# Seroprevalence of foot and mouth disease in traditionally managed cattle in East and West Hararghe zones, Ethiopia

M. Yahya[1] Z. Hailemariam[2] L.B. Amare[2*] T. Rufael[3]

***Keywords***

Cattle – Foot and mouth disease virus – ELISA – Immunodiagnosis – Morbidity – Ethiopia.

***Summary***

Serological evidence of exposure to foot and mouth disease virus (FMDV) was assessed in traditionally managed cattle in 21 districts of East and West Hararghe zones in Oromiya State, Ethiopia, through a cross-sectional survey conducted between November 2008 and March 2009. Sera collected from 504 cattle were tested for antibodies against FMDV using a commercial ELISA. Antibodies to FMDV were detected at an overall prevalence rate of 11.6% [95% confidence interval (95CI): 8.6–14.5%]. In West Hararghe the seroprevalence was significantly ($p < 0.05$) higher (25.7%; 95CI: 19.6–31.9%) than in East Hararghe (1.4%; 95CI: 0.0–3.3%). Location [odds ratio (OR) 0.87], altitude (OR 0.62), and age (OR 1.12) were found to be significant infection risk factors. Cattle sampled in the lowlands had a significantly ($p < 0.05$) higher FMDV seroprevalence (36.2%) than those in the highlands (3.4%). Furthermore, cattle in districts dominated by agropastoralists and those closer to the pastoral and agropastoral communities of Somali (6.4%) and Afar (21.3–46.1%) regional states showed higher seropositivity. The study found that FMDV circulated in the areas at a relatively low frequency, which may however increase because of unrestricted movement of animals within the region and across borders. Owing to the extensive livestock production system and difficulties in controlling livestock movement, alternative control strategies involving targeted surveillance, enhanced early disease recognition and reporting, and prophylactic vaccination are suggested as feasible options of FMD control in the areas. Further studies are also suggested to ascertain the volume and pattern of livestock movement and characterize the circulating FMDV serotypes in the areas.

## ■ INTRODUCTION

Foot and Mouth disease (FMD) is one of the highly contagious infectious diseases of livestock. It induces severe economic losses to the trade of cloven-hoofed animals and their products. The disease is endemic in Ethiopia and remains largely uncontrolled due to the absence of prophylactic vaccination except for a few dairy herds containing imported breeds (1, 12, 19). Although all regional states that make up the country have long suffered from periodic episodes of FMD epidemics, the disease incidence has increased noticeably in the past two decades. However, only a small percentage of the outbreaks is reported and investigated in Ethiopia, thereby underestimating the actual extent of the disease in the country (4, 19).

Serotypes O, A and C are indicated as the serotypes responsible for the FMD outbreaks observed in Ethiopia over the period 1957–1973 (10). Antibodies to SAT2 were detected in 1971 in sera collected from cattle in North Omo administrative zone, in the south-western part of Ethiopia. During the period 1988–1991, serotyping of FMD virus (FMDV) in samples collected from cattle in Borena area, South Ethiopia, further revealed the presence of FMDV serotypes O and SAT2 (16). Further serological surveys reported detection of FMDV serotypes A, SAT1 and SAT2 from buffaloes in Omo National Park, Southern Ethiopia (19), and serotypes O and A in sera of small ruminants (10, 16, 19).

Any FMD control program requires updating the state of knowledge on the disease epidemiology, including evaluating potential risk factors that are likely to modify the disease incidence, so that appropriate measures can be designed and implemented. The objectives of this study were to determine FMD seroprevalence in

1. Bureau of Pastoral and Agro Pastoral Development, Somali Regional State, Ethiopia.

2. College of Veterinary Medicine, Haramaya University, PO Box 138, Dire Dawa, Ethiopia.

3. National Animal Health Diagnostic and Investigation Center, Ethiopia.

* Corresponding author

Tel.: +251 920 564 940; Fax: +251 255 530 325/331

E-mail: amaexharar@yahoo.com

cattle maintained under traditional husbandry systems in the eastern part of Oromiya Regional State, Ethiopia, and to assess potential factors that favor exposure to the disease.

