International Journal of Veterinary Sciences and Animal Husbandry

ISSN: 2456-2912
VET 2016; 1(2): 30-36

www.veterinarypaper.com
Received: 07-07-2016
Accepted: 08-08-2016

Nazima Gul
Department of Zoology,
University of Kashmir,
Jammu and Kashmir, India

Hidayatullah Tak
Department of Zoology,
University of Kashmir,
Jammu and Kashmir, India

Khalid M Fazilli
Department of Biotechnology,
University of Kashmir,
Jammu and Kashmir, India

Iram Abdullah
Department of Zoology,
University of Kashmir,
Jammu and Kashmir, India

Tanveer A Sofi
Department of Zoology,
University of Kashmir,
Jammu and Kashmir, India

Correspondence
Nazima Gul
Department of Zoology,
University of Kashmir,
Jammu and Kashmir, India

Prevalence of *Fasciola* infection in slaughtered Animals in Kashmir

Nazima Gul, Hidayatullah Tak, Khalid M Fazilli and Iram Abdullah and Tanveer A Sofi

Abstract
Fasciolosis is denoted as a significant veterinary health problem. During current study, a total of 714 cattle slaughtered at different abattoirs of Srinagar city (J&K) were examined for the presence of *Fasciola* sps in the liver from January 2014 to January 2016. There was moderate prevalence of 26.84% in the studied area. Predominance of *Fasciola gigantica* (20.86%) was seen as compared to *Fasciola hepatica* (3.361%) infection with mixed infection of 2.66%. Epidemiological determinants like age, gender, breed and body condition showed statistically significant ($p<0.05$) effect on bovine Fasciolosis. Seasonal data showed highest prevalence in autumn (39.87%) followed by winter (28.84%) with lowest prevalence in spring (16.40%).

Keywords: Epidemiology, *Fasciola,* cattle, Abattoir and Srinagar

Introduction

Ruminant productivity around the world is majorly affected by trematode parasitism (Vercruysse and Claerebout 2001) [63]. Among them, Fasciolosis gains public concern not only due to its prevalence and economic significance to animal stock in all continents (Scheweizer *et al*., 2005, Mungube *et al*., 2006) [53] but also to its zoonotic aspect. Bovine Fasciolosis is an impediment in profitable bovine farming and for butchers and consumers too. Parasite of genus *Fasciola* i.e *Fasciola hepatica* and *Fasciola gigantica* is the causative agent of Fasciolosis which occur in a wide range of definitive hosts. Over the last decade there has been a substantial increase in the number of fasciolosis cases recorded. It is spurred on by both environmental changes (warmer, wetter climate) and man-made modifications such as an increase in animal movements and intensification of livestock farming (Mas-Coma *et al*., 2005) [36].

According to Annual Reports of Department of Animal Husbandry, Dairying and Fishries, species -wise incidence of Bovine Fasciolosis in India is tabulated as under:

Table 1

Year	Outbreaks	Attacks	Deaths
2008-2009	85	391402	2
2009-2010	84	375237	6
2010-2011	105	345108	27
2011-2012	130	316363	74
2012-2013	195	509195	31
2013-2014	137	802698	11
2014-2015	129	3606	4

While comparing the apparent prevalence of liver fluke infection, detected by liver, faeces and bile examination it has been reported that examination of liver or bile samples was more sensitive than faecal examination (Braun *et al*., 1995 and Kumar *et al*., 2002) [14, 33]. Thus the abattoir study was carried out to determine the prevalence.

Material and Methods

A two-year prospective systematic sampling study was undertaken from January 2014 to January 2016 to determine the relative occurrence of *Fasciola* infection in the livers of cattle presented to six abattoirs across the Kashmir. Samples were taken from the three studied localities i.e., Hazratbal, Parimpoora, and Gouskimber of Srinagar district but sampling effort was more important in Parimpoora locality, where four slaughterhouses were closely located.

The sample size was calculated using the formula given by Thrustfield, M. (2005).

$$n = \frac{1.96^2 . P_{exp}(1 - P_{exp})}{d^2}$$

Where n = required sample size

P_{exp} = expected prevalence= 50%

d = desired absolute precision=5%

Hence, d = 0.05 and p= 0.5 (50%).

The expected prevalence in the study area was 55 % (Akhoun and Peer, 2014) [4]. Thus the minimum desired annual sample size was calculated to 381. However, due to drastic floods only 316 cattle were examined in Year 2014 as collection areas were inaccessible and sample size was extended to 396 in Year 2015.

Study of epidemiological parametes

Antimortem analysis

Age, Gender and breed of animal:

The age of each animal was confirmed by looking at the physical appearance of body and examining the dental pad and incisor teeth (Cockrill, 1974). The data was collected according to predesigned proforma: Young (1Yr-3Yrs), adult (3-6Yrs) and aged (Above 6 years).During survey the gender and breed of animals was also recorded.

