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Condemnation of lungs in abattoirs in peninsular Malaysia due to parasitic infection from 1998 - 2004

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Abstract. A study on causes of lung condemnation in 25 abattoirs from peninsular Malaysia for a period of seven years (1998-2004) was conducted by examining the records at the Department of Veterinary Services headquarters in Kuala Lumpur. A total of 5.3% of lungs from 233,417 cattle and buffaloes were condemned from 1998 to 2004. The main cause of condemnation was congestion (2.98%). The percentage of lungs that were condemned due to parasitic infection among the total population slaughtered was low (0.11%). Parasitic infection contributed to 2.1% of all lungs condemned. It was also found that the prevalence of parasitic infection in the lungs was generally much higher in buffaloes than in cattle.

INTRODUCTION

Parasitic infection of the lungs is caused by the strongyle *Dictyocaulus viviparus* (Johnstone, 2005). The infection is important in temperate countries and many studies have examined its significance and impact on the livestock industry (David, 2001; Ploeger, 2002). In Malaysia, the parasite is relatively unknown to veterinarians and researchers. Reports of clinical lungworm infection are mainly anecdotal. As the infection has always been assumed to be of minimal importance, it has often been overlooked, undiagnosed and underemphasized. Sporadic occurrence has been documented mainly in imported animals (Tham & Sheikh-Omar, 1981). However, its importance in the local livestock industry has not been studied.

In controlling a disease, it is important that as much as possible is learned about its epidemiology. A great deal of work has been done on the epidemiology of lungworm infection in bovine caused by *D. viviparus* in other parts of the world (Poynter, 1963); however, very little has been done in Malaysia. Therefore records from 25 abattoirs for a period of seven years (1998-2004) were retrospectively examined to determine the occurrence of *D. viviparus* infection in Malaysia. We believe that by examining these records, necessary basic information could be obtained pertaining to the occurrence of the parasite.

MATERIALS AND METHODS

Source of Data

Annual records and reports from 25 abattoirs in Peninsular Malaysia were examined at the Department of Veterinary Services (DVS) headquarters in Kuala Lumpur. Data on all condemned lungs at post-mortem inspection were collected. The information available included: total number of animals slaughtered, year of slaughter, species, condemnation statistics and reasons for condemnation. Information was collected using a standard survey form.

Data Management and Analysis
The data was managed and analysed using SPSS ver. 12 (SPSS Inc.). One-way ANOVA was used to test the differences in means.

RESULTS

Description of Data from Records
A total of 233,417 cattle and buffaloes were slaughtered in 25 abattoirs from 1998-2004 (Table 1). Cattle was the predominant species slaughtered (198,073). The highest mean number of cattle (6,737.8) was slaughtered in Shah Alam abattoir and the highest mean number of buffaloes (851.4) was slaughtered in Kuala Terengganu abattoir. The lowest mean number of cattle and buffaloes slaughtered a year was in Raub (34.1) and Jelebu abattoirs (8.4), respectively. The number of animals slaughtered fluctuated over the period of study; however, in general a slight decrease in the number was observed from year to year (Table 2). The mean number of cattle and buffaloes slaughtered per abattoir per year was 1,131.8 and 201.9, respectively. There was also a large variation in the number of animals slaughtered between abattoirs in a year. Table 3 shows the proportions of specific lesions of the lungs found in 25 abattoirs at post-mortem examination of cattle and buffaloes in Peninsular Malaysia from 1998 to 2004. The calculation for the rate of lungs condemned was performed using the following formulae:

$$\text{Lung condemnation rate} = \frac{\text{total lungs condemned}}{\text{total number of animals slaughtered}} \times 100$$

(Formula 1)

$$\text{Lesion - specific lung condemnation rate} = \frac{\text{lungs condemned due to specific lung lesion}}{\text{total number of animals slaughtered}} \times 100$$

(Formula 2)

$$\text{Proportional lung condemnation rate} = \frac{\text{lungs condemned due to specific lung lesion}}{\text{total number of lungs condemned}} \times 100$$

(Formula 3)

Condemnation of Lungs
A total of 12,342 lungs (5.3%) were condemned from 1998 to 2004 (Table 3). Total cattle and buffaloes slaughtered from 1998 to 2004 were 198,073 and 35,344, respectively. Among the cattle and buffaloes slaughtered, 9,941 (5.02 %) and 2,401 (6.79%) lungs were condemned, respectively. The main causes of condemnation in order of importance were lung congestion (2.98%), pneumonia (0.82%), emphysema (0.63%) and abscesses (0.5%).