## ■ MATERIALS AND METHODS

### *Study area*

The study was conducted in East Hararghe (latitude: 7°30'–9°45' N; longitude: 41°10'–42°50' E; altitude: 500–340 m) and West Hararghe (latitude: 7°50'–9°50' N; longitude: 40°00'–41°25' E; altitude: 1200–3060 m) administrative zones which are located on the eastern part of Oromiya Regional State and share boundaries with Somali Regional State, as well as the urban administrative regions of Dire Dawa and Harari (Figure 1).

The livestock population of East Hararghe is estimated at 1,995,072 cattle, 849,956 goats, and 399,273 sheep, whereas West Hararghe has a population of 1,149,089 cattle, 510,164 sheep and goats (East and West Hararghe Zone Bureaus of Agriculture, 2006, unpubl. report).

East Hararghe has 18 *woredas* (district equivalent) of which four are in the lowlands (< 1500 m), and the remaining ones are located at higher altitudinal ranges (> 2000 m). In contrast, West Hararghe is subdivided into 11 *woredas* the majority of which are lowland areas. Both zones have two rainy seasons, the short rainy season and the main rainy season, with a mean annual rainfall ranging from below 700 mm in the lowlands to nearly 1200 mm at higher altitudes. Most of the people living in Hararghe lowlands are nomadic agropastoralists who move their livestock seasonally, following grazing opportunities and water availability (6).

### *Study animals and sample size*

Cattle maintained under traditional husbandry system were used for the study. The sample size was calculated with a 95% significance level and a 5% margin of error. Since no previous information was available on FMD prevalence to provide an estimate of the disease prevalence in the areas, a 50% assumed prevalence was arbitrarily taken, to which were added some extra samples to compensate for possible sample losses. Accordingly, a total of 504 cattle were sampled.

### *Sampling strategy and study design*

To determine FMD seroprevalence, a cross-sectional seroprevalence survey was carried out on traditionally managed cattle from November 2008 to March 2009 in 36 randomly selected peasant associations (PAs) from the 21 *woredas* of East and West zones. In Ethiopia, PA is the lowest level of civil administration, equivalent to a village within a district. Relevant data was also collected simultaneously on potential risk factors, i.e. geographic location, altitude, age and sex. Age was determined based on the dentition

