CLINICOPATHOLOGICAL INVESTIGATION OF PULMONARY DISEASES IN SLAUGHTER HOUSE AT BIRGANJ UPAZILA OF DINAJPUR DISTRICT

A THESIS

BY

MD. ASADUZZAMAN JEMY

Registration No. 1305080
Semester: January- June, 2014
Session: 2013-2014

MASTER OF SCIENCE (M.S.)
IN
PATHOLOGY

DEPARTMENT OF PATHOLOGY AND PARASITOLOGY

HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY, DINAJPUR-5200

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Hajee Mohammad Danesh Science and Technology University, Dinajpur,
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DEPARTMENT OF PATHOLOGY AND PARASITOLOGY

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DEDICATED
TO
BELOVED
PARENTS

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The Author

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Abstract

An observational (cross-sectional) study of pulmonary diseases in slaughter cattle of Birganj upazila of Dinajpur District was conducted during January to June 2014 to study the epidemiological, clinical, pathological and parasitological findings using standard methods. Out of 104 cattle, 92 (88.5%) were affected with pulmonary diseases (overall), such as pulmonary lesions (73.1%), parasitic bronchitis (29.8%) and pulmonary hydatids (24%). The pulmonary lesions included: congestion (61.5%), emphysema (25.0%), anthracosis (11.5%), pleuritis (10.6%), abscess (6.7%) and hemorrhage 5.8%). Higher frequency of congestion in male cattle of ≤3.5 years old and hydatidosis in female cattle was observed. The clinical signs of pulmonary diseases included slightly dull demeanor, nasal discharges, abnormal respiration, mild, tachycardia etc. There were numerous immature worms along with mature worms (*Dictyocaulus viviparous*).

Abbreviation and Acronyms

BBS	Bangladesh Bureau of Statistics
CRD	Completely Randomized Design
DLS	Department of Livestock Services
FAO	Food and Agricultural Organization
GDP	Gross Domestic Product
GNI	Gross National Income
Kcal	Kilocalorie
ml	Milliliter
ng	Nanogram
NRC	National Research Council
SPSS	Statistical Package for the Social Sciences
SID	Statistics and Informatics Division

Table of contents

Table of contents (Contd.)

List of Tables

List of Photos

List of Figures

CHAPTER I

INTRODUCTION

Bangladesh is an agricultural least developing country. Livestock is one of the major components of its agricultural output which plays a vital role in national economy. In 2013, the contribution of livestock sub-sector to the GDP was 2.95%, which was estimated about 17.3% GDP to agriculture (DLS, 2014). About 36% of the total animal protein comes from the livestock products in our everyday life and 25% peoples are directly engaged in livestock sector, and 50% peoples are partly associated with livestock production (DLS, 2014).

Livestock population in Bangladesh is currently estimated about 25.7 million cattle, 0.83 million buffaloes, 14.8 million goats, 1.9 million sheep, 118.7 million chicken and 34.1 million ducks. The density of livestock population per acre of cultivable land is 7.37 (Banglapedia, 2012). The relative density of the cattle population is well above the averages found in many other countries of the world. It ranks twelve in cattle populations in the world and third among Asian countries (Alam *et al.*, 1994). In spite of a high density of livestock population, the country suffers from an acute shortage of livestock products like milk, meat and eggs. The domestic production of milk, meat and egg are 3.46, 2.33, and 7303 million tons in the 2011-2012 fiscal year against the demand of 13.50, 6.48, and 15392 million tons, respectively (Hossain, and Hassan, 2013).

The reason of these deficiencies may be due to various causes, lung disease is one of them. The functional efficiency of the respiratory system depends on its ability to oxygenate and remove carbon dioxide from blood as it passes through in the respiratory circulation. Interference with these functions can occur in a number of ways but the underlying defect in all instances is lack of adequate oxygen supply to tissues. The hypoxia of respiratory insufficiency is responsible for most of the clinical signs of respiratory diseases and for respiratory failure, the terminal event of fatal cases (Radostits *et al*., 2000). The respiratory diseases are responsible for major economic losses to the livestock industry. High mortality, cost of diagnosis and

treatment unacceptable performance, etc. due to respiratory diseases are incurred to economic losses (Fels *et al*., l999). Chavai *et al.* (1999) reported 25% mortality associated with pneumonia in cattle. In the USA, 65 to 79% morbidity and 56 to 72 % mortality were due to respiratory diseases during a four year period (Edwards, 1989).

Information on various aspects of respiratory diseases in cattle and other animals has been reported from many countries of the world (Hadziosmanovic 2001, Viring *et al*., 2001, Njoroge *et al*., 2002). The frequency, seasonal distribution and pathology of pulmonary diseases in Black Bengal goats of Bangladesh have been reported by few investigators (Islam 1981, Ali 1983, Haque and Samad 1997, Alam 2001). Qadir (1983) recorded death in 5 goats (case fatality 22.7%) of 22 affected with pneumonia.

There are several reports of respiratory diseases in cattle of Bangladesh. In intensively managed calves respiratory diseases were responsible for a proportional mortality of 15.8% (Roy, 1993). Clinical propaedeuties and therapeutics of inhalation pneumonia were described by Nooruddin and Rahman (1982) and Hoque (1986). Of the 665 cases of inhalation pneumonia in beef cattle of Munshiganj and Dhaka districts due to faulty drenching instantaneous death in 190 (28.6%), insidious death in 173 (26.0%) and recovery in 302 (45.4%) cases were observed by Hoque (1986). The prevalence and distribution of pulmonary and other hydatidosis in cattle have been reported by Islam (1982). Haque and samad (1996) analyzed the hospital records and reported proportional morbidity of pneumonia in cows (7.1%) and calves (9.6%). They also observed more cases of pneumonia during spring in cows. The information on bovine respiratory diseases is still limited in Bangladesh. Therefore, a cross-sectional observational study of pulmonary diseases in slaughter cattle was undertaken to achieve the following objectives:

1. To study prevalence of lung diseases in bovine
2. To study clinical findings
3. To study pathology of the diseases and
4. To study pulmonary parasites

CHAPTER II

REVIEW OF LITERATURE

2.1 Pulmonary lesions

Ali (1963) reported the prevalence of pulmonary abscess (0.4%), purulent bronchopneumonia (0.9%), nodular lymphocytic peribronchitis (0.5%) and dark circular lung lesions (0.2%) in goats.

In a pathological study on 100 adult slaughter cattle, Barberan and Bascuas (1986) found 85.0% pneumonic lesions, 3.0% anthracosis and 2.0% hemorrhage in Bovine lungs.

Haque and Samad (1996, 1997) reported proportional morbidity of pneumonia (7%) in cows, in calves (9.6%) and in goats (8.8%) on the basis of pneumonia was recorded during spring in cows and goats.

Jones *et al.* (1996) reported anthracosis frequently in dogs required to sleep in coal bins. The pneumoconioses were found limited largely to humans and experimental animals since domestic animals were seldom exposed to causal dusts.

Zaid (1996) observed multiple abscesses in the lungs of 4 cattle (0.7%) out of 585 examined.

Scott (1997) reported prevalence of respiratory diseases (76.5%) in three beef farms.

Aiello (1998) reported two major forms of emphysema in lungs. Alveolar emphysema i.e. permanent enlargement of alveolar spaces accompanied by rupture of alveolar septae and interstitial emphysema in which there would be presence of air within interlobular, subpleural and interstitial areas of the lungs.

Radostits *et al.* (2000) stated that pulmonary congestion was caused by an increase in the amount of blood in the lungs due to engorgement of the pulmonary vascular bed. Primary pulmonary congestion occurred in early stages of most cases of pneumonia, by inhalation of smokes and fumes, anaphylactic reactions and hypostasis in

recumbent animals. Secondary pulmonary congestion occurred in congestive heart failure. The authors also reported higher susceptibility of bovine lung to the development of emphysema from many different causes, not all of them respiratory in origin. It was common to find pulmonary emphysema when the primary lesion in the lung caused trapping of air in the alveoli or terminal bronchioles. They pointed out the following causes of pulmonary emphysema in cattle: acute interstitial pneumonia, parasitic pneumonia with pulmonary edema in acute anaphylaxis, perforation of lungs by foreign bodies (traumaticreticuloperitonitis), poisoning by plants such as Senecioquadridentatus, rape, Zieriaarborescens, perillafrutescens and the fungus Periconia sp. According to Radostits *et al.* (2000) pulmonary abscess could be a part of primary disease orarisen secondarily to diseases in other parts of the body. Two types of pleuritis-primary and secondary-were described by Radostis *et al.* (2000). Primary pleuritis occurred usually by traumatic penetration of the thoracic wall. Secondary pleuritis occurred as a part of specific infectious diseases like *Pasuerella multocida* and *Pasuerella hemolytica* infection in all species of animals. In cattle, pleuritis could also occur in the following infectious diseases: tuberculosis, sporadic bovine encephalomlclitis, contagious bovine pleuropneumonia and Hemo philussommus infection.

