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Sero-Prevalence of Bovine Foot and Mouth Disease in Selected Districts of Eastern Showa Zone, Oromia Regional State, Ethiopia

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Abstract- A cross-sectional study was conducted from September 2014 to July 2015 with the objective of determining sero-prevalence of Foot and Mouth Disease (FMD) in cattle in selected districts of Eastern Showa Zone, Oromia Regional. Blood samples were collected from a total of 634 cattle at Export abattoir, Veterinary Clinics in and around Bishoftu town of Adaa district and Bull screening quarantine station in Adama. The study animals were selected by systematic random sampling and blood samples were collected from jugular vein using sterile vacutainer tube. The blood samples were submitted to the National Veterinary Institute (NVI), and the serum were harvested and processed by using 3ABC-ELISA technique. The current study indicated the overall sero-prevalence of bovine FMD was 10.88% and statistically there were differences (P=0.002) in sero positivity of FMD among animals from Abattoir, Veterinary clinic and Feedlot. The sero-prevalence was higher in animals tested from export abattoirs than those from Feedlot and Clinics.

Keywords: *bovine, FMDV, sero-prevalence, ethiopia, 3ABC-ELISA.*

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Keywords: bovine, FMDV, sero-prevalence, ethiopia, 3ABC-ELISA.

I. Introduction

FMD is one of the major endemic trans-boundary livestock diseases of socioeconomic importance in Ethiopia. It is highly contagious viral disease of both domestic and wild cloven-hoofed animals (FAO 2007). FMD is caused by virus of the genus Aphtho virus which belongs to the family picornaviridae (Shao et al 2010). There are seven serotypes of the virus namely: A, O, C, SAT-1, SAT-2 SAT-3 and Asia 1. Within serotypes, many subtypes identified by biochemical and immunological tests (OIE 2004) and infection with one serotype does not confer immune protection against another. The serotype O, A and C have had the widest distribution in the world (Rweyemamu et al 2008) and serotype A, O, C and SAT_2 are identified and reported from Ethiopia (Gelaye et al 2005).

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The disease has a high morbidity although mortality is rare in adult animals. However, myocarditis may occur in young animals resulting in death. The recovered animals remain in poor physical condition over long periods leading to economic losses for livestock industries (Sangare 2002). The economic importance of the disease is not only due to production loss, but also because of restrictions on the local and international animal trade (James and Rushton 2002).

The transmission of FMD is primarily occurs via respiratory aerosols and direct or indirect contact with infected animals. Aerosol transmission requires proper temperature and humidity. However, in FMD endemic countries, both the respiratory and oral routes are considerably important. Cattle and sheep may be source of the virus up to 5 days before they develop the clinical signs. Small ruminants mostly develop silent or clinically in-apparent infection and play important role in epidemiology or spread of FMD to cattle, (Radostits et al 2000). In addition to live animals, shipment of untreated meat and meat products, milk and semen from infected animals are also factor for FMD virus transmission. The FMDV can survive for 1-2 days in the human respiratory tract, thus potentially spreading to animals (Asseged 2005). Contact with contaminated fomites such as boots, glove, and clothes can also be a source of infection (Sahle 2004).

After initial replication in cornfield epithelia the virus enters the bloodstream through regional lymph nodes (Alexandersen et al 2003). When susceptible animals are in contact with clinically infected animals, clinical signs usually develop in 3 to 5 day (Kitching, 2002). Most of the time virus vesicles develop at skin and mouth than other organs during the acute phase of the disease and rupture, usually within 48 hr. The viremia persists for 4–5 days (Alexandersen et al 2001). The severity of clinical signs of the disease varies with the strain of the virus, the exposure dose, the age, and the breed of the animal, the host species, and its degree of immunity.

In cattle clinical sign of FMD include fever, dullness, anorexia and fall in milk production followed by oral lesion such as vesicle on the tongue, dental pad, gums, soft palate, nostrils or muzzle that lead to excess salivation, drooling and serous nasal discharge. Teat lesion can occur and cause a decrease in milk

production, and hoof lesion in the inter-digital space and on the coronary band are leading to lameness (Sahle 2004).

