

Clinical, Gross and Histopathological Study on Common Local Chicken Diseases in Enderta District, South East Tigray

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Abstract: Poultry play an important economic, nutritional and socio-cultural role in the livelihoods of poor rural households in Ethiopia. However, due to abundance of infectious diseases most chickens grow slowly and are poor producers of eggs. Thus, this study was conducted aiming at investigating the clinical, gross, histopathological and necropsy examinations of common local chicken diseases in *Enderta* District, Tigray. A cross-sectional design was employed in purposively selected four Kebeles of the *District*. Infestations of external parasites together with clinical signs of other pathological and infectious diseases were observed. During detailed necropsy examination various gross lesions were found on liver, duodenum, ileum, lung, heart, kidney and head. Besides, coccidia species followed by *Ascaridia galli* at prevalence rate of 40% and 35.1%, respectively were reported to be causes of the major gross lesions. The histopathological analysis revealed that diffused hemorrhage was the principal microscope lesion appreciated. The results of the study revealed that, chickens reared in the study area suffer from various parasitic, infectious and non-infectious diseases and hence, produce less. The occurrence of high prevalence of diseases might be due to the inappropriate farming management and limited veterinary services in the study area. Therefore, introduction and implementation of modern poultry farming system and provision and practicing of adequate veterinary services are recommended.

Key words: Chicken • Histopathology • Necropsy • Parasitic Diseases

INTRODUCTION

Poultry sector is a fastest growing among the animal production activities [1] offers an opportunity to feed the fastest growing human population and provide income resources for poor farmers [2]. Moreover, poultry, in many parts of the modern world is considered as the chief source of not only cheaper protein of animal origin but also of high quality human food [3]. Important factors in continued growth of the poultry industry in many countries are the efficiency of poultry in converting vegetable protein into animal protein, attractiveness and acceptability of poultry meat and egg to many people [4].

Raising poultry has also a number of advantages over the other livestock sectors which include fast return on investment, spreading income throughout the year, high return compared to feed cost, low land requirement, adaptability to both small part time enterprise and large commercial enterprise and the operation can be highly mechanized with high output per hour or labor [5].

Poultry has become the largest livestock group in the world with a population estimated to be approximately 14 billion. Around 80% of the world poultry population is found in traditional scavenging systems, where the indigenous domestic fowl (*Gallus domesticus*) is the predominant species in the rural poultry sector [6]. It is also estimated that Ethiopia and the region Tigray have 50.38 million and about 5.24 million chickens respectively [7].

Poultry breeding in Ethiopia has long traditional practice, which is mainly used as an immediate cash income for the rural communities. Especially, women are more involved in keeping backyard for egg collection and selling adult chickens. These are village or backyard, small scale and commercial poultry production systems. Backyard poultry production is the predominant system in Ethiopia and account for nearly 99% of the poultry population consisting mainly of local chicken breeds under individual farm household management and it is also common to find a few exotic breeds distributed

through the extension programs. Small scale poultry production system comprises a flock size ranging from 50 to 500 exotic breed operation commercial bases and outdoor with a low bio-security level. Commercial poultry production system is highly intensive production system that involves greater than 10,000 birds kept under in door and heavily depends on imported breeds [8].

Even though village chicken products are the main and often the only source of animal protein for poor households they are poor in productivity. The problem related with this is mainly associated with low input of feeding, poor management practices, prevalence and wide distribution of infectious and non infectious diseases augmented with poor veterinary services and lack of appropriate selection and breeding practices [9].

In Ethiopia, the fast growing and young poultry industry is facing many of the above mentioned constraints from which the infectious diseases are the predominant once with a significant impact on the poultry industry development. Most of the infectious diseases are endemic in the country and some of the more emerging and re-emerging diseases. Generally, poultry diseases are responsible for a number of adverse economic effects due to mortality and morbidity of chickens, cost of medication, miscarriage in production and international trade ban and public health significance [10].

