Seroprevalence of Newcastle Disease in Backyard Chickens in Sebata Hawas District, Central Ethiopia

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Abstract: The study was conducted in Sebata Hawas District, Oromia Region, Central Ethiopia with the objective of determining the sero-prevalence of Newcastle disease (ND) in backyard chickens using blocking-enzyme linked immunosorbent assay from November, 2014 to March, 2015. A total 344 chicken sera were collected from five randomly selected peasant associations (PA) for this study. An overall sero-prevalence of 11.34% (95% CI: 8.19-15.17%) of the Newcastle disease was recorded in the study area. The highest sero-prevalence 20% (95% CI: 12.83-28.93) was recorded at Dima peasant association which is located near to market and the sero-prevalence in each PA ranges from 0% to 20%. The sero-prevalence of Newcastle disease significantly varied among peasant associations ($\chi^2 = 21.0; P=0.00$). The sero-prevalence of Newcastle disease in cross and local breeds of chickens were 13.9% and 10.7% respectively and the difference was not significantly varied between breeds of chickens ($\chi^2=0.59; P=0.44$). Similarly, no significant difference in sero prevalence was observed between female and male; young and adult chickens.

Key words: Poultry · Traditional · Peasant Association · Newcastle Disease · Sero-Prevalence · Newcastle Disease

INTRODUCTION

In Ethiopia the total poultry population is estimated to be about 50.38 million which includes 96.9 %, 0. 54 % and 2.56% indigenous, hybrid and exotic breeds respectively [1]. Majorities (99%) of these chickens are kept under a traditional production system [2]. The traditional backyard chicken production system is described by small flock sizes, less human involvement, with birds scavenging in the backyard for food and periodic devastation of the flock by disease [3-5]. Keeping village chicken in developing countries has a vital role in the livelihood of the rural population [6]. In Ethiopia, Chickens raised in traditional village poultry systems have multiple purposes such as for sale, egg and meat production [7-9]. Keeping village chickens is facing challenges from the periodical and recurrent outbreak of poultry diseases [10]. Among which Newcastle disease is highly prevailed infectious disease of backyard chickens causing heavy mortalities throughout the world [11, 12]. With this regard in Ethiopia, backyard chicken production system is not exceptional in that it is facing major constraints among which diseases are the main [13, 14] particularly, frequent outbreaks of Newcastle disease is an indication of the endemic behavior of the disease in village poultry populations [15]. Studies conducted in certain parts of Ethiopia have indicated that Newcastle disease is one of the major infectious diseases in poultry [13-16]. Regardless of the huge population of the backyard chickens in Ethiopia there is no well coordinated poultry disease reporting
Moreover, the epidemiology of Newcastle disease is not clearly understood in village chickens of Ethiopia. Therefore, the objective of this study was to determine the sero-prevalence of Newcastle disease in backyard chickens in Sebata Hawas districts.

MATERIALS AND METHODS

Study Area and Animals: The study was conducted in Sebata Hawas district, Oromiya National Regional State (ONRS), located at 24 km southwest of the capital Addis Ababa in Oromia Region, Central Ethiopia with altitude of 2240 meter above sea level. The study area is located geographically at 8°55’N latitude and 38°37’E longitude and receives annual rain fall of 890mm with a mean annual maximum and minimum temperature of 21°C and 15°C respectively [18]. The study animals were backyard chickens from selected peasant associations of Sebata Hawas District. The vaccination status of the chickens to be sampled was evaluated through questionnaire survey for each and every household thus; none of the sampled chickens were vaccinated against Newcastle disease.

Study Design and Sample Size: Cross sectional study was employed from November, 2014 to March, 2015 to determine the sero-prevalence of Newcastle disease in unvaccinated backyard chickens. The sample size was calculated using 95% confidence interval, 5% desired absolute precision and with the assumption of 29.69% [14] expected sero-prevalence of Newcastle disease, the sample size was determined according to the formula given by Thrusfield [19].

\[ n = \frac{1.96^2 \times P_{exp} (1 - P_{exp})}{d^2} \]

Where \( n \) is the required sample size, \( P_{exp} \) is the expected prevalence and \( d \) is the desired absolute precision, for \( n = 321 \). The total sample size was proportionally allocated between randomly selected peasant associations of study area. To avoid loss of sample units and increase precision 23 additional backyard chickens were selected. Thus, total samples of 344 chickens were selected for this study.

Sera Collection and Blocking Enzyme Linked Immunosorbent Assay: Blood samples were collected and left on a bench for overnight to permit the serum to ooze out. The sample sera were harvested with labeled sterile cryovial tube. The sera in the cryovial tubes were kept at -20°C until the B-ELISA test was conducted in the laboratory [20]. The SVANOVAR® Newcastle disease antibodies Blocking-ELISA kit was used to detect Newcastle Disease virus (NDV) specific antibodies in the serum samples. The test was performed as described previously [21] and according to manufacturer’s recommendations (Svanova Biotech AB, Uppsala, Sweden).