Alam (2001) recorded the prevalence of pulmonary diseases (6.7%) such asbronchitis (1.2%), bronchiolitis (0.2%), bronchopneumonia (0.5%), bronchointerstitial pneumonia (0.3%), purulent bronchopneumonia (0.5o/o). interstitial pneumonia (0.7%), hemorrhagic pneumonia (1.3%), fibrinous pneumonia (0.3%), emphysema (0.7%) and lesion free lungs (0.7%). The overall prevalence of lung lesions or diseases in goats was found to be highest during winter (7 547%).

Ozcan and Beytut (2001) recorded the prevalence of anthracosis (3.85%) in cattle of Turkey.

In Tanzania, Mellau LS, *et al.* (2010) found 15,245 (13.2%), 4668 (7.8%) and 3192 (8.4%) lungs of cattle, sheep and goat, respectively, were condemned due to nine diseases/conditions namely pneumonia, hydatidosis, emphysema, abscesses, anthracosis, pleurisy, calcified cysts, melanosis and bovine pulmonary tuberculosis.

Pneumonia was the leading cause of condemnations as it was responsible for 4594 (30.1%), 1495 (31.4%) and 1072 (33.6%) of all the condemned lungs in cattle, sheep and goats, respectively. Anthracosis, pleurisy, melanosis and pulmonary tuberculosis were only recorded in cattle attributing to 7.3%, 6.4%, 2.9%, and 0.7% of lung condemnations, respectively.

Belkhiri *et al.* (2009) worked in Algeria, have shown a high frequency of pathological pulmonary lesions in 870 bovine lungs that were inspected. 744 lungs were concerned by these lesions. The seasonal impact of the lesions has been highly marked. The hydatid cyst was the most frequently observed lesion with 330 cases (42.64%) followed by pulmonary emphysema with 111 cases (14.35%) and pulmonary congestion with 61 cases (7.89%).

Belkhiri *et al.* (2012) also studied 2863 ovine lungs that. 803 lungs were concerned by these lesions. The seasonal impact of the lesions has been highly marked. The verminous pneumonia was the most frequently observed lesion with 419 cases (14.63%) followed by hydatid cyst with 374 cases (13.06%) and pulmonary fasciolosis with 10 cases (0.35%).

Comert *et al.* (2012) included 104 patients in this study; 49(47.1%) of which were female, 55 (52.9%) male. The most common complaints were cough, dyspnea and sputum production in 71.2%, 57.7% and 49.0% patients, respectively. Regarding geographical location, they found that the majority of the patients (38.5%) were from BlackSea region located in northern Anatolia. While the most common chest x-ray findings were consolidation (51.9%) and fibrosis (18.3%), consolidation (38.5%) and fibrosis (36.5%) were also found to be the leading thorax CT findings. The most common broncho scopic findings were bilateral anthracosis, stenosis and bronchial torsion 67.3%, 40.4%and 23.1% patients, respectively. Among the anthracosis patients, with bronchoscopy 11 of them were found to have malignancy and 7 of them tuberculosis.

Majid (2014) found that anthracosis of the lungs is black discoloration of bronchial mucosa that can occlude bronchial lumen and is associated with bronchial

anthracofibrosis (BAF). Computed tomography (CT) may show more specific findings such as lymph node or bronchial calcification and mass lesions. Final diagnosis can be made by bronchoscopy when obtaining samples for tuberculosis (TB), which is the most common diseases associated with BAF.

Gebrehiwot *et al.* (2015) conducted a cross-sectional epidemiological study on slaughtered cattle at Mekelle abattoir, Northern Ethiopia. The most common lesions were congestion (38.5%), emphysema (36.3%), hydatidosis (18.3%), abscesses (7.1%) and verminous pneumonia (3.2%). The risk factors identified on statistical basis ($p < 0.05$) were fat in cattle in pulmonary congestion, old age (>7 years) and very lean cattle in pulmonary emphysema and pulmonary abscesses and young age (<7 years) in verminous pneumonia.

2.2 Parasitic bronchitis

Ali (1983) reported 0.13% prevalence of *Dictyocaulus viviparus* infection in goats. Female goats were found more susceptible to lungworm infection.

Boon (1983) reported *Dictyocaulus viviparous* in about 80% of dairy cattle during the grazing season of 1981 in the Netherlands.

Gronvold and Jorgenscn (1986) found no *Dictyocaulus viviparous* larvae in calves kept in barn in Denmark where lungworm infection was a frequent problem. In six of the 9 study farms, where calves were fed fresh cut grass or grass silage, had lungworm infection in previous years.

Zurita *et al.* (1987) found lungworm infection in calves housed individually since birth. The calves showed mild signs of respiratory disease and they had been fed freshly cut grass from pasture frequented by dairy herd.

Eysker *et al.* (1994) reported higher prevalence of mild infections caused by patent stags of lungworm in cattle during mid-April to mid-June than February to March. They also reported that husk occurred predominantly in young animals. Older animals developed an acquired immunity when the incidence was high. Occasionally, outbreaks of husks were also seen in older cattle in the Netherlands.

Obviously, there could be a considerable variation between the farms and regions in the buildup of population and the buildup of immunity to lungworm infection.

Urquhart *et al.* (l996) reported lungworm infection in temperate areas with high rainfall. The disease typically affected young cattle during their first grazing season on permanent or semi-permanent pastures. In endemic areas, older animals had a strong acquired immunity. They also reported that parasitic bronchitis was predominantly a problem in areas such as northern Europe where a mild, climate, a high rainfall and abundant permanent grass were available. Epidemics of the disease occurred from June until November, but were most common during July to September.

David (1997) found 6 to 100% of adult cattle in dairy herds infected with lungworm although appropriate anthelmintics for worm control were used either singly or in combination. Possible risk factors were identified as failure to vaccinate a group on an endemically infected farm, introduction of susceptible animals in endemically infected herd and young stock grazed away or housed in their first year.

Umur and Arslan (1998) recorded a 2% prevalence of lungworm inflection in cattle by fecal examination.

Thamsborg *et al.* (1998) reported an overall prevalence of lungworm (8 to28%) in cattle. The prevalence was higher in calves (0-42%) than cows (0-20%). They concluded that on large dairy farms of Tanzania with exotic breeds, lungworm infection was widespread in both young and old stock.

Ploeger (2000) carried out a cross-sectional survey distributed in The Netherlands and reported 41% positive infection. A comparison with previous data showed lungworm infection in Dutch dairy farms as a result of high level of parasite control using anthelmintics and other management practices.

Hoglund *et al.* (2001) surveyed l0 herds of cattle at the beginning and at the end of the grazing period. The sero prevalence of lungworm infection was found significantly higher in calves (14.9%) than in adult cattle (7.0%). The result also

suggested that arrested larvae in older cattle play an important rote in the wintering survival for lungworm in Sweden.

Viring *et al.* (2001) reported that 20% of the beef-sucker calves of 12herds were seropositive to *Dictyocaulus viviparous* in Sweden. In none of the herds the owner observed clinical signs of parasitism.

Eyob and Matios (2013) examined 381 fecal sample of sheep in central Ethiopia from November 2009 to May 2010, 276 (72.4%) were found to be infected with one or more species of lungworm.

Chanie and Ayana (2013) found the overall prevalence of lungworm was 57.5%, there was no statistical significance between breeds of sheep and lungworm infection ($p>0.05$). The highest prevalence 76.5% was observed in sheep greater than three years of age followed by 57.1% and 37.5% prevalence of age groups one to three and less than one year of age respectively. Female and male animals appear similarly affected with lungworm even though very small difference applies 57.8% and 57.2% respectively in Ethiopia.

Eyob and Matios (2013) examined 381 fecal sample of sheep in central Ethiopia from November 2009 to May 2010, 276 (72.4%) were found to be infected with one or more species of lungworm.

Mahmood *et al.* (2014) found overall non-significant difference in prevalence of *D. viviparu s*in fecal samples of cattle (4.76%) and buffaloes (5.10%) were recorded.

Mohammad *et al.* (2015) examined 200 collected lungs, where infected 33 cases (16.5%) to hydatid cyst, 95 cases (47.5%) to *Dictyocaulus viviparous*. also 13 cases (6.5%) of lungs were infected to *Linguatulaserrata* larva.

2.3 Hydatidosis

Dada (1980) conducted an abattoir survey in Nigeria for cestode larvae in food animals and reported hydatid cyst in 14.7% of cattle. The cysts occurred in the lungs,

liver and spleen; 94% of cysts from camels, 8l.3% from goats, 59.7% from sheep and 7.4% from cattle were fertile.

Islam (1981) recorded hydatid cysts in 8.3% of 12,344 goats. The hydatid cysts were found in liver (36.7%), lungs (32.0%), spleen (4.7%), heart (3.1%), kidney (l.6%), omentum (0.8%) and both liver and lungs (21.1%).

Ali (1983) recorded 0.2% pulmonary hydatidosis in slaughter female goats at Mymensingh town.

Lorenzini and Ruggieri (1987) reported prevalence of hydatid cysts 4.5-5.4% in sheep and goats, 0.5-0.7% in cattle, 0.2-0.4% in pigs and 0.1-0.3% in horses. The liver was more frequently affected than that of spleen.

Mersie (1993) found echinococcosis in 20.5% cattle and 22.5% in stray dogs in Ethiopia.

