

Full Length Research Paper

Sero-prevalence of infectious bursal disease in backyard chickens around Mekelle, Northern Ethiopia

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A cross sectional study was conducted from January to June 2012 to determine the sero-prevalence of Infectious bursal disease (IBD) in chicken reared under backyard poultry production systems around Mekelle town, Tigray regional state. During the study period blood samples were collected from 384 unvaccinated backyard chickens from three different areas. A commercial indirect enzyme linked immuno sorbent assay (ELISA) was used to test the sera for IBD antibodies kit. The overall sero-prevalence of infectious bursal disease virus (IBDV) antibody in chickens was found to be 45.05% (173/384). There was a significant difference ($P < 0.05$) in the sero-prevalence of IBDV among/between the different age groups, sex and origin of chickens. The result of this study indicates that IBD is prevalent in the study area. The prevalence of IBDV antibody in unvaccinated backyard chickens might be due to field exposure of chickens to the disease and indicated the importance of further study on the epidemiology of the disease and the sero-type of the IBDV that are circulating in the country to design appropriate control measures.

Key words: Infectious bursal disease (IBD), chickens, sero-prevalence, Mekele, indirect enzyme linked immuno sorbent assay (ELISA).

INTRODUCTION

Livestock plays an important role in the agricultural economy of Africa. Poultry occupies a unique position in terms of its contribution to the provision of high quality food protein to rural small holder farming families in Africa. Both poultry meat and eggs enrich and contribute to a well-balanced diet of young children in sub-Saharan Africa (Tadelle et al., 2003). Despite these facts, the contribution of poultry production to the small holder farmers and the country economy is still restricted by various factors like low inputs of feeding, poor manage-

ment, infectious diseases and lack of appropriate selection and breeding practice (Alemu, 1995; Tadelle and Ogle, 2001; Halima et al., 2007).

Infectious diseases such as newcastle disease and infectious bursal disease are reported to be the major health and production constraints of chickens (Alamargot, 1987; Zeleke et al., 2002; Zeleke et al., 2005b). Infectious bursal disease (IBD) is an acute highly contagious globally occurring viral poultry disease. The causal virus belongs to the family Birnaviridae of the genus

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Avibirnavirus. Two serotypes of the virus are known. Serotype 1 virus is pathogenic to chickens. Serotype 2 virus is non-pathogenic to chickens but has been isolated from both chickens and Turkeys. Serotype 1 viruses can be further categorized into four groups on the basis of their pathogenicity, as classical, variant, attenuated and very virulent strains (Lim et al., 1999).

Infection with infectious bursal disease virus (IBDV) is presents in two clinical forms: Acute onset high mortality in chickens (up to 20%), usually in birds around 3 to 4 weeks old; immune-suppressive disease as a result of infection at an early age, predisposing birds to secondary infections such as gangrenous dermatitis, inclusion body hepatitis, anaemia syndrome, and *Escherichia coli* infections (Lukert and Saif, 2003). Older birds show the subclinical form of IBD depending on the strain and amount of the infecting virus, age and breed of birds, route of inoculation, and presence and absence of neutralizing antibodies (Muller et al., 2003). A previous study in Ethiopia indicated that the mortality rate of IBD ranges from 45 to 50%. The overall seroprevalence of IBD antibody recorded in different part of the country and different poultry production systems reached up to 93.3% (Zelege et al., 2005a). This study was conducted to determine the Sero-prevalence of IBD in unvaccinated backyard chickens around Mekelle town, Northern Ethiopia.

MATERIALS AND METHODS

Study area

The study was conducted in chicken around Mekelle, the capital city of Tigray regional state, Ethiopia. Three areas around the city namely, Chelekot, Adigudom and Wukro were selected for this study. Mekelle is located at a latitude of 30° 29' N and a longitude of 39° 28' E with an elevation of 2084 m above sea level (CSA, 2005). The mean annual rainfall ranges from 11.3 to 39.1 mm and the temperature varies from 12 (in November and December) to 27°C (in January and March). Mekelle and its surrounding have humid and hot climate (MoM, 1998).

Sample size determination and study type

A cross-sectional study was undertaken from January 2012 to June 2012 to determine the sero-prevalence and risk factors of IBD infection in non-vaccinated backyard chickens. The sample size was determined using the formula described by Thrusfield (1995). A total of 384 was collected for this study by considering an expected prevalence of 50% and an absolute precision of 5% with 95% confidence level.

Study animals and sample collection

Apparently, healthy chickens reared in a backyard poultry production system were selected randomly from each study areas. The chickens were categorized into three age groups (< 6 months, 6 to 12 months and ≥ 12 months). Blood samples (2.5 ml) were collected from the brachial (wing) vein of chicken using 5 mL sterile disposable syringe with 22 gauge and 1¼ needle size (Alcorn,

The blood samples were allowed to clot for 24 h at room temperature to allow serum separation. Sera samples were separated into labeled sterile cryovial tube and stored at -20°C until tested. All sampled chickens were not-vaccinated against IBDV.

