



Epidemiological Survey of Fascioliasis in Cattle, Buffalo and Goat in Mahottari and Dhanusha, Nepal

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Abstract | Fascioliasis is a widely distributed and economically important parasitic disease of ruminants. A cross sectional opportunistic survey was conducted using qualitative and quantitative faecal examination techniques to determine the prevalence of fascioliasis in household's cattle, buffalo and goat in Nepal. Animals were sampled from households, in Mahottari and Dhanusha districts during July, 2014. The overall prevalence of fascioliasis was 51% in cattle, 86% in buffalo and 47% in goat, respectively. Faecal samples from Mahottari district had shown a significantly higher prevalence [cattle (70.59%), buffalo (58.82%) and goat (68.09%)] of *Fasciola spp.*, egg than in Dhanusha [cattle (29.41%), buffalo (41.18%) and goat (31.91%)]. The mean egg count per gram of faeces was found 66 (CI: 51.6- 80.4), 118 (CI: 97. 4-138.6) and 54 (CI: 41.3-66.7) in cattle, buffalo and goat, respectively. Variation in prevalence was also significant in relation to age and body condition score (BCS) of the animals. So, it is concluded that fascioliasis in ruminants are prevalent in Nepal. Therefore, it is essential to study detailed epidemiology of fascioliasis and to find out effective control strategies against it.

Keywords | Fascioliasis, Epidemiology, Cattle, Goat, Buffalo

Editor | Muhammad Imran Rashid, Department of Parasitology, University of Veterinary and Animal Sciences, Lahore, Pakistan.

Received | July 06, 2015; **Revised** | August 18, 2015; **Accepted** | August 20, 2015; **Published** | September 29, 2015

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Citation | Yadav SK, Ahaduzzaman M, Sarker S, Sayeed MA, Hoque MA (2015). Epidemiological survey of fascioliasis in cattle, buffalo and goat in Mahottari and Dhanusha, Nepal. J. Adv. Parasitol. 2(3): 51-56.

DOI | <http://dx.doi.org/10.14737/journal.jap/2015/2.3.52.56>

ISSN | 2311-4096

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INTRODUCTION

Fascioliasis is a parasitic disease, caused by two species of trematode: *Fasciola gigantica* and *F. hepatica* commonly known as liver fluke. *Fasciola hepatica* has a worldwide distribution, but predominates in temperate zones while *Fasciola gigantica* is found in most continents, primarily in tropical regions (Andrews, 1999; Bennema et al., 2014). Both species are transmitted by the snails of the family Lymnaeidae. There are about 75 biotopes of Lymnaeidae snails were found responsible for the transmission (Caron et al., 2014). Infection with *Fasciola spp.*, are usually associated with grazing wetland and drinking places contaminated by the infective metacercariae (Payne, 1990). Moreover, the distribution and abundance of fascioliasis is extremely related to geological position, topography and environmental conditions (Dutra et al., 2010). Based on this, climatic factors have been reported to be a sensitive means of predicting the annual prevalence and geospatial

variability (Fuentes, 2006). This fluke infects the bile duct of the final host especially domestic ruminants such as cattle (*Bos taurus*), buffaloes (*Bubalus bubalis*), goats (*Capra hircus*) and sheep (*Ovis aries*) that have a significant contributory role in national and social economic condition across the globe (Choubisa and Jaroli, 2013). *Fasciola* can also infect human (*Homo sapiens*) and is classified in Neglected Tropical Disease (NTD). In livestock, fascioliasis is important for losses caused by either mortality in acute cases or weight loss, infertility and reduced production in chronic cases (Siddiki et al., 2010). Although several efforts have been available for the diagnosis of fascioliasis through immunological and molecular techniques, but still detection of eggs by faecal examination techniques remains as the gold standard for the diagnosis of trematode infection like fascioliasis (Esteban et al., 2014). Therefore, the objective of this study was to assess the *Fasciola spp.* infection in cattle, buffalo and goat in Mahottari and Dhanusha of Nepal, adopted qualitative and quantitative technique to

identify the prevalence and risk factors for better and appropriate control strategies.

