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Seroprevalence of Foot and Mouth Disease in Cattle in Dessie Zuria and Kombolcha Area, South Wollo, Ethiopia

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Abstract: A cross-sectional study of foot and mouth disease was conducted from November 2009 to April 2010 on apparently healthy cattle in South Wollo, Dessie Zuria and Kombolcha area to determine the seroprevalence of foot and mouth disease in cattle. A total of 286 serum samples were collected from cattle originated from Dessie Zuria and Kombolcha areas. Serological investigation was performed using 3ABC-ELISA test. The overall seroprevalence of FMD infection was found to be 5.59% (16/286). Higher prevalence of 11.1% (4/36) was observed in cattle from Dessie Zuria while the prevalence report from Kombolcha origin was found to be 4.8% (12/250) although, the difference was statistically not significant ($p>0.05$). Seroprevalence recorded among age groups were found to be 6.45% (14/255) in the adult which is higher than the young age group with a prevalence of 5.49% (2/31) and the difference was also statistically not significant ($p>0.05$). The study has indicated that FMD is prevalent in the study area affecting all age groups of cattle as well as breeds which insist further study on the epidemiology of the disease and serotype determination.

Key words: Cattle, Dessie Zuria, FMD, Kombolcha, seroprevalence, 3 ABC ELISA

INTRODUCTION

Foot and mouth disease has been found to be the most contagious disease of cloven-hoofed animals and is one of the most economically important diseases of livestock (Bronsvoort *et al*., 2004). The disease is also called aphtous fever which is characterized by fever and vesicular eruptions in the mouth on the feet and teats. It is caused by virus of the genus *Aphthovirus* in the family Picornaviridae of which there are seven immunologically district serotypes O, A, C, South African Territories (SAT) 1, SAT2, SAT3 and Asia1 (OIE, 2000).

The disease spreads rapidly by movement of infected animals or mechanically on fomites such as clothing, shoes, vehicles and veterinary instruments. The reasons for the rapidity of spread to fully susceptible population is due to the highly infectious nature of the virus the production of high titer in respiratory secretions and the large volumes of droplets and aerosols of virus shed by infected animals the stability of virus in such droplets the rapid replication cycle with very high virus yields and the short incubation period (Sellers and Daggupaty, 1990).

Foot and mouth disease is endemic in sub Saharan Africa widespread outbreaks of clinical disease occur during most years (Vosloo *et al*., 2002). Of the serotypes (except Asia 1) six have reportedly occurred on the continent and disease control becomes more complicated because of marked regional differences in the distribution and prevalence of various serotypes (Knowles and Samuel, 2003).

According to the annual report of Animal Health Division of Ministry of Agricultural in 2000, the incidence of FMD outbreaks has increased by 1.3-1.5 folds since, 1990 (Asfaw and Sintaro, 2000; Mesfin, 2004). The morbidity rate in outbreaks of FMD in susceptible animals can rapidly approach 100% but some strains of the virus are limited in their infectivity to particular species. However, the case fatality is generally very low, about 2% in adults and 20% in young stock. Nonetheless, sever outbreak of a more violent form some times occur in exotic animals with a case fatality of up to 50% in adult cattle (Radostits *et al*., 2000).

Studies in Ethiopia have shown that serotypes O, A, C and SAT2 were responsible for FMD outbreaks between 1974 and 2003 (Gelaye *et al*., 2005) while serotypes O, A and C caused FMD outbreaks in cattle from 1957-1979 (Roeder *et al*., 1994). According to, the annual report of Animal Health Division of Ministry of Agricultural in 2000, the incidence of FMD outbreaks has increased by 1.3-1.5 folds since, 1990 (Mesfin, 2004).

The most important resource in the prevention of FMD is the informed animal owner or manager. Livestock

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owners at all levels of production, dealers and traders should be familiarized with the basic features of FMD including the recognition of the essential signs of the disease the need for urgent action and how and where to seek help if they suspect the disease (Geering, 1984). There is no research work conducted as to the prevalence of foot and mouth disease in the study area and this study was aimed to determine the seroprevalence of the disease in Dessie Zuria and Kombolcha area.