Umur and Aslantas (1993) studied prevalence and economic loss of hydatidosis in ruminant of Turkey and recorded hydatid cyst in 24.7% cattle. In sheep, the cysts were found mostly in the liver, but in other species they were found mostly in the lungs. The economic loss from discarded lungs and liver in 1993 was estimated to be about TL 170 million.

Luengo *et al.* (1995) found echinococcosis in 21.6% cattle and reported significant differences in the prevalence of the disease between different regions of Chile.

Das and Das (1998) recorded hydatid cyst in 45% cattle of greater Calcutta. In cattle and buffalo, lungs were affected more commonly than the liver. On the other hand, in sheep, goat and pig hepatic cysts were more common than pulmonary cysts. Right lung was more frequently affected than left in all animals.

Musinov (1999) found hydatidosis in 20.8% cattle. 47 23% sheep and 7.73% pigs in Uzbekistan. They found hydatid cysts most frequently in lungs of cattle, liver of pigs and equally in liver and lungs of sheep.

Toncheva and Zhelyaskov (1999) found hydatid cysts in 50.0% of sheep.29.0% of cattle and 3.3% of pigs.

Sarma (2000) reported 13.7% prevalence of hydatid cysts in cattle of Guwahati city. Unilocular cystic infection was more frequent than multiple infection.

Apt *et al.* (2000) conducted an epidemiological survey of echinococcosis in south-central Chile and found l3% of cattle infected with hydatidosis. 0.8% people seropositive for hydatidosis by indirect hemagglutination and ELISA tests.

Alam (2001) reported 0.4% pulmonary hydatidosis in slaughtered goat. Hydatidosis was found only in adult goats (>18 months old).

Hadziosmanovic (2001) reported from Croatia that more than 400 tons of liver and lungs of slaughtered animals were rejected due to echinoccrccoid changes. He also reported that during sanitary examinations of animals for slaughtering, echinococcosis was established in a total of 55699 pigs, 521 piglets, 366 cattle, 20 calves and 29 sheep and goats.

Njoroge *et al.* (2002) found hydatidosis in 19.4% cattle, 3.6% sheep. 4.5% goats and 61.4% camels in an abattoir survey in Kenya. They also stated that the differences in prevalence were attributed to difference in environmental conditions, livestock stocking intensity and cross-border migration of livestock in different divisions.

Belkhiri *et al.* (2009) worked in Algeria, have shown that the hydatid cyst was the most frequently observed lesion with 330 cases (42.64%) followed by pulmonary emphysema with 111 cases (14.35%) and pulmonary congestion with 61 cases (7.89%).

Zewdu *et al.* (2010) examined total 384 cattle where 114 (29.69%) were found infected with hydatidosis. From the examined animals 61 (15.89%), 19 (4.95%) and 26 (6.77.3%) contained hydatid cyst in their lungs, livers, and in both lung and liver, respectively.

Desta *et al.* (2012) observed the overall prevalence of hydatidosis was 11.6% which was significantly higher (P<0.005) in relatively older sheep.

Banda (2013) found that out of the 4061 cattle examined during postmortem inspection, 84 (2.1%) were positive for hydatidosis. No cases were detected from Kaoma and Shangombo districts; however, prevalence ranged from 0.6% to 2.5% in districts where it was present. Sex was found to be positively associated with hydatidosis with female cattle being more likely to have hydatidosis.

Asfaw *et al* (2014) conducted a cross sectional study with the objective of assessing the prevalence of hydatid cyst on 440 cattle from May to June 2014 in Shire municipal abattoir. The present finding revealed that the overall rate of the parasite was 32%. Sex wise distribution of the parasite was -29.9% and 3.2% in male and female cattle with no statistical significance variation between male and female. Similarly, the rates in adult and old cattle were 23.6% and 8.4% respectively. The rate of the parasite in adult and old cattle showed significance variation (p<0.05). Similarly the prevalence in local and cross breed was also 31.6% and 0.5% with no statistical variation between the two breeds. Moreover, hydatid cysts prevalence of each organ at the abattoir survey indicated 70 (17.5%) in lung; 65 (14.77%) in liver; 2 (0.45%) in heart and 4 (0.9%) in kidney respectively.

Gebrehiwot *et al.* (2015) conducted a cross-sectional epidemiological study on slaughtered cattle at Mekelle abattoir, Northern Ethiopia. They found hydatidosis (18.3%), abscesses (7.1%) and verminous pneumonia (3.2%).

Mohammad *et al.* (2015) examined 200 collected lungs, where infected 33 cases (16.5%) to hydatid cyst.

CHAPTER III

MATERIALS AND METHODS

An observational (cross-sectional) study of pulmonary diseases in slaughter cattle of Birganj upazila of Dinajpur District conducted during January 2014 to June 2014.

3.1 Sampling strategy

The sample constituted 104 of about 900 cattle slaughtered annually at butcher house in Birganj upazila of Dinajpur District. 3-4 animals were slaughtered at Saturday and Wednesday but often animals were slaughtered on Friday in this butcher house. The animals were collected different village markets of Birganj upazila. During January 2014 to June 2014 about 500 cattle were presumed to be slaughtered in the butcher house. The animals (104 cattle) in the sample were selected conveniently from about 500 cattle at the rate of 4 animals per week.

3.2 Cleaning and sterilization of required glassware

Test tubes, glass tubes, glass slides, cover slips, beakers, pipettes, reagent bottles, glass bottle, spirit lamp, measuring cylinders etc. were used in this study. The conical flask, measuring cylinder, beakers, glass slides, cover slip, for the slide preparation of histopathological study and staining of organisms after smear and pipettes, reagent bottle, glass tubes for different biochemical tests. New and previously used glassware were collected and dipped in 2% sodium hypochlorite solution and left there until cleaned. After overnight soaking in a household dishwashing detergent solution, the glassware were cleaned by brushing and washed thoroughly in running tap water and rinsed three times in distilled water. The cleaned glass wares were then dried on a bench at room temperature or in an oven at 50-70^{0}C

3.3 Clinical examination of cattle and collection of their lungs

Clinical examination of cattle was made individually on the day(s) before slaughter. The samples were collected with sterile instrument and transferred in the laboratory

of the Department of Pathology and Parasitology for necropsy and histopathological examination.

3.3.1 Distant inspection

A distant inspection and auscultation technique was used individually to record presenting signs such as demeanor, physical condition, nasal discharge, respiratory characters, spontaneous cough and other respiratory sounds.

3.3.2 Physical examination

After appropriate restraint to control movement of the animal, physical examination was performed to study physical signs such as heart rate, respiratory rate, bronchial tones (trachea, lungs), silent lung, adventitious sounds, etc. using indirect auscultation technique. Induction of cough (induced) was attempted by direct palpation of trachea and direct auscultation. Chest pain was detected by pinching of the back (withers) and direct deep percussion on the chest wall on the basis of pain response. Rectal temperature was recorded using a clinical thermometer (^{o}F). The other organ systems of the body were not examined. Appropriate age of the animals was determined on the basis of dentition. The age of the animals ranged from 3-8 years with an average of 4.9±0.16 SEM years. The lungs were collected from the butcher house immediately after slaughter.