In Ethiopia, Understanding of the geographic distribution of the disease and serotypes of FMD the virus involved are among important in puts required to initiate control program, furthermore, lack of awareness of the intermediary cattle dealers regarding the risk and the relatively short distance between production and feedlot locations makes the feedlots particularly vulnerable to the introduction of the disease without diagnosis. In general in Ethiopian the current traditional livestock management with uncontrolled movement of animals, attributes to FMDV spread (Megersa et al 2009). Extensive movement of livestock, the high rate of contact among animals in communal grazing areas, watering points and at commercial markets in Ethiopia is major transmission and dissemination factor (Bayissa and Bereda 2009). Different papers were published on FMD in different area of the country but there is no recent published data from the export abattoir and Veterinary Clinics or feedlot of Eastern Showa, particularly in the Bishoftu and Adama cities. Therefore, this study was designed to investigate the Sero-prevalence of bovine FMD from abattoir, veterinary clinic and feedlot in Adaa district and Adama special zone of Eastern Showa zone in Oromia.

II. Materials and Methods

a) Study Area

The study was conducted in selected Abattoirs and Veterinary Clinics in and around Bishoftu and Bull screening quarantine station (for feedlot) in Adama of East Showa zone. Bishoftu and Adama the two main towns of east Showa zone located to the South East of Addis Ababa. Because of closeness to Addis Ababa in both cities there are huge investments on feedlot and dairy activities and also export abattoirs. Bishoftu of the Adana district has an altitude of 1, 860 m.a.s.l. with an average annual rainfall of 866 mm. It has a bimodal rainy seasons; a main rain season extends from the month of June to September and a short rain season from March to May. The annual average minimum and maximum temperature is 11°C and 26°C respectively. Humidity is about 61.3%. Though those animals from Adama feedlot were originally from different parts of the country they were tested after they stayed a minimum of two months at the screening station. Adama the special zone is located at 8°32`N 39 ° 16`E at elevation of 1712m a.s.l. The City sits between the base of an escarpment to the west, and the Great Rift Valley to the east. Adama has a tropical climate of wet and dry season (NMSA, 2011).

b) Study Animals

The study animals were cattle selected from abattoir and veterinary clinics in and around Bishoftu of Adaa, and Bulls screened for export at screening quarantine station in Adama feedlot. Both sexes and different age groups were included the age groups were considered as (≤4years) Young, (4years<x< 10years) Adult and (≥10 years) Old.

c) Study Design

A cross-sectional study was undertaken from November 2014 to July 2015. During the laboratory work, a total of 634 sera samples collected from abattoir, veterinary clinics and feedlot station were examined by using 3ABC ELISA for the detection of FMD antibodies in Selected districts of eastern Showa Zone of Oromia Region.

d) Sample Size Estimation

The sample size was determined according to the formula given by Thrusfield (2005), by considering 14.5% (Alemayehu et al 2014) previous prevalence and absolute desired precision of 5% at confidence level of 95%.

$$n = \frac{1.96^2 pexp\ (1\text{-}pexp)}{d^2}$$

Where: n= sample size, Pexp= expected prevalence=14.5%, d= absolute precision of 5%.

Accordingly the sample size was 191; however, in order to increase precision of the study it was raised by 3.3 folds and a total of 634 animals were included in the study.