Enzyme linked immuno sorbent assay (ELISA) test

Sera samples were tested for IBDV specific antibodies using a commercial IBDV-ELISA kit (proFLOK®PLUS IBD, Synbiotics Corporation, Frontera San Diego, CA, USA) in National Veterinary Institute, Debre zeit, Ethiopia, following the manufacturer's directions. Serum, diluted in dilution buffer, is added to an IBD antigen coated plate. Specific IBD antibodies in the serum form an antibody-antigen complex with the IBD antigen bound to the plate. After washing the plate, an affinity purified goat anti-chicken IgG (H+L) peroxidase conjugate was added to each well and the formed antibody-antigen complex binds to the conjugate. After a brief incubation period, the unbound conjugate is removed by a second wash step. Substrate which contains a chromogen (ABTS) is added to each well. Chromagen color change from clear to green blue occurs in the presence of peroxidase enzyme. The relative intensity of color, developed in 15 min (compared to the controls), is directly proportional to the level of IBD antibody in the serum. After the substrate has incubated, a stop solution was added to each well to terminate the reaction and the plate was read using an ELISA plate reader at 405 to 410 nm. The test sample was found to be positive when the SP >0.299 and titration > 0 according to the following formula:

$$\text{Sample to be positive (SP)} = \frac{\text{Sample absorbance} - \text{Average normal control absorbance}}{\text{Corrected positive control absorbance}}$$

An IBD ELISA titer value was calculated by the equation given as below:

$$\text{Log}_{10}\text{Titer} = (1.172 \times \log_{10}\text{SP}) + 3.614$$

$$\text{Titer} = \text{Antilog of } \log_{10}\text{Titer}$$

Data analysis

The data was entered into Microsoft excel spread sheet and coded appropriately. For data analysis, SPSS version 16, was used. Descriptive statistics were used to determine the sero-prevalence of IBD in chicken. The Chi-square test was used to determine the association between the disease and the considered risk factors such as origin, age and sex. In all cases, 95% confidence intervals and P<0.05 were set for significance.

RESULTS AND DISCUSSION

Of the 384 examined backyard chickens sampled, 45.05% (n=173) were positive for IBD antibodies. The sero-prevalence of IBD in Wukro, Adigudom and Chelekot was 60.77, 43.08 and 30.65%, respectively. The sero-prevalence of IBD recorded in female and male chickens was 54.18 and 27.82%, respectively. The sero-prevalence of IBD in chicken aged above 12 months (64.57%) was relatively higher than both chickens aged

Table 1. Sero-prevalence of IBD between/among the different areas and the sex and age groups.

Risk factors	Category level	Number of collected samples	Number of positive samples	Percentage (%)	<i>p-value</i>
Origin	Chelekot	124	38	30.65	0.041
	Wukro	130	79	60.77	
	Adigudom	130	56	43.08	
	Total	384	173	45.05	
Sex	Male	133	37	27.82	0.047
	Female	251	136	54.18	
	Total	384	173	45.05	
Age	< 6 month	152	33	21.71	0.039
	6 to12 months	105	58	55.24	
	>12 months	127	82	64.57	
	Total	384	173	45.05	

six to 12 months (55.24%) and below six months of age (21.71%). In general, there was statistically significant difference (*p-value* < 0.05) in the sero-prevalence of IBD between/among the different areas and the sex and age groups (Table 1).

The overall prevalence of IBD in this study was 45.05%. This sera-prevalence is lower than the findings of Degefu et al. (2010) in South West and West Shoa, Abrar (2007) in selected areas of East Shoa Zone and Nigussie (2007) in Addis Ababa and Adami Tulu areas, who reported a prevalence of 76.64, 76.3 and 65.9%, respectively, in non-vaccinated backyard chickens. Kassa and Molla (2012) also reported IBD prevalence of 75% in West Gojjam and 72% in North Gondar, in unvaccinated local breed backyard chickens. However, our finding of this study (45.05%) was higher than that of Reta (2008) in unvaccinated backyard chickens in East Shoa Zone and Hailu et al. (2009) in North West Ethiopia in village chickens who reported a prevalence of 39.2 and 38.9%, respectively. The variations in the sero-prevalence of IBD might be attributed to differences in the sensitivity and the specificity of the tests used by the authors. In addition, differences in the breed used and the agro-ecological zones of the studied area, the availability of the veterinary service and the awareness of the public towards the control and treatment of the disease, and the breed difference between these study areas could also influence the sero-prevalence results.

The prevalence of IBD among/between the different age and sex groups and origins was statistically significant (*p-value* < 0.05). The highest sero-prevalence of IBD was in Wukro (60.77%), as compared to other cities showing low sero-prevalences, like Adigudom (43.08%) and Chelekot (30.65%). This difference in sero-prevalence may be due to the variation in geographic and climatic conditions of the area, and husbandry and hygienic condition of the production systems. With regard to sex, the sero-prevalence of IBD was higher in female

(54.18%) than male (27.82%). This difference might be due to physiological and immunological difference between the two sexes. Moreover, the reproductive demands placed on females may increase the risk of infection as compared to male. It is also possible that there are some other unmeasured risk factors in common, such as different male and female behaviours, which increases exposure to pathogens (Bettridge et al., 2014). The sero-prevalence of IBD was higher in chickens aged above 12 month (64.57%) than those aged 6 to 12 months (55.24%) or below 6 month (21.71%). However, this finding is contrary to that reported by Singh and Dhawedkar (1992) and Saif et al. (2000) showing higher sero-prevalence of IBD in chicken aged below 12 weeks of old.

The results of this study would suggest that Infectious Bursal Disease virus is prevalent in the study areas and the sero-prevalence of IBDV antibody in backyard chickens is most probably due to field exposure to these viruses. A further study on the epidemiology, possible risk factors of IBDV exposure and strains of the IBDV circulating in the country would be valuable in helping to develop control strategies to prevent clinical disease.

Conflict of interests

The authors did not declare any conflict of interest.

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