Poultry mortalities due to disease are estimated to range from 20% to 50% but they can rise as high 80% during epidemics in Ethiopia. The impact of disease on animal agriculture is typically assessed in quantitative terms. In poultry industry these terms include for example: Lost revenue cost of vaccination (Prevention, eradication, decontamination and restocking) and they have been reported as negative in puts [1].

Diseases are also considered to be the most important factor responsible for reducing both the number and productivity of chickens. Poultry disease such as Newcastle disease, Coccidiosis, Infectious Bursaldisease (Gumboro), salmonellosis and nutritional deficiency are considered to be the most endemic and the one to incur huge economic losses. Poultry disease has worsened since the initiation of certain localities. Prior to this program disease outbreak usually occurred at the beginning of the rainy season, but after villagization outbreaks remain a problem throughout the year [11].

Even though, there are many studies on diseases which are endemic to Ethiopia as a country, it is important to study and specify the diseases which are common to specific localities such as Enderta districts of Tigray.

Therefore, the objective of this study was to investigate the pathological appearance of major economically important local chicken diseases in Enderta District and understand the level of the injuries on their survival and productivity.

MATERIALS AND METHODS

Study Area: The study was conducted in *Enderta* District, South East Zone of Tigray, Ethiopia. It encircles the Mekelle city in all directions. It is located at 39° 30' to 47° 30' East longitude and 13° 00' to 13° 30' North altitude with total area coverage of 88,055 hectares. The agro climatic classification of the area is 1% Degas (Highland), 96% Woyna Dega (Mid highland) and 3% kola (Lowland), with a land formation of 35% plain and the remaining 65% are mountain and valleys. The mean annual rainfall ranges from 450 to 500 mm with annual temperature ranging between 10°C and 24°C.

Source and Study Materials: The study materials for this study were 100 tissues of 20 chickens brought from four villages of Enderta District namely: *Romanat, Maimekden, Meremeity* and *Maikayah*. The tissues were stored and being preserved using formalin solution in the Mekelle University College of Veterinary Medicine Pathology Laboratory. On the other hand, secondary raw data on the clinical signs and necropsy examinations of the same chickens were used.

Sampling Procedure and Sample Size: All of the 100 tissue samples from 20 chickens were considered for histopathological investigations. For clinical study and necropsy examination, secondary raw data were obtained from previously collected bulk of data of an ongoing research project. A raw clinical sign data of a total of 37 clinically sick and suspected of major diseases and raw data of necropsy examination of 20 were considered for further organization, analysis and compilation.

Study Design: Cross-sectional study to obtain primary data, histopathological study/investigations of 100 tissues of 20 chickens and secondary raw data of clinical signs and necropsy examinations survey/ review was conducted to organize, analyze and compile the results.

Clinical Study: As per the secondary data obtained, prior to necropsy, live birds were closely examined for any clinical signs as per appropriate procedure. The

examination included assessment of general appearance, feathering, weight, pigmentation of skin and visible mucous membrane, physical injuries, facial tissues, eyes, feces (Droppings), nasal or respiratory discharges, respiration, gait, leg (Joint deformities) and external parasites.

Necropsy and Histopathological Examination: As per the secondary data obtained, detailed necropsy examination was carried out on randomly selected clinically sick and birds suspected of major diseases based on standard procedures set [12] at Mekelle University College of Veterinary Medicine Pathology laboratory (Kallamino Campus). The presence of gross lesions was carefully recorded and representative pieces tissues, such as liver, lung, heart, intestines, spleen, kidney and proventriculus/ventriculus were collected for histopathological examination.

The representative pieces of less than 5 mm thickness tissues specimens from respective organs, such as liver, lung, heart, intestines, spleen, kidney and proventriculus/ventriculus were collected in 10% formalin. After adequate fixation, the tissues were trimmed to 1-2 mm thickness and washed in running water for 7-8 h, dehydrated in ascending grades of ethyl alcohol (50, 70, 80, 90, 95 and 100%), cleared in xylene and embedded with melted paraffin wax (Melting point 58°C). The paraffin blocks were prepared and the sections were cut at 5 micro meter thickness with a hand operated microtome. The paraffin embedded sections were then passed through sequential steps of deparaffinisation in xylene, rehydrated by passing through descending grades of ethyl alcohol to running tap water and stained by routine haematoxylin and eosin stain [12]. The stained sections were allowed to dry well and examined under the microscope for assessing histopathological alterations. Every microscopic lesion was then carefully described, analyzed and recorded.

