



Seasonal prevalence of bovine fasciolosis and its direct economic losses (del) due to liver condemnation at Makurdi abattoirs north central Nigeria

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Abstract

This study was conducted to report the prevalence of bovine fasciolosis and to estimate the direct economic losses (DEL) from condemnation of liver as a result of detection of lesions of fasciolosis in cattle slaughtered in Makurdi abattoirs. Retrospective data were collected from the abattoir records obtained from Ministry of Agriculture and Natural Resources (MANR) Makurdi, from 2008 to 2012. Direct economic losses were calculated based on a pilot study to determine the average price of liver per kilogram (AvP/kg) and using the formula: $DEL = n \times W \times AvP/kg$, where n is the number of livers condemned and W is the average liver weight in kg. Between 2008 and 2012, 64,978 cattle were slaughtered at Makurdi abattoirs, out of which 9,478 cattle were infected with *Fasciola* species. This represents an overall prevalence of 14.56% (95%, C.I.: 12.99 – 16.85%). Annual prevalence of bovine fasciolosis was significantly ($P < 0.05$) high in 2010 and decreased from 2011 to 2012. During the late dry season, the prevalence of bovine fasciolosis was significantly high ($P < 0.05$). A total of 4220 liver were condemned during the study period. This amounted to 12660 kg and valued at ₦12,660,000.00 (\$79251.60 USD). The highest prevalence was recorded during the late dry season. However, cattle acquire the infection during the wet season and early dry season. Pathological lesions were much obvious during the late dry season possibly when the animals were most stressed, hence we suggest that control measures should be targeted towards wet and early dry seasons. Bovine fasciolosis is prevalent in cattle slaughtered in Makurdi abattoirs and accounts for huge financial losses.

Keywords: Bovine fasciolosis, Economic losses, Makurdi, Prevalence, Season

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Introduction

Benue state is known as the food basket of Nigeria. It accounts for a significant proportion of agricultural production in Nigeria (Abu *et al.*, 2011) due to its geographical location which provides suitable ecological conditions that favour crop and animal production (Idoga & Egbe, 2012).

Ruminant production accounts for a high percentage of protein consumption, in addition to generation of revenue for farmers and other stakeholders in livestock trade (Steinfeld, 1997; Blench, 2010). However, livestock productivity in sub-Saharan Africa is constrained by a number of factors prominent among which is diseases,

especially, those of parasitic origin (Soulsby, 1982; Blench, 2010).

Bovine fasciolosis is a disease of economic and veterinary importance (Mc Kenna *et al.*, 2002), and has been identified as a major cause of morbidity and mortality in cattle (Soulsby, 1982).

Fasciolosis is caused by members of the subclass: *Digenea*, genus: *Fasciola* (Soulsby, 1982). *Fasciola gigantica* is the cause of fasciolosis (liver fluke) in the tropics while *Fasciola hepatica* is the frequent cause of fasciolosis in the temperate region of the world.

Fasciolosis is transmitted by ingestion of metacercaria-infested plant or drinking water containing floating metacercariae (Arjona *et al.*, 1995). Man is infected mainly by eating watercress (*Nasturtium officinale*) infested with metacercariae. Raw lettuce and cabbage which are common delicacies in northern Nigeria and other contaminated plants that are eaten raw can also be a source of infection, as can water from irrigation ditches or other receptacles. Alfalfa juice has also been implicated in places where people drink this beverage (Pan American Health Organization, 2003).

Fasciolosis caused by *F. gigantica* is responsible for heavy economic losses to farmers due to reduced weight gain, poor carcass quality, reduced milk yield, cost of treatment and control, mortality and condemnation of affected livers at abattoirs in Nigeria (Ekunife & Eneanya, 2006; Njoku-Tony, 2011; Okaiyeto *et al.*, 2012; Odigie & Odigie, 2013; Yahaya & Tyav, 2014).

The disease is an emerging zoonosis worldwide and the World Health Organisation has estimated that over 2 million people are infected and 180 million are at risk of infection (Khalid *et al.*, 2010). There have been systematic and coordinated efforts at documenting the prevalence of fasciolosis in livestock in several countries of the world. However, there is paucity of information in recent years on the prevalence of fasciolosis and economic losses from condemnation of livers infected with *Fasciola* in cattle slaughtered in Makurdi. Therefore, the aim of this study was to investigate the seasonal prevalence and direct economic losses from condemnation of livers due to fasciolosis in cattle slaughtered at abattoirs in Makurdi, Benue state, Nigeria.

