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Epidemiological study of pulmonary lesions and diseases in slaughter cattle

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Abstract

A cross-sectional epidemiological study using a multistage sampling strategy in slaughter cattle in Mymensingh, Bangladesh was conducted during September 2001 to April 2002 to study distributions and risk factors of specific pulmonary lesions and diseases. The pulmonary lesions and diseases were diagnosed on the basis of macroscopic and microscopic pathological and parasitological findings. The frequency distribution of pulmonary lesions and diseases in slaughter cattle was found to vary among categories of the study variables. The risk factors identified on statistical basis were male cattle and ≤3 years old cattle and summer in congestion, slightly thin physical condition and summer season in pulmonary emphysema, slightly thin physical condition in parasitic bronchitis as well as female cattle, autumn and rainy seasons in pulmonary hydatidosis. The population impact and etiologic significance of summer season on pulmonary congestion and emphysema was more important than that of adult male cattle. The population impact and etiologic significance of autumn season on pulmonary hydatidosis was more important than that of female cattle during rainy season. Population impact of slightly thin cattle on parasitic bronchitis was poor.

Key words : Bronchitis, Hydatidosis, Risk factors, Emphysema, Congestion

Introduction

Bovine respiratory diseases are caused by a number of etiological agents in association with multiple stressors[1]. Younger age, poor air circulation and purchased cattle were identified as important risk factors of bovine respiratory diseases in the Netherlands[2]. The distribution and risk factors of bovine parasitic bronchitis and pulmonary hydatidosis have also been reported by other workers[3~5]. The frequency, seasonal distribution and

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pathology of pulmonary diseases in Bengal goats of Bangladesh have been reported by few investigators[6-9]. Haque and Samad[10] observed more cases of pneumonia in cows during spring. The overall frequency and distribution of pulmonary lesions and diseases in slaughter cattle in Bangladesh have recently been reported by Rahman *et al*[11]. In this study the distribution and risk factors of pulmonary congestion, emphysema, hydatidosis and parasitic bronchitis in slaughter cattle were investigated.

Materials and Methods

A total of 104 indigenous cattle slaughtered in Mymensingh, Bangladesh during September 2001 to April 2002 were examined for pulmonary lesions and diseases. The sampling strategy and diagnosis of pulmonary lesions and diseases of this study was previously described in the earlier paper of the series[11]. Chi-square test was performed to asses the associations of the bovine pulmonary lesions and diseases with the demographic and temporal variables such as age, gender and season[12]. The strength or degree of association of pulmonary lesions and diseases with demographic and temporal variables that were significant($p \leq 0.05$ and $p \leq 0.01$) was assessed by odds ratio statistics[13]. An approximate 95% confidence interval for the odds ratio was computed on the basis of transformation of the limits for the natural logarithm($\log_e$) of odds ratio[14]. The attributable risk(exposed) and its 95% confidence intervals as well as etiologic fraction(population and exposed) of the risk factors with significant odds($p \leq 0.05$) ratios were computed using the methods described by Thrushfield[15].

Results and discussion

The frequency distribution of pulmonary congestion, emphysema, parasitic bronchitis and pulmonary hydatidosis in slaughter cattle and their association with demographic and temporal variables are presented in Tables 1, 2, 3, 4. The population impact of the risk factors is shown in Table 6.

Pulmonary congestion and emphysema: Pulmonary congestion was associated significantly($p<0.01$) with gender, age and season(Table 1). Pulmonary congestion was 2.82, 3.23 and 8.65 times more likely to be present in male than female cattle, 3 years old or older cattle and during summer season. Pulmonary emphysema was found to be associated with physical condition and season(Table 2). The lesion was 2.63 and 33.00 times more likely to be present in slightly thin than moderately thin animals and during summer season than others(Table 5). The population impact and etiologic significance of risk factors on pulmonary congestion and emphysema were relatively more important than that of other factors such as slightly thin and adult male cattle (Table 6). The prevalence of pulmonary congestion and emphysema during summer attributable to season, of 37% and 72% per 100 animals during the period of observations, respectively. Therefore, only 37% and 72% cases of pulmonary congestion and emphysema could be avoided by control measures. Assuming the season as causal only 9% of pulmonary congestion and 41% of pulmonary emphysema in the population are attributable to the summer season respectively. A high proportion of pulmonary congestion(39%) and emphysema(83%) during summer are attributable to season.

