Agricultural Economics Research Review
Vol. 27 (No.2) July-December 2014 pp 281-288
DOI: 10.5958/0974-0279.2014.00031.7

Estimation of Milk Losses due to Fasciolosis in Uttarakhand§

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Abstract

The milk loss due to Fasciolosis in dairy animals has been assessed in four major agro-ecological regions, viz. High-hills, Mid-hills, Bhabar, and Tarai area of Uttarakhand state. The prevalence rate of Fasciolosis has been found lower in the High-hills than in Mid-hills, Bhabar, and Tarai regions. A comparison of prevalence rates of Fasciolosis across different species and breeds has revealed a higher prevalence rate of Fasciolosis in buffaloes than in crossbred and indigenous cows. In buffaloes, the adverse effect of Fasciolosis, in terms of reduction in milk yield, becomes more prominent during the latter stages of lactation. The milk loss in the state due to Fasciolosis has been observed highest for buffaloes, followed distantly by crossbred and indigenous cows. The annual milk loss in the state of Uttarakhand due to Fasciolosis has been estimated to be of ₹ 90.41 crore. The milk loss has been found highest in buffaloes and since the adult female buffaloes constitute 66 per cent of the total bovine population in the state, Fasciolosis seems to be an important parasitic problem which needs to be tackled adequately to prevent substantial milk losses.

Key words: Fasciolosis, economic analysis, ruminants, Uttarakhand

JEL Classification: Q10, Q12

Introduction

The diseases reduce production potential of livestock and hence affect the livelihood of those who are involved directly or indirectly in production, marketing, processing and distribution of livestock and livestock products. The consumption of infected food products may even impair human health. Amongst many, Fasciolosis is one of the widely prevalent livestock diseases in the developing countries. It is caused by helminth *Fasciola gigantica*. There are only a limited studies available that have examined the prevalence of Fasciolosis in developing countries (Maqbool *et al*., 2002; Kithuka *et al.*, 2002; Asrat *et al.*, 2005) including India (Garg *et al.*, 2009). Also, there is little information available on the economic impact of this disease. Under this background the present study has been carried out with the following objectives:

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§ This paper is based on the findings of a research project 'Economic impact assessment of Fasciolosis and Mastitis in Uttarakhand – An action research project', sponsored by Department of Science and Technology, Government of India, New Delhi.

- Study the prevalence rate of Fasciolosis in bovines in the state of Uttarakhand, and
- Estimate the milk loss due to Fasciolosis, in physical and value terms.

Such information can provide important input to policymakers to take informed decisions on the prevention and control of the disease.

Methodology

Data

To estimate milk loss due to Fasciolosis, surveys were conducted in four major agro-ecological regions, viz. Tarai, Bhabar, Mid-hills and High-hills of Uttarakhand. The Tarai region is swampy and humid, consisting of many springs and slow-flowing streams. The region is one of the most fertile regions in India. The Bhabar region consists of a narrow belt of sloping land located at the foothills of Himalayas. The Bhabar tract is devoid of springs or streams and the water table is quite low. Its terrain is porous consisting mainly of boulders and gravel.

The surveys were conducted during 2010-11 in 22 administrative blocks spread across 9 districts representing major agro-ecological regions. The number of blocks, households and dairy animals were selected from each agro-ecological region in proportionate to the livestock population of a region. A total of 604 households — 155 from High-hills, 219 from Mid-hills, 82 from Bhabar and 148 from Tarai region — were selected for the the study. The faecal samples of 453 in-milk buffaloes, 201 in-milk crossbred cows, and 146 in-milk indigenous cows were collected from these households. These samples were screened for the presence of *Fasciola* eggs following the sedimentation technique (Soulsby, 1982) to ascertain the incidence and intensity of *Fasciola* infection. The intensity of *Fasciola* infestation was ascertained in term of eggs per gram (EPG).