Data Analysis: Generated primary and secondary data were entered and managed in Excel Microsoft spread sheet, analyzed using Excel Microsoft and presented as descriptive results (Frequency and percentages).

RESULTS

Clinical Results: Clinical physical examination was performed on 37 chickens for any clinical sign caused by major disease. Accordingly, external parasite infestation

of flea (*Echidnophaga gallinaline*) and red mite (*Dermanyssus gallina*) with similar prevalence rate of 35.1% and associated pale ocular and oral mucous membranes showing severe anaemia and depression and abnormal droppings (Thin mucoid diarrhoea), pale visible ocular and oral mucosa (Anaemia) and retarded growth and emaciation, with similar prevalence rate of 13.5% were found to be the common clinical signs manifested by the birds in the study area (Table 1, Figure 1a, b and c).

Gross Pathology/Necropsy Examination Results: The necropsy examinations were made based on appropriate procedure [12]. A total of 20 chickens were sacrificed, the necropsy examination of the sacrificed chicken bodies revealed various gross lesions in liver, intestine, lung, heart, proventriculus, ventriculus and spleen. The major gross lesions recorded include enteritis characterized by haemorrhagic, oedematous and thickened wall, air sacculitis characterized by cloudy, multi foci caseous and pin point granulation and excessive fat accumulation in abdominal cavity, liver and heart.

Necropsy Finding Results: Twenty liver were examined grossly and out of that 8(40%) were found to have gross pathological lesions, of which, 4(50%) were with excessive fat accumulation, pale and discolored, 2(25%) hemorrhagic and bulged cut surface with bleeding, 2(25%) multi foci necrotized. Out of 20 lungs, 4(20%) were found to have frothy exudates and black spotted areas (Anthracosis). Out of 20 hearts, 7(35%) were observed to have gross lesions, of these, [4(57%) were excessive fat deposition around and at the apex of the heart, 2(28%) were focal myocardial and pericardial necrosis and 1(14%) was fibrinous pericarditis]. Out of 20 kidneys, 1(5%) were observed to have edematous and hemorrhagic lesions. Out of 20 spleens, 3(15%) were found to have gross lesions of mild petechial hemorrhage. One of the 20 heads, they were observed to have cheesy exudates in the infra orbital sinus. Out of 20 intestines, 15(75%) were observed with different gross lesions and 7(35%) were coccidian positive. Considering each segment of the intestines, 13(65%) [Duodenum were observed with gross lesions, of which, 3of 13(23%) edematous and thickened wall, 4(30%) harbored with Cestode (*Ralleitina* spp.) parasites, 2(15%) abnormal (Frothy, bloody, mucoid) excessive content and, 1(7%) inflamed and necrotized enteritis and 3(23%) hemorrhagic enteritis and edematous and thickened wall. Similarly, 5(25%) jejunum were harbored with cestode (*Ralleitina* spp.) *Ascaris galli*. And four Ileum had gross



Fig. 1: Different clinical signs and conditions reported, (a) Depression, (b) flea (*Echidnophaga gallinaline*) infestation and associated hair loss and dermatitis in the neck area and (c) Numerous red mite (*Dermanyssus gallinae*) infestation and associated anemia

Table 1: Clinical signs reported to be observed during the previous study, N=37

S.No	Type of Clinical signs	Frequency	Prevalence
1	Depression	5	13.5%
2	Vent pasting with diarrhoea	5	13.5%
3	Ruffled and Loss of feather and dermatitis	2	5.4%
4	Whitish visible ocular and oral mucosa (anaemia)	5	13.5%
5	Retarded growth and emaciation	5	13.5%
6	Ocular oedema	1	2.7%
7	Stick tight flea (<i>Echidnophaga gallinaline</i>)	13	35.1%
8	Red mite (<i>Dermanyssus gallinae</i>)	13	35.1%
9	Soft tick (<i>Argas spp.</i>)	1	2.7%