Condemnation of Lungs Due to Parasitic Infection
From 1998 to 2004, approximately 2.1% of all lung condemnation was due to parasitic infection. This was 0.11% of parasitic lung condemnation from all slaughtered animals (11 parasitic cases in 10,000 animals slaughtered). The prevalence of parasitic infection in the lungs was generally much higher in buffaloes than in cattle (Figure 1). The prevalence of parasitic lung infection among the slaughtered cattle population from 1998-2004 varied between 0.0037% and 0.082% (mean = 0.037%), while the prevalence among the buffalo population varied between 0.085% and 1.002% (mean = 0.508%).

Among the lungs condemned for seven years, parasitic lung infection in cattle and buffaloes was responsible for 0.6% and 1.51% of the total lung condemnation, respectively. In 2002, it appeared that the parasitic infection among condemned lungs of cattle, although not statistically significant ($p>0.05$), was proportionately higher than those of buffaloes (Figure 2).

Cases of parasitic lung condemnation were recorded in Ipoh (1.409%), Raub (0.743%), Jasin (0.632%), Taiping (0.390%), Tapah (0.217%), Johor Bahru (0.110%), Bentong (0.109%), Tampin (0.085%), Dungun (0.025%), Jejawi (0.009%) and Shah Alam abattoirs (0.002%). The highest prevalence was recorded in Ipoh (Figure 3).

The proportion of parasitic lung condemnation varied from month to month

Table 1. Total number, mean and standard deviation of cattle and buffaloes slaughtered in each of the 25 abattoirs in Peninsular Malaysia between 1998 and 2004

Abattoir	Total		Mean per year		Standard Deviation	
	Cattle	Buffalo	Cattle	Buffalo	Cattle	Buffalo
Ipoh	3,104	2,074	443.4	296.2	87.7	62.5
Melaka	7,943	181	1,134.7	25.8	387.4	14.2
K.Pilah	7,101	1,983	1,014.4	283.2	1,452	103.6
Taiping	12,704	5,738	1,814.8	819.7	417.6	231.1
Senawang	11,627	1,334	1,661	190.5	133.7	77.1
Temerloh	1,496	2,662	213.7	380.2	121.9	201.7
Jasin	9,935	1,139	1,419.2	162.7	189.1	59.1
Bentong	1,540	322	220	46	174.4	34.7
Besut	5,248	474	749.7	67.7	125.5	30.1
Johor Bahru	21,750	259	3,107.1	37	761	21.3
Jelebu	771	59	110.1	8.4	50.4	8.2
Kuantan	4,247	843	606.7	120.4	319.2	103
Tapah	1,931	1,765	275.8	252.1	37.4	33.6
Kemaman	1,729	3,220	247	460	43.6	178
Banting	14,028	326	2,004	465	310.1	35.7
Raub	239	568	34.1	81.1	18.1	11.5
Labuan	383	130	54.7	18.5	85.3	14.8
Jejawi	9,713	393	1,387.5	56.1	364.5	61.4
Tampin	3,234	1,590	462	227.1	156.9	76.8
K. Lipis	1,311	1,144	187.2	163.4	54.2	22.1
Alor Gajah	7,668	1,704	1,095.4	243.4	103.4	79.1
Dungun	3,115	872	445	124.5	101.5	33.1
K.Terengganu	17,618	5,960	2,516.8	851.4	403.6	90.7
Alor Setar	2,473	1	353.2	0.1	446.3	0.3
Shah Alam	47,165	603	6,737.8	86.1	923.2	84.5

Table 2. Total number, mean and standard deviation of cattle and buffaloes slaughtered per year in 25 abattoirs in Peninsular Malaysia from 1998 to 2004