Materials and methods

Study area

Makurdi, the administrative headquarter of Benue state, lies within latitude 7°44' N and longitude 8°54' E in north central Nigeria. It is characterised by tropical, dry and wet climate. The dry season lasts for a minimum of six months, beginning from November to April, while the wet season spans from May to October. Mean annual rainfall is about 1,290mm (Gobo, 1988). Makurdi is located in the Benue valley and is drained by the river Benue and its tributaries. Due to the general low relief of Makurdi, a large portion of the area is waterlogged and flooded during heavy rainstorm (Ologunorisa & Tersoo, 2006). This provide suitable environment for snails to breed. Natural pasture is available in Makurdi throughout the year. Cattle rearing in Nigeria is predominantly nomadic system, where Fulani herdsmen travel on foot for very long distances for grazing purpose (Blench, 1999). During the dry season, Fulani herdsmen from the extreme north eastern states

and north western states travel over a thousand kilometres to Benue valley where pasture is available throughout the year for grazing (Blench, 1999). Makurdi has two main abattoirs that supply slaughtered meat for over 1,000,000 people; an average of 80 heads of cattle are slaughtered daily (Ejeh *et al.*, 2014a). Cattle slaughtered in Makurdi originate from Benue State and from cattle markets in surrounding states such as Nasarawa, Niger, Taraba, Adamawa, Bauchi, and Plateau State. Most of the cattle slaughtered in the abattoirs were adult local breeds (Ejeh *et al.*, 2014b).

Collection of data

Five-year abattoir records (2008–2012) were collated from the Ministry of Agriculture and Natural Resources, Makurdi, Benue State. From these records, data on fasciolosis cases per month were extracted. These include the number of cattle examined before slaughter and the number of whole liver condemned as a result of the presence of *Fasciola* species. Partially condemned liver were not included in the study because their actual or estimated quantity was not recorded. It was also not possible to get the correct data on age, breed, and sex for each of the slaughtered cattle during the study period due to poor abattoir recording system at the Ministry of Agriculture and Natural Resources (MANR), Makurdi (Ejeh *et al.*, 2014b). Veterinarians who are staff of the Ministry of Agriculture and Natural Resources (MANR), Makurdi, carried out the post-mortem examination.

Estimation of financial losses resulting from condemnation of liver due to fasciolosis

The average cost per kilogram of a liver was obtained through oral interviews with the butchers and meat traders at the abattoirs. The total numbers of whole livers that were condemned as unfit for human consumption during meat inspection were noted for cattle slaughtered in Makurdi abattoirs within the five-year period under review.

Financial losses in Naira and Dollar (US) were subsequently calculated based on a previous study and the formula: $DEL = nw \times Av.P/kg$ was used to determine financial losses (Ejeh *et al.*, 2014b). Where DEL stands for direct economic losses due to total liver condemnation, n is the total number of condemned liver for the period, w is the average weight of a liver (3.0 kg) estimated from a pilot study, and Av. P/kg is the average price per kg (₦1000 = 6.28USD) of whole non-condemned liver. US Dollar equivalent of Naira was calculated based on Central Bank of Nigeria's exchange rate which stood at N159.24 = 1 USD as at 31st December, 2012 (CBN, 2015).

Data analysis

From the data obtained, the annual, seasonal, monthly, and overall prevalence of fasciolosis were calculated as the total number of cases of fasciolosis detected divided by the total number of cattle slaughtered at particular points in time (Ejeh *et al.*, 2014b). Data obtained were further subjected to ANOVA to establish levels of significance using SPSS® version 16 statistical software.

Results

Annual and seasonal prevalence of bovine fasciolosis

Between 2008 and 2012, 64,978 cattle were slaughtered at Makurdi abattoirs in Benue State. Of these cattle, 9478 (14.59%) were infected with *Fasciola* species.

Annual prevalence of bovine fasciolosis increased from 12.86% in 2008 to 21.21% in 2010 and then decreased to 10.90% in 2012. There were significant differences ($P < 0.05$) between the prevalences of fasciolosis in 2010 and the rest of the years studied (Table 1).

During the late dry season, prevalence (21.16%) of bovine fasciolosis was significantly higher ($P < 0.05$) compared to the other seasons of the year. The difference in prevalence of bovine fasciolosis from early wet season to early dry season was not significant (Table 1).

Direct economic losses (del) from liver condemnation due to fasciolosis

A total of 4220 livers were condemned during the study period, this amounted to 12,660 kg and valued at twelve million six hundred and sixty thousand (₦12.66 Million) naira equivalent to seventy nine thousand two hundred and fifty one US dollars and sixty cents (\$79251.60) (Table 2). The lowest direct economic losses (₦1,653,000, \$10380.84) was recorded in 2011 and the highest losses (₦3,966,000) were recorded in 2010. There were significant differences between direct economic losses from liver condemnation due to bovine fasciolosis in Makurdi abattoirs from 2008 to 2012 (Table 2).