III. Study Methodology

a) Sample collection

A total of 634 blood samples were collected from Abattoir, Veterinary clinic and Adama feedlot by using systematic random sampling method. Blood sample was collected from jugular vein of individual animals by using 10 ml of sterile vacutainer tube and labeled with specific field code. Then the blood was allowed to clot by placing it overnight at room temperature. Then the samples were transported to the National Veterinary Institute (NVI) Laboratory by using an icebox for serological examination. The sera sample then stored at - 20°c until laboratory investigation.

b) Serological test

The serological test was conducted for the Sero-prevalence of FMD by using the 3ABC-ELISA. The 3-ABC-ELISA was used according to the manufacturer's instructions. Briefly, the serum was diluted 1/100, added in duplicate to the wells of a 96-well micro-titer plate pre-coated with the vector-expressed viral 3ABC antigen, and incubated for 60 min at 37°C in a humid chamber. Unbound antibody was washed away, and a horseradish peroxidase-labeled guinea pig anti-bovine immunoglobulin G conjugate was added. Unbound conjugate was removed by washing, and the substrate was added and incubated until the difference in the

optical density (OD) reading between the negative and positive controls become greater than or equal to 0.4 (after about 20 min). The OD was determined for each well at 405 nm with an automatic ELISA reader.

c) Data Analysis

Data was entered in to Microsoft Excel and analyzed by using SPSS version 20.0 statistical software. Prevalence differences of the study variables (infection rate, age, sex, geographic origin of the animals and group of animal from which sample collected were analyzed by chi- square and descriptive statistics. A statistically the difference was considered significant when the calculated p-value is less than 0.05 at 95% confidence level.

IV. Results

Out of 634 sera tested using 3ABC ELISA 69 (10.88%) animals were sero-positive for bovine FMDV. The highest prevalence was recorded in animals from export abattoirs (15.5%) whereas the lowest sero-prevalence was recorded in animals from Clinics. Animals from abattoir were found to be more affected than feedlot and Vet. Clinic groups of animals the difference was statistically significant (P=0.002) (Table 1).

Table 1 : Sero-prevalence of FMD in cattle of different groups of the study animals

Animal group	№ of examined	№ Positive (%)	χ^2 (P-Value)
Feedlot	250	17 (6.8)	
Abattoir	303	47 (15.5)	12.843 (0.002)*
Vet. Clinic	81	5 (6.17)	
Total	**634**	**69 (10.88)**	

* Statistical significant

The prevalence of bovine FMD was statistically insignificant among different age groups (P=0.41), Sex (P=0.85) geographical origin (P=0.45) of the study animals (table 2 and 3).

Table 2 : Sroprevalence of FMD in cattle of different age and sex groups

Variables	levels	№ of examined	№ Positive (%)	χ 2 (P-value)
Age	Young	320	30 (9.37)	1.79 (0.41)
	Adult	248	32 (12.90)	
	Old	66	7 (10.60)	
	Total	**634**	**69 (10.88)**	
Sex	Male	623	68 (10.90)	0.04 (0.85)
	Female	11	1 (9.10)	
	Total	**634**	**69 (10.88)**	

Table 3 : Seroprevalence of FMD in cattle of different origin

Variables	Levels	№ of examined	№ Positive (%)	χ 2 (P-value)
Origin	Borena	369	45(12.20)	3.66 (0.45)
	Harar	33	3(9.10)	
	Wallo	44	3(6.80)	
	Bishoftu	82	5(6.10)	
	Adama	106	13(12.26)	
	Total	**634**	**69(10.88)**	

V. Discussion

The present study showed that, the overall sero-prevalence of bovine FMD was 10.88% which was comparable with the findings of Gelaye et al (2009), who reported 12.05% in the Bench Maji zone, Southern Ethiopia, Molla et al (2010), who reported 8.8% in South Omo Zone and Megersa et al (2009), who reported 9.5% in indigenous cattle in Southern Ethiopia. On other hand, the sero-prevalence of bovine FMD in this study was lower than the findings of Rufael et al (2008), who reported 26.5% from Borena pastoral system, Southern Ethiopia, Mekonnen et al (2011), who reported 24.6 % in Borena and Guji Zones, Tesfaye (2006), who reported

21% in Borena pastoral area. This variation of sero-perevance of bovine FMD reported from the different area of the country by different researcher might be due to variation in management system, intervention and agro-climatic condition. However, the sero-prevalence of bovine FMD reported in this study was higher when compared to the previous findings of Bedru (2006), 5.53%, on quarantined bulls for export at Nazareth and Dire Dawa stations; Jenberie (2008), 5.6%, from Afar Regional State and Abunna et al (2013), reported 8.01% from Dire Dawa and its surroundings, Eastern Ethiopia.