Assessment of Body condition

Body scoring of the cattle was made based on the method described by Nicholson and Butterworth (1986). Each scoring were given number from 1(L-, very lean) to 9 (F+, very fat) and these scores finally included under three body condition scores, good, medium and poor.

Season

On the basis of temperature and precipitation, four seasons in a year recognized in Kashmir valley are: winter (December to February); spring (March to May); summer (June to August); autumn (September to November) (Dar *et al*., 2002) [19].

Postmortem examination

Types of infection

Infection based on causative agent were classified as *Fasciola hepatica*, *Fasciola gigantica*, mixed *Fasciola* species (*Fasciola hepatica*, *Fasciola gigantica*) infection.

Postmortem fluke recovery

Worms were recovered from infected livers by squeezing them manually to macerate the parenchyma and the flukes were carefully removed and placed in petridish containing 0.15M Dubecco's PBS buffer (pH 7.3) for initial washing. The flukes were stored in collection vials containing PBS and were transported to the laboratory of Department of Zoology, University of Kashmir, Srinagar. Fasciolids were identified primarily on differences in body shape and size of the adults, with the smaller *F. hepatica* exhibiting wide and defined shoulders compared to the slender *F. gigantica* having less defined shoulders and shorter cephalic cones (Soulsby, 1986) [56]. For permanent slide preparation flukes were rapidly killed in 70% ethyl alcohol to avoid shrinkage. The flukes were then transferred to vials containing 6-10% formalin for preservation. Flukes were stained with Borax Carmine, dehydrated in ascending grades of ethanol, cleared in Xylene and mounted in Balsam Canada and viewed under monocular light microscope.

Data Analysis

Data was recorded, entered and managed into MS Excel work sheet and analyzed using Minitab Version 13.Prevalence was calculated as percentage of infected among the examined samples. Chi square test was employed to examine the effect of above mentioned epidemiological determinants on the level of parasitism in host. In all statistical analysis, confidence level was held at 95% and P-value is <0.05 (at 5% level of significance) was considered as significant.

Results

Fasciolosis in an area is influenced by a multifactorial system which comprises both definitive and intermediate hosts, parasite and environmental effects. Numerous factors (both intrinsic and extrinsic) form an association posing a potential epidemiological threat and it is important that the existence and localization of such an association should be recognized beforehand so that the situation can be brought under control. Thus in this portion of result, these factors have be assessed and potential reason behind the association have been well documented.

Fig 1: *Fasciola hepatica*

Fig 2: *Fasciola gigantica*

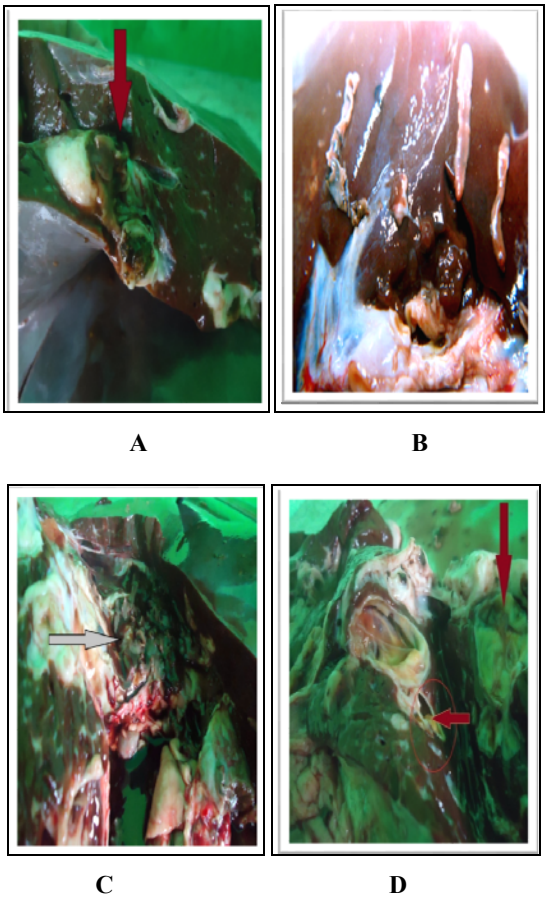

Fig 3: Infected Liver Samples. (A) Bovine liver showing oozing parasite. (B, C) Parasites lying free and soaked in foul smelling fluid (D) Yellowish tissue

Overall Prevalence (Table 1)

The overall prevalence of Fasciolosis for the period of two years (2014-2015) was found to be 26.84% in the current study areas. In 2015, the percentage prevalence was higher (27.02%) than in 2014 (25.31%). There was an increase of 1.71% in prevalence rate from 2014 to 2015.But difference in prevalence rate was not statistically significant (p>0.05) as there was sampling error in year 2014 because of scarcity of data collection for a period of 2 months (September and October) due to Floods that affected the whole valley.