Table 2: List of internal parasites identified during the necropsy examination, N=20

S.No	Type of Internal parasites identified	Frequency	Prevalence
1	<i>Ascarida galli</i>	7	35%
2	<i>Heterakis gallinae</i>	2	10%
3	Coccidia spp.	8	40%
4	Cestode (Ralleitina spp.)	4	20%

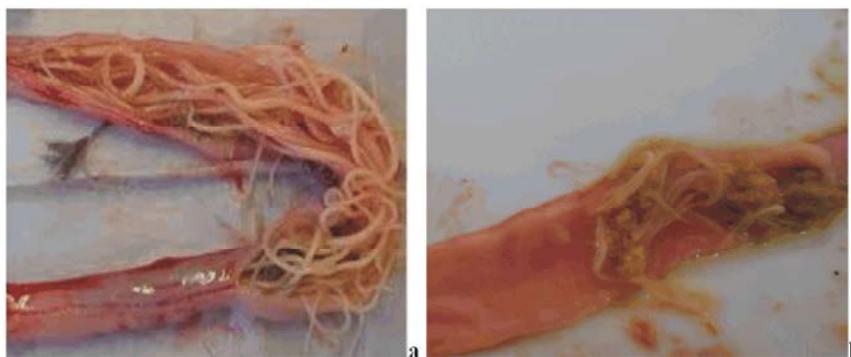


Fig. 2: Intestinal segment harboring large number of *Ascaris galli* (a) and *Heterakis gallinae* (b) and associated enteritis characterized by haemorrhagic, edematous and thickened wall

Table 3: Gross lesions in different organs and their frequency and percentages, N=20

No.	Organ	Necropsy findings	Frequency	%	Remark
1	Liver	Fatty liver (pale or yellowish)	4	20%	
		Haemorrhage	2	10%	
		Bulged cut surface and bleeding	1	5%	
		Focal Necrotized area	2	10%	
2	Intestine				
2.1	Duodenum	Oedematous and thickened wall	2	10%	Coccidiosis
		Cestode (<i>Ralleitina</i> spp.)	4	20%	Coccidiosis
		Abnormal intestinal content	2	10%	Coccidiosis
		Inflamed, necrotized	2	10%	Coccidiosis
		Haemorrhage	1	5%	
2.2	Jejunum	Cestode (<i>Ralleitina</i> spp.)	3	15%	
		<i>Ascarida galli</i>	13	65%	Ascariidiosis
		Inflamed, necrotized	4	10%	Coccidiosis
		Oedematous and thickened	5	25%	Coccidiosis
		Sever haemorrhage	1	5%	
2.3	Ileum	Sloughed mucosa, diphtheritic lesion	1	5%	Coccidiosis
		Cestode (<i>Ralleitina</i> spp.)	1	5%	
		Oedematous and thickened	1	5%	
		<i>Heterakis gallinae</i>	4	20%	Coccidiosis
3	Spleen	Petechial haemorrhage	3	15%	
4	Lung	Frothy and whitish caseousation	1	5%	
5	Heart	Fat deposition and haemorrhage	1	5%	
6	Kidney	Oedematous and congested	1	5%	
7	Head	Ecto-parasites and dermatitis	2	10%	
8	Proventriculus	Thickened wall	1	5%	
		Hyperplasic gland	2	10%	

pathological lesions which include 1(2.5%) severe hemorrhagic, 1(2.5%) sloughed mucosal surface, 1(2.5%) edematous and thickened and 1(2.5%) cestode, respectively. On the other hand, 1(2.5%) cecum was found to harbor *Heterakis gallinae* and *Coccidia* spp, respectively.] In one of the 20 local chickens, there were whitish spots on air sacs, numerous pyogranulomatous lesions in the intestine which indicates TB or *E. coli* in association with the pale, hard and congested kidney. In 2 of the 20 local chickens were also found that cloudy thick air sacs, caseous exudates in both the thorax and air sacs which indicate *E. coli* and CRD (Table 2 and 3, Figure 1a and b, Figure 3).