3.4 Examination of the lungs

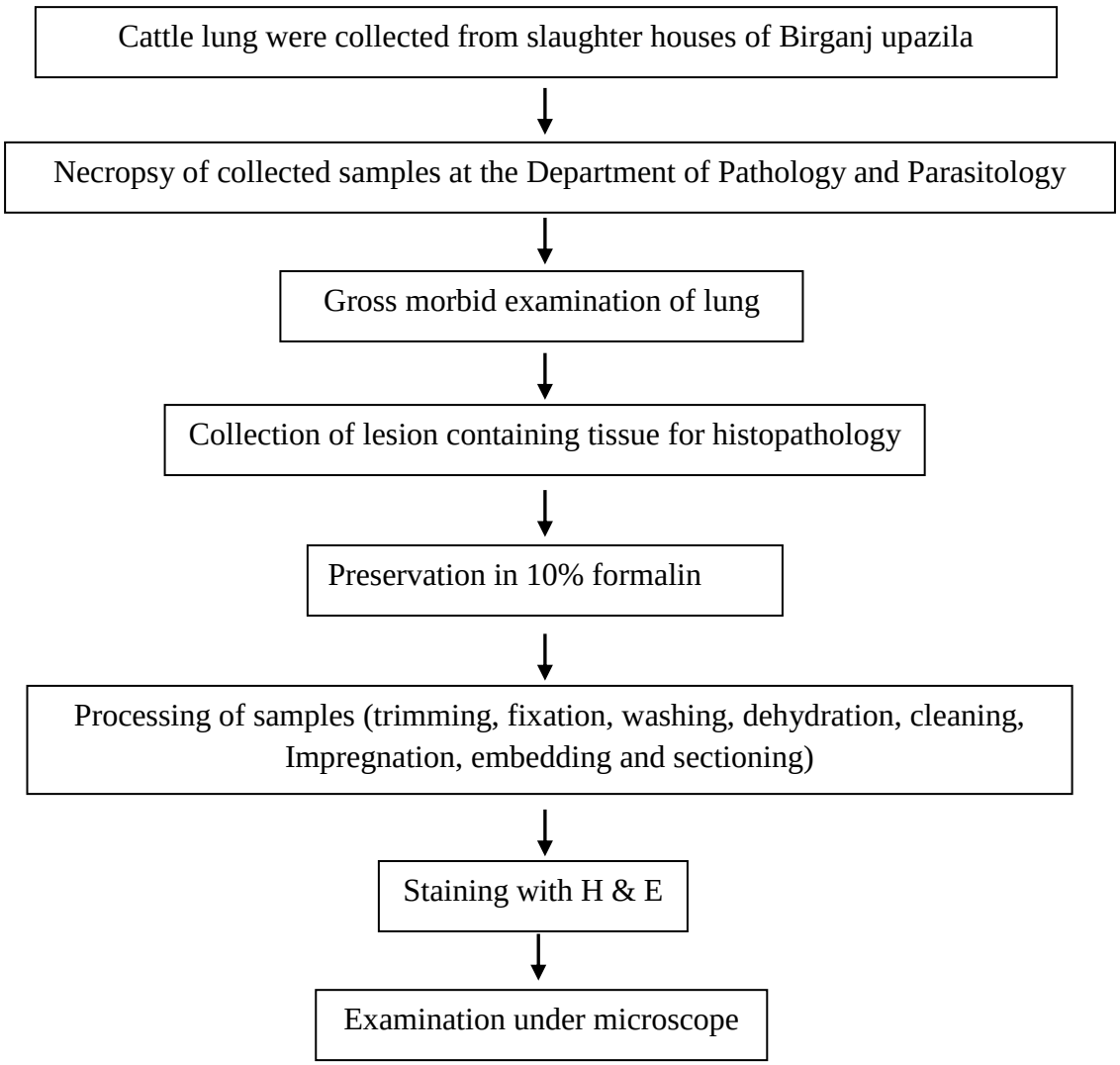
3.4.1 Physical examination

The lungs were examined in the laboratory for gross lesions. The lesions were identified on the basis of their physical characteristics. The number, size, shape and other characteristics of lesions were recorded. The severity of pulmonary lesions was determined on the basis of size and number of lesions as well at area of individual lesions. The suspected tissue specimens were collected and fixed in l0% buffered neutral formalin solution.

3.4.2 Collection and identification of lung parasites

The lungs together with trachea were placed on a large deep tray. The trachea and bronchi were cut open with scissors. The main bronchioles were cut open up to their tips followed by the smaller lateral bronchioles. Then the lungs were washed thoroughly in normal saline in a bucket. The saline was poured through a wire mesh screen with an aperture of 0.038 mm. The material retained in the mesh was gently washed and then fixed in formalin. The materials were examined under a dissecting microscope for counting and identification of the lungworms following the procedure published in the literature (Anon., 1977). The other lung parasites were studied and identified using the standard procedure (Soulsby, l982).

EXPERIMENTAL DESIGN



Flow diagram of the experiment

3.5 Histopathology

Formalin fixed tissue samples were processed and stained as per standard method (Luna, 1968).

3.5.1 Materials required for histopathology

- Samples (lungs)
- 10% formalin
- Chloroform
- Paraffin
- Alcohol
- Tape water
- Xylene
- Hematoxylin and Eosin stain
- Distilled water
- Clean slides
- Cover slips
- Mounting media (DPX).
- Microscope
- Microtome
- Water bath

3.5.2 Processing of tissue for histopathology

1. Collection of tissue and Processing

During tissue collection the following point were taken into consideration-

The tissues were collected in conditions as fresh as possible. Normal and diseased tissues were collected side by side. The thickness of the tissues were as less as possible (5mm approximately). The tissues (lungs) were collected from the goats in the Histopathology Laboratory of the Department of Pathology and Parasitology, HSTU, Dinajpur.

2. Fixation: 10% formalin was added in the plastic container (10 folds of the tissue size and weight) and fixed for 3-5 days.

3. Washing: The tissues were trimmed into a thin section and washed over night in running tap water to remove formalin.

4. Dehydration: The tissues were dehydrated by ascending ethanol series to prevent shrinkage of cells as per following schedule.

- 50% alcohol – one hour
- 70% alcohol – one hour
- 80% alcohol – one hour
- 95% alcohol – one hour
- Absolute alcohol – three changes (one hour for each changes)

5. Cleaning: The tissues were cleaned in chloroform for 3 hours to remove ethanol (2 changes; 1 and half an hour for each change).

6. Impregnation: Impregnation was done in melted paraffin (56- 60°C) for 3 hours. (2 changes; 1 and half an hour for each change)

7. Embedding: Paraffin blocks containing tissue pieces were made using templates and molten paraffin

8. Sectioning: Then the tissues were sectioned with a microtome at 5-6µm thickness. The sections were allowed to spread on luke warm water bath (40-45 °C) and taken on a glass slide. A small amount of gelatin was added to the water bath for better adhesion of the section to the slide. The slides containing sections were air dried and stored in cool place until staining.

3.5.3 Routine Hematoxylin and Eosin staining procedure

3.5.3.1 Preparation of Ehrlich's Hematoxylin solution

Hematoxylin crystals	4.0 g
Alcohol, 95%	200.0 ml
Ammonium or potassium alum	6.0 g
Distilled water	200.0 ml
Glycerine	200.0 ml
Glacial acetic acid	20.0 ml

Hematoxylin was dissolved in the alcohol and the alum was dissolve in distilled water and mixed thoroughly. After these were in complete solution the glycerin and acetic acid were added.

3.5.3.2. Preparation of eosin solution

1% stock alcoholic eosin

Eosin Y, water soluble	1 g
Distilled water	20 ml
95% alcohol	80 ml

Eosin was dissolved in water and then 80 ml of 95% alcohol was added.

Working eosin solution

Eosin stock solution	1part
Alcohol, 80%	3 parts

0.5ml of glacial acetic acid was added to 100 ml of working eosin solution just before use.

3.6 Staining protocol

The sectioned tissues were stained as described bellow:

- The sectioned tissues were deparaffinized in three changes of xyline (three minutes in each)
- Then the sectioned tissues were rehydrated through descending grades of alcohol as per following schedule.
  - Absolute alcohol (three changes; three minutes for each)
  - 95% alcohol - two minutes
  - 80% alcohol - two minutes
  - 70% alcohol - two minutes
  - Dipping with distilled water for 10 minutes.
- The tissues were stained with Harris hematoxylin for 2-10 minutes.
- Washed in running tap water for 10-15 minutes.
- Then the tissues were dipped in ammonia water (few dips).
- Stained with eosin for one minute.
- Differentiated and dehydrated in ascending grade of alcohol.
  - 95% alcohol (three changes; 2-4 dips for each change)
  - Absolute alcohol (three changes; 2-3 minutes for each change)
- Cleaned in xyline (three changes; five minutes each change).
- Tissues were mounted with cover slip by using DPX
- The slides were dried at room temperature and examined under a low (10X) and high (40X, 100X) power objectives.

3.7 Statistical analysis

The collected data of this study were analyzed and presented using simple statistical techniques. The raw data were entered and sorted into MS Excel spread sheet, then transferred to the analytical software SPSS (Statistical Package for the Social Sciences, version, 16) for descriptive analysis. Compare mean values under pair simple T-test to know different factors. All data were expressed as mean ± SEM. Differences were considered significant at the level of $P<0.05$.

CHAPTER IV

RESULTS

The cross-sectional study of pulmonary cattle presented for slaughter at Birganj conducted from January 2014 to June 2014 included epidemiological (frequency, distribution), clinical, pathological and parasitological findings of the diseases.

4.1 Epidemiological findings

4.1.1 Frequency

Of the 104 cattle examined after slaughter for pulmonary diseases, 92(88.5%) were found to be affected with pulmonary lesions, parasitic bronchitis and hydatidosis (Table l). The frequency of pulmonary lesions is shown in Tables 2, 3. A total of 76 cattle (73.1%) out of 104 showed pulmonary lesions: congestion (61.5%), emphysema (25.0%), anthracosis (11.5%) pleuritis (10.6%), abscess (6.7%) and hemorrhage (5.8%). The parasites found in the lungs are shown in Table 1. The most common pathogenic parasites of the lungs included *Dictyocaulus viviparus* (29.8%) and hydatid cysts (24.0%).

4.1.2 Distribution

The demographic and temporal distribution of pulmonary diseases in cattle presented for slaughter in Birganj has been presented in tabular forms (Tables 2, 3). The frequency of pulmonary lesions (overall) was significantly higher during summer season ($p<0.01$) (Table 2). The frequency of pulmonary congestion was higher in male cattle ($p<0.02$) of ≤ 3.5 years old ($p<0.01$) and summer season ($p<0.01$) (Table3). Higher frequency of parasitic bronchitis (lungworm infection) was recoded in slightly ill health ($p<0.01$) cattle (Table 5).