The result of current study indicated that Fasciolosis in cattle is spread relatively with moderate prevalence rate of 26.84% in the study area as compared to high prevalence of 51.42%, 42.06% and 43.63% in Ladakh and Srinagar province of Jammu and Kashmir (Kuchai *et al*. 2011; Akhoun and Peer, 2014 respectively) [32, 4]. The reported difference may be attributed to different factors like mode of infestation, agroclimatic variations, technique used for data collection and different management conditions under which cattle are reared. However, the result of the present study is in close proximity to the prevalence rates of 29.38% and 25.40% reported earlier by Sheikh *et al*. 2007 [54] and Fatima *et al*. 2012 [23] in neighboring areas of Kashmir using the same abattoir survey. The prevalence rate was also within ranges of findings of other authors like 25.46% by Khan *et al*. 2009 [31] from Pakistan; 27.26% and 25.2% by Kabir *et al*. 2010 [28] and Afroze *et al*. 2013 [3] from different provinces of Bangladesh; 25.9% by Mungube *et al*. 2012 [42] from Kenya; 26.55% by Nega *et al*. 2012 [45] from Ethopia; 23.96% reported by Asressa *et al*. 2012 [8] from Andassa Livestock Research Center in North-West of Ethiopia.

Table 2: Yearwise Prevalence of Fasciolosis

Year	EX.	INF.	PREV	χ^2(P-Value)
2014	316	80	25.31%	0.183 0.669
2015	396	107	27.02%	
Total	714	192	26.84%	

Month-wise prevalence (Fig. 1)

The results revealed that the lowest prevalence of Fasciolosis for Year 2014 was in the month of May (14.2%) and highest being in the month of August (35.8%).However in Year 2015, the prevalence rate was highest in the month of September (44.66%) followed by October (39.66%) and lowest in May (9.3%). Moreover, the infection was reported throughout the year due to resistance of metacercariae for desiccation, especially during the dry season and continued presence of the shallow water, enough vegetation and humidity for continued exposure of the animals to encysted metacercariae and no restriction on cattle grazing habits and movement between the infected and treated localities which was also suggested by El Bahy, 1998 [21].

These results are in agreement with Pfukenyi *et al*. 2006 and Faria *et al*. 2005 [22] who reported high intensity in August-September in Zambian cattle and in dairy cattle herd in Minas Gerais, Brazil respectively. Similarly, Qureshi *et al*. 2012 [49] recorded lowest prevalence in the month of May in Buffaloes of Northwestern Punjab, Pakistan which supports the findings of the current study. In both years, the lowest infection in May-June can be related to progression of hot dry weather, as the temperature was high and humidity was low in these months.

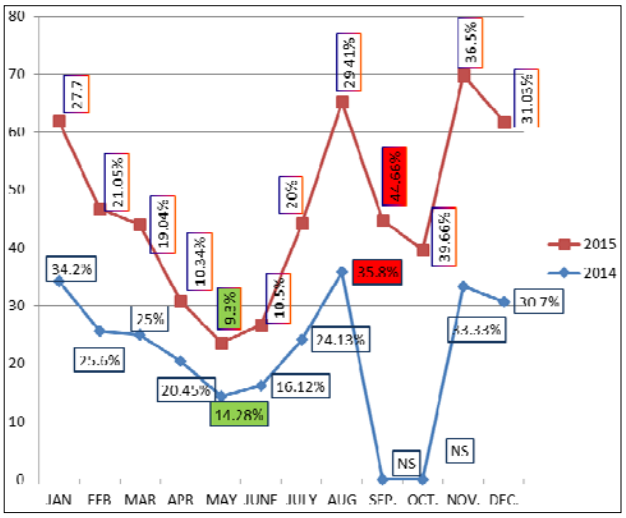

Fig 4: Monthwise prevalence of Fasiolosis (2014-2015)

Season wise Prevalence (Table and Fig 2)

On seasonal basis, the current study showed maximum spread of disease in Autumn Season i.e. 33.33% and 40% in Year 2014 and 2015 respectively. The minimum infection was recorded in spring season showing prevalence of 20% and 12.9% in consecutive studied years. There was no statistically significant difference between seasons in year 2014 which has already been stated could be attributed to skipping the data of two months due to natural disaster Kashmir valley faced. However statistically significant difference was observed between seasons in year 2015.

This difference could be due to a variety of weather condition in each year. The highest prevalence in autumn was also reported by Chaudhri *et al*. 1993 [16]; Maqbool *et al*. 1994 [34] and Ghirmire and Karki 1996 [25]; Abrous *et al*. 1999 [1]; Maqbool *et al*. 2002 [35]; Pfukenyi *et al*. 2005 [47] and Haridy *et al*. 2006 who emphasized that the possible reason for the same could be availability of favourable temperature and moisture for the rapid propagation of the parasitic trematode life cycle in this very season.