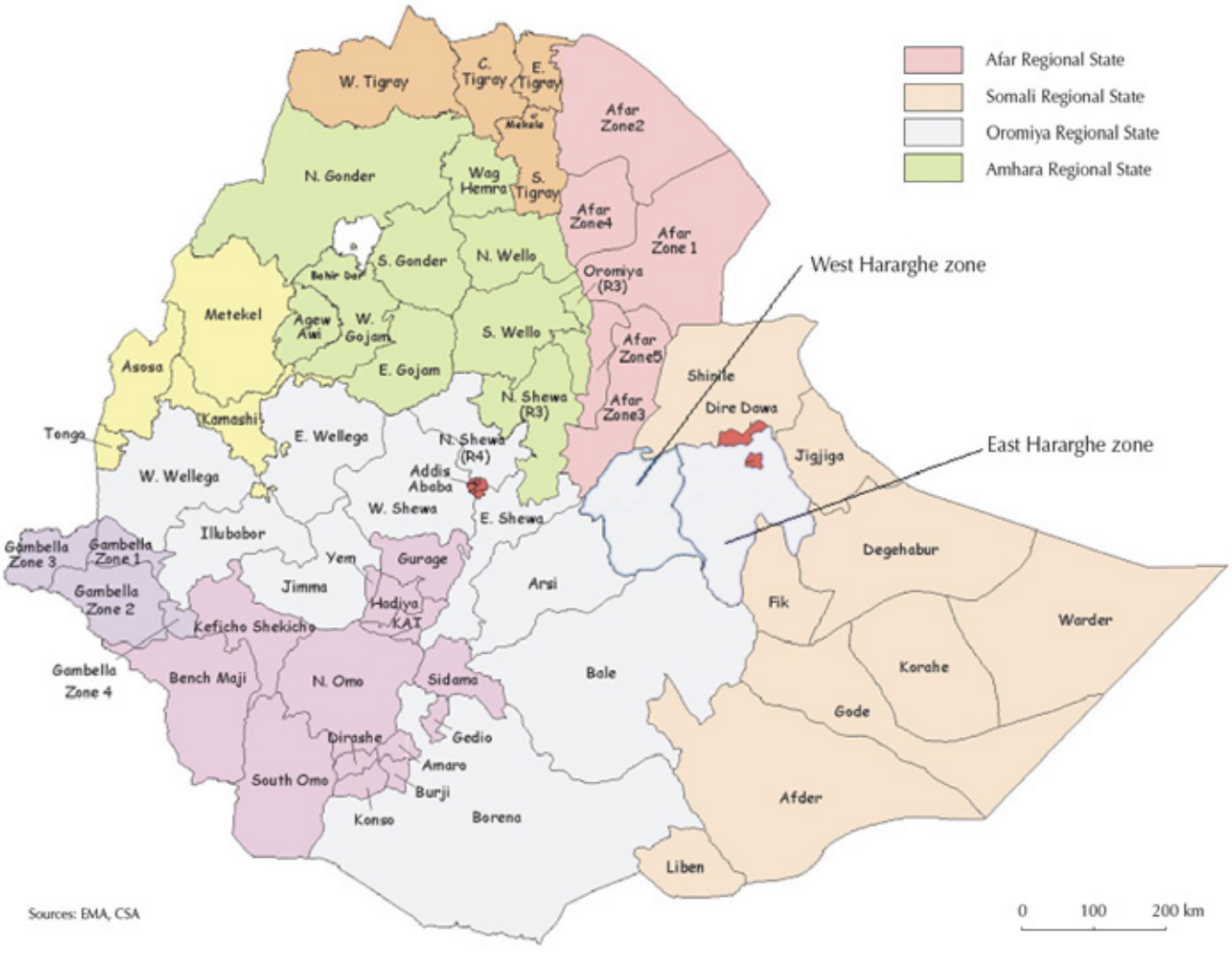


***Figure 1:*** *Map of Ethiopia showing the study areas.*

pattern: cattle were classified as young (under 2 years old), sub-adult (3 to 4 years old), and adult (over 4 years old).

For sampling of the study animals, East and West Hararghe were first selected purposively because of the fact that the status of FMD was not well known in the areas. A lottery method was then applied to select 13 and 8 districts from East and West Hararghe, respectively. A similar approach was followed to select randomly 36 PAs from the 21 districts selected. From the selected PAs, cattle herds were randomly selected and 14 animals were randomly chosen from the selected herds, for a total of 504 cattle head.

### *Sample collection and laboratory assay*

Blood samples were drawn by puncture of the jugular vein using plain sterile vacutainer tubes. They were maintained inclined overnight at room temperature for serum separation. The sera were separated from the clotted blood by simple decantation and transported in an ice box with ice packs to the National Animal Heath Diagnostic and Investigation Center (NAHDIC), Sebeta, Ethiopia. At NAHDIC, each serum sample was transferred into sterile cryovial, labeled with specific laboratory number and stored at -20°C until analysis.

Samples were assayed for antibodies to the nonstructural protein (NSP) 3ABC of FMDV using the commercial SVANOVIR® 3ABC Ab ELISA kit (SVANOVA, Sweden; CEVAN, Argentina). Selection of the test kit was based on its availability at NAHDIC during the time. In addition to its high diagnostic sensitivity (97.2%) and specificity (99.5%), the test differentiates between naturally infected and vaccinated animals (www.svanova.com). Although the test, as other NSP ELISA tests, is reported to lack sensitivity in detecting SAT serotypes by comparison with other serological tests (20), it can detect antibodies to all other FMDV serotypes in previously infected animals, some of which corresponding to persistently infected carriers (1, 15).

