

Seroprevalence of Infectious Bursal Disease in Backyard Chickens of Oromia Regional State, Ethiopia

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Abstract: A cross-sectional study was conducted in backyard local chickens in three woredas of south west and west shoa from November 2009 to March 2010. The objective of the study was to determine sero-prevalence of Infectious Bursal Disease by using I-ELISA. A total of 351 serum samples were collected randomly from Waliso (186), Ambo (116) and Welemera (49) woredas. The overall seroprevalence of IBD was 76.64% (269/351). The study revealed prevalence of 89.78% in Waliso that had significant difference with seroprevalence in Ambo (70.69%) and Welemera (40.81%) ($p < 0.05$). The seroprevalence based on different age groups were: 87.26% in 3-12 weeks, 74.4% in 13-24 weeks and 55.38% in 25-36 weeks old ($p < 0.05$). The seropositivity of birds kept in poor hygienic (83.33%) condition was very high as compared to those kept in good hygienic condition ($p < 0.05$). A significantly higher seroprevalence was also found in chickens sharing the same house with the owners than those kept in separate shed. The result of this study indicates that IBD is widespread in backyard local chickens of the study areas that call for detail epidemiological investigation of the disease.

Key words: Backyard chickens, infectious bursal disease, seroprevalence, Ethiopia, epidemiological investigations, woredas

INTRODUCTION

There are about 56.5 million poultry of all species in Ethiopia. Local chicken constitute about 99% of the total poultry population in the small-scale rural farms, however losses due to chicken mortality that occur in different age group is very high (61%). Among the different diseases causing such damage in the country is infectious bursal disease (IBD, Gumboro Disease).

Infectious bursal disease is an acute highly contagious viral disease of young chicken. The disease was first recognized in 1957 by Cosgrove in an outbreak in Gumboro, Delaware, USA and further outbreaks were subsequently referred to a Gumboro disease (Cosgrove, 1962). The most prominent lesion was found in the bursa of Fabricius, hence the name Infectious bursal disease, IBD which is used presently (Murphy *et al.*, 1999; Miller, 1995).

Currently IBDV has a worldwide distribution, occurring in all major poultry producing areas. During the 63rd general session of the Office International des Epizooties (OIE, 2004), it was estimated that IBD has considerable socio-economic importance at the international level as the disease is present in >95% of the member countries and the

occurrence of acute clinical cases (vvIBDV) was reported in 80% of the country (Van den Berg, 2000).

Gumboro disease was first reported in 2002 in Ethiopia at privately owned commercial poultry farm in which 45-50% mortality rate was documented (Zelege *et al.*, 2003). In addition to this report Solomon and Abebe (2007) reported seropositivity of 98.9% (91/92) by Agar Gel Immuno-diffusion test in Amhara region (Andasa farm), other published reports (Hailu *et al.*, 2009; Zelege *et al.*, 2005) also documented incidence rates of 38.4 and 17.4% in two localities namely Bahir Dar and Farta and Debrezeit, respectively in an outbreak of IBD. The situation of the disease at local, small scale and back yard poultry is not well established in this country. Therefore, the objective of this study was to assess and determine seroprevalence of infectious bursal disease in backyard local chickens of the study areas.

MATERIALS AND METHODS

Study areas: The study was conducted in three selected districts of south and west Showa zones of Oromia region namely: Waliso, Welemera and Ambo from November 2009-March 2010.

Waliso: The altitude of this area ranges from 1500-2900 m above sea level. The area is located at 38.3°E and 9.3°N. It is characterized by mild subtropical weather, average minimum and maximum temperatures from 5.5 and 23°C, respectively. This area experiences a binominal rainfall pattern with a long rainy season from June-September and short rainy season from March-April.

Welemera (Holetta): It is located 29 km from Addis Ababa in western direction in central highland of Oromia special zone surrounding Addis Ababa at a latitude of 8°50'-9°15'N and longitude of 38°25'-38°45'E at altitude of 2060-3380 m above sea level. The annual rainfall of the area is between 834-1300 mm and annual temperature of minimum and maximum, 11 and 22°C, respectively. Rainy season occurs with bimodal distribution 70% of which occurs during the main rainy season (June-September) and 30% during the small rainy season (February-April) and relative humidity of 50.4%.

