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**AN ASSESSMENT OF METHODS FOR THE QUANTITATION OF  
LUNG LESIONS IN SHEEP AND GOATS**

*A THESIS PRESENTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS  
FOR THE DEGREE OF MASTER OF PHILOSOPHY  
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GERMAN VALERO-ELIZONDO

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## ABSTRACT

Although pneumonia is one of the most common diseases of ruminants worldwide, there is a wide variation in the way research workers have assessed the severity of pneumonic lesions. The problem is further complicated by the variable accuracy observers may have in judging the proportions of pneumonic areas in affected lungs.

The work reported here was undertaken to evaluate the methods available for quantitation of pneumonia in livestock killed in slaughterhouses. Some of the methods were then used to investigate the prevalence and variety of pneumonic lesions in the lungs of 4284 goats killed in a North Island slaughterhouse during the winter months.

A preliminary study of the *postmortem* change in lung volume demonstrated that the greatest decrease occurred from 3 to 24 hours *postmortem*, at which time there was an average loss of volume of 10%. A measurable decrease in lateral area occurred after 8 hours *postmortem*, and peaked at 96 hours with an average decrease of 8%. Image analysis was efficient in detecting changes in lung area, but the positioning of the lungs at the time of photography was a source of measurement error.

In assessing pneumonic surface areas there was no advantage in photographing a mid-sagittal section of the lungs over a dorso-lateral view of the whole lungs, but lungs separated into left and right sides before photography gave less distortion than if left attached to the trachea.

An image analysis technique proved to be more accurate than a paper silhouette technique for measuring lung areas.

While measuring the densities of the lungs, it was found that the density of the non-pneumonic portions of lung varied markedly between animals. This variation should be taken into account by using a formula to calculate the proportion of pneumonic tissue within each lung. A formula was derived which can be applied in all species when an objective estimate of the amount of pneumonic tissue is necessary, or a volumetric rather than an area value is required; but the need to sample and measure a non-pneumonic portion makes this technique inappropriate for routine work.

It was concluded that even though the percentage of lung volume impaired by pneumonia may be theoretically more important than the percentage of affected area, its measurement is too time consuming for routine use. Simple measurement of whole lung density is a poor indicator of the extent of pneumonia, while the measurement of pneumonic areas tended to overestimate the volume of pneumonic tissue. This is compounded by the irregular shape of the lungs and differences in spatial distribution of lesions.

A survey of 4284 goat lungs revealed only ten cases of bronchopneumonia. Forty-one percent of the lungs had lesions compatible with *Muellerius capillaris*; 33% had lesions compatible with *Dictyocaulus filaria*, and 8% had both types simultaneously. The prevalence of parasitic lesions increased with age. There was a statistical correlation between the severity of dictyocaulus lesions, the presence of nodular muellerius lesions, and low carcass weight. The carcasses of goats with mild to severe *Dictyocaulus filaria* lesions were from 0.81 to 1.52 kg lighter than those of animals without these lesions. The carcasses of goats with more than 10 nodular (*Muellerius capillaris*) lesions were 0.75 kg lighter than those of animals without these lesions.

Twelve sets of lungs had lesions of chronic bronchiectasis. Parasite larvae were seen in the bronchial lumina of three of them. The microscopic appearance varied from a moderate dilatation of occluded bronchi which retained an intact epithelium, to large foreign-body granulomas where the remaining bronchial outlines were barely discernible.

Subpleural lymph nodes were a common finding in more than 4% of goat lungs. Their frequency varied between flocks from as little as 2% to as much as 27%. Their distribution, architecture, and differentiation from the pulmonary lymphoid nodules described in cattle with dictyocaulus reinfection syndrome are discussed.

Multifocal fibrous pleural plaques were found in two cases of the over 4000 goat lungs sampled. They have not been described previously in the veterinary literature.

Pleural adhesions were found in 350 cases (8.16%). The relatively higher frequency of pleurisy *versus* pneumonia suggests that pneumonia in goats in the North Island of New Zealand completely resolves in most cases and probably has a seasonal occurrence, with a much lower prevalence than chronic non-progressive pneumonia of sheep.

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