Table 3: Season wise prevalence of Fasciolosis (2014-2015)

Year	2014			2015		
Season	Ex.	Inf.	Prev.	Ex.	Inf.	Prev.
Spring	115	23	20%	82	10	12.9%
Summer	99	26	26.26%	102	20	19.6%
Autumn	12	4	33.33%	146	59	40%
Winter	90	27	30%	66	18	27.27%
χ^2(p-Value)	3.218(0.486)			25.26(0.000)		

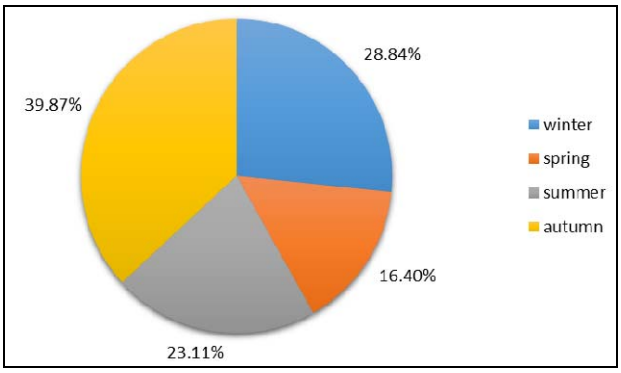

Fig 5: Cumulative Season wise prevalence

Distribution on the basis of infection type (Table 3)

Of the total 192 affected livers by fasciolosis, 149 (77.60%), 24 (12.5%) and 19 (9.89%) respectively showed *Fasciola gigantica, Fasciola hepatica* and mixed infection (*Fasciola hepatica* and *Fasciola gigantica).*

The finding of this study was in consistence with the earlier investigation by Ashrafi *et al*. 2004 [7] from Gilan province; Mir *et al*. 2008 [38] from Kashmir and Khan *et al*. 2009 [31] from Punjab Province (Pakistan) and by Phiri *et al*. 2005 [48]; Abunna *et al*. 2009 [2]; Fufa *et al*. 2009 [24]; Mwabonimana, *et al*. 2009 [44]. The predominance of *Fasciola gigantica* could be due to the availability of appropriate environmental conditions and topography (lowland and middle altitude zone) which are favorable habitat to its intermediate host *L. natalensis* (Urquhart *et al*. 1996) [62]. However, inverse distribution was reported by Melugeta *et al*. 2011 [42]; Belay *et al*. 2012 [12]; Chakiso, *et al*. 2014 [15] and Alemu and Abebe 2015 [5, 58]. Mixed infection of *F. hepatica* and *F. gigantica* occurs presumably as a result of the movement of stock between high and low ground or through overlapping of the territories of the snail vector at altitudinal range of 1200-1800 M.a.s.l. (Kendel 1954 and Graber, 1975) [29, 26].

Table 4: Prevalence based on type of infection

Infection Type	Infected	Prev. Among Infected Ones (N=192)	Overall Prevalence (N=714)
F. gigantica	149	77.60%	20.86%
F. hepatica	24	12.5%	3.361%
Mixed	19	9.89%	2.66%
$\chi2$		254.29(p=0.000)	186.22(p=0.000)

Age-wise distribution (Table4)

Out of 714 cattles, 166 heads were of age group <1-3Years, 396 of age between 3-6 years and 152 having age >6 Years. Among these 3 age categories, prevalence of Fasciolain livers was highest in >3-6 years age group (30.30%) followed by age group >6 years (28.28%) and least infection in bovines of age 1-3Years(17.46%).The results in current study were in consistency with Keyu *et al.* 2005 [30]; Rehman *et al*. 2015. The sound explanation behind the lower prevalence in age group >6 yrs compared to younger age group(3-6yrs) could be due to self-cure phenomenon (Assanji, 1988) [9] or high acquired immunity which increase with age (Dwinger *et al*. 1982) [20]. It has been also reported that *Fasciola* infected hosts may recover from parasitic infection with increasing age and hence become resistant (Yilma and Mesfin, 2000 [64]; Shiferaw *et al*. 2011 [55]; Mufti, 2011 [40]. Mulcahy *et al*. 1999 [41] suggested that resistance is not wholly immunological based rather resistance to reinfection may be due to hepatic fibrosis resulting from primary infection. Least infection in age group <1-3 years is possibly due to less chances of acquiring infection due to short exposure time as compared to older animals which is in agreement with (Anderson *et al*. 1999) [6] and Teklu *et al*. 2015 [58].

Table 5: Agewise prevalence of fasciolosis

Age	Ex.	Inf.	Prevalence	χ^2 p-Value
1Yr-3Yrs	166	29	17.46%	9.991 0.007
3Yrs-6Yrs	396	120	30.30%	
>6Yrs	152	43	28.28%%	

Genderwise prevalence (Table 5)

Out of 531 males and 183 females slaughtered during the survey period, males won by retaining lesser infection of 19.96% and were par to females who showed higher prevalence of 46.99%. The difference was highly significant and thus revealed sex as determinant influencing the prevalence of Fasciolosis rate. Our findings are in agreement with results of Daniel 1995 [18]; Molina *et al*. 2005 [39]; Bhutto *et al*. 2012 [13] and Teklu *et al*. 2015 [58] who reported higher prevalence of this parasite in female than male.