4.2 Clinical findings

The frequency of clinical findings of bovine pulmonary diseases has been shown in Table 4. The presenting signs observed in bovine pulmonary diseases included

slightly dull demeanour, poor physical condition, nasal discharges, abdominal type of respiration, shallow breathing and slight dyspnea in few animals. The physical signs were mild tachycardia and crackles in few animals, tachypnea, harsh bronchial tones and silent lungs. There was no evidence of fever in pulmonary diseases of slaughter cattle. History of spontaneous cough was not available and attempts to induce cough were unsuccessful.

The frequency and distribution of clinical findings of bovine pulmonary diseases presented in Table 5 and 6. The clinical signs were significant for the diseases (i.e, significant clinical signs) were few. Pulmonary diseases (overall) were significantly higher in slightly ill health animals ($p<0.01$) (Table 5). The frequency of pulmonary lesions (overall) were significantly higher in slightly dull animals ($p<0.05$) in which tachypnea observed as significant clinical sign ($p<0.05$) (Table 6).

4.3 Pathological findings

4.3.1 Pulmonary lesions

4.3.1.1 Macroscopic findings

The pulmonary lesions observed in this study included congestion, emphysema, anthracosis, pleuritis, abscess and hemorrhage. The diaphragmatic lobes were found to be affected by all the pulmonary lesions. The congestion and emphysema had generalized distributions as well. The severity of lesions is shown in table 7. Higher frequency of severe cases of congestion (65.1%) and mild cases of emphysema (80.8%) was observed. Pleuritis was characterized by thick pleura. Abscesses were characterized by firm nodular structures. The lesions of anthracosis showed black discoloration on the lung surface. Of the 6 cases of hemorrhage, there were 4 (66.7%) cases of petechial and 2 (33.3%) cases of echymotic hemorrhages.

4.3.1.2 Microscopic findings

The histopathological findings of congestion were variable. In some cases there were severe pneumonia characterized by hemorrhage and large number of leukocytes fitting the lumen of the alveoli. Both bronchitis and pneumonia were found in some

cases in which the major microscopic lesions were infiltration of leukocytes in the wall of bronchus and lumen of the alveoli. In addition, there were congestion and hemorrhage. Both bronchiolitis and pneumonia and were also found in few cases and their histological lesions included infiltration of leukocytes in the wall and lumen of bronchioles. In emphysematous areas many alveoli were found distended and many showed wide opening into each other or into a common space due to replacement of alveolar walls. The alveolar walls were thin and atrophic. Abscesses were characterized by accumulation of neutrophils surrounded by immature fibroblasts forming a capsule like structure.

4.3.2 Pulmonary parasitic diseases

No significant gross lesion related to lungworm infestation was observed in tissues. The microscopic lesions of bronchitis and bronchiolitis appeared to be associated with lungworm infection. The portions of lung occupied by hydatidcysts varied according to number and size of the cysts present in individual lungs. The entire lungs appeared to be affected in case of 80 cysts. The alveoli were compressed around the cyst wall. The wall of the cysts showed proliferation of connective tissue, dead keratinized layers and numerous mononuclear cells.

4.4 Parasitological findings

The lungworms collected in this study were identified as *Dictyocaulus vivipapus*. Numerous immature worms were collected along with mature worms from individual lungs. There was no case with only immature worms.

Table 1. Frequency of bovine pulmonary diseases: lesions and parasites (overall) (n=104)

Lesions and parasites	No. of cases	Percentage (%)
Pulmonary lesions[a]	43	41.3
Pulmonary lesions+ lungworms	18	17.3
Pulmonary lesions+ hydatid cyst	11	10.6
Pulmonary lesions+ hydatid cyst + lungworms	4	3.8
Lungworms	6	5.8
Hydatid cyst	7	6.7
Lungworms + hydatid cyst	3	2.9
No pulmonary disease	12	11.5

n= No. of lungs examined

a= Pulmonary lesions include congestion, emphysema, anthracosis, pleuritis, abscess and hemorrhage

Table 2. Frequency of bovine pulmonary diseases: pulmonary lesions in individual lung (n= 104)

Lesions	No. of cases	Percentage (%)
Congestion	29	27.9
Congestion + emphysema	18	17.3
Congestion + pleuritis	6	5.8
Congestion + anthracosis	4	3.8
Congestion + emphysema + anthracosis	2	1.9
Congestion + abscess + anthracosis	2	1.9
Congestion + hemorrhage	1	0.9
Congestion + abscess	1	0.9
Congestion + emphysema + hemorrhage	1	0.9
Congestion + emphysema + hemorrhage + pleuritis	1	0.9
Congestion + emphysema + pleuritis	1	0.9
Emphysema + pleuritis	2	1.9
Anthracosis	1	0.9
Anthracosis + abscess	1	0.9
Anthracosis + emphysema + hemorrhage	1	0.9
Pleuritis	1	0.9
Pleuritis + anthracosis	1	0.9
Abscess	3	2.9
Congestion + anthracosis	4	3.8
Hemorrhage	2	1.9
No pulmonary lesions	12	11.5

Table 3. Frequency of bovine pulmonary diseases: individual lesions (n= 104)

Pulmonary lesions	No. of cases	Percentage (%)
Congestion	63	60.6
Emphysema	26	25.0
Anthracosis	12	11.5
Pleuritis	11	10.6
Abscess	7	6.7
Hemorrhage	6	5.8
No pulmonary lesions	12	11.5

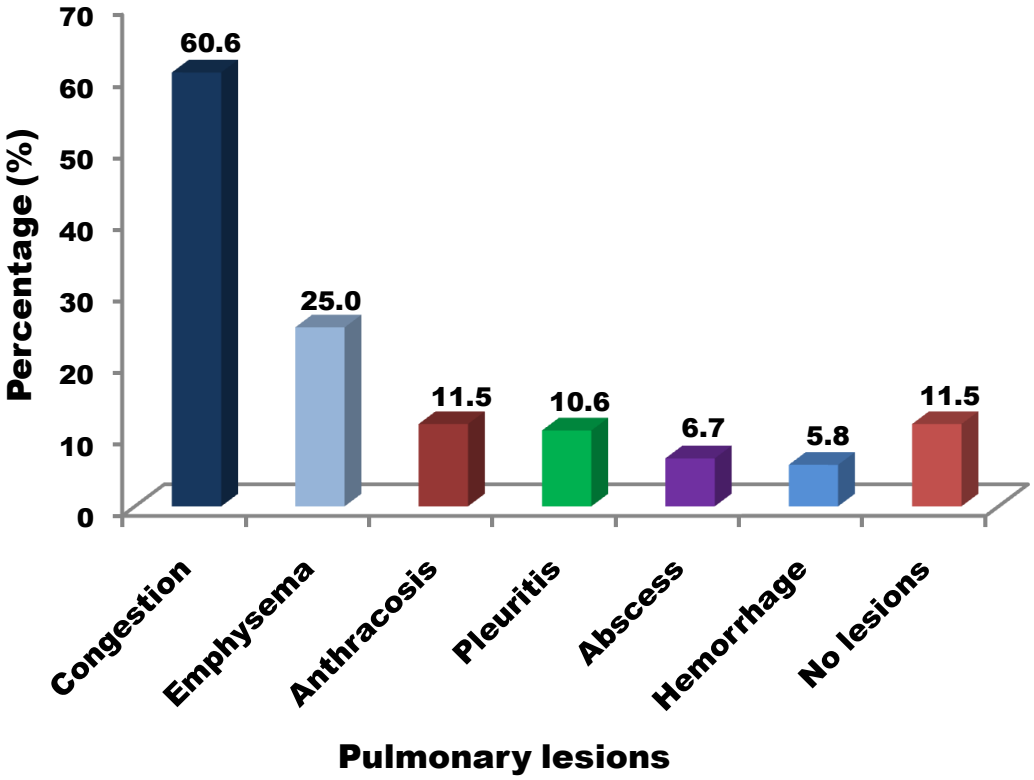


Figure 1: Frequency of bovine pulmonary diseases: individual lesions

Table 4. Demographic and temporal distribution of bovine pulmonary diseases: pulmonary lesions (overall)[a] (n= 104)

Variable		No. of cattle examined	No. of cases	Percentage (%)	χ^2- value	P- value
Name	Categories					
Gender	Male	47	37	78.7	0.63	0.728
	Female	57	41	71.9		
Age	≤ 3.5 years	33	27	81.8	3.45	0.486
	4-5 years	38	30	78.9		
	≥ 6 years	33	21	63.6		
Physical condition	Slightly thin	38	30	78.9	1.54	0.464
	Moderately thin	66	48	72.7		
Season	Winter (January to March)	40	30	75.0	22.3**	0.001
	Summer (April to June)	15	15	100.0		

n= No. of animal examined

a= Pulmonary lesions include congestion, emphysema, anthracosis, pleuritis, abscess and hemorrhage

**= Significant at 1% level

Table 5. Clinical findings of pulmonary diseases: lesions and parasites

Clinical findings			No. of animals examined	No. of cases	Percentage (%)	χ^2-value	P-value
Type	Name	Categories					
Presenting signs	Demeanor	Bright	62	57	91.9	7.38	0.390
		Slightly dull	42	35	83.3		
	Physical condition	Slightly thin	38	35	92.1	20.29**	0.005
		Moderately thin	66	57	86.4		
	Nasal discharge	Absent	67	61	91	9.26	0.234
		Present	37	31	83.8		
	Dyspnea	Absent	96	84	87.5	13.15	0.069
		Present	8	8	100		
Physical signs	Heart rate	Normal (48-80/ min)	98	86	87.8	6.17	0.520
		Tachycardia (≥81/ min	6	6	100		
	Respiratory rate	Normal (10-30/ min)	78	67	85.9	8.08	0.325
		Tachypnea (RR ≥30/min	26	25	96.2		