More livers were condemned (1594) during the early dry season than other periods with significantly ($P < 0.05$) high direct economic losses during the same (Table 2).

Table 1: Annual and seasonal prevalence of bovine fasciolosis lesions detected in cattle slaughtered at Makurdi abattoirs from 2008 to 2012

Parameter	No. slaughtered	No. with <i>Fasciola</i>	Prevalence (%)	(95% CI)
Year				
2008	15642	2011	12.86 ^b	(9.12 – 17.43)
2009	14234	2177	15.29 ^b	(12.99 – 18.05)
2010	11943	2533	21.21 ^a	(15.83 – 28.30)
2011	11682	1502	12.86 ^b	(8.81 – 17.04)
2012	11476	1251	10.90 ^b	(7.86 – 13.76)
Season				
Early wet	16638	2162	12.99 ^c	(11.10 – 15.37)
Late	16135	1904	11.80 ^c	(9.77 – 14.34)
Early dry	15952	1960	12.29 ^c	(8.59 – 16.48)
Late dry	16253	3439	21.16 ^d	(16.75 – 26.90)
Total	64978	9478	14.59	(12.99 – 16.85)

Mean percentages with the letters a and d were different significantly ($P > 0.05$)

Table 2: Direct economic loss from condemnation of livers as a result of detection of fasciolosis lesions detected in cattle slaughtered at Makurdi abattoirs

Parameter	No. condemned (n)	Wight, W = nw (kg)	Wight, W = nw (kg)	
			₦	\$
Year				
2008	620	1860.00	1860000.00 ^c	11680.80
2009	1015	3045.00	3045000.00 ^d	19122.60
2010	1322	3966.00	3966000.00 ^d	24906.48
2011	551	1653.00	1653000.00 ^c	10380.84
2012	712	2136.00	2136000.00 ^c	13414.08
Season				
Early wet	918	2754.00	2754000.00 ^e	17295.12
Late wet	740	2220.00	2220000.00 ^e	13941.60
Early dry	1594	4782.00	4782000.00 ^f	30030.96
Late dry	983	2904.00	2904000.00 ^e	18179.04
Total	4220	12660.00	12660000.00	79504.80

Mean DEL with the different letter d and f were different significantly ($P > 0.05$). W = Total average weight

Discussion

Abattoirs are important in order to ensure wholesomeness of meat and meat products for human consumption. They also provide by-products for livestock based industries. More importantly, abattoirs are used for the purpose of surveillance against animal and zoonotic diseases. Abattoir investigation of bovine fasciolosis have provided useful information on the prevalence and economic losses from condemnation of liver worldwide (Ekwunife & Eneanya, 2006; Ibronke and Fasina, 2010; Bernardo *et al.*, 2011; Abdulhakim & Addis, 2012; Petros *et al.*, 2013).

In this study we reported an overall prevalence of 14.56% (95% C.I.: 12.99 – 16.85%) bovine fasciolosis in cattle slaughtered at Makurdi abattoirs from 2008 to 2012. Similar results were reported from other parts of the country. Ekwunife & Eneanya (2006) reported a prevalence of 10.5% in Onitsha while Raji *et al.* (2010) reported a prevalence of 13.09% in Zaria.

Lower prevalences of bovine fasciolosis were reported in the south eastern and south western parts of the country (Odigie & Odigie, 2013; Oladele-Bukola & Odetokun, 2014). Oladele-Bukola & Odetokun (2014) explained that the rate of fasciolosis reported in the southern parts of the country was low because more animals, especially male with good body condition were transported to the south from the north since animals with good body condition are more resistant to infection and stress than animals with poor body condition.

There was no significant difference in the annual prevalence of bovine fasciolosis in cattle slaughtered in Makurdi abattoirs except in 2010 where the prevalence was significantly ($P>0.05$) high. This may be as a result of increase in the intensity of meat inspection by veterinarians and not necessarily an increase in prevalence of the disease.

During the late dry season, the prevalence of bovine fasciolosis was high (21.16%; 95% C.I. 16.75 – 26.90%), this represents a strong association between detection of *Fasciola* in cattle slaughtered in Makurdi abattoirs and season. This is in agreement with the results of Danwesh & Ardo (2012) who also observed that the prevalence of fasciolosis was high before and during the onset of rainy season in Adamawa state, Nigeria. In other countries similar findings have been made (Benardo *et al.*, 2011, Qureshi *et al.*, 2012 and Shahzad *et al.*, 2014). However, Njoku-Tony (2011) reported a high prevalence of bovine fasciolosis in cattle slaughtered in Imo state during the rainy season. Kuchai *et al.* (2011) also reported a low prevalence of bovine fasciolosis during the dry season among cattle of Ladakh in Egypt and further explained that it could be due to

the existence of positive relationship between the prevalence of fasciolosis and rainfall, humidity and temperature.