Information on the parameters such as quantum of milk production, loss of milk, unit price of milk, etc. was collected by interviewing the household-head or household member who was directly involved in looking after the animals. Although, each household was visited once, data were collected for a period of one week preceding the survey based on short recall by the respondents.

Method of Estimation of Losses

Direct loss of milk per day (daily average for one week) was estimated using Equation (1):

$$DLM = R \times W \times M \times P \quad \ldots(1)$$

where,

DLM = Direct loss of milk per day in litres,

R = Prevalence rate of Fasciolosis (proportion of in-milk animals infested),

W = Proportion of milk yield lost per in-milk animal,

M = Daily milk yield (average for one week) of in-milk animals, and

P = Population of in-milk animals.

The value of milk loss was calculated by Equation (2):

$$VLM = P_w \times DLM \quad \ldots(2)$$

where,

VLM = Value of milk loss per day (₹)

DLM = Direct loss of milk per day in litres (as estimated above), and

P_w = Price of milk (₹/L).

To estimate the annual milk loss due to Fasciolosis, it was assumed that the parasite lives in the animals for 1 year (Junquera, 2014) and hence the loss in milk yield will be for the duration of lactation in the animals. The annual milk loss from Fasciolosis was estimated by multiplying the average per day milk yield loss with the average lactation period of the relevant species. The economic value of annual milk loss due to Fasciola infestation was then obtained as the product of annual milk loss and price of milk for different breeds/species of animals.

It should be kept in mind that considering the total population of milk animals or breedable females of a particular category, this type of milk loss is relevant only for in-milk animals and not for dry animals and heifers.

Results and Discussion

The feacal samples were screened for Fasciola infestation. The distribution of samples tested positive for all the agro-ecological regions, for different species

across different stages of lactation, and intensity of infection, is presented in Table 1.

Prevalence Rate of Fasciolosis

The prevalence of Fasciolosis in different regions is shown in Table 2. In the High-hills, the prevalence rate of Fasciolosis was highest among crossbred cows (9.52%), followed by buffaloes (3.36%). The prevalence of Fasciolosis was not observed in indigenous cows in the High-hills. The prevalence rate of Fasciolosis for all the tested animals was 3.83 per cent. In the Mid-hills, the prevalence rate of Fasciolosis was highest among indigenous cows (17.7%), followed by buffaloes (12.69%) and crossbred cows (6.06%). For all animals combined, the prevalence rate of Fasciolosis was 12.55 per cent. In the Bhabar area, prevalence rate of Fasciolosis was highest in buffaloes (16.67%), followed by indigenous cows (13.04%). The incidence of Fasciolosis was not observed in the crossbred cows and the prevalence rate for all the animals was 12.90 per cent in this region. In the Tarai area, the number of samples screened from indigenous cows was negligible compared to that of buffaloes and crossbred cows. The prevalence rate of Fasciolosis was higher among buffaloes (16.95%) than crossbred cows (8.47%). The combined prevalence rate of Fasciolosis for all the animals was 13.39 per cent. Across the regions, the prevalence rate of Fasciolosis for all animals was lower in the High-hills than in other regions of the state. The average intensity of infection was highest in the Bhabar region (28 EPG), followed by Mid-hills (25 EPG), Tarai (19 EPG) and the High-hills (13 EPG).

A comparison of prevalence rates of Fasciolosis across different species and breeds revealed that prevalence rate of Fasciolosis was higher in buffaloes than in crossbred or indigenous cows. The intensity of infection among crossbred cows was lower as compared to the other breed/species of dairy animals. The average intensity of infection was also higher among buffaloes than among indigenous cows.

Milk Loss due to Fasciola Infestation

The average per day loss in milk production due to Fasciola infestation for different species/breeds of animals across different regions is given in Table 3. Since milk production varies as per lactation stage, milk loss per animal per day was calculated separately at different lactation stages, viz. less than 4 months, 4-10 months and more than 10 months.