Year	Breed	Total	Mean	Standard deviation
1998	Cattle	32,632	1,305.28	1,669.98
	Buffalo	4,947	197.88	243.71
1999	Cattle	31,993	1,247.72	1,566.46
	Buffalo	5,487	219.48	292.07
2000	Cattle	27,807	1,112.28	1,516.31
	Buffalo	5,959	238.36	267.38
2001	Cattle	28,940	1,157.6	1,510.34
	Buffalo	4,847	193.88	220.50
2002	Cattle	28,085	1,123.4	1,464.58
	Buffalo	4,794	191.76	230.48
2003	Cattle	26,461	1,058.44	1,326.6
	Buffalo	4,667	186.68	216.69
2004	Cattle	22,955	918.2	1,038.63
	Buffalo	4,643	185.72	198.53

Mean cattle per abattoir per year = 1,131.8
Mean buffalo per abattoir per year = 201.9

Table 3. Number and rate (%) of lungs condemned due to specific lung lesions from 25 abattoirs in Peninsular Malaysia from 1998-2004

Year	Total SL Animals	Cong	Abs	Spla	Emph	Pneu	Ingesta	Par	Pleur	Aspi	Case	Others	Total condemned (**)
1998	37,579	820 (2.18) [50.21]	192 (0.51) [11.76]	79 (0.21) [4.84]	179 (0.48) [10.96]	267 (0.71) [16.35]	3 (0.007) [0.18]	37 (0.09) [2.27]	25 (0.07) [1.53]	0 0	0 0	31 (.0.08) [1.89]	1,633 (4.34)
1999	36,680	1,202 (3.28) [54.17]	233 (0.64) [10.50]	46 (0.13) [2.07]	260 (0.71) [11.72]	326 (0.89) [14.69]	9 (0.02) [0.41]	67 (0.18) [3.02]	57 (0.16) [2.57]	0 0	0 0	19 (.0.051) [0.86]	2,219 (6.05)
2000	33,766	1,083 (3.21) [51.69]	261 (0.77) [12.46]	5 (0.01) [0.24]	212 (0.63) [10.12]	426 (1.26) [20.33]	3 (0.008) [0.14]	56 (0.17) [2.67]	32 (0.09) [1.53]	0 0	0 0	17 (0.05) [0.81]	2,095 (6.20)
2001	33,787	1,122 (3.32) [58.38]	189 (0.56) [9.83]	25 (0.07) [1.30]	275 (0.002) [14.31]	213 (0.63) [11.08]	12 (0.04) [0.62]	44 (0.13) [2.29]	28 (0.08) [1.46]	0 0	0 0	14 (0.04) [0.73]	1922 (5.69)
2002	32,879	1,196 (3.64) [63.75]	142 (0.43) [7.57]	19 (0.06) [1.01]	175 (0.53) [9.33]	256 (0.78) [13.65]	4 (.0.01) [0.21]	36 (0.11) [1.92]	31 (0.09) [1.65]	2 (0.006) [0.11]	0 0	15 (0.04) [0.79]	1,876 (5.71)
2003	31,128	805 (2.59) [61.36]	82 (0.26) [6.25]	14 (0.04) [1.07]	147 (0.47) [11.20]	234 (0.75) [17.83]	0 0	5 (0.02) [0.38]	11 (0.04) [0.84]	9 (0.02) [0.69]	5 (0.02) [0.38]	0 0	1,312 (4.21)
2004*	27,598	728 (2.64) [56.65]	69 (0.25) [5.37]	10 (0.04) [0.78]	230 (0.83) [17.89]	188 (0.68) [14.63]	7 (0.03) [0.54]	16 (0.06) [1.25]	31 (0.11) [2.41]	6 (0.02) [0.47]	0 0	0 0	1,285 (4.66)
1998-2004	233,417	6,956 (2.98) [56.36]	1,168 (0.50) [9.46]	198 (0.08) [1.60]	1,478 (0.63) [11.98]	1,910 (0.82) [15.48]	38 (0.02) [0.31]	261 (0.11) [2.11]	215 (0.09) [1.74]	17 (0.007) [0.14]	5 (0.002) [0.04]	96 (0.04) [0.78]	12,342 (5.29)

* Data was obtained from 24 abattoirs; (**) refer *Formula1*; ( ) lesion-specific lung condemnation rate for the year – refer *Formula 2*; [ ] proportional lung condemnation rate for the year – refer *Formula 3*; Total SL Animals, Total slaughtered animals; Cong, Congestion; Abs, Abscess; Spla, Splashing; Emph, Emphysema; Pneu, Pneumonia; Ingesta, Ingesta; Par , Parasite; Pleur, Pleurisy; Aspi, Aspiration; Case, Caseous.

