European Journal of Applied Sciences 8 (2): 62-66, 2016
ISSN 2079-2077

DOI: 10.5829/idosi.ejas.2016.62.66

# Seroprevalence Study on Infectious Bursal Disease and Associated Risk Factors in Backyard Chicken Production in Sebeta Hawas District, Oromia, Ethiopia

*[1]Asamenew Tesfaye, [2]Beshada Tesfaye and [3]Moti Yohannes*

[1]National Animal Health Diagnostic and Investigation Center, P.O. box 04, Sebeta, Ethiopia
[2]Jimma University Collage of Agriculture and Veterinary Medicine

**Abstract:** A cross sectional study was conducted in Sebeta Hawas district from November 2014 to march 2015 to determine the sero-prevalence of infectious bursal disease (IBDV) using Indirect ELISA techniques and associated risk factors. A total of 180 chickens raised in the backyard production system were bleed to get sera from randomly selected five PA's in the district. An overall seroprevalence of 38.3% (69/180) for the entire study area were detected. The highest (58.6%) and lowest (9.4 %) seroprevalence was recorded in Koche and Tefki PA's respectively. The difference was statistically significant (p-value < 0.05) among study areas. In relation to age highest seroprevalence of IBD was recorded in 3-12 weeks age 45.8% (11/24) and lowest seroprevalence was recorded in chickens 13-24 weeks and greater than 24 weeks of age 34.9% (29/83) and 39.7%(29/73) respectively. However, there was no significant difference (p-value>0.05) between age groups in the seroprevalence of IBDV. The study revealed higher prevalence of in female(40.4%) than male (35.8%) though sex doesn't have significant effect on the occurrence of (Infectious bursal disease) in the study area (p-value > 0.05). In conclusion, the higher prevalence reported in this study indicates that the disease is widely distributed in backyard chicken production system and one of the potential threats for poultry production in the study areas and hence an urgent control and intervention measures should be implemented.

**Key words:** Backyard Chicken Production · Infectious Bursal Disease (IBD) · Sebeta Hawas Seroprevalence

## INTRODUCTION

Chicken production under backyard system has long been an important component of rural economy in Ethiopia. The total poultry population in Ethiopia is estimated at 43 million of which 97% are village chickens [1]. In Ethiopia, chicken are widespread and almost every rural family owns chicken, which provide a valuable source of family protein and income [2]. However, unlike the intensive, traditional poultry production system is characterized by low input, low output and periodic destruction of a large portion of the flock due to outbreak of disease. In backyard poultry production systems, disease was the most important stumbling block for production problem in Ethiopia [3, 4].

Infectious bursal disease (IBD) virus (IBDV, genus Avibirnavirus, family Birnaviridae) infects chickens, turkeys, ducks, guinea fowl and ostriches, but causes clinical disease solely in young chickens [5] and causes immunosuppression due to extensive destruction of lymphocytes in the bursa of fabricius [6, 7]. After its first outbreak in poultry in Southern Delaware in the United States in 1962 [8], the disease has been recorded from all over the world [9]. The clinical form of the disease, of less importance nowadays, occurs in chickens over weeks of age when the bursae are well developed. The greatest economic losses are due to sub clinical disease in chicks from one to twenty one days of age. At this stage the virus impairs the immune response and renders the chicks susceptible to various infections. The effects of late infection from three to ten or more weeks of age result in the clinical disease [9].

Infectious bursal disease is a newly emerging disease of chicken in Ethiopia, which has been speculated to be introduced concurrent with increased number of commercial state and private poultry farms flourishing in the country [10]. It was first reported in 2002 in Ethiopia at privately owned commercial poultry farm in which 45-50% mortality rate was documented [11]. Frequent outbreaks and occurrence of new strains of infectious bursal disease

**Corresponding Author:** Asamenew Tesfaye, National Animal Health Diagnostic and Investigation Center, P.O. box 04, Sebeta, Ethiopia E-mail: asefiker@yahoo.com

became a challenge to the juvenile poultry industry in Ethiopia [12]. Over the past few years, 25 to 75% of the deaths/losses in exotic and cross chickens have been associated with infectious bursal disease [13]. The disease has since spread to all investigated commercial farms and multiplication centers occurring at an average outbreak rate of 3-4 farms per year [14]. Serological survey in different parts of the country and documented results indicated that IBD is a threat for both backyard and commercial chicken production system. Therefore, the aims of this study were to determine the seroprevalence and the associated risks to IBDV infection in backyard chicken production systems.

