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Prevalence of Bovine Fasciolosis and Economic Importance in Wulnchit Municipal Abattoir, Ethiopia

By Asefa Getnet & Tegegne Bayih
Hwassa University

Abstract- A cross-sectional study was conducted to estimate the prevalence and economic importance of fasciolosis slaughtered at Wulnchit Municipal Abattoir from November, 2011 and April, 2012. A total of 500 livers from cattle selected were examined with systematic random sampling for the presence of liver fluke. Of 500 examined cattle, 171 (34.23%) livers were infected with Fasciola. Both species of Fasciola were identified during the study. These are Fasciola hepatica (F. hepatica) and Fasciola gigantica (F. gigantica). From 171 livers F. hepatica were 120 (70.17%), F. gigantica 30 (17.54%) livers, while mixed infection with both was 11 (6.4 %) animals and 10 (5.8%) cattle were infected with unidentified immature liver flukes. F. hepatica was found to be the predominant fasciola species causing bovine fasciolsis in the study areas. Statistically significant variation was observed in the prevalence of fasciolosis among animals with medium (50%) and good (32.9%) body conditions (P<0.05) and animal origin. The economic significance of bovine fasciolosis was also assessed from condemned liver and carcass weight loss. Thus based on the retail value of bovine liver and 1kg of beef the total annual economic loss from fasciolosis during the study time was estimated to be 4, 522,550,000 ETB.

Keywords: *abattoir, bovine, fasciola, prevalence and economic significant.*

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Strictly as per the compliance and regulations of:

Prevalence of Bovine Fasciolosis and Economic Importance in Wulnchit Municipal Abattoir, Ethiopia

Asefa Getnet [α] & Tegegne Bayih [σ]

Abstract- A cross-sectional study was conducted to estimate the prevalence and economic importance of fasciolosis slaughtered at Wulnchit Municipal Abattoir from November, 2011 and April, 2012. A total of 500 livers from cattle selected were examined with systematic random sampling for the presence of liver fluke. Of 500 examined cattle, 171 (34.23%) livers were infected with Fasciola. Both species of Fasciola were identified during the study. These are Fasciola hepatica (F. hepatica) and Fasciola gigantica (F. gigantica). From 171 livers F. hepatica were 120 (70.17%), F. gigantica 30 (17.54%) livers, while mixed infection with both was 11 (6.4 %) animals and 10 (5.8%) cattle were infected with unidentified immature liver flukes. F. hepatica was found to be the predominant fasciola species causing bovine fasciolsis in the study areas. Statistically significant variation was observed in the prevalence of fasciolosis among animals with medium (50%) and good (32.9%) body conditions (P<0.05) and animal origin. The economic significance of bovine fasciolosis was also assessed from condemned liver and carcass weight loss. Thus based on the retail value of bovine liver and 1kg of beef the total annual economic loss from fasciolosis during the study time was estimated to be 4, 522,550,000 ETB.

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I. Introduction

Livestock in developing countries play crucial role in improving the ever worsening situation between food supply and demand due to human population pressure. Generally animals have a positive impact on diet, Sustainable crop yields, employment prospects and social status of our growing human population (EVA, 2003). Ethiopia posses the largest live stock in Africa with an estimated population of 47.5 million cattle, 26.1 million sheep, 21.7 million goats, 7.8 million equines,1millon camels, and 39.6 million chicken (CSA, 2000), but is not efficiently exploited. The major problem hindering the full exploitation of these resources is animal's disease and traditional management system of domestic animals (Solomon, 1975). The presence of fasciolosis due to *Fasciola hepatica (F. hepatica)* and *Fasciola gigantica (F. gigantica)* in Ethiopia has long been known and its prevalence and economic significance has been reported by several workers (Tadele and Worku, 2006).

Helminth infection on food animal's because significant economic loses (FAO, 1982). They may vary considerably from clinical disease including mortality to chronic production loses which may appear for example as reduced growth rate, weight losses due to reduced animal production, yet, another dimension added by the fact that several helminth infection can be permitted to man (zoonosis). One of the helmithiasis that cause direct and indirect lose, especially in domestic ruminants is fasciolosis. It is serious hazard to efficient production of cattle and sheep (Radiostits *et al*., 2007).