Ambo: It is located 114 km far from Addis Ababa. It is geographically between 8°59'30"N latitude and between 37°47'30"-37°55'15"E longitude. The town's altitude ranges from 1872-2362 m above sea level. The mean annual maximum and minimum temperature of the town are 23.76 and 10.67°C, respectively. The mean annual rainfall is about 987.78 mm.

Study animals and sampling procedure: A multi stage sampling procedure was adopted to get sampled birds. Three districts were selected from South west and West shoa of Oromia regional state. A total of 351 apparently healthy local back yard chicken with age range from 3 week to 1 year were randomly selected and blood samples were taken from each bird of these chicken 116, 186 and 49 of them were from Ambo, Waliso and Welemera districts, respectively, again six villages (Kebele: the lowest administrative unit in Ethiopia) were selected, two villages from each districts.

Study design: A cross-sectional study was carried out to determine the seroprevalence of IBD in backyard local chicken.

Blood sample collection: About 2-3 mL of blood samples were collected from the brachial (wing) vein of apparently healthy chicken using 5 mL sterile disposable syringe with 22 gauge and 11/4 needle size. The method described by Alcorn (2002) for intravenous techniques was applied for this procedure. The blood was allowed to clot for 3-4 h at 4°C then the syringe was placed horizontally for about 6 h to allow serum separation. Serum separated was

transferred into labeled sterile cryovial tube and then kept cool for transportation to National Animal Health Diagnostic and Investigation Center (NAHDIC), Sebeta. The sera in cryovial tube were centrifuged at 1000 rpm for clarification and then the sera were stored at -20°C until tested. The housing system and hygienic conditions of the birds were also noted during sample collection.

Sample processing: The serum samples were tested at National Animal Health and Disease Investigation Center (NAHDIC). The procedure employed was for Indirect Enzyme-Linked Immunosorbant Assay (ELISA) using commercially available Proflok plus infectious bursal disease virus antibody test kit.

ELISA validity test: In valid IBD ELISA result, the average Optical Density (OD) value of negative control serum is <0.25 and that of corrected positive control serum value range is in between 0.25 and 0.9. If OD found is out of these ranges, IBD ELISA result is considered invalid. OD value range of normal control serum is between 0.08-0.2 and for positive control serum 0.4-0.85.

Interpretation of ELISA test: Serum sample positive control ratio was required for test interpretation. Accordingly, the following equation was applied:

$$SP = \frac{\text{Sample absorbance} - \text{average normal control absorbance}}{\text{Corrected positive control absorbance}}$$

If SP (sample to positive control) value was ≥ 0.5 the IBD antibody status was considered to be positive but <0.5 was taken as negative.

Statistical analysis: The data collected from the study area was coded and recorded in Microsoft excel spread sheet and then analyzed by using SPSS version 16. The prevalence was calculated by dividing the number of chickens that were positive by the total number of chickens examined.

Percentage to measure the prevalence of virus (p-value <0.05 was considered significant) and chi-square (χ^2) to measure association between prevalence of the age, result and agro-ecology were the statistical tools applied.

RESULTS AND DISCUSSION

Seroprevalence in relation to district: The overall seroprevalence of IBD in the selected study areas was 76.64% (269/351). In case of different district, higher prevalence was recorded in Waliso (89.78%) and followed

Table 1: Seroprevalence of IBD in backyard local chickens of the different Woreda

District	No. sampled	Positive (%)	95% CI*
Ambo	116	82 (70.69)	61.52-78.77
Waliso	186	167 (89.78)	84.51-93.70
Welemmera	49	20 (40.82)	26.99-55.79
Total	351	269 (76.64)	71.85-80.97

*CI = Confidence Interval, $\chi^2 = 55.4$, $p = 0.00$

by Ambo (70.69%) and Welemmera (40.82%). Based on the chi-square test the seroprevalences of IBD of the three districts showed significant variation ($p < 0.05$) (Table 1). The overall seroprevalence (76.64%) of IBD in local backyard chickens recorded in this study was high which indicates the wide spread of IBD virus in the study areas. again the presence of IBD antibody in the sera of backyard local chickens was also an indication of previous exposure of chicken to natural infection in the field.