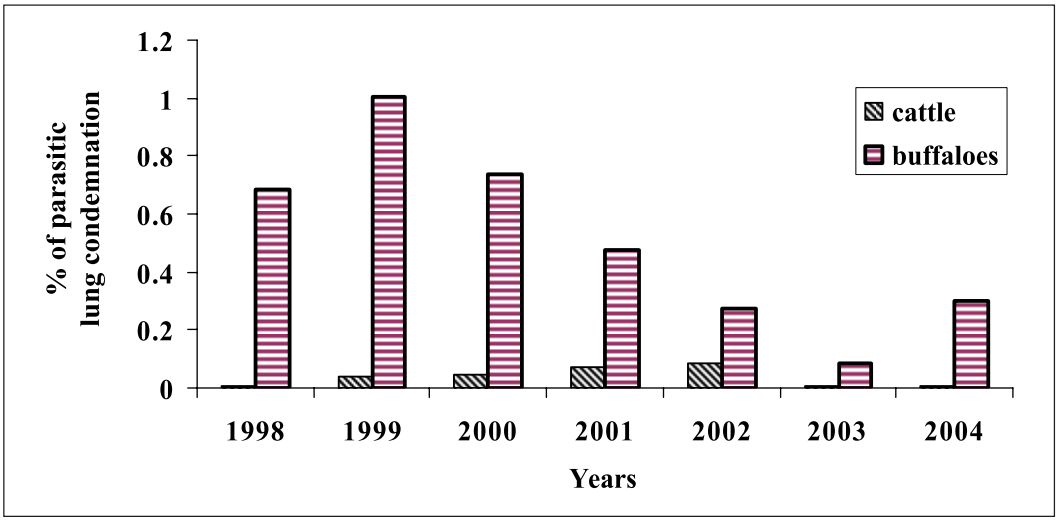

Figure 1. Species specific parasitic lung condemnation in 25 abattoirs from 1998 to 2004.

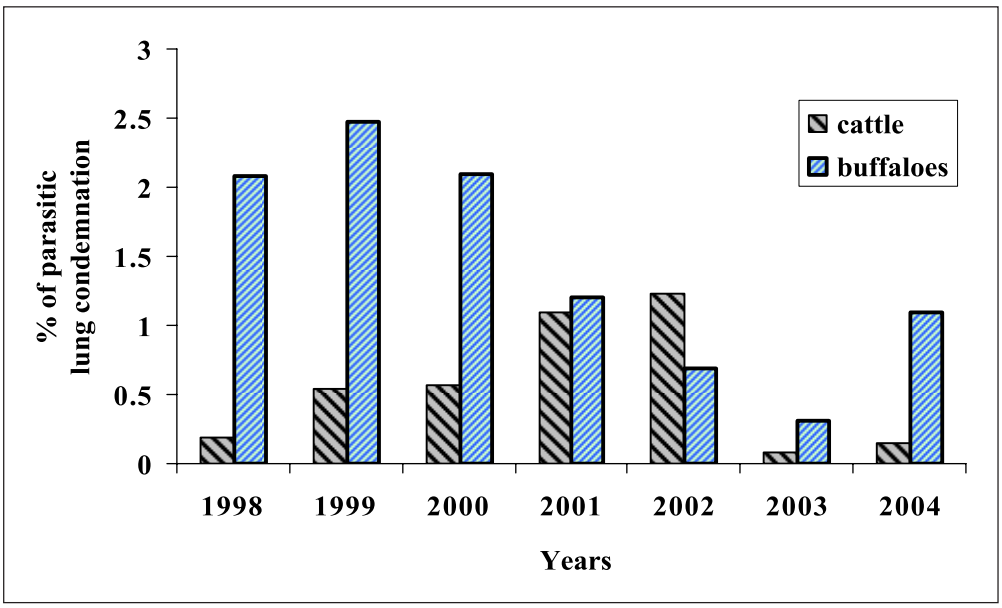

Figure 2. Species specific proportional lung condemnation due to parasitic infection in 25 abattoirs from 1998 to 2004.