## MATERIALS AND METHODS

**Study Area:** The study was conducted in Sebeta Hawas district, a special zone around Addis Ababa of Oromia regional state. The district is located 25 km South West of Addis Ababa at an altitude of 1800 -3385m above sea level and at latitude and longitude of 8°55- 8.917°N and 38°37- 38.617°E respectively. It receives an average annual rainfall of 1073 ml and temperature that ranges from 11.3- 28°C. It has a total area of 102,758 $km^2$[15]. Both Livestock rearing and crop production are the main economic activities of the majority of communities. Teff, Wheat and Sorghum are the major crops grown in the district. The major livestock reared in the district include cattle, sheep, goats and poultry [16].

**Study Population:** The study was conducted in chickens raised under backyard production system in randomly selected Peasant Associations (PA's) of Sebeta Hawas district. None of the sampled chickens had history of vaccination against infectious bursal disease.

**Study Design:** A cross-sectional study was conducted from November 2014 to March 2015 in the selected study area to determine the seroprevalence of Infectious Bursal Disease (IBD) in backyard chicken production. Peasant Associations (Villages) were randomly selected from the list obtained from Sebeta Hawas agricultural office.

**Sample Size and Sampling Technique:** The total sample size was proportionally allocated between selected peasant associations of study area. The desired sample size for this study was calculated using the formula given by Thrusfield [17] with 95% confidence interval at 5% precision. The overall expected prevalence of infectious bursal disease in Woliso town of south-west showa, Ethiopia was accounted 89.78% [18]. Therefore, the required sample size was calculated using the formula:

$$n = \frac{z^2 \, Pexp \, (1\text{-}Pexp)}{d^2}$$

Where, n = sample size; d = Desired absolute precision at 95% confidence interval = 5%; $z^2$=1.96; Expected prevalence =89.78%

Using the above formula n=141. To avoid loss of sample units and increase precision, additional 40 samples, with a total of 181 was collected from selected households found in the Peasant Associations (Villages) of the selected districts.

**Sample Collection:** Sera samples were collected from a total of 180 chickens in the study areas. About 2-3 ml of blood samples were aseptically collected from the branchial (Wings) vein of apparently healthy chickens using 3ml syringe with 22gauge needle size and the syringe was placed horizontally at 45°C for overnight at room temperature to drain the sera samples. The separated serum was transferred into each labeled sterile Cryovials tube and transported to National Animal Health Diagnostic and Investigation Center maintaining its cold chain (4°C) for laboratory analysis. Upon arrival the sera were stored at -20° until the test was performed.

**Laboratory Analysis:** Serum sample was tested for IBDV specific antibodies using a commercial IBDV-ELISA kit (Proflok plus IBD, Sybiotic Corporation, Frotera San Giego, CA, USA) following manufacture's direction. Serum was pre -diluted to1:500 in dilution buffer, added to an antigen coated plate. Specific IBD antibodies in the serum form antigen -antibody complex with antigen bounded to the plate. After washing the plate, anti- chicken horse radish peroxidase conjugate was added to each well and the formed antigen- antibody bind to the conjugate.After incubation period un bounded conjugate was removed by washing and substrate which contains chromogen was added which form a clear to green blue color in the presence of enzyme, after incubation for 15 minute stop solution was added terminate reaction and plate was read using ELISA reader at 450nm

ELISA test was valid if the mean of optical density (OD) of the positive control is greater than 0.25(OD > 0.025) and the ratio of the mean of the OD of positive and negative controls ($OD_{PC}$ and $OD_{NC}$) is greater than 3. The sample to positive ratio was calculated by the following formula directed by the manufacturer:

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

The result was interpreted as, if SP (Sample to positive control) value was ≥ 0.5 the sample was positive for antibody against IBDV and negative if SP was < 0.5.