Among the major livestock parasitic diseases responsible for high prevalence and economic losses on livestock production particularly in sheep and cattle is fasciolosis. Bovine fasciolosis is an economically important fasciolidae trimatode of the genus fasciola which migrate in the liver parenchyma and establish and develop in the bile ducts. Fasciolosis mainly affects domestic ruminants, which is caused by the liver fluke parasites. The parasite lives part of its life in aquatic snails and farm animals. The aquatic snails which are found in and around wet areas such as water holes, act as intermediate host. The farm animals act as final hosts which are likely to pick up the parasite if they drink from these sources or eating aquatic plants containing encysted organisms (Okewole *et al*., 2000 and WHO, 1995).

Generally, the distribution of fasciolosis is worldwide, however, the distribution of *F. hepatica,* is highlands of tropical and subtropical regions (Soulsby, 1986). The definitive hosts for *F. hepatica* are most mammals among which sheep and cattle are the most important once. The geographical distribution of trimatode species is dependent on the distribution of suitable species of snails. The genus lymnaea in general and *lymnaea trancatula* in particular is the most common intermediate hosts for *F. hepatica*. In Ethiopia the presence of both *lymnea trancatula (L. tancatula)* and *lymnea natalensis (L. natalensis)* has been reported (Bergeon, 1968 and Garber, 1975). *L. trancatula* is an amphibious snail living in shadow ponds, wet lands, and water troughs while *L. natalensis* is true aquatic mullusk which lives in immersed clear water and slow flowing givers mixed infections by both species of fasciola may

Author α: Haramaya University P. O. Box 138, Diredawa, Ethiopia.
Author σ: Researcher and Instructor at Hawassa University, P. O. Box 05, Hawassa, Ethiopia. e-mail: tegegnebayih@gmail.com

occur in areas where the ecology is conducive for replication of snail intermediate host. In this species of snail was reported to have worldwide distribution (Urquhart *et al*., 1996).

In Ethiopia, *F. hepatica* is wide spread in areas with attitude above sea level (a.s.l), while *F. gigantic* appears to be the most common species in areas below 1200 meters a.s.l. Both species co-exist in areas with an altitude ranging between 1200-1800 meters a.s.l (Graber, 1975).

Fasciola is fairly large hermaphrodite parasite with a brown leaf shaped body. The anterior end is usually prolonged in to the shape of a cone and the anterior sucker is located at the end of the cone. The ventral sucker is placed at the level of the shoulder of the fluke. Both *F. hepatica* and *F. gigantica* are hamatophagus or blood sucking (Radiostits *et al*., 2007). *F. gigantica* resembles *F. hepatica* but is readily recognized by its large size. The anterior cone in *F. gigantica* is smaller than that of *F. hepatica*, the shoulder are not as prominent as *F. hepatica* and the body is more transparent. Both *F. hepatica* and *F. gigantic* are greyish-brown in colour when they are fresh, but they are changed to gray when preserved. Fasciola eggs have oval shape and yellowish brawn shell with an indistinct operculum (Soulsby, 1982 and Urquhart et al, 1996).

The life cycle of fasciola consists certain phases, adult fasciola live in bile ducts producing eggs, passage of eggs from the host to the outside environment and then subsequent development, hatching of miracidia, then search for and penetration of the intermediate host (snail): *L. trancatula*, development and multiplication of the parasites inside the snail, emergence of the cercariae and then encysted, ingestion of infective metacercaria by final hosts and development to adult worms. Hatching mostly occurs in moist conditions annoyance of the cycle depends on the mortality rate of the snails during the winter, which varies from region to region and from year to year (Radiostits *et al*., 2007).

The pathogenesis of fasciolosis vary according to the stage (phase) of the parasite in liver and the species of the host involved. Essentially the diseases entity can be divided in to acute and chronic form (Soulsby, 1983). Acute fasciolosis is due to massive invasion (migration) of young flukes in the hepatic parenchyma, and the pathological impact is associated to liver damage and haemorrhage. Chronic fasciola infection being the most common form, it is manifested intermes of submandibular oedema, hypoalbuminamia and fasciola eggs in the feces (Soulsby, 1986).