Table 6. Clinical findings of bovine pulmonary diseases: pulmonary lesions

Clinical findings			No. of animals examined	No. of cases	Percentage (%)	χ^2-value	P-value
Type	Name	Categories					
Presenting signs	Demeanor	Bright	62	45	72.6	6.93*	0.031
		Slightly dull	42	33	78.6		
	Physical condition	Slightly thin	38	30	78.9	1.54	0.464
		Moderately thin	66	48	70.6		
	Nasal discharge	Absent	67	50	74.6	0.62	0.733
		Present	37	28	75.7		
	Dyspnea	Absent	96	72	75.0	0.35	0.840
		Present	8	6	75.0		
Physical signs	Heart rate	Normal (48-80/ min)	98	74	75.5	1.63	0.444
		Tachycardia (≥81/ min	6	4	66.7		
	Respiratory rate	Normal (10-30/ min)	78	54	69.2	6.28*	0.043
		Tachypnea (RR ≥30/min	26	24	92.3		

Table 7. Severity of bovine pulmonary lesions

Pulmonary lesions	Mild		Severe		Total
	No. of cases	Percentage (%)	No. of cases	Percentage (%)	
Congestion	22	34.9	41	65.1	63
Emphysema	21	80.8	5	19.2	26
Anthracosis	4	33.3	8	66.7	12
Pleuritis	5	45.5	6	54.5	11
Abscess	7	100	0	0	7
Hemorrhage	6	100.0	0	0	6

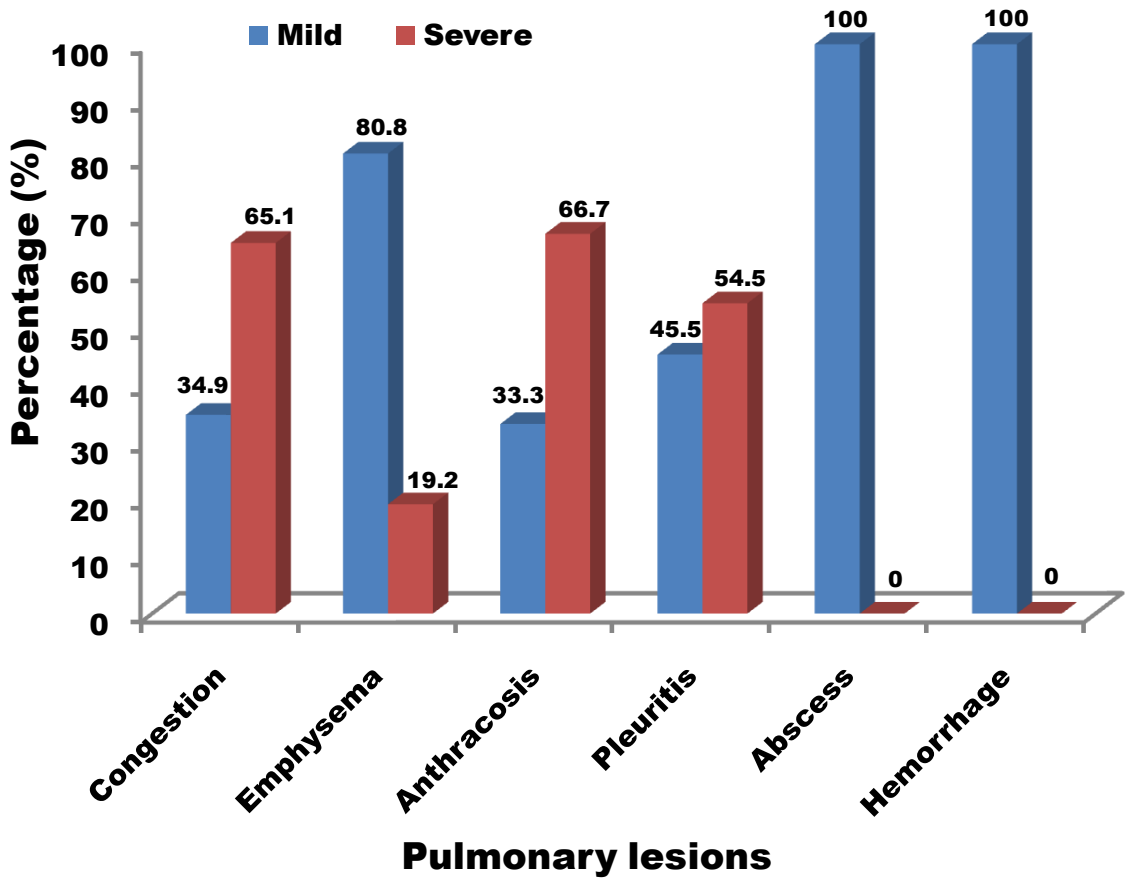


Figure 2: Severity of bovine pulmonary lesions

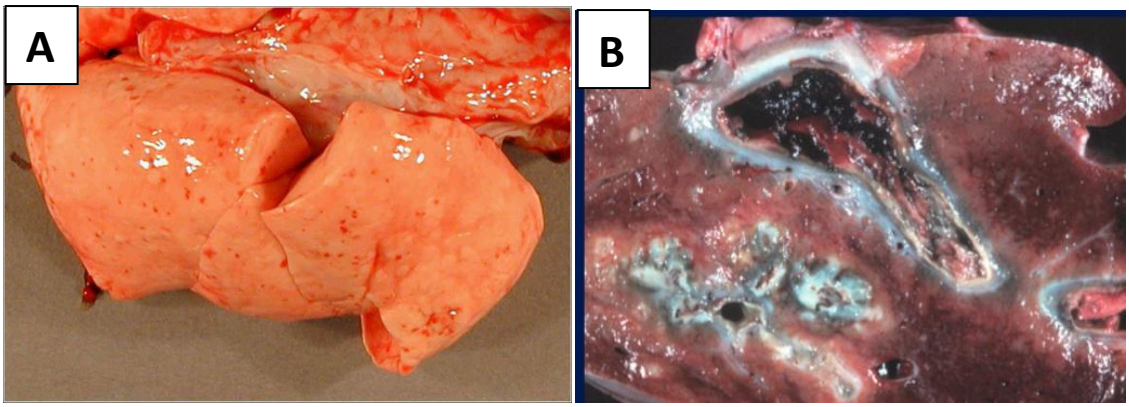


Photo 1: Normal (A) and affected lung (B).

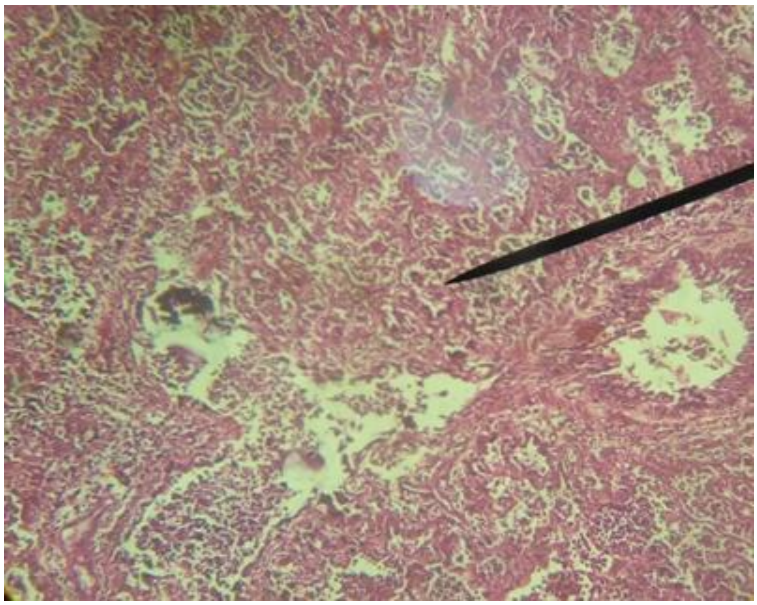


Photo 2: Reactive cell infiltration in lung parenchyma (Arrow)

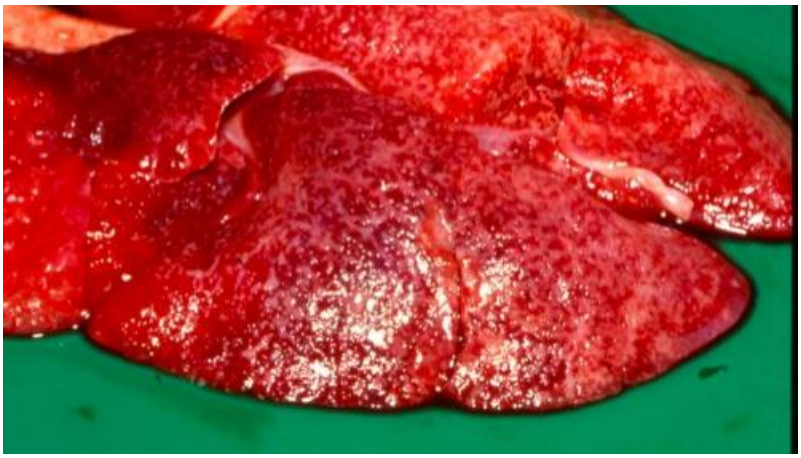


Photo 3: Congested and haemorrhagic spots in lung.