**Data Management and Analysis:** All the data collected were entered to MS excel spread sheet before analysis by using SPSS version 20. Descriptive statistics was used to determine the prevalence of the disease and Chi-square test was used to determine any association between the disease with age, sex and body and origin. In all the analyses, confidence level was held at 95% and P<0.05 was set for significance.

## RESULTS

**Seroprevalence IBDV among Villages:** Out of 180 serum samples, 69 were found positive for antibody against IBDV which yields an overall seroprevalence of 38.3% (95%CI=31.4-45.6) in the study areas. Five villages were investigated during this study in which the highest (56.8%) and the lowest (9.4%) seroprevalence were recorded in Koche and Tefki respectively. The seroprevalence of IBDV among the villages were significantly different ($x2$=19.7, P=0.001) (Table 1).

**Sex Based Seroprevalence:** Assessment was also made to determine the seroprevalence IBDV in relation to sex. The higher seroprevalence was recorded in female chickens 40.4% (40/99) than males 35.8% (29/81); however, there was no significant difference were recorded between sexes ($x2$=0.399, P=0.528) (Table 2).

**Age Based Sero-Prevalence:** The highest sero-prevalence was recorded in chicken 3-12 weeks of age with 45.8% (11/24) and the lowest in chickens 13-24 weeks of age with 34.9% (29/83); however, there was no significance difference ($x2$=1.035, P=0.596) among the age groups (Table 3).

## DISCUSSION

The study indicated that an overall seroprevalence of 38.3% (69/180) of IBD in chickens kept under backyard production system that implies the virus is widely spread in the study areas. This higher prevalence of IBDV generally attributed to the poor poultry management systems in back yard poultry production such as poor vaccination practice, poor sanitary condition, nutritional deficiencies frequent contact wild birds and the flourishing commercial poultry farms in the area. The overall seroprevalence in the current finding was lower than serological studies conducted in different parts of the country 90.3% in Mekele [19] 89.78% in Woliso [18] 85.4 in Addis Ababa [17] and 72.7 in Gondor [20]. The current finding is comparable to the reported prevalence of 38.39% in Bahrdar [21] and 40.8% in Wolmera [18].

Table 1: Seroprevalence of IBD in selected PA's

| PA's | Number sampled (%) | Number negative (%) | Number positive (%) | 95%CI | $x2$ | P-value |
|---|---|---|---|---|---|---|
| Guranda | 56 (31) | 34 (60.7) | 22 (39.3) | 27.2-52.5 | | |
| Tefki | 32(17.8) | 29(90.6) | 3 (9.4) | 2.4-23.4 | | |
| Jawe | 31(17.2) | 21(66.7) | 10 (32.3) | 17.7-50 | 19.7 | 0.001 |
| Jimjima | 24(13.3) | 11(45.8) | 13 (54.2) | 34.3-73 | | |
| Koche | 37(20.6) | 16(43.2) | 21 (56.8) | 40.6-71.9 | | |
| Total | 180(100) | 111 (61.7) | 69 (38.3) | 31.4-45.6 | | |

Table 2: Seroprevalence of IBDV between sex groups

| Sex | Number sampled (%) | Number negative (%) | Number positive (%) | 95%CI | $x2$ | P-value |
|---|---|---|---|---|---|---|
| Male | 81(55) | 52(64.2) | 29 (35.8) | 25.9-46.7 | 0.399 | 0.528 |
| Female | 99(55) | 59(59.6) | 40 (40.4 ) | 31.1-50.3 | | |
| Total | 180(100) | 111(61.7) | 69 (38.3) | 31.4-45.6 | | |