Information on the association of bovine

Table 1. Demographic and temporal distributions of bovine pulmonary congestion(n=104)

Variables		No of cattle examined	No of cases	%	χ^2-value	p-value
Gender	Male	47	35	74.5	6.06*	0.014
	Female	57	29	50.9		
Age	≤ 3.5 years	33	26	78.8	7.77**	0.021
	4-5 years	38	23	60.5		
	≥ 6 years	33	15	45.4		
Physical condition	Slightly thin	38	23	60.5	0.03	0.872
	Moderately thin	66	41	62.1		
Season	Autumn(October to December)	37	15	40.5	15.72**	0.001
	Winter(January to March)	40	25	62.5		
	Summer(April to June)	15	14	93.3		
	Rainy(July to September)	12	10	83.3		

n, No of lungs/animals examined
*Significant at 2% level
**Significant at 1% level

Table 2. Demographic and temporal distributions of bovine pulmonary emphysema(n=104)

Variables		No of cattle examined	No of cases	%	χ^2-value	p-value
Gender	Male	47	12	25.5	0.01*	0.909
	Female	57	14	24.6		
Age	≤ 3.5 years	33	10	30.3	2.52**	0.284
	4-5 years	38	11	28.9		
	≥ 6 years	33	5	15.1		
Physical condition	Slightly thin	38	14	36.8	4.48	0.034
	Moderately thin	66	12	18.2		
Season	Autumn(October to December)	37	3	8.1	38.63**	0.000
	Winter(January to March)	40	6	15.0		
	Summer(April to June)	15	13	86.7		
	Rainy(July to September)	12	4	33.3		

n, No of lungs/animals examined
*Significant at 4% level
**Significant at 1% level

Table 3. Demographic and temporal distributions of bovine parasitic bronchitis(n=104)

Variables		No of cattle examined	No of cases	%	χ^2-value	p-value
Gender	Male	47	18	38.3	2.95	0.066
	Female	57	13	22.8		
Age	≤ 3.5 years	33	10	30.3	0.16	0.922
	4-5 years	38	12	31.6		
	≥ 6 years	33	9	27.3		
Physical condition	Slightly thin	38	17	44.7	6.38**	0.011
	Moderately thin	66	14	21.2		
Season	Autumn(October to December)	37	13	35.1	1.37	0.714
	Winter(January to March)	40	11	27.5		
	Summer(April to June)	15	3	20.0		
	Rainy(July to September)	12	4	33.3		

n, No of lungs/animals examined
**Significant at 1% level

Table 4. Demographic and temporal distributions of bovine pulmonary hydatidosis(n=104)

Variables		No of cattle examined	No of cases	%	χ^2-value	p-value
Gender	Male	47	7	14.9	3.93*	0.039
	Female	57	18	31.6		
Age	≤ 3.5 years	33	6	18.1	4.02	0.134
	4-5 years	38	7	18.4		
	≥ 6 years	33	12	36.4		
Physical condition	Slightly thin	38	8	21.0	0.29	0.385
	Moderately thin	66	17	25.7		
Season	Autumn(October to December)	37	16	43.2	15.70**	0.001
	Winter(January to March)	40	5	12.5		
	Summer(April to June)	15	0	0.0		
	Rainy(July to September)	12	4	33.3		

n, No of lungs/animals examined
*Significant at 4% level
**Significant at 1% level

Table 5. Strength of association of pulmonary lesions and diseases in slaughter cattle with significant[#] demographic and temporal variables

Pulmonary lesions and diseases	Variables		Odds ratio	95% Confidence limits	
Congestion	Gender	Male	2.82*	1.22,	6.55
	Age	≤ 3 years	3.23*	1.23,	8.91
		4-5 years	0.93	0.41,	2.12
		≥ 6 years	0.37	0.16,	0.88
	Season	Autumn	0.25	0.11,	0.59
		Winter	1.07	0.48,	2.41
		Summer	8.65*	1.09,	68.72
		Rainy	2.79	0.58,	13.59
Emphysema	Physical condition	Slightly thin	2.63*	1.06,	6.55
	Season	Autumn	0.17	0.05,	0.61
		Winter	0.39	0.14,	1.07
		Summer	33.00*	6.62,	162.39
		Rainy	1.50	0.44,	2.29
Parasitic bronchitis	Physical condition	Slightly thin	3.01*	1.26,	7.17
Pulmonary hydatidosis	Gender	Female	2.64*	1.01,	7.03
	Season	Autumn	4.14*	1.79,	9.58
		Winter	0.39	0.16,	0.92
		Summer	1.90	0.59,	6.05
		Rainy	9.74*	3.06,	31.31