The pathogenic effect usually depends on the number of metacercaria ingested over a period of time and relative susceptibity of the animal. Generally the parasite is capable of developing pathogenic action mechanical by cuticular spines and suckers, predatory by consumption of liver tissue (Urquhart *et al*., 1996).

Both *F. gigantica* and *F. hepatica* can infect human sporadically. Human cases of fasciolosis occur throughout the world. In Ethiopia a case fasciolosis in man has been reported (Taylor *et al*., 2007).In Ethiopia, the prevalence of Bovine Fasciolosis has shown to range from 11.5% to 87% (Taylor *et al*., 2007). *F. hepatica* was shown to be the most important fluke species in Ethiopia. The distribution of *F. gigantica* was mainly localized in the western humid zone of the country that encompasses approximately one fourth of the nation (Tadele and Worku, 2006).

Ethiopian highlands contain pockets of water logged marshy areas which provide suitable habitats year round for the intermediate host of fasciola (Solomon and Abebe, 2007). Though the problem due to fasciola was reported from different parts of the country information on the current status from different location need to be attained, this study aims to fill such gap hence be carried out in cattle in and around Wulnchit.

The objectives of this work are:

- To determine the prevalence of bovine fasciolosis by post mortem examination.
- To identify the commonly involved fluke species.
- To evaluate the direct and the indirect economic losses due to the disease.

II. Materials And Methods

a) *Study Area*

The study was conducted at Wulnchit municipal abattoir which is located in Wulnchit east shoa zone, 99km south east of Addis Abeba (37.17^{0}N and 8.33^{0}E) with an altitude of 1622 m.a.s.l situated in the well known east African Rift Valley. It has an annual rain fall ranging from 400-800mm and temperature 13.9-27.7^{0}c (National Metrology Service Agency, 1999/2000).

b) *Study Animal*

The study was conducted on cattle, local breed, originate from neighboring provinces such as; Arsi, Bale, Harar, around Wulnchit area and Borena zones of Ethiopia.

c) *Study Design*

A cross sectional study was conducted from October, 2011 to April, 2012 by collecting data on events associated with fasciolosis in cattle slaughtered at Wulnchit Municipal Abattoir. After autopsy the liver was inspected grossly, the fluke recovery and count was aimed to be conducted following the approach Hammond and swell, (1990) and identification of the fluke species were carried out by using size parameters described by (soulsby, 1982).

d) Sample Size Determination

Systematic random sampling method was employed to generate data for the study at the abattoir on cattle presented for slaughter. Thus, taking 73.26% expected prevalence the sample size used for the present study was calculated according to the method described by Thrusfield (1995) as follows:

$n = 1.96^2 pexp\ (1\text{-}pexp)/d^2$

Where; n = required sample size

Pexp = expected prevalence

d = required precision (usually 0.05)

The expected prevalence of fasciola in Wulnchit Abattoir is 73.26% and the confidence interval is 95% with the required precision of 5%. By subtitling the value in the above formula we get sample size (n) =384. But to increase the precision; the sample size is increased to 500.

e) Ant Mortem Examination

During ante-mortem examination detail records about the species, breed, sex, age, and origin and body condition of the animals was recorded. The age estimation was made by using dentitions and owner's information.

f) Post-Mortem Examination

During post mortem examination organs of thoracic cavities specifically liver was systematically inspected for the presence of fasciola by applying the routine meat inspection procedures which consists primary examination followed by secondary examination for the presence of any fasciola. The primary examination involves visualisation and palpation of organ. Whereas secondary examination involves further incisions deep in to the organ incise where a single or more fasciola found.

g) Economic Loss Assessment

The total economic loss due to fasciolosis in cattle slaughtered from the summation of annual liver condemnation cost (direct loss) and cost due to carcass weight reduction (indirect loss) was assessed.

h) Direct Loss due to Organ Condemnation

Direct economic loss was resulted from condemnation of liver affected by fasciolosis. All livers affected with fasciolosis were totally condemned. The annual loss from liver condemnation was assessed by considering the overall annually slaughtered animal in the abattoir and retail market price of an average zebu liver is 50ETB. The information obtained from was subjected to mathematical computation using the formula set by (ogunrinade, 1982).