Table 3: Seroprevalence of IBDV between age groups

| Age (week) | Number sampled (%) | Number negative (%) | Number positive (%) | 95%CI | ?2 | P-value |
|---|---|---|---|---|---|---|
| 3-12 | 24(13.3) | 13(54.2) | 11 (45.8) | 27-65.7 | | |
| 13-24 | 83(46.1) | 54(65.1) | 29 (34.9) | 25.3-45.6 | 1.035 | 0.596 |
| >24 | 73(40.6) | 44(60.3) | 29 (39.7 ) | 29-51.3 | | |
| Total | 180(100) | 111(61.7) | 69 (38.3) | 31.4-45.6 | | |

However, lower prevalence (29%) than the current finding was reported from East Shoa zone, Akaki and Adama [22]. The report from this study also indicated higher prevalence of IBDV in back yard chicken production than other countries in Africa 30.7% in Sudan [23] 30% in Botswana [24] and 33.9% in Cameroon [25]. The variation in the seroprevalence of IBD may be attributed to the difference in the sensitivity and specificity of the tests used by the researcher, breeds of chicken, different in agro-ecological condition of the study areas, availability of veterinary services and awareness of public toward the control of the disease.

Origen of the chickens had significant effect on seroprevalence of IBDV. This finding is in agreement with the report made from the same country that indicates the effect of the origin of chicken in the seroprevalence of the disease [22, 26]. The reason may be associated with cross contamination from exotic breed chickens and proximity to Sebeta town where commercial poultry farms are flourishing. Moreover, poor husbandry and hygienic condition of the production system also contributed to the variation.

Sex and age had no significant effect on IBDV seroprevalence at $P>0.05$. This finding was in agreement with the reports from the same country with similar back yard production system [26-28]. Similar report was made from Tanzania indicating sex and age had no significant effect on seroprevalence of IBDV [29]. In contrast to our findings, significant effect of sex and age was reported from the same country who detects higher prevalence of IBDV in scavenging chickens [22, 27] who reported that chickens were more susceptible to IBD due to bursal development during early age. In conclusion, the study revealed that the seroprevalence of IBDV in back yard poultry production is very high that indicates a circulating wild strain virus in the area. Therefore, further studies on the characteristics of the circulating virus and possible risk factors will help to design effective prevention and control strategies in the country.

## REFERENCES


1. CSA, 2012. Agricultural Sample Survey (2011/12) Volume II, Report on Livestock and Livestock characteristics, Statistical Bulletin, 505. Addis Ababa, Ethiopia.
2. Tadelle, D., T. Million, Y. Alemu and K.J. Peters, 2003a. Village chicken production systems in Ethiopia: Use patterns and performance valuation and chicken products and socio-economic functions of chicken. Livestock Research for Rural Development (15)1. (Available from http://www.lrrd.org/ lrrd15/1/tadeb151.htm) (Accessed on 28 November 2016).
3. Tadelle, D. and B. Ogle, 2001. Village poultry production systems in the central highlands of Ethiopia. Trop. Anim. Health Prod. J., 33: 521-537.
4. Lobago, F., D. Nigussie, A. Wossene and H. Ashenafi, 2003. Study on major disease of chickens in Debre Zeit, Central Ethiopia. Bull. Anim. Health Prod. Afr. J., 51: 11-21.
5. OIE, 2012. Office of International des Epizooties. Manual of Diagnostic Tests and Vaccines for Terrestrial Animals. Infectious Bursal Disease: Chap, 12: 549-565.
6. Lukert, H. and Y. Saif, 1997. Infectious bursal disease. In Diseases of poultry, 10th Ed. Iowa State University Press, Ames, pp: 721-738.
7. Anjum, A., 1997. Infectious bursal disease. Detection of antibodies against infectious bursal disease virus. Avi. Path. J., 29: 24-29.
8. Cosgrove, A., 1962. An apparently new disease of chicken avian nephrosis. Avian Dis J., 9: 385-389
9. De Wit, J., H.W. Van De Sande, G.H. Counotte and G.J. Wellenberg, 2007. Analysis of the result of different test systems in the 2005 global proficiency testing schemes for infectious bursal disease virus and newcastle disease virus antibody detection in chicken serum. Avi. Path, 2: 177-183.
10. Muller, H., M. Islam and R. Roué, 2003. Research on infectious bursal disease,the past, the present and the future. Vet. Microbiol.J., 97: 153-165.
11. Zeleke, A., E. Gelaye, T. Sori, G. Ayelet, A. Sirak and B. Zekarias, 2005. Investigation on infectious bursal disease outbreak in Debre zeite, Ethiopia. Inter. J. Poult. Sci., 4: 504-506.
12. Zeleke, A., M. Yami, F. Kebede, N. Melese and B. Senait, 2003. Gumboro, an emerging disease threat to poultry farms in Debre Zeit. Proceedings of the 17th Annual Conference of Ethiopian Veterinary Association, Addis Ababa, Ethiopia.
13. Woldemariam, S. and A. Wossene, 2007. Infectious bursal disease (Gumboro disease): Case report at Andasa poultry farm, Amhara region. Vet. J., 11: 141-150.
14. Aregitu, M., 2015. Outbreak investigation and molecular characterization of infectious bursal disease virus and vaccine immunogenesity trial in Ethiopia, MSc Thesis at AAU, pp: 34-35.