Considering the endoparasites burden result, *Coccidia* spp. followed by *Ascarida galli* at prevalence rate of 40% and 35%, respectively, were the major parasites identified (Table 2).

Histopathological Examination Results: A total of 20 chickens were sacrificed and a total number of 100 tissue samples were collected from all organs to look for possible cause of diseases, type and severity of microscopic lesions in various organs. The histopathological examinations were made according to Chauhan and Chandra (2007) and the microscopic

findings are summarized as follows. Histopathological analysis of the representative tissue sections of intestines, livers, heart, spleen of chickens were diagnosed under light microscope.

Histopathology of Livers and Lungs: The liver tissues were found microscopically with diffused hemorrhage, mild to moderate degeneration with bulged cytoplasm, sinusoidal hemorrhage, congestion, focal necrosis, cellular swelling and vaculation in hepatocytes, kupffer cell hyperplasia (Figure 4 a and b). Diffused hemorrhage was the principal microscope lesion appreciated in 60% of the liver tissues.

On the other hand, the lungs were found to have mild to moderate congestion and hemorrhage, anthracosis (Fine black particles throughout lung microscopic structure), sever congestion, alveoli filled with erythrocytes were also found. Anthracosis was found to be the major microscopic lesion in 45% of the lung tissues (Figure 5).

Histopathology of Intestines, Proventriculus and Ventriculus: Microscopically, the intestines were observed to have diffused hemorrhage on mucosal layer, mucoid frothy intestinal fluid, mononuclear cell infiltration



Fig. 3: A necropsy finding showing whitish caseous air sacculitis which indicate *Mycoplasma gallisepticum* and *E. coli* mixed infections

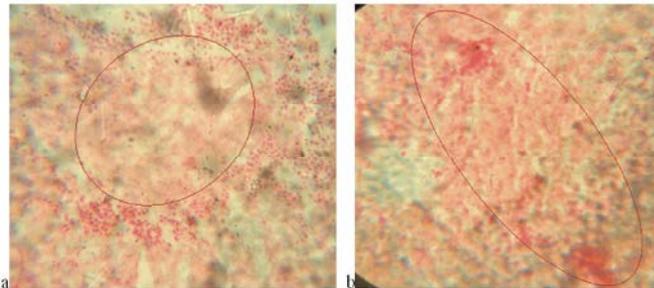


Fig. 4: Liver with (a) Diffused hemorrhage around the circle and necrotized area inside the circle, HE 400x and (b) Congested venous and sinusoidal space in the mid zonal area and Degenerative hepatocytes, HE 400x

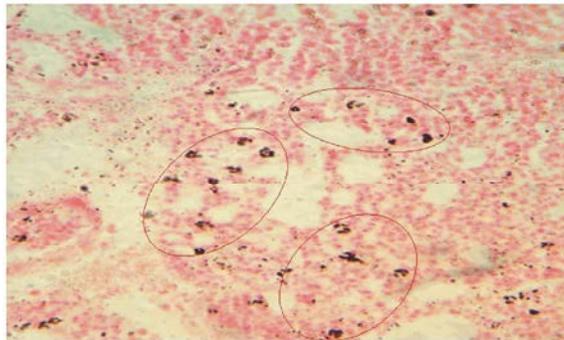


Fig. 5: Lung with Diffused accumulations of carbon particles (Anthracosis) in the extracellular space, inside alveoli and engulfed by giant cells (Macrophages) infiltration of inflammatory cells and erythrocytes occupying the alveolar spaces, HE 400x