The high sero-prevalence of IBD detected in this study was well in agreement with serological studies carried out by (Abrar, 2007) who reported 76.30% in East Shoa of Oromia region and who documented a seroprevalence of 65.90% in local non-vaccinated chickens in Addis Ababa and Adamiyulu areas in central Ethiopia. Similarly prevalence study done on IBD elsewhere in the world documented a closer report Karunakaran *et al.* (1993) from India reported a prevalence of 73.8% in poultry farm and Ibrahim and Tany (2001) reported 60.6% prevalence from Nigeria in village chickens in Morocco, Kichou disclosed a high prevalence of IBD in surveyed farms varying from 72-90% among village chickens, further more (Hernandez-Divers *et al.*, 2006; Biswas *et al.*, 2009) reported 100 and 74% seroprevalences in North West Ecuador and in Bangladesh, respectively by using commercialized ELISA. However, a low prevalence of 38.9% as compare to the finding was reported by Hailu *et al.* (2009) in village chickens of Amahra region, Northwest of this country. Likewise, Emikpe *et al.* (2007) documented 19.1% by using the quantitative Agar Gel Precipitation Test. Ndanyi *et al.* (2004) in Kenya reported a prevalence of 49.3% in non-vaccinated village chickens. Similarly, Mushi *et al.* (1999) reported a seroprevalence of 30% for IBD in non-vaccinated indigenous chickens on selected farms around Gaborone, Botswana.

Seroprevalence in relation to districts and kebeles:

Sero-prevalence of IBD in different districts and kebeles of the study areas are shown in Table 1 and 2. Among the kebeles higher prevalence rate was recorded in Obi-koji (94.56%) and followed by Grura (85.1%), Wadesa (83.33%) and Awaro (70.45%). This sero-prevalence rate of IBD in the different kebeles was highly significant ($\chi^2 = 59.7871$, $p = 0.00$).

Table 2: Seroprevalence of IBD in backyard local chickens of different kebeles

Kebeles	No. sampled	Positive (%)	95% CI*
Sankale	54	36 (66.67)	52.53-78.90
Awaro	44	31 (70.45)	54.79-83.20
Wadesa	18	15 (83.33)	58.58-96.40
Grura	94	80 (85.10)	76.28-91.60
Obi-koji	92	87 (94.56)	87.77-98.20
Holleta	49	20 (40.82)	26.99-55.79
Total	351	269 (76.64)	71.85-80.97

*CI = Confidence Interval, $\chi^2 = 59.8$, $p = 0.00$

Table 3: Seroprevalence of IBD based on different age groups

Age in weeks	No. sampled	Positive (%)	95% CI*
3-12	157	137 (87.26)	80.40-92.00
13-24	129	96 (74.40)	65.99-81.67
25-36	65	36 (55.38)	42.53-67.73

*CI = Confidence Interval, $\chi^2 = 26.7$, $p = 0.00$

In the present study, the seroprevalences of IBD were 89.78, 70.69 and 40.82% for Waliso, Ambo and Welemmera districts, respectively (Table 1). It was found very high in those chickens from Waliso and Ambo as compared to chickens from Welemmera. Likewise statistically significant variations were observed in the prevalence of IBD among the six villages birds (Table 2). A similar finding was reported by Hailu *et al.* (2010) in village chicken of different districts of Amhara national regional state here in this country.

The difference in prevalences of this disease in those areas can be associated with various factors such as geographic, climatic conditions, age, breed of the chickens, immunity of the host, husbandry, the hygiene and conditions.

Age-wise seroprevalence: The prevalence of the disease in different age group is shown in Table 3, statistically significant difference was observed between the three age groups ($p < 0.05$). The seroprevalence the was more prevalent in birds of 3-12 weeks age group and low in chickens with age > 25 weeks (Table 3).

Singh and Dhawedkar (1992) reported a high seroprevalence of IBD (61.82%) in chicken between 7 and 11 weeks and lowest in those above 22 weeks of age which was very close to the findings of present study. But many researcher who have studied the out break of this disease in different part the world reported the more susceptible age groups were between 3-5 weeks (Zelege *et al.*, 2005; Mor *et al.*, 2010).