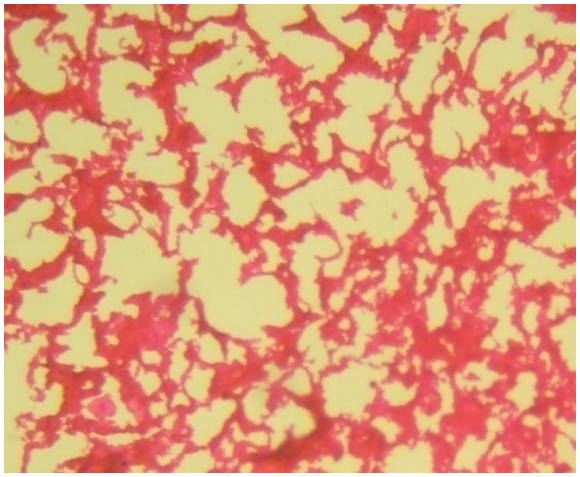


Photo 4: Alveolar destruction and exudate filled alveoli

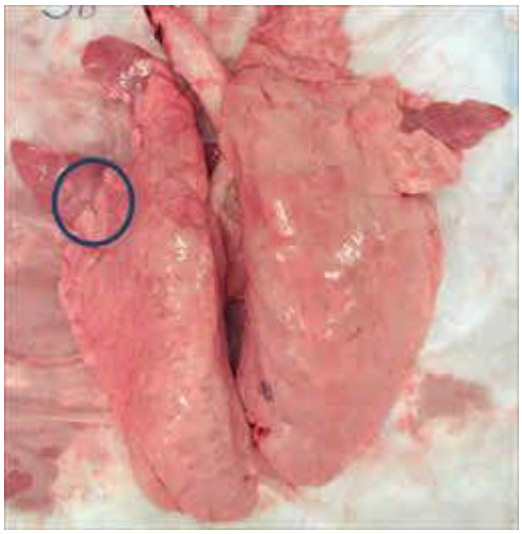


Photo 5: Exudates in the lungs

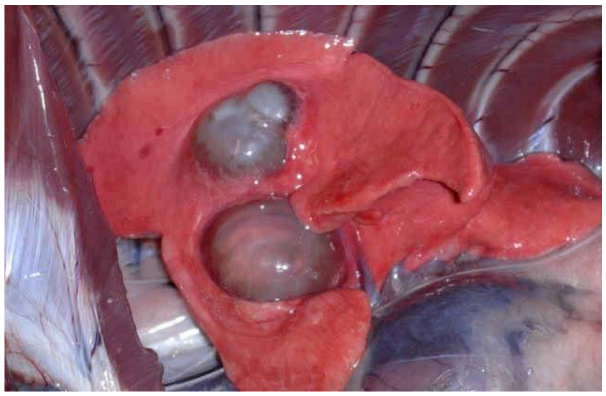


Photo 6: Cystic development on pulmonary surface.

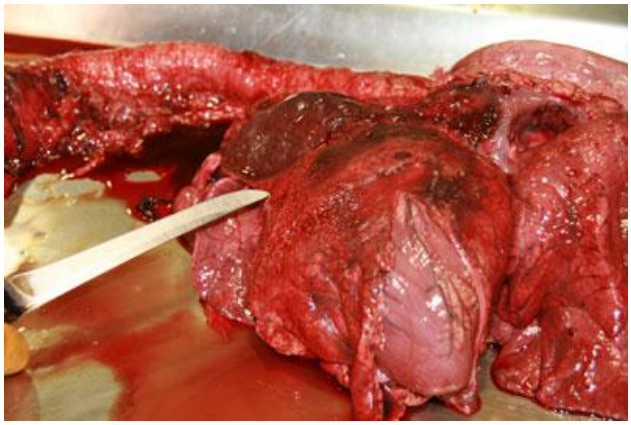


Photo 7: Pleuritis in the lungs

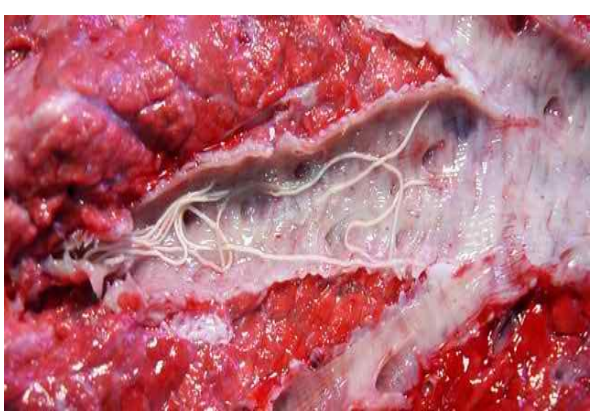


Photo 8: Lungworms in the lungs

CHAPTER V

DISCUSSION

The cross-sectional study of pulmonary diseases in slaughtered cattle conducted during January to June 2014 in Birganj included epidemiological, clinical, pathological and parasitological findings.

Most of the slaughter cattle were found to be affected with pulmonary diseases (88.5%) such as pulmonary lesions (78.8%), parasitic bronchitis (29.8%) and hydatidosis (24.0%). The pulmonary lesions included congestion (61.5%), emphysema (25.0%), anthracosis (l1.5%), pleuritis (10.6%), abscess (6.7%) and hemorrhage (5.8%). The occurrence of these pulmonary lesions has also been reported by other workers (Jones *et al.,* 1996, Aiello 1998, Radostits *et al.,* 2000).

The higher prevalence of *Dictyocaulus* sp. was reported by Dar *et al.* (2012), Chanie and Ayana (2013), Alemu *et al.* (2006) in Northeast Ethiopia, Eyob and Matios (2013) in Central Ethiopia which was 26.6%, 57.6%, 53.6% and 72.4%, respectively. The lower prevalence was reported by Ali (1983) in goats (0.1%).

Barberan and Bascuas (1986) reported the prevalence of pneumonic lesion (85.0%), anthracosis (3.0%) and hemorrhage (2.0%). The prevalence of parasitic bronchitis reported from other countries are 6-100% (Thamsborg *et al.,* l998), 41% (Ploeger, 2000) and 20% (Viring *et al.*2001). The prevalence (24.0%) of hydatidcysts recorded currently is similar to Desta *et al*., (2012), Sarma *et al*., (2000) and Islam *et al*., (1995) which was 11.6%, 13.7%, and 11.1%, respectively. However, higher prevalence of hydatid cyst was reported by Dada (1980), Mersie *et al*., (1993) in Ethiopia, Umur and Aslantas (1993) in Turkey, Luengo *et al*., (1995), Musinov (1999) in Uzbekistan, Toncheva and Zhelyaskov (1999) was 59.7%, 20.5%, 24.7%, 21.6%, 47.2% and 50.0%, respectively.

However, much lower (13-21.6%) (Dada 1980, Mersie 1993, Luengo *et al.,* 1995, Musinov 1999, Sarma 2000, Apt *et al.,* 2000, Njoroge 2002) and higher (29-45%) (Das l998, Toncheva and Zhelyaskov l999) prevalence of pulmonary hydatidosis

have been reported previously. The differences infrequency of pulmonary diseases between current and previous studies might be due differences to sample size, study design and commodity, spatial and temporal variables (Luengo *et al.*, 1995).

Study of the distribution of pulmonary diseases was limited to certain demographic and temporal variables in this study. Significantly higher frequency of pulmonary diseases (overall), emphysema and parasitic bronchitis in slightly thin cattle, congestion in male cattle and ≤3.5 years old cattle, and hydatidosis in female cattle was observed. Significantly higher prevalence of pulmonary diseases (overall), pulmonary lesions (overall) and congestion was recorded during summer and rainy seasons and hydatidosis during autumn. Higher frequency of parasitic bronchitis during summer (Eysker *et al.*, 1994) and rainy seasons (Urquhart *et al.*, 1996) was also reported by other workers. Frequency of parasitic bronchitis was reported higher in carves during their first grazing season by many authors (Zurita *et al.*, 1987, Eysker *et al.*, 1994, Gronvold and Jorgensen 1996, Thamsborg *et al.*, 1998, Hoglund *et al.*, 2001, Viring *et al.*, 2001) because older cattle had a quickly developed strong acquired immunity (Eysker *et al.*, 1994, Urquturt *et al.*, 1996). Radostits *et al.* (2000) reported occurrence of primary pulmonary congestion in the 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 intestinal pneumonia, parasitic bronchitis with pulmonary edema in acute anaphylaxis (Radostits *et al.*, 2000). They also reported occurrence of primary pleuritis in traumatic penetration of the thoracic wall and secondary pleuritis in some infectious diseases of the lungs. Many factors of pulmonary diseases could not be studied due to limitations of the present observational study design. Therefore, it is not known that whether thin condition of the animals acted as demographic variable or it was a clinical sign associated with the pulmonary disease.