MATERIALS AND METHODS

Study area: The study was conducted from November 2009 to April 2010 in Kombolcha area and Dessie Zuria, South Wollo, North East Ethiopia which is located at 375 km North of the capital city, Addis Ababa. The altitude ranges from 1000-1840 masl. The topography of South Wollo Zone is marked by the presence of numerous mountains, plateaus, hilly and sloppy areas, rivers and lakes. The study area is generally categorized as 14% high altitude (Dega) 34% mid altitude (Woyna Dega) and 52% low altitude (Kolla).

South Zone of Wollo experiences a bimodal rainfall the short and long rains with 39.63 and 1000 mm, respectively. The short rain season in and around Kombolcha occurs usually from March to May. The minimum and maximum mean annual rainfall ranges from 750-900 mm. The average maximum and minimum daily temperature during short and long rains are 23.9° and 11.7°C, respectively and relative humidity of the region varies from 23.9-79%.

The vegetation in the area changes with altitude ranging from scattered free bushes to dense shrubs. The farming system in the area is mixed type crop-livestock production. The major crops grown in the area include sorghum, wheat, teff, barely, maize and others.

Study population: The study animals were randomly selected from cattle population coming to Kombolcha City veterinary clinic (n = 250) from districts namely Kombolcha City, Kalu, Cheffa and in Dessie Zuria veterinary clinic (n = 36) from Dessie Zuria woreda seeking treatment for another related disease conditions. The animals were apparently healthy cattle with adult and young age groups, cross and local breeds included in the study from Dessie Zuria and Kombolcha area.

Sample size determination: The sample size was estimated using Win Episcope 2.0 Improved Epidemiological Software for Veterinary Medicine (Thursfield *et al*., 2001) by assuming the cattle population of the study area which is 100,000. Additionally, expected prevalence of 12.3% (from earlier research at NVI in 2007) absolute precision of 4% and confidence level of 95% were used.

Accordingly, the minimum sample size required was 259 but 286 cattle from the study areas were considered in the study of prevalence of FMD to increase precision.

Study design: A cross sectional study was undertaken from November 2009 to March 2010. During the laboratory work, a total of 286 sera samples collected from herds of Kombolcha City and Dessie Zuria veterinary clinics were examined by using 3ABC ELISA for the detection of FMD antibodies.

Sample collection: Blood samples were collected from the jugular vein of individual animals using plane vacutainer tube of 10 mL capacity. The blood was allowed to clot by putting at room temperature overnight. The sera were harvested on separate tube and labelled with permanent marker on a piece of waterproof adhesive tape attached to each vaccutainer tube and transported using an icebox containing icepacks to the National Veterinary Institute (NVI) immunology laboratory, Debre Zeit. The sera sample then stored at -20°C until laboratory investigation.

Laboratory method

Enzyme Linked Immuno-Sorbent Assay (ELISA): The CHEKIT-FMD-3ABC ELISA kit was used and this was indicated to be rapid, simple, sensitive and specific method for detecting antibodies against the pathogen responsible for FMD in serum samples of bovine origin. In the kit all the necessary reagents for a standard indirect ELISA technique were included with polystyrene microtiter plate pre-coated by recombinant FMD Virus 3ABC protein.

Dilutions of samples to be tested are incubated in the wells. Any antibody specific for 3ABC protein binds to the antigen in the wells. A peroxides labeled anti-IgG-conjugate is added which binds to antibodies of the sample complexed with the antigen. The TMB-containing substrate is added to the wells. The degree of color development, measured by spectrophotometer is directly proportional to the amount of antibody in the sample serum specific to the antigen. In this assay, adequate washing procedures were undertaken in order to remove unbound reagents at each step of the testing procedure.

Statistical analysis: Prevalence was defined as the proportion of the number of cattle positive for anti body against foot and mouth disease virus by the 3ABC ELISA test to the total number of cattle tested which was

expressed in percent. The data collected was entered into MS-Exel and coded for analysis. Association of the prevalence between the two areas, two age groups and two breeds of cattle, Kombolcha City and Dessie Zuria veterinary clinics origin, young and adult and local and cross breeds of cattle was analyzed by χ^2-test. The laboratory investigation for prevalence result was analyzed using statistical package for Intercooled STATA 7.0 Software.

RESULTS AND DISCUSSION

During the study period, 286 cattle were examined for the presence of significant amount of antibody against FMD virus in their blood samples using 3ABC-ELISA test. The animals were from Dessie Zuria veterinary clinic (n = 36) and Kombolcha City veterinary clinic (n = 250) origin adults (n = 255) and young (n = 31) age groups and 165 were local and 121 cattle were cross breeds.