In the current study, age group was also considered as risk factor for Sero-prevalence of bovine FMD and the result showed age was statistically insignificant (P= 0.41). This result agreed with the findings of Gelaye et al (2009), who reported no significant association between bovine FMD and age of cattle. This might be because of unequal involvement of different age groups in our sampling where majority of our study animals were young animals due to accessibility. However, contradicting our present finding Mohamoud et al (2011), Molla et al (2010), Gebretsadik (2009) and Kibore et al (2013), reported from different geographical areas that sero-prevalence of bovine FMD was statistically associated with the age of animals. Radostits et al (2000), indicated that young animals are relatively more susceptible than adult animals even though, the present study indicated that higher sero-prevalence in adult (between 4 and 10 years age) than both young (≤4years) and old (≥10years) (table: 2). This variation might be because of the adults and old cattle were acquired the infection through repeated exposure to the different serotypes of the virus and close contact with other animals due to uncontrolled animal movement at market place and communal pasture grazing area, however, young cattle were herded around homesteads and hence may have less chance of exposure to the virus and additionally the prevailing passive maternal immunity may give them protection against the disease (Megersa et al 2009).

The previous findings of Mohamoud et al (2011), in Awbere and Babille districts of Jijiga zone, Somalia Regional State, Eastern Ethiopia; Gelaye et al (2009), from Bench Maji zone, southwestern Ethiopia and Megersa et al (2009), in indigenous cattle in Southern Ethiopia indicated there is no significant difference between sexes in sero-prevalence of FMD in cattle. Supporting these findings our present study also showed statistically no significant difference between sexes in sero-prevalence of bovine FMD (table 2). However, Hailu et al (2010), reported from northwest part of Ethiopia that the incidence of sero-prevalence of bovine FMD was statistically higher in females than in male in cattle. In our present study such variation might be resulted from a very small female to male sampling ratio.

In the current study, though there was no statistical difference (P= 0.45) in sero-prevalence of bovine FMD among the origins of animals, the highest sero-prevalence was found in animals from Borena (12.2%) than animals came from Adama, Harar, Walo and Bishoftu. This might be due to the fact that Borena is found in pastoral area where animal movement is highly uncontrolled. Attributing to this finding Megersa et al. (2009), also reported sero-prevalence of bovine FMD was higher in animals originated from pastoral areas in Ethiopia. The variation in the sero-prevalence of bovine FMD in relation to the origin of animals in this study might be due to differences in animal's production and management system at their geographical origins and also due to the uncontrollable movement of cattle from one border of the country to other border of the country.

The difference in prevalence among the group of animals where sample were collected was statistically significant (P= 0.002) (table1). The highest prevalence was recorded in animals from Abattoirs (15.5%) and the lowest prevalence was recorded in animals from Clinics (6.17%). This variation might be due the fact that animals brought to export abattoirs and feedlot were come from different geographical areas of the country where there was a chance of contact among animals from different zones and districts whereas animals brought to the Clinic come from kebeles surrounding or nearby the study areas.

VI. Conclusion and Recommendations

The present study indicated that, the overall sero-prevalence of bovine FMD at the study area was 10.88%. The highest sero-prevalence was found in cattle slaughtered at abattoirs in Bishoftu than animals include in the study from Veterinary Clinics, and Adama feedlot. Age, sex and origin of the animals were statistically insignificant with sero-prevalence of bovine FMD. The occurrence of bovine FMD in the study area may cause restriction on the trade of animals and animal products internationally. Therefore, Special attention should be given to those areas with higher sero-prevalence of bovine FMD by designing appropriate control measure, including vaccination and restriction of animal movements to minimize further transmission of the disease, animals brought to export abattoirs and feedlots from different localities have to be transported separately in accordance with their geographic origins and further study on FMD virus distribution and transmission should also be conducted.

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