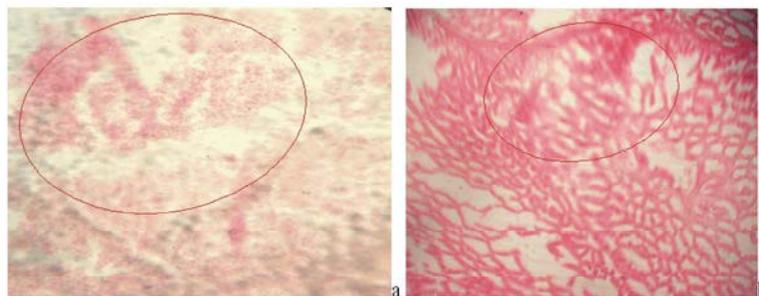


Fig. 6: Intestine (a) showing desquamated villi, infiltration of inflammatory cells in the mucosal layer, HE 400x and (b) Ventriculus showing hyperplastic glands with excessively accumulated glandular secretions, HE 400x

in the mucosal layer, proliferation of connective tissue, desquamation of villi, degenerative changes, ulceration in mucosa at places, enteritis, infiltration of heterophils and eosinophil in lamina propria, desquamation of epithelial cells, macrophages and few enteritis foci at places, infiltration of leucocytes (Heterophils, Lymphocytes) around necrotic areas, degeneration of mucosal epithelium, few leucocytes in lamina propria few congested capillaries (Figure 6 b). Histopathology, the proventriculus and ventriculus also had diffused type of hemorrhage, proliferation of connective tissue and glands, desquamation of glands contained excessive mucoid type of proteinacious substance in the lumen, diffused hemorrhage in the mucosal and sub mucosal layers and desquamation (Figure 6 b).

Histopathology of Hearts and Spleens: Under light microscopy, the hearts were also observed having diffused intramuscular fiber hemorrhage, congestion, diffused multi foci fibrinous edema, moderate degeneration, few mononuclear infiltrations appeared as eosinophils, few leucocytes, mild congestion and hemorrhage between myocardium muscle fiber and mild degenerative changes on myocardium. The spleens were also seen that there were mild to moderate degenerative lesions and diffused hemorrhages.

DISCUSSION

In the study, all of the 37 local chickens were examined clinically and 62.2% of them were found with at least one of the clinical signs, i.e. ruffled feather, poor and emaciated body condition, vent pasting with diarrhea, external parasite infestation of flea (*Echidnophaga gallinaline*) and red mite (*Dermanyssus gallina*) with similar prevalence rate of 35.2% and associated pale ocular and oral mucus membranes showing severe anaemia and depression, Whitish visible ocular and oral mucosa (Anaemia) and retarded growth and emaciation.

The result of this study showed a wide range of diseases among village chickens in the study area. Internal parasites such as Cestode (*Ralleitina* species), nematodes and coccidian species had the highest rank followed by ecto-parasites such as flea infestations from the identified diseases. This is because; local village chickens freely scavenge their feed sources from the unhygienic environment, poor management and low veterinary care. This is similarly stated by other investigators [13] that village chicken production is constrained by many extrinsic factors among which

malnutrition, poor management and the absence of bio-security are outstanding. Losses have also been attributed to limited housing and veterinary care services. Parasitism ranks high among factors that threaten village chicken production. Common poultry parasites range from flea, mites, ticks, helminthes and coccidia.

Parasitism causes reduced growth, egg production, emaciation, anemia, immuno-suppression and mortality. Moreover, some of the ecto-parasites especially tick and mites are vectors of other poultry diseases such as pasteurellosis, Fowl pox, Newcastle disease and possibly Chlamydia [13].

Among the twenty livers examined grossly 8(40%) were found with gross pathological lesions such as, fatty, pale and discolored, combinations of hemorrhagic and bulged cut surface with bleeding, necrotized variable areas and microscopically diffused hemorrhage, mild to moderate degeneration, congestion, necrosis, cellular swelling and kupffer cells hyperplasia. These gross and microscopic abnormalities could be due to systemic diseases such as Salmonellosis, Colibacillosis, Mycoplasmosis and mycobacteriosis. Besides, out of the 20 lungs, 4(20%) were found with frothy exudates and black areas and microscopically mild to severe congestion and anthracosis. This might also be due to improper housing because in village chickens housed in kitchen so that they are being exposed to charcoal carbons during feed scavenging and inhales it. Traditionally, chickens receive little care at night; they are sheltered in small hen houses or in a room of the family house or in kitchen, to protect them from predators and bad weather [14]. During the day, the chickens seek their food around the house.