Samples were analyzed according to the manufacturer's instruction. In brief, 50 $\mu$l of prediluted control and sample sera were dispensed into the appropriate wells of micro titer plates precoated with FMDV antigen (NSP 3ABC) and control antigens. After sealing the plates with lids and incubating at 37°C for 30 min, the plates were rinsed three times with diluted phosphate buffered saline (PBS) Tween buffer. Then 50 $\mu$l of a reconstituted horseradish peroxidase (HRP) conjugated antibovine IgG was dispensed into each well, and the plates were sealed and incubated at 37°C for 30 min. After rinsing the plate three times with PBS Tween buffer, 50 $\mu$l of substrate solution ABTS-[2,2'-Azinobis (3-ethylbenzothiazoline-6-sulfonic acid)-diammonium salt] were dispensed into each well and incubated for 30 min at room temperature (18 to 25°C) in the dark with timing beginning when the first well was filled. Finally, 50 $\mu$l of stop solution (sulfuric acid) was dispensed into each well and mixed thoroughly.

The optical density (OD) of the controls and samples were measured using a microphotometer (Behring AG, Marburg, Germany) at 405 nm within 15 min of the addition of the stop solution. The OD values of each test serum were corrected ($OD_{Corr}$) by deducting the OD values of the corresponding wells containing the control antigen ($OD_{NSP\ 3ABC}$) ($OD_{NSP\ 3ABC} - OD_{Control} = OD_{Corr}$). The percent positivity (PP) was then calculated for each sample as a ratio of $OD_{corr}$ of the test sample or negative control to the $OD_{corr}$ of the positive control, and expressed as a percentage.

Sera were considered positive if PP was higher than or equal to 48%, and negative if PP was lower than 48%, following the manufacturer's recommendations. True prevalence estimates were derived from the apparent prevalence rate (19).

### *Statistical analysis*

Pearson's chi-square tests were used to detect significant differences in seropositivity among groups. Multivariate logistic regression analysis was used to identify risk factors associated with FMDV-seropositive results, and to calculate the odds ratio (OR) and its confidence interval. Epidemiologic data (location, altitude, sex, and age) were used as independent variables and sero-status as a dependent variable. In all the analyses, the confidence level was set at 95%. Statistical analyses were performed with Stata Statistical Software 9.0 (Stata, 2006, USA).

## ■ RESULTS

### *Seroprevalence of FMD in East and West Hararghe*

The overall FMDV seroprevalence among the 504 cattle was 11.6% [95% confidence interval (95CI): 8.6–14.5] using SVANOVIR® FMDV 3ABC-Ab ELISA test. Cattle positive to anti-FMDV antibodies were detected in 11 of the 21 *woredas* surveyed within both zones. Table I shows that in West Hararghe, Meisso *woreda* recorded the highest prevalence (46.1%), followed by Chiro and Darolebu *woredas* (28.7% each). Table II shows that in East Hararghe, Girawa *woreda* had the highest seroprevalence (10.1%), followed by Babile and Gola-Oda *woredas* (6.4% each). The respective zone-specific seroprevalence rates for East and West Hararghe were 1.4% (95CI: 0.0–3.3) and 25.7% (95CI: 19.6–31.9), with statistical evidence to suggest that FMDV seroprevalence was significantly ($p < 0.05$) higher in West Hararghe than in East Hararghe (Table III).

### *Altitude and seropositivity*

Results revealed a significantly ($p < 0.05$) higher FMDV seroprevalence in animals sampled in Hararghe lowlands (36.2%) than in those from highlands (3.4%) (Table III).

### *FMDV frequency according to age and sex*

There were statistically significant differences ($p < 0.05$) in seropositivity between the three age groups, with adults recording the highest seroprevalence rates (16.3%) and young cattle the lowest (4.7%) (Table III). No significant ($p > 0.05$) difference was noted between the seroprevalence rates of males (8.1%) and females (13.6%) (Table III).