In the current studied abattoirs, the number of slaughtered male cattles (531) was far higher than the females (183). The number of positive females was higher in proportion than males even if the number of female cattle that come to abattoir were fewer in number. These results were in consistent to Kara *et al*. 2009. High infection rate in females can be multifactorial like high stress during parturition period (Spithill *et al*. 1999) [6, 57], weak and malnourished making them more susceptible to infection (Blood and Radostits, 2000) or due to the feeding conditions i.e females are generally being let loose to graze freely in pastures. The other possible reason for the same could be that the most of people traditionally feed their lactating cows with grasses during dry season which are grown around rivers and marshy areas for the sake of getting high milk yield as suggested by Gracy *et al*. 1999 [27] and Tilahun *et al*. 2014 [61]. However, some authors revealed that male cattle are more prone to Fasciolosis than female counterparts like Khan and Maqbool 2012 [49]. But, Rahmeto 1992 [51] and Dagne 1994 [17]; Keyyu *et al*. 2005 [30]; Phiri *et al*. 2005 [48]; Khan *et al*. 2009 [31]; Kabir *et al*. 2010 [28]; Kanyar *et al*. 2010; Assefa *et al*. 2015 [10] reported no significant difference between the gender of animal and infection rate which could be associated with similar management given to both group of animals or probably due

to common grazing pastures on which both are fed together, which expose them to the same risk of infection.

Table 6: Genderwise prevalence of Fasciolosis

	Examined	Infected	Prevalence
Males	531	106	19.96%
Females	183	86	46.99%
χ2 (p-value)	49.221(0.000)		

Association of body condition with infection (Table 6)

Among all examined animals (n = 714), 30.53% (n = 218) were marked as poor (body score 1-3), 35.05% (n =250) as Medium (4-6) and 34.44% (n = 246) as Good (7-9) body conditions. 42.66% of infection (n_i=93) was recorded in animals with poor body condition, 22.40% of infection (n_i=56) in animals with medium body score and 17.47% of infection (n_i=43) in animals having good body condition. Thus, an inverse association was found between the body condition and infectious rate of Fasciolosis which was statistically significant (p<0.05).These findings are in accordance to Mihreteab *et al*. 2010 [37]; Tilahun *et al*. 2014 [61] and Teklu *et al*. 2015 [58]

The current findings that lean animals are associated with higher *Fasciola* infection compared to animals with medium and normal body condition could be attributed to emaciation due to lack of nutrients, loss of blood and tissue fluid and demage to liver parenchyma caused by presence of flukes. Similar findings were reported by Beckele *et al*. 2010 [11]; Tesfay *et al*. 2012 [59] and Assefa *et al*. 2015 [10]. Radostits *et al*. 1994 [50] has mentioned that Chronic fasciolosis is the commonest disease in cattle and significantly characterized with weight loss.

Table 7: Effect of body condition on prevalence of Fasciolosis

Body Condition	Ex.	Inf.	Prevalence	χ^2 p-Value
Poor	218	93	42.66%	41.223 0.000
Medium	250	56	22.40%	
Good	246	43	17.47%	

Breedwise prevalence of Fasciolosis (Table7)

Out of the total 71 cattle examined, 213 were reared locally and 501 were imported from other states to the valley for slaughter purpose. The prevalence of fasciolosis was 40.80% and 20.90%for local and nonlocal breed cattle, respectively. There was statistically significant (χ^2 = 29.06, P = 0.000) association of fasciolosis with breeds. Our results are in agreement with study conducted by Teklu *et al*. 2015 [58].

This difference in prevalence based on breed might be due to the management of the animals as most of the local animals were reared in the extensive system of management which makes them easily susceptible to the parasites.

Table 8: Breed wise Prevalence of Fasciolosis

Breed	Ex.	Inf.	Prevalence	χ^2 p-Value
Locals	213	87	40.80%	29.06 0.000
Non-locals	501	105	20.90%	

Conclusion

Moderate intensity of fasciolosis was recorded in the current study. In line with above findings, it is recommended that strategic application of flukicides should be done and further epidemiological studies on biology and ecology of intermediate host should be carried out so to develop substantial planning for considerable success in control of Fasciolosis. There is need to carry out economic analysis so as to give appropriate economic losses directly by liver condemnation.

Acknowledgement

I extend my heartily thanks to Dr. Javed, Assitant Professor, Dept. of Statistic, University of Kashmir for proficiency and support regarding Biostatistics computation and analysis. I would like to thank butchers of abattoirs visited during current study for their interest to participate in research work by providing liver samples of cattle which form the basic tool for this piece of research work.

