasciolosis at a rate of 15.29%, higher than the incidence of fasciolosis in cows (10.66%). We recorded a greater prevalence of fasciolosis in females than in males, as the prevalence of bovine fasciolosis in females and males reached 15% and 9.09%, respectively. The infection rate in slaughtered buffalo for males and females was 13.33% and 20%, respectively. The results of the current research also showed that the infection rate in the age group <1.5 reached 10.34%, while the infection rate in the age group 1-2.5 was about 13.79%, and the infection rate in the age group 2-2.5 was about 15.51%. In the age group between 2.5-3.5, the percentage was 22.72%, while for the oldest age group it was >3.5, with a rate of 30.30%, which is the highest. Taken together, finding of this study provide clear distribution of fasciolosis across animals, ages and sex. These findings facilitate better control measures, assess efficacy of existing deworming application and to delineate the causation of dropping animal productivity.

Keywords | *Fasciola gigantica*, Fasciolosis, Prevalence

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INTRODUCTION

Fasciolosis is a parasitic disease caused by two species of liver flukes known as *Fasciola (F) hepatica* and *F. gigantica*, which are widespread worldwide (Mas-Coma et al., 2009). Fasciolosis is a neglected tropical zoonotic disease that occasionally affects humans. According to the World Health Organization, human infections were considered only of secondary importance until 1990 (Chen

and Mott, 1990), however, it has now become evident that fasciolosis is one of the economically impactful diseases of livestock and impose public health risks.

The public health importance of this disease was highlighted when considering cases of severe pathogenicity, even including fatal cases (Mas-Coma et al., 2014). Global estimates indicate that there are about 17 million infected people around the world. This number is an underestimate

due to the expansion of the spread areas. *F. gigantica* and *F. hepatica*, two species of the genus *Fasciola*, are most commonly causing Fasciolosis in domestic and wild ruminants but are also causative agents of Fasciolosis in humans. Fasciolosis reduces the productivity of animal industries, imposing an economic burden of at least \$3.2 billion annually, worldwide (Spithill et al., 1999).

Foodborne diseases represent a major public health problem and are the leading cause of morbidity and mortality world wide (Shonhiwa et al., 2019). Among foodborne pathogens, fasciolosis caused by *F. hepatica* and *F. gigantica* is of major concern (Khademvatan et al., 2019; Bargues et al., 2021). The life cycle of *F. gigantica* begins when adult worms invade the body of the livestock species. Adult worms live in the liver and lay their eggs in the intestines. Eggs are excreted in the stool. The eggs hatch in the water into Miracidia and then swim to find the snails. Different species of snails are vectors that play a major role in the life cycle of *F. gigantica* (Vázquez et al., 2019). Miracidia remain in the body of the snail for two weeks, then transform into Sporocysts that reproduce asexually to produce Rediae and become cercariae. The Cercaria larva then develops a tail and turns into Metacercaria, after which it leaves the snail's body to attach to aquatic plants. When cattle feed on plants contaminated with Metacercaria, they penetrate the intestinal wall and reach adulthood in the liver of the cattle (Tenorio and Molina, 2021). Animals become infected when they consume feed or water containing the infective larval stage of parasites, called metacercariae, of *Fasciola* spp. (Jean-Richard et al., 2014; Line et al., 2019). Humans can acquire infections by consuming raw or undercooked liver products, as well as contaminated crops and water (Mas-Coma et al., 2009; Cárdenas-Perea et al., 2015).

Fasciolosis has acute and chronic clinical stages, such as inflammation of the liver and bile ducts, anemia, anorexia, general malaise, jaundice, and eventually death (Keiser and Utzinger, 2009). Fasciolosis causes significant financial loss due to the high cost of anthelmintics needed for treatment, stigmatization of infected livers, loss of production due to death, decreased production of meat, milk, and wool, slowed weight gain, and disturbance of fertility (Tietz and Scroferneker, 2003; Mason and Offer, 2004).

Most animals in developing countries, fasciolosis is common infections which is mainly attributed to weak or non-existent control measures, this complicates the task of studying the disease from an epidemiological and public health perspective (Isah and Control, 201). This study was setup to interrogate the prevalence of fasciolosis in Iraq to better guide control measures, efficacy of existing deworming application and to delineate the causation of dropping animal productivity (Bashar et al., 2022; Lafta et

al., 2023; Al-Jassani et al., 2022; Sane et al., 2023; Hijazi et al., 2023; Gupta et al., 2023; Al-Safi and Qasim, 2023).