ALC = CSR X LCX P.

Where ALC = Annual loss from liver condemnation.

CSR = Mean annual cattle slaughtered at Adama municipality abattoir.

LC = Mean cost of one liver in Wulnchit Town.

P=Prevalence rate of the disease at the study abattoir.

i) Indirect Loss due to Carcass Condemnation

A 50% carcass weight loss due to fasciolosis in cattle has been described by Yugoslavian investigator (Polydorous, 1981). Retail market price condemned organs was assessed based on information from local butchers. On the other hand, the indirect economic loss was associated with carcass weight reduction due to fasciolosis. A 10% carcass weight loss due to fasciolosis in cattle was reported by Robertson, (1976). Average carcass weight of an Ethiopian zebu was taken as 126 kg (ILCA, 1992). The annual economic loss because of carcass weight reduction due to bovine fasciolosis was assessed using the formula set by Ogunrinade and Ogunrinade, (1980).

ACW = CSR* CL * BC * P*126 kg.

Where ACW = Annual loss from carcass weight reduction.

CSR = Average number of cattle slaughtered per annum at study abattoir.

CL = Percentage of carcass reduction.

BC = an average price of 1 kg beef in Wulnchit town.

P = Prevalence rate of Fasciolosis at Wulnchit abattoir, 126 kg= Average carcass weight of Ethiopian zebu.

j) Data Management and Statistical Analysis

Data generated from post-mortem meat inspection was recorded and later on entered into Microsoft Excel data sheet and statistical analysis was done. SPSS 20 statistical soft ware was used to analyze the data. Liver condemnation rates defined as proportion of condemned liver to the total number of liver examined. The data obtained during the study was subjected to chi square statistical analysis to see the association between rejection rates of liver, origin, and body condition differences were regarded statistically significant since the p value < 0.05.

III. Results

a) Overall Prevalence

From the total 500 cattle slaughtered during the period from November, 2011 to April, 2012 at *Wulnchit* Municipal Abattoir, 171(34.2%) where found to harbour fasciola from the analysis that was made on the bases of origin and body condition.

b) Species Composition of Fasciola

From a total of 171 infected livers *F. hepatica* was the most commonly encountered parasite with the prevalence of 70.17% while *F. giantica* accounted prevalence rate of 17.54%, mixed infection rate 6.4% and those immature flukes accounted as 5.8% (table 1).

Table 1: Proportion of Fasciola Species

Species of Fasciola	Number of Livers	Percentage (%)
F. Hepatica	120	70.17
F. Gigantic	30	17.54
Mixed Infection	11	6.4
Immature Fluke	10	5.8
Total	**171**	**100.00**

Table 2: Prevalence of Fasciolosis Based on Origin of the Animal

Origin	No Examined	Positive No (%)	P-Value
Harar	113	5(4.4)	0.006
Wulnchit	92	18(19.6)	0.0012
Arsi	106	68(64.2)	0.006
Bale	112	67(57.8)	
Borena	73	13(17.8)	

Prevalence of fasciolosis based on the animal origin was also assessed and the infection of bovine fasciolosis in animals slaughtered in Wulnchit municipal abattoir was originated from Harar, Bale, Borena, Wulnchit and Arsi. The prevalence is highest (68.2%) in animals brought from Arsi and (57.8%) in animals came from Bale. Both of the above two areas are highlands and this may have high population of snail intermediate host or may have marshy areas. Harar (4.4%), which is midland while Borena(17.8%) and Wulnchit (19.6%) are both low lands resulting lower prevalence of fasciolosis. The origin of animals (table 2) p=0.006 which was statistically significant since p-vaue is less than ($P<0.05$).

Table 3: Prevalence of Fasciolosis on the Base of Body Condition

Body Condition Score	No. of Cattle Examined	No. of Positive Cases	No. of Negative Cases	Infection Rate (%)
Medium	38	19	19	50
Good	462	152	310	32.9
Total	**500**	**171**	**329**	**34.2**

Pearson Chi2 (1) =0.035, P-Value = 0.015.