Reference

1. Abrous M, Rondelaud D, Dreyfuss G, Cabaret J. *Paramphistomum daubneyi* and *F. hepatica*: Influence of temperature changes on the shedding of cercariae from dually infected *Lymnaea truncatula*. Parasitol. Res. 1999; 85:765-769.
2. Abunna F, Asfaw L, Megers BA, Regassa A. Bovine Fasciolosis: Coprological, Abattoir Survey and its Economic Impact due to Liver Condemnation at Soddo Municipal Abattoir, Southern Ethiopia. Tropical Animal Health and Production. 2009; 42:289-292.
3. Affroze S, Begum N, Islam MS, Rony SA, Islam MA. Mondal MMH. Risk Factors and Gross Pathology of Bovine Liver Fluke Infection at Netrokona District, Bangladesh. J. Anim. Sci. Adv. 2013; 3(2):83-89.
4. Akhoon ZA, Peer FU. Prevalence of fascioliasis in district Srinagar of Kashmir valley. Vet. Sci. Res. J. 2014; 5(1&2):54-57.
5. Alemu A, Abebe B. Fasciolosis: Prevalence, Evaluation of Floatation and Simple Sedimentation Diagnostic Techniques and Monetary Loss due to Liver Condemnation in Cattle Slaughtered at Wolaita Soddo Municipal Abattoir, Southern Ethiopia. Food Science and Quality Management, 2015, 43.
6. Anderson N, Luong TT, Vo NG, Bui KL, Smooker PM, Spithill TW. The sensitivity and specificity of two methods for detecting Fasciola infection in cattle. Vet. Parasitol. 1999; 83:15-24.
7. Ashrafi K, Massoud J, Holakouei K, Mahmoodi M, Joafshani MA, Valero MA. Evidence Suggesting that Fasciola gigantica Might be the Most Prevalent Causal Agent of Fascioliasis in Northern Iran. Iranian J Publ Health. 2004; 33(4):31-37.
8. Asressa Yeneneh, Hassen Kebede, Tewodros Fentahun, Mersha Chanie. Prevalence of cattle fluke's infection at Andassa Livestock Research Center in north-west of Ethiopia. Veterinary Research Forum. 2012; 3(2):85-89.
9. Assanji MF. Helminth infection in livestock. J. Helminthol. 1988; 62:243-249.
10. Assefa A, Assefa Z, Beyene D, Desissa F. Prevalence of bovine Fasciolosis in and around Inchini town, West Showa Zone, Ada'a Bega Woreda, Centeral Ethiopia. J. Vet. Med. Anim. Health. 2015; 7(6):241-248.
11. Bekele M, Haftom T, Yehenew G. Bovine fasciolosis: Prevalence and its economic loss due to liver condemnation at Adwa municipal abattoir, North Ethiopia. Ethiopian Journal of Agricultural Science and Technology. 2010; 1:39-47.
12. Belay E, Molla W, Amare A. Prevalence and Economic Losses of Bovine Fasciolosis in Dessie Municipal