MATERIALS AND METHODS

STUDY AREA

The study was conducted in two different districts of Nepal, named Mahottari and Dhanusha (Figure 1). Geographically Mahottari and Dhanusha fall in the arid and semi-arid hydrological zones, with average annual rainfall of 2,020 mm (Mahottari) and 1,480 mm (Dhanusha) mostly occur during the monsoon period (June to September). Average temperatures range between 6°C to 40°C in Mahottari and 11°C to 30°C in Dhanusha respectively. Both districts are naturally riverine and experiences five seasons: summer, monsoon, autumn, winter and spring. Moreover, a quarter of Mahottari territory is forested (UN, 2013).

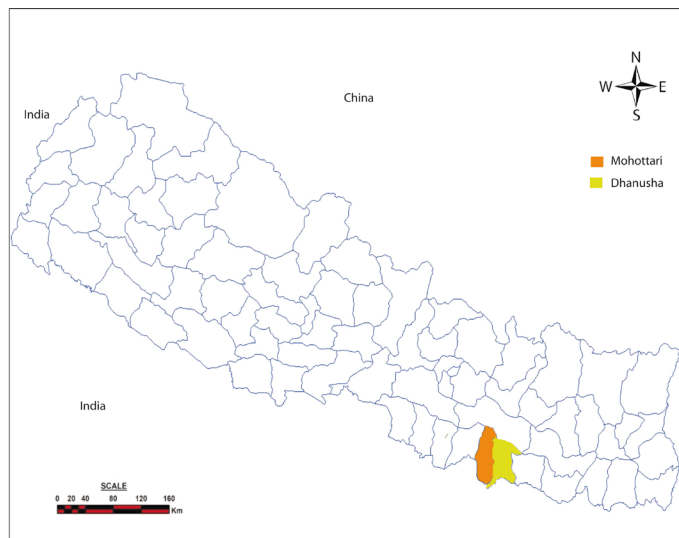


Figure 1: Map showing Mahottari and Dhanusha district, Nepal

EPIDEMIOLOGICAL DATA COLLECTION

Species, age, sex and body condition score of each individual animal were recorded using a structured record keeping sheet through physical inspection and face-to-face interview.

SAMPLE COLLECTION AND TRANSPORTATION

An opportunistic cross-sectional coprological survey was performed in plain riverside rural areas of Mahottari and Dhanusha districts of Nepal during July, 2014 with the aim of estimating prevalence of fascioliasis in local breeds of cattle (*Bos indicus*), buffalo (*Bos bubalis*) and goat (*Capra hircus*). Mixed livestock, household farms were considered for the study. One individual animal of each livestock species per household was sampled. A total of 300 faecal samples were collected from cattle, buffalo and goat directly from the rectum of animal using hand glove. Samples were placed in 10% formalin containing sterile vials labelled

with unique identity numbers, transferred to the laboratory at Chittagong Veterinary and Animal Sciences University, Chittagong, Bangladesh and stored at 4°C until being evaluated.

EXAMINATION OF SAMPLES

Two different types of qualitative analyses, namely direct and sedimentation technique were followed to detect the eggs in the faecal materials. The direct smear method for faecal examination was performed, as described by Hosain et al. (2011). At least three smears were prepared for each sample and eggs were identified on the basis of their morphological features (Soulsby, 1986). In addition, the Modified McMaster Counting technique as described by Soulsby (1986) was performed to determine the parasitic load (egg per gram).

EPIDEMIOLOGICAL DATA ANALYSIS

Field and laboratory data were entered into the Microsoft Excel Program 2007. Data were sorted and checked the integrity before exporting to STATA 13 (Stata Corp, 4905, Lakeway Drive, College station, TX 77845, USA) for epidemiological analysis. Descriptive analysis was performed on qualitative and quantitative results of fascioliasis. A fisher's exact test was applied to assess the association between *Fasciola spp.* infection (yes or no) and the selected factors viz. age, sex and body condition score. To determine the age wise prevalence all ages were categorized based on percentile that is 50% in one group and 50% in another group. The results were presented as frequency, percentage, mean and 95% confidence interval (CI). The set level of significance was 0.05. A value of $p < 0.05$ was considered significant in all statistical tests at confidence interval 95%.