The prevalence of bovine fasciolosis was found to be 50% and 32.9% for medium and Fatty body condition score respectively (Table 3) which was statistically significant ($P<0.05$) indicating body condition was directly related to infestation rate.

c) Economic Loss Analysis

The direct economic loss results from liver condemnation as the result of fasciolosis. The average annual cattle slaughtered was estimated to be 54000, while the mean retail price of bovine liver in Adama town was 50 ETB and the prevalence of fasciolosis in Adama municipal abattoir was estimated to be 34.2%, therefore, the estimated annual loss from organ condemnation is = 9,230,000.00 ETB.

ALC = CSR X LCX P

ALC = 54000×50×34.2=9,230,000.00ETB

The indirect economic loss is due to carcass weight reduction as a result of fasciolosis. From 500 inspected animals 171 were identified as positive in the study abattoir which results in total of 376,110,000ETB monthly losses as a result of carcass weight reduction (indirect loss) during the study. In the study area the average price of 1Kg beef was 60ETB, the annual financial loss from carcass weight reduction due to bovine fascioosis is calculated as follows.

ACW = CSR* CL * BC * P*126 kg

ACW = 54000 × 10% × 60 × 34.2 × 126 = 4,513,320,000ETB

Therefore, the total annual economic loss due to bovine fasciolosis in the study abattoir is the summation of the losses from organ condemnation (direct loss) and carcass weight reduction (indirect loss) with a total of 4,522,550,000ETB equivalent.

IV. Discussions

Both *Fasciola hepatica* and *Fasciola gigantic* have been reported to exist in many parts of Ethiopia. The prevalence of bovine Fasciolosis in Ethiopia varies from 11.5 in buno province (Seyoum, 1987) to 87% in Debre Birhan and abattoir studies have also reported up to 88.57% prevalence of fascioosis in Debre Birhan (Dagne, 1994 and Tsegaye, 1995).

The overall prevalence of bovine fasciolosis in cattle slaughtered at Adama municipal abattoir during the study period was 34.2% and this is highly reduced to the earliest prevalence reported in this area 73.26% by Eyakem, (2008). As the result showed the prevalence is closely similar with that of Hagos 33.1 % (2007) at Mekelle Municipal abattoir. The result was lower when compared with higher prevalence reported by Tadele and Worku, (2007) 46.58%, Adem, (1994) in Ziway (56.8%) and Mulualem, (1998) in South Gondar (83.08%), Bahiru and Ephrem, (1979) in Keffa (86%). It is higher when compare with 14.0% at Wolaita Soddo abattoir by Abunna, *et a*l., (2009), Berhe *et al*., (2009) in Mekelle was 24.3%. This variation may be due to the ecological and climatic condition such as altitude, rain fall, and also temperature for the presence of their intermediate snail host. Or due to expansion of veterinary service, awareness created among the people, the advantage of periodically deforming of animals or due to local husbandry condition.

In relation to body condition of the animals, the prevalence was higher in those animals with medium body condition than in those fatty body conditions, 50% and 32.9% respectively. This finding corresponds with the reports of Hagos, (2007). The prevalence reported by this researcher was 33.1, and 29.1% in medium and good body condition animals respectively. This is due to the fact that animals with medium body condition are usually less resistant and are consequently susceptible to infectious diseases.

Species identification revealed that *F. hepatica* was more prevalent (70.17%) as compared to *F. gigantica* (17.57%); certain proportion of animals (6.4%) harboured mixed infestation and others unidentified immature fluke (5.8%). In support of the present study, Dechasa *et al.,* (2012) reported that 45.20% *F. hepatica*, 26.54% *F. gigantica*, 15.72% mixed infections and 12.53% immature flukes. Gebretsadik *et al.,* (2009) reported that 56.42% of cattle were infested with *F. hepatica* and 9.17% with *F. gigantica.* However, in another study (Fufa *et al.,* 2009) stated that the most common liver fluke species affecting cattle at Welaita Sodo was *F. gigantica*. The higher prevalence of *F. hepatica* might be associated with the existence of favourable ecological biotopes for the intermediate host *L. truncatula.*

In relation to origin of the animals the prevalence was higher in those animals brought from Arsi (64.2%) and Bale (57.8%), Harar (4.4%), Borena (17.6%) and Adama (19.6) this indicates that the above two areas have highest value. That may be due to the presence of marshy areas or a large population of the snail intermediate host.