**Table I**

District-level seroprevalence of foot and mouth disease in West Hararghe

| District | Tested | Positive (%) | 95% CI* |
|---|---|---|---|
| Kuni | 42 | 2 (3.9) | 0.0–10.6 |
| Darolebu | 14 | 4 (28. 7) | 4.1–53.4 |
| Meisso | 84 | 38 (46.1) | 35.0–57.2 |
| Boke | 14 | 0 (0) | 0.0–0.00 |
| Chiro | 14 | 4 (28. 7) | 4.1–53.4 |
| Anchar | 14 | 3 (21.3) | 0.0–43.7 |
| Tulloo | 14 | 0 (0) | 0.0–0.0 |
| Gobakoricha | 14 | 3 (21.3) | 0.0–43.7 |
| Zone total | 210 | 54 (25.7) | 19.6–31.9 |

* Confidence interval

**Table II**

District-level seroprevalence of foot and mouth disease in East Hararghe

| District | Tested | Positive (%) | 95% CI* |
|---|---|---|---|
| Melkabelo | 14 | 0 (0) | 0.00–0.00 |
| Deder | 14 | 0 (0) | 0.00–0.00 |
| Gurugutu | 28 | 0 (0) | 0.00–0.00 |
| Fidis | 14 | 0 (0) | 0.00–0.00 |
| Gursum | 28 | 1 (2.7) | 4.5–9.8 |
| Haramaya | 14 | 0 (0) | 0.0–0.0 |
| Babile | 14 | 1 (6.4) | 0.0–20.5 |
| Meta | 56 | 1 (0.8) | 0.0–4.4 |
| Girawa | 28 | 3 (10.1) | 0.0–22.1 |
| Gola-oda | 14 | 1 (6.4) | 0.0–20.5 |
| Kersa | 42 | 0 (0) | 0.0–0.0 |
| Bedeno | 14 | 0 (0) | 0.0–0.0 |
| Malkabal'oo | 14 | 0 (0) | 0.0–0.0 |
| Zone total | 294 | 7 (1.4) | 0.0–3.3 |

* Confidence interval

**Table III**

Seroprevalence and univariate risk factor analysis for foot and mouth disease seropositivity in East and West Hararghe

| Risk factor | Tested | Seroprev. (%) | 95% Confidence interval | |
|---|---|---|---|---|
| Location | | | | |
| East Hararghe | 294 | 1.4 | -0. 4–3.3 | $\chi^2 = 62.69$ |
| West Hararghe | 210 | 25.7 | 19.6–31.9 | $p < 0.0001$ |
| Altitude | | | | |
| Lowlands (< 1500 m) | 126 | 36.2 | 27.4–44.9 | $\chi^2 = 88.04$ |
| Highlands (> 2000 m) | 378 | 3.4 | 1.3–5.5 | $p < 0.0001$ |
| Sex | | | | |
| Male | 183 | 8.1 | 3.8–12.3 | $\chi^2 = 3.00$ |
| Female | 321 | 13.6 | 9.6–17.5 | $p > 0.05$ |
| Age | | | | |
| < 2 years (young) | 128 | 4.7 | 0.6–8.8 | |
| 2-4 years (subadult) | 160 | 10.7 | 5.6–15.8 | $\chi^2 = 9.87$ |
| > 4 years (adult) | 216 | 16.3 | 11.1–21.5 | $p < 0.05$ |
| Total | 504 | 11.6 | 8.6–14.5 | |

### *Analysis of risk factors*

The geographic location, altitude, age and sex were explored as potential risk factors related to FMDV seroprevalence in the study areas. Multivariate logistic regression analyses showed the location (OR 0.87), altitude (OR 0.62) and age (OR 1.12) were significant risk factors to exposure (Table IV).