The average per day milk loss in buffaloes was highest in the High-hills followed by Mid-Hills, Tarai and Bhabar regions. The disaggregated analysis across different stages of lactation revealed that average per day milk loss per animal increased with increase in lactation stage, in all the regions, except in High-hills. This indicates that the adverse effect of Fasciolosis becomes more prominent during the latter stages of lactation among buffaloes in the Mid-hills, Bhabar and Tarai regions. The average per day milk loss in crossbred cows due to Fasciolosis was highest in the High-hills, followed by Mid-hills and Tarai region, with no incidence in the Bhabar region. No definite pattern in milk loss was observed across different lactation stages in case of crossbred cows. The average per day milk loss due to Fasciolosis among indigenous cows was highest in the Bhabar region, followed by the Mid-hills, with no incidence in the High-hills and Tarai area. A reduction of 1.75 litres (30.55%) in milk per animal per day over a period of 4 weeks has been reported in the cattle of Uttarakhand by Kumar *et al.* (2006).

An attempt was also made to estimate the per day milk loss due to Fasciolosis according to different degrees of intensity of Fasciola infestation. The animals were classified into three categories based on the intensity of infection, viz. low intensity (< 10 EPG), medium intensity (10-40 EPG) and high intensity (> 40 EPG). The results are presented in Table 4. In the case of buffaloes, per day milk loss increased with increase in intensity of infection. The per day milk losses were highest for high intensity of infection category in hills, bhabar and tarai regions. In the case of crossbred cows also, the per day milk losses increased with increase in intensity of infection. However, in indigenous cows, no distinct pattern could be identified regarding association of per day milk loss with intensity of infestation.

Based on the prevalence rates of Fasciolosis in different categories of in-milk animals and estimates of milk losses in infected animals, estimates of milk losses in the blocks, covered in the survey — representing different agro-ecological regions — were computed. The results of this analysis are presented in Table 5. The average per day milk loss was highest among buffaloes (56530 litres), followed distantly by

Table 1. Distribution of samples according to stages of lactation and intensity of infection

Stage of lactation (months)	Distribution of +ve samples as per stages of lactation						Intensity of infection (EPG)	Distribution of +ve samples as per stages of lactation		
	Buffaloes		Cross-bred cows		Indigenous cows			Buffaloes	Cross-bred cows	Indigenous cows
	No. of samples examined	No. of samples positive	No. of samples examined	No. of samples positive	No. of samples examined	No. of samples positive				
S1 (≤ 4)	188	37	81	6	44	0	I1 (≤ 10)	33	15	12
S2 (4-10)	100	12	91	12	73	12	I2 (10-40)	18	4	4
S3 (≥ 10)	124	16	31	2	23	10	I3 (≥ 40)	14	1	6
Pooled	412	65	203	20	140	22	Pooled	65	20	22

Table 2. Region-wise prevalence rate of Fasciolosis in different milk animals

Region-wise prevalence rate	Buffaloes		Crossbred cows		Indigenous cows		Pooled sample	
	No. of samples	No. of +ve samples for Fasciola	No. of samples	No. of +ve samples for Fasciola	No. of samples	No. of +ve samples for Fasciola	No. of samples	No. of +ve samples for Fasciola
High-hills	149	5	21	2	13	0	183	7
Prevalence rate (%)	3.36 (12)	9.52 (15)	0.00	3.83 (13)				
Mid-hills	126	16	66	4	79	14	271	34
Prevalence rate (%)	12.69 (33)	6.06 (15)	17.72 (20)	12.55 (25)				
Bhabar region	60	10	18	0	46	6	124	16
Prevalence rate (%)	16.67 (34)	0.00	13.04 (17)	12.90 (28)				
Tarai region	118	20	98	10	8	0	224	30
Prevalence rate (%)	16.95 (22)	8.47 (12)	0.00	13.39 (19)				

Note: Figures within the parentheses indicate intensity of infection (EPG)