Seroprevalence in relation to different hygienic conditions:

Table 4 shows the seroprevalence of gumobro disease in different hygienic conditions where the sampled birds kept. The prevalence of IBD was found to be very low in birds kept under good hygienic condition. The statistically significant variation ($\chi^2 = 20.32$, $DF = 2$, $p = 0.00$) in the seroprevalence of birds kept in good,

Table 4: Seroprevalence of IBD in different hygienic conditions

Hygienic conditions	No. sampled	Positive (%)	95% CI*
Good	59	32 (54.23)	36.60-61.83
Moderate	189	147 (77.77)	71.17-85.89
Poor	108	90 (83.33)	74.88-89.83

*CI = Confidence Interval, $\chi^2 = 20.32$, $p = 0.00$

Table 5: Seroprevalence of IBD in different housing systems

Housing system	No. sampled	Positive (%)	95% CI*
Separate houses	175	123 (70.28)	62.92-76.94
Living with human	176	146 (83.42)	76.56-88.19

*CI = Confidence Interval, $\chi^2 = 8.42$, $p = 0.015$

moderate and hygienic conditions recorded in this study may be attributed to variation in predisposing factors such as improper cleaning, keeping used litter, poor ventilation and crowding as these factors influence spread of the infection from house to house and from flock to flock (Animal Health Australia, 2009; Sil *et al.*, 2002) observed some management practice such as fumigation of the shed with formalin and potassium permanganate were essentials to prevent IBDV infection in addition to this Hailu *et al.* (2010) reported the status of hygienic condition of the chicken shed highly associated with the occurrence of Infectious bursal disease in their research. On the contrary Lukert and Saif (1997) suggested that IBD virus is very stable and persists in poultry houses even after cleaning and disinfection.

Seroprevalence based on housing system of birds: The seropositivity of birds kept in separate house and birds sharing the same house for the disease showed a significant variation at $p < 0.05$ (Table 5).

The seroprevalence of the disease was more in chickens sharing the same house with the people than those kept in a separate shed ($\chi^2 = 8.42$, $p = 0.015$). This can be associated with the frequent movement of people and constant contact, presence of rodents in the house.

CONCLUSION

In conclusion, higher seroprevalences for IBD were revealed in three districts of south west and west Shoa of Oromia regional State, Ethiopia. Further more, the present study demonstrated that the magnitude of seropositivity of infectious bursal disease in backyard chickens was influenced by hygienic condition and the housing system in which the birds were kept. Thus this study anticipates detailed epidemiological investigation of the disease in order to reduce the indirect losses like increased susceptibility to other diseases. Besides this identification and characterization of the serotypes of IBD virus in the country is very important in the understanding of the disease and also for the production of efficient vaccines to avoid the economic impact of both clinical and subclinical form of the disease.

REFERENCES

- Abrar, A., 2007. Sero-prevalence study of infectious bursal disease in non-vaccinated backyard chickens in selected areas of east shoa zone. DVM Thesis, Addis Ababa University, Ethiopia.
- Alcorn, M.J., 2002. How to Carry out Field Investigation. In: Poultry Disease, Jorman, F., M. Pattison, D. Alexander and T. Faragher (Eds.). 5th Edn., W.B. Saunders Company, USA., pp: 13-42.
- Animal Health Australia, 2009. Disease Strategy: Infectious Bursal Disease Caused by very Virulent IBD Virus or Exotic Antigenic Variant Strains of IBD Virus (Version 3.0). Australian Veterinary Emergency Plan (AUSVETPLAN). 3rd Edn., Primary Industries Ministerial Council, Canberra, ACT Australia.
- Biswas, P.K., H. Barua, G.M.N. Uddin, D. Biswas, A. Ahad and N.C. Debnath, 2009. Serosurvey of five viruses in chicken on smallholdings in Bangladesh. Prev. Vet. Med., 88: 67-71.
- Cosgrove, A.S., 1962. An apparently new disease of chickens-avian nephrosis. Avian Dis., 6: 385-389.
- Emikpe, B.O., D.O. Oluwayelu, O.A. Fagbohun, O.A. Oladele and O.G. Omore, 2007. Seroprevalence of infectious bursal disease in flocks of indigenous Nigerian ducks (*Anas platyrhynchos*). J. Anim. Vet. Adv., 6: 64-67.
- Hailu, M., S.B. Tilahun and T. Negash, 2009. Incidence of infectious bursal disease in village chickens in two districts of Amhara Region, Northwest Ethiopia. LRRD., 21: 214-214.
- Hailu, M.S., B. Tilahun and T. Negash, 2010. Newcastle disease and infectious bursal diseases are threat to village chicken production in two districts of Amahara National Regional State, Northwest Ethiopia. J. Life Sci., 4: 62-72.
- Hernandez-Divers, S.M., P. Villegas, F. Prieto, J.C. Unda and N. Stedman *et al.*, 2006. A survey of selected avian pathogens of backyard poultry in Northwestern Ecuador. J. Avian Med. Surg., 20: 147-158.
- Ibrahim, U.T. and S.N. Tany, 2001. Prevalence of antibodies to IBVD in village chickens in Sahel zone of Nigeria. Bull. Anim. Prod. Afr., 49: 150-152.
- Karunakaran, K., M. Thanappapillai and N. Raghavan, 1993. Sero-prevalence of Infectious Bursal Disease (IBD) in parts of Tamil Nadu, India. Comp. Immunol. Microbiol. Infect. Dis., 16: 241-244.
- Lukert, P.D. and Y.M. Saif, 1997. Infectious Bursal Disease. In: Diseases of Poultry, Calnek, B.W., H.J. Barnes, C.W. Beard, L.R. McDougald and Y.M. Saif (Eds.). 10th Edn., Iowa State University Press, Ames., pp: 721-738.