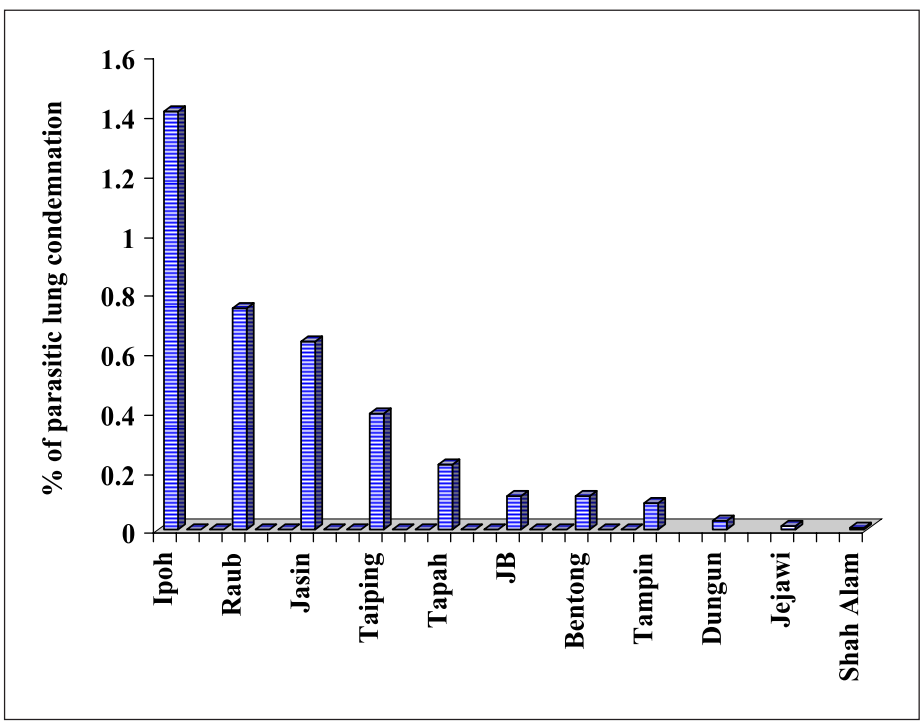

Figure 3. Parasitic lung condemnation rate between 1998 and 2004 based of the location of abattoirs.

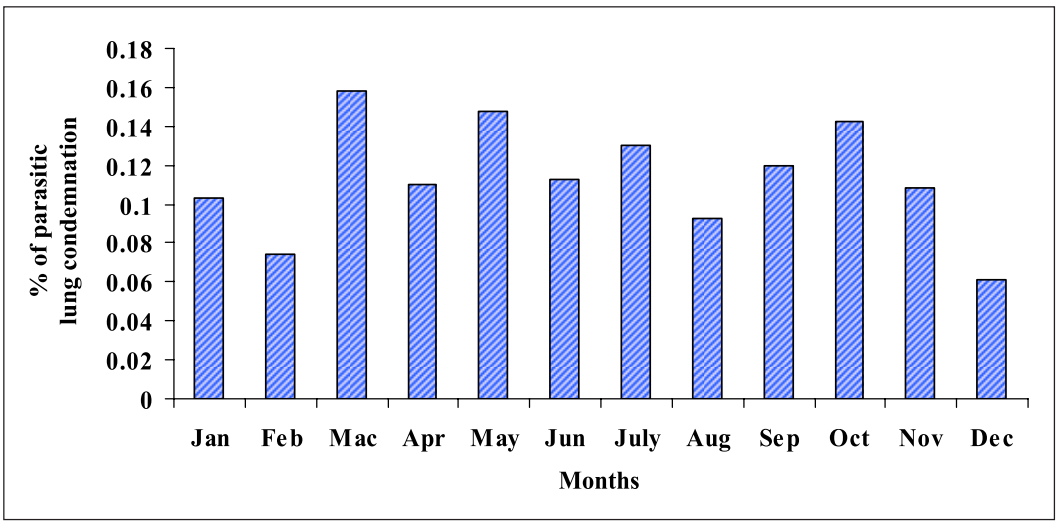

Figure 4. Cumulative monthly distribution of lung condemnation from 1998 to 2004 due to parasitic infection in 25 abattoirs.

from 1998 to 2004. The highest number of cases was recorded in March (Figure 4). When the mean number of cases between months for the period of seven years was tested, no significant difference at $p \leq 0.05$ was found.