MATERIALS AND METHODS

SAMPLE COLLECTION

The study was conducted in the period from January 2023 to October 2023, during which the data was collected from cattle slaughtered in the central slaughterhouse of Nasiriyah. The study was carried out on buffaloes and cows in the slaughterhouses through periodic visits. A total of 470 heads of livestock species were examined in this slaughterhouse, designated for slaughter, from different areas of Dhi Qar Governorate in southern Iraq. A total of 58 adult *F. gigantica* were collected from the livers of cows and buffaloes through the process of examining samples slaughtered in the slaughterhouse.

DIAGNOSIS

We based the diagnosis of the samples on the external appearance of the worms including morphological characteristics such as shape and size, and based on characteristics reported earlier (Urquhart et al., 1987). These include classification of *F. gigantica* (relatively large in size and more leaf-like), as the size of the *F. gigantica* worm was larger than *F. hepatica*, which can reach 7.5 cm in length, is grayish brown in color, and becomes fully mature in the bile ducts.

The age of cattle was estimated on the basis of teeth. The body condition of each cow or buffalo was also recorded before slaughtering the animal according as suggested before (Nicholson and Butterworth, 1986). Sex-related information was recorded based on previous guidelines (Nicholson and Butterworth, 1986; Obialigwe et al., 2023). The livers of each studied animals were carefully examined by palpation and incision was made into each liver and bile duct for the presence of lesions suggestive of exogenous *F. gigantica* infection and were sliced for confirmation. The infected livers were then collected along with adult parasites (Jilo et al., 2021).

We also relied on the molecular diagnosis referred to in our previous research, which was registered in the NCBI-BLAST GenBank under the serial numbers OQ152484, OQ152485, OQ152486, OQ152487, OQ152488.

RESULTS AND DISCUSSION

Approximately 300 cows and 170 buffaloes were slaughtered in the central slaughterhouse of Nasiriyah on a regular basis and from different regions. The total infection rate of Fasciolosis in the slaughtered cows was 10.66%, and the infection rate in buffaloes was 15.29% (Table 1, Figure 1).

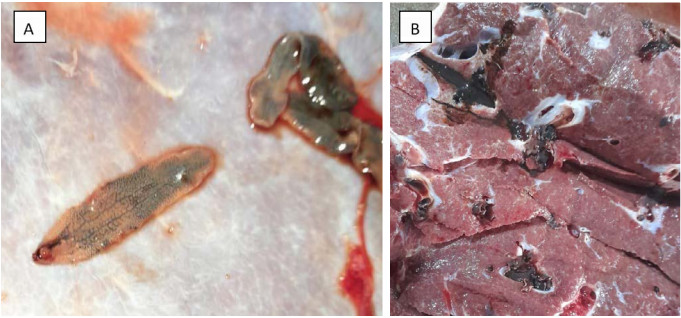


Figure 1: *Fasciola gigantica* (A) *Fasciola gigantica* morphology. (B) Buffalo liver infected with *Fasciola gigantica*.

Table 1: The total number of fasciolosis rates in slaughtered animals.

Slaughtered animals	Total number	Infections	Percentage %
Cows	300	32	10.66
Buffalo	170	26	15.29

Based on the analysis, we noticed that buffaloes were infected with fasciolosis at a rate of 15.29%, higher than the incidence of fasciolosis in cows, which amounted to 10.66%. The reason for this may be that the buffalo live in the marshes south of the city of Nasiriyah and near a water source that causes *Lymnea* spp. snails to gather. Which are the intermediate hosts for this parasite that increases the risk of Fasciolosis, as buffalo pick up more metacercarial cysts released by snails while grazing on the banks of rivers and near water sources. The results of our research are consistent with the findings reported previously (Jean-Richard et al., 2014; Margiana et al., 2022; Arif et al., 2023; Lei et al., 2022; Abbas et al., 2022; Husseun et al., 2022).