- Miller, H.S., 1995. The emergence of the Delaware strain of IBD and its control in the U.S. Proceedings of the International Poultry Symposium Summit on IBD, (IBD'95), Athens, GA., pp: 99-101.
- Mor, S.K., G. Narang, N. Jindal, N.K. Mahajan, P.C. Sharma and N.K. Raka, 2010. Epidemiological studies on infectious bursal disease in broilers chicken in Haryana, India. *Int. J. Poult. Sci.*, 9: 395-400.
- Murphy, F.A., E.P.J. Gibbs, M.C. Horzinek and M.J. Studdert, 1999. *Veterinary Virology*. 3rd Edn., California, Academic press, USA., pp: 405-409.
- Mushi, E.Z., M.G. Binta, R.G. Chabo and R.T. Ndebele, 1999. Seroprevalence of infectious bursal disease in non-vaccinated indigenous and exotic chickens on selected farms around Gaborone, Botswana. *Onderstepoort J. Vet. Res.*, 66: 135-137.
- Ndanyi, S.N., F.M. Njue, P.N. Mukendi and A.M. Bojesen, 2004. Seroprevalence of IBD and Impacts of its vaccination on village poultry in Taita Taveta District of Kenya. M.Sc. Thesis, The Royal Veterinary and Agricultural University, Denmark.
- OIE, 2004. Infectious bursal disease (Gumboro disease): Manual of diagnostic test and vaccine for terrestrial animals. OIE. http://www.oie.int/eng/normes/mmanual/A_00102.htm#top.
- Sil, G.C., P.M. Das, M.R. Islam and M.M. Rahman, 2002. Management and disease problems of cockerels in some farms of Mymensingh, Bangladesh. *Int. J. Poult. Sci.*, 1: 102-105.
- Singh, C.P. and R.J. Dhawedkar, 1992. Prevalence of subclinical bursal disease and its significance in India. *Trop. Anim. Health Prod.*, 24: 204-206.
- Solomon, W. and W. Abebe, 2007. Infectious Bursal Disease (Gumboro disease) case report of Andasa poultry farm Amahara region. *Ethiop. Vet. J.*, 11: 150-154.
- Van den Berg, T.P., 2000. Acute infectious bursal disease in poultry: A review. *Avian Pathol.*, 29: 175-194.
- Zelege, A., E. Gelaye, T. Sori, G. Ayelet, A. Sirak and B. Zekarias, 2005. Investigation on infectious bursal disease outbreak in Debre Zeit, Ethiopia. *Int. J. Poult. Sci.*, 4: 504-506.
- Zelege, A., M. Yami, F. Kebede, N. Melese and B. Senait *et al.*, 2003. Gumboroo: An emerging disease threat to poultry farms in Debre Zeit. Proceedings of the 17th Annual Conference of Ethiopian Veterinary Association, Addis Ababa, Ethiopia.