Abattoir, South Wollo Zone, Ethiopia. European Journal of Biological Sciences. 2012; 4(2):53-59.
13. Bhutto B, Arijo A, Phullan MS, Rind A. Prevalence of fascioliasis in buffaloes under different agro-climatic areas of Sindh Province of Pakistan. International Journal of Agricultural Biology. 2012; 14:241-245.
14. Braun U, Wolfensberger R, Hertzberg H. Diagnosis of liver flukes in cows- a coparison of the findings in the liver, in the faeces and in the bile. Schweizer Archiv for Tierheilkunde. 1995; 137(5):187-92.
15. Chakiso B, Menkir S, Desta M. On Farm Study of Bovine Fasciolosis in Lemo District and its economic loss due to liver condemnation at Hossana Municipal abattoir, Southern Ethiopia. Int. J. Curr. Microbiol. App. Sci. 2014; 3(4):1122-1132.
16. Chaudhri SS, Gupta RP, Kumar S, Singh J, Sangwan AK. Epidemiology and control of *Fasciola gigantica* infection of cattle and buffaloes in Eastern Haryana, India. Indian. J. Anin. Sci. 1993; 63:600-605.
17. Dagne M. Survey on Prevalence and Economic Significance of Bovine Fasciolosis in Debre Berhan region. DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University, Debre Zeit, Ethiopia, 1994.
18. Daniel F. Economic importance of organs condemnation due to fasciolosis and hydatidosis in cattle and sheep slaughtered at Dire Dawa Abattoir, DVM thesis, Faculty of Veterinary Medicine, Addis Ababa University Debre zeit, Ethiopia, 1995.
19. Dar GH, Bhagat RC, Khan MA. Biodiversity of the Kashmir Himalaya. (Valley Book House, Srinagar — 190006, J&K), 2002, 19.
20. Dwinger RH, Leriche PD, Kuhne GI. Fasciolosis in beef cattle in North West Argentina. Trop. Anim. Health Prod. 1982; 14:167-171.
21. El-Bahy NM. Strategic Control of Fascioliasis in Egypt. Review article. Continual Scientific Committee of Pathology, Microbiology and Parasitology, Egypt, 1998.
22. Faria RN, Cury MC, Lima WS. Prevalence and dynamics of natural infection with Fasciola hepatica (Linnaeus, 1758) in Brazilian cattles. Revue Méd. Vét. 2005; 156(2):85-86
23. Fatima M, Chishti MZ, Ahmad F, Lone BA. Epidemiological Study of Fasciolosis in Cattle of Kashmir Valley. Advances in Biological Research. 2012; 6(3):106-109.
24. Fufa A, Loma A, Bekele M, Alemayehu R. Bovine fasciolosis: Carpological, abattoir survey and its economic impact due to liver condemnation at Soddo municipal abattoir, Southern Ethiopia. Tropical Animal Health Production. 2009; 42:289-292.
25. Ghirmire NP, Karki NPS. Prevalence of fascioliasis and efficacy of various anthelmintics in buffaloes of Rural Kathamandu vetcon. N. U. A. 1996, 43.
26. Graber MM. Helminths and helminthiasis of domestic and wild animals of Ethiopia. Bulutin Animal Health Production. 1975; 23:57-86.
27. Gracy J, David S, Collins, Robert Huey. Meat Hygiene, 10 edition, Harcourt Brace, 1999, 681-686.
28. Kabir MHB, Eliyas M, Hashem MA, Mohiuddin Miazi OF. Prevalence of zoonotic parasitic diseases of domestic animals in different abattoir of Comilla and Brahman Baria region in Bangladesh. Univ. J. Zool. Rajshahu univ. 2010; 28:21-25. http://journals.sfu.ca/bd/index.php/UJZRU
29. Kendall SB. Fascioliasis in Pakistan. Ann. Trop. Med. Parasitol. 1954; 48(3):307-313.
30. Keyyu JD, Monrad J, Kyvssgard NC, Kassuku AA. Epidemiology of Fasciola gigantica and paramphistomes in cattle on traditional, smallscale dairy and largescale dairy farms in the southern highlands of Tanzania. Tropical Animal Health and Production. 2005; 37:303314.
31. Khan MK, Sajid MS, Khan MN, Iqbal Z, Iqbal MU. Bovine fasciolosis: Prevalence, effects of treatment on productivity and cost benefit analysis in five districts of Punjab, Pakistan. Research in Veterinary Science. 2009; 87:70-75.
32. Kuchai JA, Chishtin MZ, Zaki MM, Dar SA, Muzaffar Rasool, Ahmad J. Some Epidemiological Aspects of Fascioliasis among Cattle of Ladakh. Global Veterinaria. 2011; 7(4):342-346.
33. Kumar V, Banerjee PS, Hira Ram, Rajat Garg, Yadov CL. Faecal examination vis-à-vis bile examination for the diagnosis of bubaline fasciolosis. Journal of Veterinary Parasitology. 2002; 16:185-186.
34. Maqbool A, Arshad MJ, Mahmood F, Hussai NA. Epidemiology and chemotherapy of fascioliasis in buffaloes. Assiut. Vet. Med. J. 1994; 30:115-123.
35. Maqbool A, Hayat CS, Akhtar T, Hashmi HA. Epidemiology of fasciolosis in buffaloes under different managemental conditions. Vet. Arhiv. 2002; 72:221-228.
36. Mas-Coma S, Bargues MP, Valero MA. Fascioliasis and other plant- borne trematode zoonoses. International Journal for Parasitology. 2005; 35:1255-1278.
37. Mihreteab B, Haftom T, Yehenew G. Bovine Fasciolosis: Prevalence and its Economic loss due to liver condemnation at Adwa Municipal Abattoir, North Ethiopia. School of Veterinary Medicine, College of Agriculture and Veterinary Medicine, Jimma. Ethiopian Journal of Applied sciences and Technology. 2010; 1(1):39-47.
38. Mir RA, Chishti MZ, Zarger MA, Tak H, Dar FA. Seasonal prevalence of trematode parasites of sheep (*Ovis aries* L.) in Kashmir Valley, India. Nigerian Journal of Parasitology. 2008; 29(2):80-83.
39. Molina EC, Gonzaga EA, Lumbae LA. Prevalence of infection with fasciola gigantic and its relationship to carcase and liver weights and fluke and egg counts in slaughter cattle and buffaloes in Southern Mindanao, Phillippines. Tropical Animal Health Production. 2005; 37:215-221.
40. Mufti S. An epidemiological study of bovine fasciolosis in potohar region. Faculty of Sciences, Arid Agriculture University, Rawalpindi, Pakiston, 2011.
41. Mulcahy G, Joyce P, Dalton JP. Immunology of Fasciola hepatica infection In: Dalton, JP (Ed), Fasciolosis CAB International, 1999, 341-376.
42. Mulugeta S, Begna F, Tsegaye E. Prevalence of Bovine Fasciolosis and its Economic Significane in and Around Assela, Ethiopia. Global Journal of Medical research, 2011, 11(3).
43. Mungube EO, Sila DM, Kariuki CW, Bauni SM, Tenhagen BA, Wamae L. *et al.* A crosssectional survey on fasciolosis in selected settlements of Taveta Division, Coast Province, Kenya. Livestock Research for Rural Development. 2012; 24(4):1-8.
44. Mwabonimana MF, Kassuku AA, Ngowi HA, Mellau LSB, Nonga HE, Karimuribo ED. Prevalence and Economic Significance of Bovine Fasciolosis in