The mild presenting signs included slightly dull demeaneur, poor condition, nasal discharge, abdominal type of respiratory shallow breathing and slight dyspnea in less than half of the affected animals. The animals exhibiting prominent presenting signs are not usually slaughtered openly. The physical signs, which were also mild and

limited tachycardia, tachypnea, harsh bronchial tones, sounds, crackles and silent lungs. The clinical signs recorded are variable and probably be the supporting clinical signs of pulmonary diseases. The clinical signs of pulmonary regions in cattle reported by Radostits *et al.* (2000) are more severe than those observed currently. The severe clinical signs associated with pulmonary lesions reported from other countries might be due to association of the lesions with specific non-infectious diseases. The association of pulmonary lesions with specific infectious or non-infectious diseases should not be ascertained in this limited observational study. The clinical signs of parasitic bronchitis were reported to be more severe in calves (Poynter and Selway 1973, 1996, Aiello 1998). The present study did include calves. The mild clinical signs recorded in the present cases of parasitic bronchitis are perhaps due to acquired immunity developed in mature animals in endemic areas (Eysker *et al.,* 1994, Urquart *et al.,* 1996). The presenting signs of bovine pulmonary hydatidosis reported currently are also recorded by Pandey *et al.* (1978). However, Urquhart *et al.* (1996) reported in domestic animals that the pulmonary or hepatic hydatid cysts were well tolerated without any clinical signs and the majority was revealed only at the abattoir. The observed presenting and physical signs are virtually not specific to hydatidosis but silent lungs in endemic areas of the disease could be a significant physical sign.

Only few clinical signs determined as significant statistically for pulmonary diseases in slaughter cattle include: slightly thin condition (parasitic bronchitis, pulmonary disease- overall), slightly dull demeanor (pulmonary lesion- overall), tachypnea (pulmonary congestion, pulmonary diseases-overall), crackles, bright demeanor (pulmonary emphysema) and silent lungs (hydatidosis). These clinical signs are determined as significant but not considered pathognomonic. Coughing, a consistent feature of parasitic bronchitis (Radostits *et al.*, 2000) was not found in the present cases. Fever was not present in these cases as well. Studies on the significance of clinical signs using statistical techniques are not available in the published literature. The dull demeanour, tachypnea, and crackles are related obviously to the nature of the pulmonary diseases. The thin animals were susceptible to diseases or poor condition caused by the diseases is not known in this limited observational study.

Experimental study is required to explain the mechanism. Similar to other space occupying lesions (e.g., abscess, tumor, etc.), silent lung could be associated significantly with hydatid cysts (Rosenberger, 1979).

All the pulmonary lesions were observed in diaphragmatic lobes along with a generalized distribution of congestion and emphysema. The majority of lesions of congestion were severe but majority of the emphysematous lesions was mild. Right lung was found more frequently affected by hydatidosis than the left in animals (Das, 1998). There were six pulmonary lesions recognized in this study: congestion, emphysema, anthracosis, pleuritis, abscess and petechial hemorrhage. Gross lesions specifically related to parasitic bronchitis could not be established in this limited study. The pulmonary lesions recorded in this study are similar to that reported in the literature (Barberur and Bascuas 1986, Zaid 1996, Jones *et al.*, 1996, Aiello 1998, Radostits *et al.*, 2000, Ozcan and Beytut 2001).

Histopathological study of present cases of congestion revealed severe pneumonia, bronchitis, acute and chronic bronchiolitis. Radostits *et al.* (2000) reported that early stages of most cases of pneumonia were associated with pulmonary congestion. However regions of bronchitis, acute and chronic bronchiolitis are presumed to be associated with lungworm infection (Jones *et al.* 1996, Urquhart *et al.*, 1973, 1996). Mild infections characterized by presence of quick development of acquired immunity in endemic areas are probably responsible for these observations (Eysker *et al.*, 1994, Urquhart *et al.*, 1996).

Belkhiri *et al.* (2009) observed lesion with 330 cases (42.64%) followed by pulmonary emphysema with 111 cases (14.35%) and pulmonary congestion with 61 cases (7.89%).*et al.*(2012) also studied that the verminous pneumonia was the most frequently observed lesion with 419 cases (14.63%) followed by hydatid cyst with 374 cases (13.06%) and pulmonary fasciolosis with 10 cases (0.35%).

Majid (2014) found that anthracosis of the lungs is black discoloration of bronchial mucosa that can occlude bronchial lumen and is associated with bronchial anthracofibrosis (BAF). Computed tomography (CT) may show more specific

findings such as lymph node or bronchial calcification and mass lesions. Final diagnosis can be made by bronchoscopy when obtaining samples for tuberculosis (TB), which is the most common diseases associated with BAF.

Gebrehiwot, *et al.* (2015) found that the most common lesions were congestion (38.5%), emphysema (36.3%), hydatidosis (18.3%), abscesses (7.1%) and verminous pneumonia (3.2%). The risk factors identified on statistical basis ($p < 0.05$) were fat in cattle in pulmonary congestion, old age (>7 years) and very lean cattle in pulmonary emphysema and pulmonary abscesses and young age (<7 years) in verminous pneumonia.

Eyob and Matios (2013) examined 381 fecal sample of sheep in which 276 (72.4%) were found to be infected with one or more species of lungworm. Chanie and Ayana (2013) found the overall prevalence of lungworm was 57.5%, there was no statistical significance between breeds of sheep and lungworm infection (p>0.05). The highest prevalence 76.5% was observed in sheep greater than three years of age followed by 57.1% and 37.5% prevalence of age groups one to three and less than one year of age respectively. Female and male animals appear similarly affected with lungworm even though very small difference applies 57.8% and 57.2% respectively in Ethiopia.

Mahmood *et al.* (2014) found overall non-significant difference in prevalence of *D. viviparus*in fecal samples of cattle (4.76%) and buffaloes (5.10%) were recorded. Mohammad *et al.* (2015) examined 200 collected lungs, where infected 33 cases (16.5%) to hydatid cyst, 95 cases (47.5%) to *Dictyocaulus viviparous*. also 13 cases (6.5%) of lungs were infected to *Linguatula serrata* larva.

Belkhiri *et al.* (2009) worked in Algeria, have shown that the hydatid cyst was the most frequently observed lesion with 330 cases (42.64%) followed by pulmonary emphysema with 111 cases (14.35%) and pulmonary congestion with 61 cases (7.89%). Zewdu *et al.* (2010) examined total 384 cattle where 114 (29.69%) were found infected with hydatidosis. From the examined animals 61 (15.89%), 19 (4.95%) and 26 (6.77.3%) contained hydatid cyst in their lungs, livers, and in both lung and liver, respectively.

Desta *et al.* (2012) observed the overall prevalence of hydatidosis was 11.6% which was significantly higher (P<0.005) in relatively older sheep. Banda (2013) found that out of the 4061 cattle examined during postmortem inspection, 84 (2.1%) were positive for hydatidosis. No cases were detected from Kaoma and Shangombo districts; however, prevalence ranged from 0.6% to 2.5% in districts where it was present. Sex was found to be positively associated with hydatidosis with female cattle being more likely to have hydatidosis.

Asfaw *et al.* (2014) found that the sex wise distribution of the parasite was 29.9% and 3.2% in male and female cattle with no statistical significance variation between male and female. Similarly, the rates in adult and old cattle were 23.6% and 8.4% respectively. The rate of the parasite in adult and old cattle showed significance variation (p<0.05). Similarly the prevalence in local and cross breed was also 31.6% and 0.5% with no statistical variation between the two breeds. Moreover, hydatid cysts prevalence of each organ at the abattoir survey indicated 70 (17.5%) in lung; 65 (14.77%) in liver; 2 (0.45%) in heart and 4 (0.9%) in kidney respectively.

The higher frequency of pulmonary diseases in slaughter cattle does not represent the higher severity or economic importance of the diseases.

CHAPTER VI

SUMMARY AND CONCLUSION

The following conclusions made from the observational study of bovine pulmonary diseases in native slaughter cattle conducted during January to June 2014 at Birganj are as follows:

1. Poor condition is widespread in slaughter cattle.
2. Most of the slaughter cattle are clinically normal and clinical signs statistically significant for pulmonary diseases are few.
3. Pathologically, pulmonary' diseases are widespread in native slaughter cattle.
4. Pulmonary congestion is a most frequently encountered pulmonary problem.
5. Parasitic bronchitis and pulmonary hydatidosis are present in a meso-endemic level in cattle.
6. Pulmonary lesions are most common in diaphragmatic lobes along with severe congestive lesions.
7. Gross lesions characteristics of parasitic bronchitis are very limited.
8. The number of mature lungworms are few in individual lungs and the female worms are larger than the males.

Further studies on the ecology of lung Parasites and epidemiology of pulmonary congestion and emphysema, parasiticbronchitis and hydatidosis in young and adult cattle prior to study other aspects are suggested.

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