Table 3. Regions-wise milk loss in dairy animals at different stages of lactation due to Fasciola infestation

Stage of lactation (months)	Buffaloes				Crossbred cows				Indigenous cows			
	No. of animals		Average milk production (L/day/ animal)	Average milk loss (L/day/ animal)	No. of animals		Average milk production (L/day/ animal)	Average milk loss (L/day/ animal)	No. of animals		Average milk production (L/day/ animal)	Average milk loss (L/day/ animal)
	Examined	Found positive			Examined	Found positive			Examined	Found positive		
High-hills												
S1 (< 4)	27	3	6.17	5.50	3	0	6.33	0.00	1	0	2.00	-
S2 (4-10)	45	0	4.83	0.00	13	2	5.82	4.00	12	0	2.75	-
S3 (> 10)	28	2	3.67	3.00	5	0	5.00	0.00	0	0	-	-
Pooled	100	5	4.58	4.50	21	2	5.40	4.00	13	0	2.69	-
Mid-hills												
S1 (≤4)	65	4	4.19	0.50	30	4	4.63	2.18	27	0	0.28	-
S2 (4-10)	29	6	3.21	1.66	22	0	0.27	-	35	10	2.29	0.60
S3 (≥10)	52	6	2.27	1.66	14	0	1.67	-	11	6	1.88	0.33
Pooled	146	16	3.24	1.53	66	4	2.19	2.18	73	16	1.47	0.39
Bhabar region												
S1 (≤4)	36	8	3.29	0.71	8	0	4.25	-	14	0	1.16	-
S2 (4-10)	14	4	1.50	1.20	8	0	2.16	-	20	2	1.50	0.50
S3 (≥10)	10	0	2.20	-	2	0	2.80	-	12	4	1.25	0.25
Pooled	60	12	2.69	0.77	18	0	3.16	-	46	6	1.33	0.59
Tarai region												
S1 (≤4)	60	22	4.41	1.17	40	2	5.00	1.00	2	0	1.06	-
S2 (4-10)	12	2	4.50	4.00	48	10	2.60	1.56	6	0	1.45	-
S3 (≥10)	34	8	3.25	0.23	10	2	3.00	0.75	0	0	-	-
Pooled	103	32	3.91	0.84	98	14	3.00	2.08	8	0	1.35	-

Table 4. Region-wise milk loss in dairy animals according to different degrees of intensity of Fasciola infestation

Intensity of Fasciola infestation	Buffaloes		Crossbred cows		Indigenous cows	
	No. of positive animals	Average milk loss (L/day/animal)	No. of positive animals	Average milk loss (L/day/animal)	No. of positive animals	Average milk loss (L/day/animal)
			High-hills			
I1 (≤10)	3	2.5	1	0.2	0	0.0
I2 (10-40)	0	0.0	0	0.0	0	0.0
I3 (≥40)	2	4.23	1	3.3	0	0.0
			Mid-hills			
I1 (≤10)	10	0.4	2	0.1	8	0.8
I2 (10-40)	4	0.1	2	1.56	2	1.1
I3 (≥40)	2	1.8	0	-	6	0.34
			Bhabar region			
I1 (≤10)	4	0.7	0	-	4	0.5
I2 (10-40)	4	0.2	0	-	2	0.4
I3 (≥40)	4	1.2	0	-	0	-
			Tarai region			
I1 (≤10)	16	0.4	12	1.1		-
I2 (10-40)	10	0.8	2	2.0		-
I3 (≥40)	6	3.0	0	-		-

Table 5. Estimated milk loss per day due to Fasciolosis in the surveyed blocks representing different agro-ecological regions of Uttarakhand