*Significant at 5% level
[#]Significant ($p \leq 0.05$ and $p \leq 0.01$) on Chi-square test

Table 6. Population impact and etiologic significance of the risk factors[#] of pulmonary lesions and diseases in slaughter cattle

Pulmonary lesions and diseases	Variables		Attributable risk (exposed)%	95% Confidence limits	Etiologic fraction(%) (population)	Etiologic fraction(%) (exposed)
Congestion	Gender	Male	24*	0.06, 0.40	17	31
	Age	≤ 3 years	25*	0.08, 0.42	11	27
	Season	Summer	37*	0.22, 0.52	9	39
Emphysema	Physical condition	Slightly thin	19*	0.02, 0.36	28	51
	Season	Summer	72*	0.55, 0.89	41	83
Parasitic bronchitis	Physical condition	Slightly thin	24*	0.07, 0.41	29	53
Hydatidosis	Gender	Female	17*	0.03, 0.31	38	53
	Season	Rainy	11	-0.16, 0.38	5	12
		Autumn	30*	0.13, 0.45	44	69

*Significant at 5% level
[#]Significant(≤ 0.05) odds ratio

pulmonary congestion and emphysema with demographic and temporal variables is not available in published literature. However, Radostits *et al.*[16] reported the occurrence of pulmonary congestion in early stages of pneumonia, by inhalation of smokes and fumes, anaphylactic reactions and hypostasis in recumbent animals. Pulmonary emphysema was found to be associated with acute interstitial pneumonia and parasitic bronchitis with pulmonary edema in acute anaphylaxis[16].

Parasitic bronchitis: Parasitic bronchitis was found to be associated with physical condition of the animals only. The disease was 3.01 times more likely to be present in slightly thin animals than moderately thin animals(Table 5). A poor population impact and etiologic significance of the demographic / management factor(slightly thin physical condition) on parasitic bronchitis was observed. Only 24% cases of parasitic bronchitis could be eliminated by improving physical condition of the animals.

In a limited observational study, it is not possible to determine that poor condition is caused by the disease or poor animals are more susceptible to the disease because most of the subsistence ruminants in Bangladesh are in poor condition. An experimental study, therefore, is required to explain the mechanism.

No association of parasitic bronchitis in adult slaughter cattle with season and gender was observed(Table 3). The mild form of the disease characterized by low worm burden[17] and acquired immunity in mature cattle in endemic areas of tropical Bangladesh might be responsible for non-association of the disease with climatically determined temporal variable. The current observational study did not include calves. Generally only calves in their first grazing season are clinically affected but in endemic areas older animals have a quickly develop strong acquired immunity[3,5]. In endemic areas infection may persists from year to year through over wintered larvae and carrier animals. Parasitic bronchitis is predominantly a problem in areas such as northern Europe, where has a mild climate, a high rainfall and abundant permanent grass. Epidemic of the disease occurs from June until November, but are most common from July until September. In tropical countries where disease may occur intermittently, epidemiology is quite different and probably depends more on pasture contamination by carrier animals such as may occur during flooding[5].

Pulmonary hydatidosis: Pulmonary hydatidosis was significantly associated with gender of the animals and season but not with physical condition(Table 4). The disease was 2.64 times more likely to be present in female cattle than males. The disease was 4.14 and 9.74 times more likely to be present in female cattle during both autumn and rainy seasons respectively than others(Table 5). The population impact and etiologic significance of autumn season on pulmonary hydatidosis were relatively more important than those of female cattle during rainy season(Table 6). A moderate proportion (30%) of cases of hydatidosis could be eliminated by preventing exposure to contaminated pasture by cestode eggs during rainy season. The etiologic (population and exposed) significance of autumn season was also higher. Assuming the season as causal 44% of hydatidosis in the population was attributable to autumn and 69% of the disease during autumn was attributable to season.

Similar observations on risk factors were

also made on bladder worms of extraneural coenuriasis in Bengal goats of Bangladesh[18]. Ecological studies in different countries indicate that moisture is required by the hexacanth embryos(oncospheres) of the cestode *Echinococcus granulosus* for survival. Rain water is responsible for breaking and spread of fecal mass containing segments of tape worms and their eggs. There is an increased rainfall, relative humidity and ambient temperature during monsoon in Bangladesh. These climatic factors independently or jointly are reported to be conducive to the development and survivability of eggs containing oncospheres in the pasture[19]. No such ecological information on the parasite is available for Bangladesh. Ecological studies would explain the mechanism of relationship of the parasite with meteorological data in Bangladesh.

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