Table 1: Prevalence and qualitative evaluation of faecal samples for fascioliasis in ruminants in Mahottari and Dhanusha districts of Nepal by direct smear and sedimentation diagnostic methods

Species	Total no of samples	Mahottari		Dhanusha	
		N (%)	CI (%)	N (%)	CI (%)
Cattle	100	36 (70.59)	57.51-83.77	15 (29.41)	17.86-44.61
Buffalo	100	40 (58.82)	66.28-89.97	28 (41.18)	41.25-70.01
Goat	100	32 (68.09)	49.19-77.08	15 (31.91)	17.86-44.61

RESULTS

Overall qualitative prevalence of fascioliasis among cattle, buffalo and goat are displayed in Table 1 and quantitative prevalence in Table 2. In both methods prevalence and intensity was higher in Mahottari than the Dhanusha district and there variations were significant ($p < 0.05$). The female

Table 2: Prevalence, intensity and quantitative evaluation of faecal samples for fascioliasis in ruminants in Mahottari and Dhanusha districts of Nepal by Modified McMaster technique

Species	Total no of samples	No of positive samples	Mean eggs (min-max)	% CI	Mahottari		Dhanusha	
					Mean egg (min-max)	Std. dev.	Mean egg (min-max)	Std. dev.
Cattle	100	51	66 (0-200)	51.6- 80.4	90 (0-200)	67.76	42 (0-200)	70.25
Buffalo	100	68	118 (0-400)	97.4-138.6	146 (0-400)	105.39	90 (0-300)	95.30
Goat	100	47	54 (0-200)	41.3-66.7	76 (0-200)	65.65	32 (0-200)	51.27

Table 3: Prevalence and qualitative evaluation of faecal samples for fascioliasis infection in ruminants according to sex, age and body condition score (BCS) in Mahottari and Dhanusha districts of Nepal

Parameters		Cattle		Buffalo		Goat		P value
		N (%)	% CI	N (%)	% CI	N (%)	% CI	
Sex	Male	9 (17.7)	8.4- 31.0	19 (27.9)	17.7-40.1	15 (31.9)	19.1-47.1	0.170
	Female	42 (82.3)	69.1-92.0	49 (72.1)	59.9-82.3	32 (68.1)	52.9-80.9	
Age ¹ (Year)	Less or equal to 5	39 (54.9)	62.5-87.2	-	-	-	-	0.012
	More than 5	12 (41.4)	12.8-37.5	-	-	-	-	
	Less or equal to 3	-	-	47 (70.2)	56.7-79.8	-	-	
	More than 3	-	-	21 (63.6)	20.2-43.3	-	-	
BCS	Less or equal to 1	-	-	-	-	31 (49.2)	50.7-79.1	0.011
	More than 1	-	-	-	-	16 (43.2)	.20.9-49.3	
	Average	1 (1.9)	0.05-10.4	57 (83.8)	72.9-91.6	38 (80.9)	66.7-90.9	
	Good	1 (1.9)	0.05-10.4	5 (7.4)	2.4- 16.3	3 (6.4)	1.3-17.5	
Grazing system ²	Cachectic	49 (96.1)	86.5-99.5	6 (8.8)	3.3-18.2	6 (12.8)	4.8-25.7	0.008
	Free ranged	-	-	-	-	30 (63.83)	21.2-39.9	

¹age values are according to percentile to minimize wide age variation among species; ² cattle and buffaloes were free ranged

animals were more likely to be infected in compared to the males, but was statistically insignificant ($p=0.170$). Moreover, the body condition score (BCS) of the animals found significant effect on the prevalence of fascioliasis ($p<0.05$). Cattle suffering for fascioliasis were mostly cachectic, on the other hand buffaloes and goats were in average BCS (Table 3). Goats grazed on free ranged system were found more infected by fascioliasis than that of reared under tethered husbandry practice ($p<0.05$).