The overall seroprevalence of the disease was found to be 5.59% (16/286). Higher prevalence 11.1% (4/36) was observed in cattle from Dessie Zuria while the prevalence report from Kombolcha origin was found as 4.8% (12/250). The difference in prevalence between the two groups of animals was found to be statistically not significant ($\chi^2 = 2.37$, p = 0.1234) (Table 1).

Seroprevalence recorded among age groups where in adult cattle was found to be 6.45% (14/255) being a little bit greater than that of young age groups with a prevalence of 5.49% (2/31). However, the difference was found to be statistically not significant ($\chi^2 = 0.05$, p = 0.8259) (Table 2).

On the other hand, seroprevalence recorded among the breeds where in local breeds was found to be 5.45% (9/165) being a little bit less than that of young age groups with a prevalence of 5.74% (7/121). Though, the difference was found to be statistically not significant ($\chi^2 = 3.39$, p = 0.728) (Table 3).

Table 1: Seroprevalence of FMD based on origin of cattle

	No. of samples		Serological status		
Origin	N	Percentage	-ve	+ve	Prevalence (%)
Kombolcha area	250	87.41	238	12	4.80
Dessie Zuria	36	12.59	32	4	11.10
Total	286	100.00	270	16	5.59

$\chi^2 = 2.37$, p = 0.1234

Table 2: Seroprevalence of FMD based on age groups of cattle

	No. of cattle examined		Serological status		
Age	N	Percentage	-ve	+ve	Prevalence (%)
Adult	255	89.16	241	14	5.49
Young	31	10.84	29	2	6.45
Total	286	100.00	270	16	5.59

$\chi^2 = 0.05$, p = 0.8259

From this study, the overall seroprevalence of foot and mouth disease in cattle from Dessie Zuria and Kombolcha City veterinary clinics was found to be 5.59% (16/286). The present research revealed that the seroprevalence of the disease in Dessie Zuria (11.1%) is higher than Kombolcha (4.8%). Although, the difference was found to be statistically non significant between cattle from Dessie Zuria and Kombolcha origin, the slight variation in the seroprevalence recorded might be attributed to the difference in production system of the study sites that is in Dessie Zuria almost all farmers use extensive type of production system unlike that of Kombolcha area which is semi intensive type. This extensive production system might contribute a lot for the distribution of the disease condition in the area which brings about a little difference of prevalence in the two study areas. In addition to this, the animal management systems and the sample size may have their own role on this.

The seroprevalence recorded in this study was slightly higher than the previous finding of Bedru (2006) from bulls of Borana and Jimma with a prevalence of 5.53%. However, this finding is lower than the finding of Sahle in which seropositivity of 26.5% was reported from Ethiopia and Tesfaye who had reported a prevalence of 21% in Borana pastoral system. This variation in the prevalence report among the different authors might be due to variation in study site, study methodology, sample size and study population considered.

Radostits *et al*. (2000) indicated that young animals are relatively more susceptible than adult animals even though, the present study revealed that the prevalence of FMD in adult cattle is slightly greater than that of young cattle. This might be due to the small number of the proportion of young cattle of age 8 months to 2 years was considered. Moreover, adult cattle might have repeated exposure and close contact with other animals due to uncontrolled animal movement. According to Mesfin (2004), movement of livestock is not limited across different administrative regions of the country but also across the neighboring countries. This creates a serious problem due to the transmission of various disease causing agents like FMDV. The molecular epidemiology of serotype of FMDV from the 2001 Ethiopian outbreak suggests that there is trans-boundary movement of the viruses between Ethiopia and the neighboring countries.

Table 3: Seroprevalence of FMD based on types of breeds of cattle

	No. of samples		Serological status		
Breeds	N	Percentage	-ve	+ve	Prevalence (%)
Local	165	57.69	156	9	5.45
Cross	121	42.31	114	7	5.74
Total	286	100.00	270	16	5.59

$\chi^2 = 3.39$, p = 0.728

CONCLUSION

The study has indicated that FMD is prevalent in the study area showing the virus is circulating among the population of cattle in the area. Although, higher seroprevalence was recorded in cattle of Dessie Zuria than Kombolcha origin, the disease is wide spread affecting all age groups of cattle as well as breeds.

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