Animals that spend time grazing near the banks of rivers and lakes are more susceptible to infection with *F. gigantica* as reported earlier (Damwesh and Ardo, 2012). It has previously been identified that a high frequency of Fasciolosis was recorded during the rainy season in the state of Adamawa, northeastern Nigeria. At the beginning of the rainy season, when snails *Lymnea* spp., the intermediate host for *Fasciola*, emerge from diapause and release huge numbers of metacercarial cysts (Njoku-Tony and Okoli, 2011; Ardo et al., 2013). Animals become infected by ingesting these parasites while grazing. In addition, it has been noted that Metacercaria were abundant on plants around the banks of rivers, lakes and streams during rainy and early dry seasons (24). Metacercaria can attach to plants that live in aquatic areas such as rice and waste plants in rivers (Rinca et al., 2019).

Our study also recorded a greater prevalence of fasciolosis in females than in males, as the prevalence of bovine fasciolosis in females and males reached 15% and 9.09%,

respectively. The infection rate in slaughtered buffaloes for males and females, respectively, reached 13.33% and 20%. Females had a higher incidence of infection than males, as shown in Table 2.

Table 2: Percentage of Fasciolosis infection by sex of slaughtered cattle.

Slaughtered animals	Sex	Total number	Infections	Percentage %
Cows	Female	80	12	15
	Male	220	20	9.09
Buffalo	Female	50	10	20
	Male	120	16	13.33

The results of our study are consistent with previous finding (Obialigwe et al., 2023). Where females were more affected by fasciolosis than males. It is also consistent with the findings of researchers (Ulayi et al., 2007; Adedokun et al., 2008; Shinggu et al., 2019) who found that the infection rate is higher in females than in males.

It has been identified that majority of infected animals were females (Tsegaye et al., 2012; Shinggu et al., 2019). The reason for this is that purchasing females is cheaper than purchasing males. The reason may also be due to the fact that animal breeders keep them for a longer period on the farm for breeding purposes and milk production. However, finding of our studies contradict with some of the results reported earlier where no clear difference of infectivity in male and female is reported (Magaji et al., 2014; Abubakar et al., 2019; Shinggu et al., 2019).

The greater incidence of fascioliasis in females is thought to be the result of biological, physiological and behavioral differences between the sexes (Ulayi et al., 2007). The reason for the increase in the infection rate in females and the decrease in males may also be due to the fact that farmers usually graze female cows in open fields. Therefore, they are more susceptible to infection than males, which are usually inside barns. The reason may also be that butchers slaughter old cows, which increases their risk of infection.

As for the age of slaughtered livestock, the oldest age group was the most infected compared to the lowest age group. The results of the current research showed that the average infection rate in the age group less than < 1.5 reached 10.34%, while the infection rate in the age group 1.5-2. About 13.79%, and the infection rate in the age group 2-2.5 was about 15.51%. In the age group between 2.5-3.5, the percentage was 22.72%, while the oldest age group was > 3.5, with a rate of 30.30%, which is the highest infection rate (Table 3).

The results of our current study are consistent with the

findings of previous studies (Vassilev, 1999; Ahmad et al., 2020) who noted that the prevalence of fasciolosis increases with age. This is because older animals had a longer time to become infected with the disease, and thus many worms accumulate in their livers compared to younger animals. Our results are also consistent earlier reports (Obialigwe et al., 2023) where it has been shown that older animals experienced more grazing activities, as the probability of developing Fasciolosis increases when the plant is contaminated with metacercariae (Valinata et al., 2020).

Table 3: Age groups affected by *Fasciolosis*.

Age	Total number	Percentage %
< 1.5	6	10.34
1.5–2	8	13.79
2–2.5	9	15.51
2.5–3.5	15	22.72
> 3.5	20	30.30

However, our study differs from some of the findings (Yatswako et al., 2017), where it was demonstrated that the presence of fasciolosis in small animals compared to large ones. It is plausible that the developed immune system and acquired immunity in adults would lead to development of resistance.

Taken together, finding of this study provide clear distribution of fasciolosis across animals, ages and sex. These findings facilitate better control measures, assess efficacy of existing deworming application and to delineate the causation of dropping animal productivity.

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NOVELTY STATEMENT

There are no comprehensive studies on the prevalence of *Fasciola* in economically important animals in Iraq. Therefore, we conducted this study because of its importance to the country's economy.

AUTHOR'S CONTRIBUTION

We did this work in solidarity, as Dr. Hind played an active role in investigating research and studies on this parasite, and Dr. Abdul Jalil and Dr. Mohammad collected samples, diagnosed them, and studied them morphologically.

CONFLICT OF INTEREST

The researchers did not encounter any significant problems

due to the active participation in carrying out the research project.

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