Data Analysis: Collected data were entered into Microsoft Excel spreadsheets (Microsoft Corp., Redmond, WA, USA) and analyzed using SPSS for Windows version 15.0 (SPSS Inc., Chicago, IL, USA). The animals were divided into different groups: according to their breed namely, local and exotic breeds; based on sex as female and male; age groups that is, young (Chickens of < 6 months) and adult (Chickens of =6 months). Associations between the explanatory variables (Breed, sex, age and the peasant associations) and sero-prevalence was evaluated by chi-square and fisher’s exact tests analysis. Parameters recognized as significant in chi-square and fisher’s exact tests analysis were then subjected to logistic regression analysis to investigate the associations between sero-prevalence and explanatory variables. Differences were considered significant at value of \( P<0.05 \).

RESULTS

Table 1 shows sero-prevalence of Newcastle disease in selected peasant associations. An overall sero-prevalence of Newcastle disease in the study area was 11.34% (95% CI: 8.19-15.17%). The highest prevalence of sero-positive samples were recorded in Diam 20% (95% CI: 12.83-28.93) peasant association followed by Tafki 17.1% (95% CI: 9.18-28.03), Jawe 5.7% (95% CI: 1.58-14.0) and Jimjima 2.5% (95% CI: 0.31-8.88). There was no sero positive sample occurred in Koche peasant association. The difference in sero-prevalence among the peasant associations was statistically significant (\( \chi^2 = 21.0; p=0.00 \)). Logistic regression revealed that backyard chickens reared at Dima peasant association were more likely to be infected by Newcastle disease virus than those reared at Jimjima (OR=8.85; 95% CI: 1.92-40.8) and chickens reared at Tafki peasant association were also more likely to be infected by Newcastle disease virus than those reared at Jimjima peasant association (OR=6.91; 95% CI: 1.4-34.04).
Table 1: Sero-prevalence of Newcastle disease in backyard chickens by peasant associations

<table>
<thead>
<tr>
<th>Peasant associations</th>
<th>No. tested</th>
<th>No. positive (%)</th>
<th>95% CI</th>
<th>( \chi^2 ) (p-value)</th>
<th>OR</th>
<th>p-value</th>
<th>95% CI for OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dima</td>
<td>105</td>
<td>21(20)</td>
<td>12.83-28.93</td>
<td>21.0(0.00)</td>
<td>8.85</td>
<td>0.01</td>
<td>1.92-40.8</td>
</tr>
<tr>
<td>Tafki</td>
<td>70</td>
<td>12(17.1)</td>
<td>9.18-28.03</td>
<td>6.91</td>
<td>0.02</td>
<td>1.4-34.04</td>
<td></td>
</tr>
<tr>
<td>Jawe</td>
<td>70</td>
<td>4(5.7)</td>
<td>1.58-14.0</td>
<td>2.21</td>
<td>0.4</td>
<td>0.65-3.39</td>
<td></td>
</tr>
<tr>
<td>Jimjima*</td>
<td>79</td>
<td>2(2.5)</td>
<td>0.31-8.88</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Koche</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td></td>
</tr>
</tbody>
</table>

CI: Confidence interval; OR: Odds ratio; *: Reference category

Table 2: Sero-prevalence of Newcastle disease in backyard chickens by associated risk factors

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>No. tested</th>
<th>No. positive (%)</th>
<th>95% CI</th>
<th>( \chi^2 ) (p-value)</th>
<th>OR</th>
<th>P value</th>
<th>95% CI for OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult (=6 months)</td>
<td>230</td>
<td>30(13)</td>
<td>8.98-18.9</td>
<td>2.01(0.16)</td>
<td>1.5</td>
<td>0.34</td>
<td>0.65-3.39</td>
</tr>
<tr>
<td>Young* (&lt;6 months)</td>
<td>114</td>
<td>9(7.9)</td>
<td>3.67-14.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Breed</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cross</td>
<td>72</td>
<td>10(13.9)</td>
<td>6.87-24.1</td>
<td>0.59(0.44)</td>
<td>1.7</td>
<td>0.21</td>
<td>0.74-3.85</td>
</tr>
<tr>
<td>Local*</td>
<td>272</td>
<td>29(10.7)</td>
<td>7.26-15.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Sex</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Female</td>
<td>244</td>
<td>33(13.5)</td>
<td>9.50-18.5</td>
<td>3.94(0.05)</td>
<td>1.5</td>
<td>0.42</td>
<td>0.56-3.39</td>
</tr>
<tr>
<td>Male*</td>
<td>100</td>
<td>6(6)</td>
<td>2.23-12.6</td>
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</tr>
</tbody>
</table>