15. Sebeta Hawas Finance and Economic Development Office (SHFDO), 2011. Annual Socio Economic profile and Statistical Abstract Report.SHAO, 2014
16. Sebeta Hawas Finance and Economic Development Office, 2015. Annual Socio Economic profile and Statistical Abstract Report.
17. Thrusfield, M., 2005. Veterinary Epidemiology 3rd edition. Black well science Ltd, London. pp: 178 -236.
18. Hailu, D., B. Melese, Y. Moti and G. Mekedes, 2010. Seroprevalence of infectious bursal disease in backyard chickens. Vet. Res. Medwell J., 4: 89-93.
19. Shiferaw, J., A. Gelagay, G. Esayas, K. Fekadu, E.L. Stacey and N. Haileleul, 2012. Infectious bursal disease: seroprevalence and associated risk factors in major poultry rearing areas of Ethiopia. Trop Anim Health Prod., 45: 75-79.
20. Kassa, S. and W. Molla, 2012. Seroprevalence of infectious bursal disease in chickens managed under backyard production system of North West Ethiopia Sci. J. of Crop Sci., 1: 20-25.
21. Sinidu, Z., T. Yisehak, A. Haftay and A. Nesibu, 2015. Seroprevalence of infectious bursal disease in backyard chickens.African J. Biotech, 14: 434-437.
22. Mazengia, H., 2012. Review on major viral diseases of chickens reported in Ethiopia. J. Infect. Dis. and Immun, 4: 34-39.
23. Mahasin, E.A. and I. Rahaman, 1998. Studies on infectious bursal disease. PhD thesis, University of Khartoum, Sudan.
24. 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 Journal of Veterinary Research, 66: 135-137.
25. Durojaiye, O.A. and P. Kwenkam, 1990. A preliminary note on the prevalence of infectious bursal disease of poultry in Cameroon.Revue d'Élévage et de Medecine Veterinaire des Pays Tropicaux, 43: 439-440.
26. Zeryehun, T. and G. Fekadu, 2012. Seroprevalence of infectious bursal disease in chickens managed under backyard production system in Central Oromia, Ethiopia. African J.of Microbio. Res., 6: 6736-6741
27. Tadesse, B. and S. Jenbreie, 2014. Sero-Prevalence of Infectious Bursal Disease in Backyard chickens at Selected Woredas of Eastern Ethiopia. Journal of Biology, Agriculture and Healthcare, 4: 2224-3208.
28. Tesfaheywet, Z., M. Hair-Bejo and A. Rasedee, 2012a. Biochemical changes in specific pathogen-free chicks infected with infectious bursal disease virus of Malaysian isolate. Global Veterinaria, 1: 8-14.
29. Swai, E.S., M.J. Kessy, P.N. Sanka and P.F. Mtui, 2011. A serological survey for infectious bursal disease virus antibodies in free-range village chickens in northern Tanzania. Tydskr.S.Afr.vet.Ver., 82(1): 32-35.