Emphasized on the statement that even if it is realized estimating the actual economic loss due to individual parasitic disease is difficult, this should not be medicate against an attempt to emphasize the cause of the disease. The direct economic loss incurred during this study as a result of condemnation of liver of cattle was estimated about 9,230,000.00ETB per annum and indirect economic loss due to carcass weight reduction was estimated about 4,513,320,000ETB per annum. Therefore, the total annual economic loss due to fasciolsis in the study abattoir is the summation of losses from organ condemnation and carcass weight reduction which is equal to 4,522,550,000ETB. This finding is much higher than the result reported by Tolosa and Tigre, (2007), Adem, (1994) and Daniel, (1995). A total economic loss of about 55,080.00, 154,188 and 215,000 Ethiopian birr per annum in cattle due to fasciolosis at Jimma, Ziway and Dire Dawa municipal slaughter houses, respectively This is probably due to the ecological and climatic difference between these localities.

V. Conclusion

The present study confirmed that fasciolosis is an important disease entity causing considerable loss of revenue due to condemnation of affected liver and carcass weight reduction at study municipality abattoir. This may be due to the fact that the area has suitable ecological condition to the existence and multiplication of the intermediate host (*L. truncatula*).

Based on the aforementioned conclusion, the following recommendations are forwarded:

- Application of good drainage and building of dams at appropriate sites in marshy and low laying areas may reduce the snail problem.
- Locally available control strategies like planting of trees and shrubs that have mollucicidal activity (phytolocia dode candara with local name Endod) along streams should be given special emphasis from economic point of view.
- Keeping the animals off from marshy areas inhabited by intermediate host or by fencing of these risky zones. Creation of awareness to the farmers about the disease shoud be raised to enable them actively participate in the control program.
- Finally, the farmers should be educated and informed about the importance of the disease control programs and regular deworming of animals before and just after rainy season.

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Annexes

ANNEX 1: Individual Animal Daily Abattoir Recording Format

Ser. No.	ID. No.	Breed	Sex	Species	Body Condition Scores	Fasciolosis	
						+/-	Species

ANNEX 2: Body Condition Scoring

1. Condition scoring 1 (p^-) marked emaciation.
2. Condition scoring 2(p) transverse process project prominently, spines appear sharply.
3. Condition scoring 3(p^+) individual dorsal spines are pointed to the touch hips, tail, head and ribs are prominent.
4. Condition sore 4(m^-) individual dorsa spines clearly visible, muscle mass between hooks and spines are sighty concave.
5. Condition scoring 5(m) ribes usually visible, little fat covers dorsa spines are barely vissibe.
6. Condition scoring 6(m^+) the animal is smooth dorsa spines cannot be seen but are easily felt.
7. Condition scoring 7(G^-) animal is smotth and well coverd but fat deposite are not marked.
8. Condition scoring 8(G) fat cover in critical areas can easily be seen and felt, transvers process cannot be seen or felt.
9. Condition scoring 9(G^+) highly deposited of clearly visible on tail, head, brisket. Dorsal spines, ribs and hooks.

(Source Nicolson and Butterworth, 1986)

ANNEX 3: Age Determination (Estimation) of Cattle from Incisors (Dentition) Teeth

Permanent Incisors	Age
One Pair of Incisors	< 2 Years (Young)
Two Pairs of Incisors	2-3 Years (Young)
Three Pairs of Incisors	$3\text{-}3^{1/2}$ Years (Adult)
Four Pairs (Full Set) of Incisors	4-6 Years (Adult)
Medial Incisors Showing Wear and Levelled Tops the Teeth	7-9 Years(Old)
Permanent Incisors Showing Wear and Space Between the Teeth Source: Gracey (1986).	> 10 Years (Old)

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