Usually cattle acquire *Fasciola* at the onset of rainy season through ingestion of the infective stage (metacercariae) while grazing, when snail (*Lymnea* species) come out of their hibernation and release large numbers of metacercariae (Amato *et al.*, 1986; Pfukenyi *et al.*, 2006; Njoku-Tony *et al.*, 2011; Ardo *et al.*, 2013b; Shahzad *et al.*, 2014). Similarly, Qureshi *et al.* (2012) observed that metacercariae can be found in considerable number on vegetation during rainy season and during the dry season along river banks, lakes, and streams. At this point, cattle come in contact with herbage infected with metacercariae. During the dry season, the concentration of snails increases along water bodies and thus leading to increased infection rate fasciola among cattle that graze along these areas.

Pathological lesions caused by bovine fasciolosis are the major cause of liver condemnation at Makurdi abattoirs, considering the amount (12,660kg) of liver condemned from 2008 to 2012 and its financial implication. The direct economic losses (DEL) as a result of condemnation of liver due to detection of pathological lesions from bovine fasciolosis was estimated at twelve million six hundred and sixty thousand (₦12.66 million) naira, equivalent to seventy nine thousand two hundred and fifty one USD. In 2010 alone, the losses were approximately ₦3.966 million (\$24,906). Although this amount may not represent actual losses, it can be considered high for a lower middle income country like Nigeria (World Bank, 2015).

In a similar study, Ejeh *et al.* (2014b) reported a total direct economic losses of two million nine hundred and ten thousand naira (₦2,910,000) from condemnation of edible organs as a result of detection of tubercle lesions in Makurdi abattoirs from 2008 to 2012. The differences between the direct economic losses from bovine tuberculosis and bovine fasciolosis in the same abattoirs and at the same period may further explain the results reported by Ibronke and Fasina (2010) that more livers were condemned as a result of fasciolosis than other diseases.

A total of 4782.00 kg of liver, valued at ₦4,782,000 (\$30,030.96) was condemned during the early dry season; this value was significantly ($P<0.05$) high compared to other seasons. The reason for the differences might be as a result of the influence of season on the prevalence of bovine fasciolosis.

Economic losses reported in this study are relatively higher than those of previous studies in Nigeria viz. ₦191,300 in Maiduguri for a period of

five years (Ahmed *et al.*, 1994), ₦1.4 million (\$9,121) in Adamawa State (Ardo *et al.*, 2013b) and ₦269,295 (\$1683.09) in Port-Harcourt (Akpabio, 2014).

Economic losses from bovine fasciolosis have been reported in other parts of the world. In USA, Malone *et al.* (1982) reported a loss of \$7.2 million while \$42.8 million was reported in Switzerland by Schweizer *et al.* (2005) and \$13,364.72 in Central Ethiopia by Regassa *et al.* (2012). In a similar study performed in Turkey, Sariozkan and Yalcin (2011) reported that the estimated cost of fasciolosis for beef and dairy cows varied between \$6.1 - \$8.8 and \$28.9 - \$42.6 million US\$ respectively. These figures are based on calculations from various factors such as production loss, cost of treatment, condemnation of livers, milk and meat losses. They however, reported smaller losses from liver condemnation compared to other factors.

We also observed that more livers were condemned during the early dry season. This may result from the fact that cattle may acquire the infective stage of *Fasciola* while grazing at river banks and around water bodies (Abdulahkim & Addis, 2012) during the late dry season and development of lesion may occur during the early wet season and late wet season respectively. Therefore, at early dry season, gross pathological lesion may become more obvious with a corresponding increase in the number of livers condemned.

Bovine fasciolosis is an economic burden to farmers and butchers. These groups bear the

burden of direct economic losses alone since there is no compensation for condemned carcasses or edible organs in Nigeria (Ibironke and Fasina, 2010; Ejeh *et al.*, 2014b).

Bovine fasciolosis is endemic in cattle slaughtered in Makurdi abattoirs, with a significantly high prevalence during the late dry season.

Detection of gross pathology due to fasciolosis in cattle slaughtered at abattoirs in Makurdi accounts for huge financial losses from condemnation of livers which occur more during the early dry season.

Butchers were not compensated for condemnation of affected liver during meat inspection at Makurdi abattoirs.

Based on our results we recommend that compensations be reintroduced in order to encourage effective meat inspection and equitable sharing of losses.

Farmers should be educated through the state veterinary services on the need to strategically treat their animals with appropriate anthelmintic. Awareness should be created on the prevention and control of animal diseases especially, fasciolosis in the study area.

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