DISCUSSION

Cattle and buffalo lungs are considered a delicacy among local people in Malaysia and often served in eateries and restaurants. From 1998 to 2004, a major proportion (68.3%) of lungs that were condemned was due to congestion and emphysema. This finding is in agreement with Tham & Sheikh-Omar (1981) who found about 73% of lung condemnations in the Shah Alam abattoir was due to congestion and emphysema. Apparently, congestion and emphysema are common findings in lungs of cattle slaughtered by the Muslim "halal" method. The same study also revealed that lung condemnation among cattle due to the lungworm parasite was 3.78%. However, there was no detailed information about the lungworm isolated and the type or breed of the affected cattle. Most of the cattle slaughtered in the Shah Alam abattoir during the study period were imported, but the country of origin was unknown.

The prevalence of parasitic infection in the lungs based on the abattoir animal population was low, i.e. an average of 11 cases in 10,000 animals for the period of seven years (1998-2004). Higher rates (%) of parasitic lung infection (not statistically significant) were recorded in March, May, July and October. Generally, in the tropics and sub-tropics, bovine dictyocaulosis is prevalent in regions with an average to high rainfall. Malaysia has a tropical climate with high temperatures and rainfall (average annual rainfall is between 2,000 and 2,500 mm). The humidity is about 70 to 90% and temperatures range from 24°C to 34°C throughout the year. This climatic condition is conducive for lungworm survival all year round. *Dictyocaulus* larvae have been known to undergo hypobiosis in adverse climatic conditions such as dryness. Larvae may become inhibited in the lung tissue for up to 150 days (Jarrett *et al.*, 1955). However, the relative humidity and temperature throughout Malaysia supports survival of the pre-parasitic stages of nematode larvae, hence hypobiosis is unnecessary. Ikeme *et al.*

(1986) found no occurrence of hypobiosis in trichostrongyle infections in goats in Malaysia.

In this study, parasitic lung condemnation rate was higher in buffaloes than in cattle. This is noteworthy as lungworm infection due to *D. viviparus*, although it has been reported to occur very sporadically in the high lands of tropical and sub-tropical regions, has been a disease known to occur commonly and widely in cattle of temperate regions around the world. There were a few reports on this disease in buffaloes in Italy and Egypt in 1933 by Cremona & Monaco. In Egypt, the disease was observed at the end of the clover grazing period and characterised by irritative bronchitis associated with adult worms. In Italian buffaloes, both irritative and allergic conditions have been observed (Quesada, 1968). In 1977, incidence of *D. viviparus* infestation in buffalo calves was reported and the death rate was 60% (Jain & Bandopadhyay, 1977).

From 1999 to 2002, an increasing trend was observed in the rate of cattle lungs condemned due to parasitic lung infection (Figure 3). This figure may be correlated with the number of animals that were imported for slaughter. From 1999 to 2002, a significant number of cattle were imported notably from Australia, to fulfill the low beef sufficiency (Wong & Chen, 2002). The occasional occurrence of *D. viviparus* infection in beef cattle on the Tablelands and North Coast regions of New South Wales, Australia was reported by Smeal *et al*. (1977). We therefore speculate that many of the condemnations recorded were probably from the imported cattle slaughtered during this period.

It should be noted that the records on observations and post-mortem diagnoses from each abattoir were evaluated and confirmed several years ago, indicating a limitation of the current study. Inter-observer variations and precision among post-mortem inspectors from different abattoirs in making diagnoses cannot therefore be validated. The present study was based entirely on information that was recorded in the slaughter house records.

In conclusion, the data from this study suggests that parasitic lung infection is prevalent at a very low percentage among cattle and buffalo populations of Peninsular Malaysia.

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