DISCUSSION

PREVALENCE OF FASCIOLIASIS

The definitive host range for *Fasciola spp.* is widely diverse and includes household ruminants. We selected cattle, buffalo and goat for this study because these livestock species are the principal source of household income in the rural areas. In this study it was found that the prevalence was more in buffalo followed by cattle and goat. This may be due to variation in grazing habit of individual species, as buffaloes are more likely to graze on swampy ground and goats are on dry pasture therefore less chance for goat to ingest metacercariae and vice versa. Similar results were reported in another study at Punjab, Pakistan; the species-wise preva-

lence of fasciolosis was found higher in buffaloes (30.50%) as compared to cattle (20.42%) (Khan et al., 2009), but in contrast with findings by Choubisa and Jaroli (2013), who found goats were more infected by fascioliasis than buffaloes at Dungarpur and Udaipur districts of southern Rajasthan, India, which may be due to variation in husbandry practice. Moreover, remarkably high (42.06%) prevalence was found by Bhutto et al. (2012) in buffalo in Sindh province of Pakistan and the incidence was almost double in female (45.08%) in comparison of male (20.89%), are in-line with this study. In China, the prevalence was about 44.7% with *Fasciola hepatica* and 24.9% with *Fasciola gigantica* in water buffalo (Liu et al., 2009). Another coproscopy examination reported that, the overall prevalence of fascioliasis in traditional, large-scale dairy and small-scale dairy cattle was 63.8%, 46.2% and 28.4%, respectively; in Iringa district, Tanzania (Keyyu et al., 2006) is almost double than the findings of this study. Joshi (1988) found above 50% prevalence of fascioliasis from cattle and buffalo in six villages of mid-western hills of Nepal. On the other hand, in Sylhet district of Bangladesh, overall prevalence of caprine fascioliasis was observed 20.75% and the rate was found higher in female goats (Hossain et al., 2011).

EFFECTS OF AGE ON FASCIOLIASIS

We also found that animals of younger aged group were more infected than the older group, which may be due to the development of partial immunity against fascioliasis by the parasitized hosts. Moreover, *Fasciola sp.*, are capable to develop an escape mechanism from the natural host immunity (Emmanuelle and Alain, 2010). In contrast, Fatima et al. (2012) noticed that a higher infection rate was recorded in older animals than in young. This speculated variation probably for random sampling strategy, where the age variation was wide; therefore, we sorted all animals age as percentile to limit the error and calculate age-wise prevalence.

EFFECTS OF GRAZING SYSTEM ON FASCIOLIASIS

It is important to realize, grazing nature and husbandry practice enrol an optimal role in the prevalence of the diseases having multiple host. Here the studied population of cattle and buffaloes were absolutely free ranged pasture grazing, but goats were either tethered or free ranged and the prevalence was notably higher in free ranged compared to tethered and which may be due to expose more contact to the risk factors such as the presence of metacercaria. Oryan et al. (2011) suggested that, differences in the animal husbandry conditions of ruminates, easier accessibility to intermediate hosts and hereditary resistance to parasitic infections might be the reasons for differences in the prevalence rate and infection of these animals.

CONCLUSION

The present study reported species, age, sex, grazing system and body condition were the factors that influence the prevalence of fasciolosis in cattle, buffalo and goat in Nepal. These parameters need to be emphasized during the planning for effective management and control of fascioliasis.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

ETHICAL STATEMENT

There was nothing to violate against animal ethics and welfare.

AUTHORS CONTRIBUTION

Saroj Kumar Yadav collected the samples from sampling areas. Saroj Kumar Yadav, Md. Ahaduzzaman and Sudeb Sarker carried out the laboratory experimentation. Md. Abu Sayeed and Md. Ahasanul Hoque analyzed the data. Md. Ahaduzzaman and Md. Ahasanul Hoque designed

the research work, drafted and revised the manuscript. All authors read and approved the final version of the manuscript.

ACKNOWLEDGEMENT

We are very grateful to the animal owners for their cordial participation to fill up the questionnaire.

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