Slaughtered Cattle at Arusha Abattoir Tanzania. Tanzania Veterinary J. 2009; 26:68-74.
45. Nega M, Bogale B, Chanie M, Melaku A, Fentahun T. Comparison of Coprological and Postmoretem Examinations Techniques for the Deterimination of Prevalence and Economic Significance of Bovine Fasciolosis. Journal of Advanced Veterinary Research. 2012; 2:18-23.
46. Ogunrinade A, Adegoke GO. Bovine fascioliasis in Nigeria. Intercurrent parasitic and bacterial infection. Tropical Animal Health Production. 1982; 14:121-125.
47. Pfukenyi DM, Monrad J, Mukaratirwa S. Epidemiology and control of trematode infections in cattle in Zimbabwe: a review. J. S. Afr. Vet. Assoc, 2005a; 76:9-17.
48. Phiri AM, Phiri IK, Sikasunge CS, Monrad J. Prevalence of Fasciolosis in Zambian Cattle Observed at Selected Abattoirs with Emphasis on Age, Sex and Origin. J. Veterinary Medicine B. 2005; 52:414-416.
49. Qureshi AW, Tanveer A, Maqbool A, Niaz S. Seasonal and monthly prevalence pattern of fascioliasis in buffaloes and its relation to some climatic factors in north eastern areas of Punjab, Pakistan. Iranian Journal of Veterinary Research. 2012; 13(2):134-137.
50. Radostitis OM, Blood DC, Gay CC. A text book of the disease of cattle, sheep, goats, pigs and horse: Veterinary medicine. 8th ed. London, UK: Bailliere, Tindall, 1994, 105-106.
51. Rahmeto A. Fasciolosis Clinical occurrences, Coprological, Abattoir and Snail survey in and around Wolisso. DVM thesis, Faculty of Veterinary Medicine, Addis Ababa University, Debre Zeit, Ethiopia, 1992.
52. Rehman TU, Khan MN, Sajid MS, Javed MT. Slaughter house based epidemiology and estimation of economic losses of bovine Fascioliasis in Tehsil Sargodha. Pakistan Journal of Science, 2013, 65(4).
53. Schweizer G, Braun U, Deplazes P, Torgerson PR. Estimating the financial losses due to bovine fasciolosis in Switzerland. Veterinary Record. 2005; 157:188-193.
54. Sheikh GN, Qadri GJ, Gunjan Das. Seasonal prevalence of bovine Fascioliasis in Kashmir valley. Indian Journal of Veterinary Medicine. 2007; 27(2):119-120.
55. Shiferaw Mulugeta, Feyisa Begna, Ephrem Tsegaye. Prevalence of Bovine Fasciolosis and its economic significane in and around Assela, Ethiopia. Global Journals Inc. 2011; 11:1-2.
56. Soulsby EJL. Helminths, Arthropods and Protozoa of Domesticated Animals, 7th. Ed edn. Bailliere Tindall, London, 1986, 212-342.
57. Spithill TW, Smooker PM, Copeman DB. Fasciola gigantica: epidemiology, control, immunology and molecular biology. Wallingford, Oxon, UK: CABI, 1999, 465-525.
58. Teklu H, Abebe N, Kumar N. Abattoir prevalence of bovine fasciolosis in the manucipal abattoir of Wukro, Northern Ethiopia. Journal of International Academic Research for Multidisciplinary. 2015; 2(12):430-438.
59. Tesfay H, Dejene T, Kebede E. Prevalence of bovine fasciolosis and its associated risk factors in Mekelle municipal abattoir. Journal of the Drylands, 2012, 10-17.
60. Thrustfield M. Veterinary Epidemiology.3rd Edition, Black Well Science Ltd. Cambridge, USA, 2005, 225-228.
61. Tilahun Z, Nemomsa A, Haimanot D, Girma K. Study on Prevalence of Bovine Fasciolosis at Nekemte Veterinary Clinic, East Wollega Zone, Oromia, Ethiopia. European Journal of Biological Sciences, 2014; 6(2):40-45.
62. Urquhart GM, Armour J, Duncan JL, Dunn AM, Jennings FW. Veterinary Parasitology. 2nd edition. Blackwell Science Ltd., Osney Mead, London, UK, 1996.
63. Vercruysse J, Claerebout E. Treatment vs non treatment of helminth infection in cattle defining the threshold. Veterinary Parasitology. 2001; 98:195-214.
64. Yilma Jabore, Mesfin Ali. Dry season bovine fasciolosis in northwestern part of Ethiopia. Revue Medical Veterinary. 2000; 151(6):493-500.