District	Prevalence rate of Fasciolosis (% infection)	Per animal daily milk loss (litres/animal)	Population of in-milk animals* (' 000 Nos.)	Total daily milk loss ('000 litres)
		Buffaloes		
High hills	3.36	4.50	47.9	7.2
Mid hills	12.69	1.53	161.7	31.4
Bhabar	16.67	0.77	75.9	9.8
Tarai	16.95	0.84	57.1	8.1
Total	**56.5**			
		Crossbred cows		
High hills	9.52	4.00	7.8	3.0
Mid hills	6.06	2.18	17.8	2.3
Bhabar	0.00	—	36.7	—
Tarai	8.47	2.08	25.1	4.4
Total	**9.7**			
		Indigenous cows		
High hills	0.00	—	58.0	—
Mid hills	17.72	0.39	125.1	8.6
Bhabar	13.04	0.59	67.9	5.2
Tarai	0.00	—	15.5	—
Total				**13.8**

*Data source: *Livestock Census* (2007)

indigenous cows (13871 litres) and crossbred (9742 litres) cows. The annual milk losses were estimated at 22.2 ML, 3.4 ML and 5.4 ML, respectively, from buffaloes, crossbred cows and indigenous cows. To calculate the economic loss due to Fasciolosis, the quantity of milk loss was multiplied by the prices prevalent in the study area. The annual milk loss was estimated to be ₹ 44.45 crore in buffaloes, followed by ₹ 9.82 crore in indigenous cattle and ₹ 6.15 crore in crossbred cattle. The average value of annual milk loss in the blocks — representing various agro-ecological regions as covered in this study — was thus calculated to be ₹ 60.42 crore.

To obtain the estimate of economic losses due to Fasciolosis in the state of Uttarakhand, the overall prevalence rates of Fasciola infestation as obtained in this study (11.26%, 7.88% and 13.70% in buffaloes, crossbred cows and indigenous cows, respectively) and average per day milk yield loss per infected animal (1.28 litres, 2.29 litres and 0.44 litres in buffaloes, crossbred cows and indigenous cows, respectively) were imputed on the species and breed-wise in-milk dairy animal population in the state as obtained from the Livestock Census (2007) data. The annual milk loss in the state of Uttarakhand due to Fasciolosis was estimated to be ₹ 57.96 crore, ₹ 13.88 crore and ₹ 18.57 crore in case of buffaloes, crossbred cows and indigenous cows, respectively. Thus, the total economic value of annual milk loss in Uttarakhand was ₹ 90.41 crores. The major share of economic loss due to Fasciolosis is accrued from infestation in buffaloes. As adult female buffaloes constitute 66 per cent of total bovine population in the state, Fasciolosis seems to be an important parasitic problem which needs to be tackled adequately to prevent substantial milk loss.

Conclusions

The study has estimated the prevalence rate of a major parasitic disease, viz. Fasciolosis in the state of Uttarakhand. The prevalence rate of Fasciolosis has been found lower in the High-hills as compared to the Mid-hills, Bhabar and Tarai regions. A comparison of prevalence rates of Fasciolosis across different species and breeds has revealed that it is higher in buffaloes than in crossbred and indigenous cows. In buffaloes, the adverse effect of Fasciolosis, in terms of reduction in milk, has been found more prominent during the latter stages of lactation. The milk loss per-day per animal due to Fasciolosis in the High-hills has been found almost same for buffaloes and crossbred cows. However, in the other regions, per-day milk loss per animal is more in crossbred cows than in buffaloes. The annual milk loss in the state of Uttarakhand due to Fasciolosis has been estimated to be of ₹ 90.41 crore. The milk loss has been found highest in buffaloes and since the adult female buffaloes constitute 66 per cent of the total bovine population in the state, Fasciolosis seems to be an important parasitic problem which needs to be tackled adequately to prevent substantial milk losses.

Acknowledgements

The authors are thankful to the Department of Science and Technology, New Delhi, for providing financial support to the project entitled 'Economic impact assessment of Fasciolosis and Mastitis in Uttarakhand – An action research project'. They also thank the anonymous referee for valuable suggestions on earlier draft of this paper.

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Revised received: March, 2014; Accepted: May, 2014