Seven (35%) hearts were observed with gross lesions such as excessive fat deposition around and at the apex of the heart focal myocardial and pericardial necrosis and fibrinous pericarditis. One head sample was found with cheesy exudates in the infra orbital sinus and this has been confirmed as being caused by Infectious Coryza.

Among the 20 intestine, 15(75%) were observed with different gross lesions and 7 were coccidian positive. Pertaining duodenum, 13(65%) were found with gross lesions of edematous and thickened wall, abnormal (Frothy) excessive mucous content inflamed and necrotized part and hemorrhagic appearance. Four ileum organs had gross pathological lesions such as sever hemorrhagic, sloughed mucosal surface, edematous and thickened wall and the whole intestines were observed with lesions such as desquamation of epithelial cells, enteritis and infiltration of eosinophils and neutrophils in lamina propria and degeneration of mucosal cells.

These pathological changes might be due to the damaged resulted from the endo-parasites i.e. ascaris, coccidian and bacterial complications such as *E. coli*.

In one of the 20 chickens, there were whitish spots on air sacs, numerous pyogranulomatous lesions in the intestine which may indicate *Mycobacterium avium* and *E. coli* in association with the pale, hard and congested kidney and granulomatous spleen. There were also cloudy thick air sacs, casous exudates in both the thorax and air sacs which might indicate *E. coli* and chronic respiratory disease due to *Mycoplasma galisepticum*. This result has also supported by reports of 5.3% gross tuberculosis lesions in different visceral organs produced by avian Mycobacteriosis in chickens from three agro-climatic areas in Ethiopia [15].

CONCLUSION AND RECOMMENDATIONS

Based on the clinical study, necropsy and histopathological examination results, the present study identified various diseases and ill health conditions. The major diseases and ill health conditions include mite and flea infestations and associated dermatitis, anemia, depression, ascaridiasis and coccidiosis and associated haemorrhagic and necrotized enteritis, air sacculitis (Mycoplasmosis, colibacillosis), anthracosis indicating pneumonia, focal myocardial and pericardial necrosis and fibrinous pericarditis and excessive fat accumulations in different organs and cavities. The findings showed that the chickens reared under extensive farming system in *Enderta* District are facing with various health problems which are the main constraints hampering their productivity and reproductivity. The level of impact of the diseases and ill health conditions might be more aggravated by low input of feeding and poor management practices magnitude. This indicates that the local community in the district is not getting adequate social, economical and cultural benefits from chickens. Therefore, Poultry diseases ought to have continued attention, surveillance and monitoring programs by farmers, veterinary professionals, animal health service delivery implementing bodies and researchers. Integrated and strategic approach of different hygienic measures, deworming, antimicrobial prophylaxis and treatment, vaccination and other managerial measures should be made on regular basis. Further specific study on identification of bacterial and viral causative agents should be done to exactly identify the underlining disease causing agents and devices proper controlling strategies in the future.

Competing Interests: We declare that we do not have competing interest on all activities pertaining this research work.

Authors' Contribution: AB, TT and YT conceived the investigation; AB generated the idea, performed field and laboratory experiments, analyzed the data and prepared the paper. TT performed laboratory experiments, analyzed the data and prepared the paper. YT performed laboratory experiments and paper and paper edition.

ACKNOWLEDGEMENTS

This investigation received free access of laboratory facilities, technical and kind support from Mekelle University College of Veterinary Medicine. The authors also extend special acknowledgement to Dr. Nesibu Awel and Mr. Kidane Werkeluel for their Technical support during all pathological activities.

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