CI: Confidence interval; OR: Odds ratio; *: Reference category

Sero-prevalence of Newcastle disease in backyard chickens by age, breed and sex are given in Table 2. The sero-prevalence of Newcastle disease in cross and local breeds of chickens were 13.9% (95% CI: 6.87-24.1) and 10.7% (95% CI: 7.26-15.0) respectively. It was observed that the sero-prevalence of Newcastle disease was not significantly varied between cross and local breeds of backyard chickens (\( \chi^2=0.59; \ p=0.44 \)). No significant difference (\( \chi^2=3.94; \ p=0.05 \)) in sero-prevalence was observed between female and male chickens although female 13.5% (95% CI: 9.50-18.5) had a relatively higher sero-prevalence than male 6% (95% CI: 2.23-12.6). Similarly, sero-prevalence of Newcastle disease in backyard chickens was not significantly (\( \chi^2=2.01; \ p=0.16 \)) varied between age groups however, adult (=6 months) 13% (95% CI: 8.98-18.9) had a relatively higher sero prevalence than young (<6 months) 7.9% (95% CI: 3.67-14.5) chickens.

**DISCUSSION**

The present study revealed an overall sero-prevalence of 11.34% (95% CI: 8.19-15.17%) of Newcastle disease virus in selected peasant associations of Sebata Hawas district which agrees with report by Regasa et al. [22] in Southern Ethiopia who reported a prevalence of 11%, but differs with the pervious findings of some other researchers. It is lower than the earlier reports by Tadesse et al. [14], Aschalew et al. [16] and Ashenafi [23] who reported 32.22% in central Ethiopia, 19.78% in Southern and Rift Valley areas of Ethiopia and 43.68% in central Ethiopia respectively. Getachew et al. [13] and Chaka et al. [24] reported prevalence of 5.6% and 6% respectively in different parts of Ethiopia. The overall sero prevalence of Newcastle disease 11.34% (95% CI: 8.19-15.17%) recorded in this study is higher than the above studies. This disparity between the current report and previous findings could be due to variation in climatic condition and management practices such as confinement, mode of disposal of poultry waste and carcasses and recovery rates of chicken from disease outbreaks [25].

The sero-prevalence of Newcastle disease among the peasant associations significantly varied (\( \chi^2=21.0; \ p=0.00 \)). Highest sero prevalence 20% (95% CI: 12.83-28.93) was recorded at Dima peasant association followed by Tafki 17.1% (95% CI: 9.18-28.03), Jawe 5.7% (95% CI: 1.58-14.0) and Jimjima 2.5% (95% CI: 0.31-8.88). There is no obvious reason why the prevalence is highest in Dima than the others peasant associations. However, Dima peasant association is located near to the market. The proximity of the peasant associations to the market could be the reason for this highest sero-prevalence in Dima peasant association [13].

This study indicates that female 13.5% (95% CI: 9.50-18.5) chickens had higher sero-prevalence of Newcastle disease compared to the male chickens 6% (95% CI: 2.23-12.6). It was however observed that this difference was statistically marginally not significant (\( \chi^2=3.94; \ p=0.05 \)). Related serological studies in Ethiopia made similar observation [13, 14, 16].
Relatively higher overall sero-prevalence rate of Newcastle disease virus in cross chickens 13.9% (95% CI: 6.87-24.1) than in local chickens 10.7% (95% CI: 7.26-15.0) was observed. However, this was not statistically significant ($\chi^2=0.59; p=0.44$) which agrees with the report of Aschalew et al. [16] in Southern Rift Valley areas of the country. Contrasting findings has been reported by Getachew et al. [13] who reported a significant difference ($p=0.00$) in the sero-prevalence between the local (2.7%) and cross (20.3%) breeds of chickens. These differences might be due to variations in the management practices in traditional production systems of the present and pervious study areas. However, issue of breed susceptibility to Newcastle disease is still controversial [4].

No significant difference ($\chi^2=2.01; p=0.16$) was noted in sero-prevalence between young (<6 months) and adult (=6 months) chickens although the former had a relatively lower 7.9% (95% CI: 3.67-14.5) sero prevalence that the later 13% (95% CI: 8.98-18.9). This might be due to more frequent exposure of older birds to field virus, which might have survived the disease at an earlier age [13].

CONCLUSION

The present study showed high sero-prevalence of Newcastle disease virus in backyard chickens in the study area thus considering effects of Newcastle disease on both health and productivity of traditionally managed chickens’ further studies on epidemiology of the disease is recommended.

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REFERENCES