**Table IV**

Findings of the multivariate logistic regression analysis for geographic location, altitude and age with respect to seroprevalence for foot and mouth disease

| Risk factor | Coefficient | Odds ratio | P > \|t\| | 95% CI* |
|---|---|---|---|---|
| Geographic location | -0.1429 | 0.87 | 0.001 | 0.80–0.94 |
| Altitude | -0.4816 | 0.62 | 0.000 | 0.57–0.67 |
| Age | 0.1165 | 1.12 | 0.000 | 1.06–1.19 |
| Constant | 0.2981 | 1.35 | 0.000 | 1.23–1.48 |

* Confidence interval

Numb. of observations = 504; Prob. > F = 0.0000; $R^2 = 0.36$; Adj. $R^2 = 0.36$

## ■ DISCUSSION

An adequate FMD control program requires consideration of the specific characteristics of the disease in different ecosystems. Although available evidence suggests that Oromiya Regional State is endemic for the disease (4) (Gelagay, 2008, unpubl. report; http://borlaug.tamu.edu/files/2012/03/Plan-for-Foot-and-Mouth-Disease-surveillance-in-Ethiopia.pdf), a large part of the region has not been assessed by national FMD serosurveillance programs. The results of this study, based on serological responses, confirmed our suspicion that FMDV is circulating in East and West Hararghe.

Considering the ability of SVANOVIR® FMDV 3ABC-Ab to detect antibodies to circulating serotypes, despite its reported lack of sensitivity in detecting SAT serotypes (20), and the high diagnostic sensitivity of the test (98–100%) that permits early detection of infected animals and its high specificity (97.0–100.0%) that minimizes false positive results (http://www.biozol.de/file.php?id=18898), the 11.6% overall seroprevalence rate reported in the present study can be considered as a reasonably accurate estimate of the actual prevalence of FMDV infection in the studied areas. This prevalence is higher than those reported for Afar Regional State (5.6%) (9), and the South Omo zone in Southwestern Ethiopia (8.18%) (13), but lower than those reported for the Bench Maji zone of Southwestern Ethiopia (12.08%) (5), Borena plateau and Guji highlands of Southern Ethiopia (24.6%) (8), all using 3ABC-ELISA, and Northwestern Ethiopia using Ceditest FMD ELISA (14.55%) (11). These differences in seropositivity might be explained by differences in (i) the diagnostic tests employed, (ii) the sampling method, demographics of the surveyed cattle population, and (iii) husbandry systems, the geographic structure and timing of infection. The seroprevalence noted in this study was similar to the mean seroprevalence (10.5%) of nine administrative states of the country – Addis Ababa, Afar, Amhara, Benishagul, Gambella, Oromiya, Southern Nations, Nationalities

and Peoples Region (SNNPR), Somali, and Tigray – as determined by SVANOVIR ELISA (Gelagay, 2008, unpubl. data).

This study also showed that location, altitude and age were significant risk factors for exposure to FMDV. The statistically significant ($p < 0.05$) prevalences between East and West Hararghe could be explained by the fact that husbandry practices and cross-border movements were different in each area. The main husbandry system practiced in many of the surveyed districts in West Hararghe is extensive with free animal movement, which favors conditions for the spread of FMDV compared to the more sedentary and more confined husbandry system in many of the surveyed districts of East Hararghe. In addition, West Hararghe incurs the free and unrestricted flow for grazing of animals from neighboring agropastoral and pastoral Somali and Afar states, which may have contributed to the high prevalence noted. By contrast, movement of animals from neighboring Somali Regional State into East Hararghe highlands is limited, which was perhaps an additional factor that contributed to the lower prevalence noted. Meisso District, where agropastoralism and pastoralism are the sole production systems, revealed the highest seroprevalence in the survey.

In Ethiopia, the movement of livestock between states and across international boundaries, which favors the exchange and spread of various pathogens, is common. This phenomenon has been confirmed by molecular epidemiological studies of virus serotypes from the 2001 Ethiopian FMD outbreaks (18). Other studies also report that the movement of herds in search of pasture and water from one area to another is a significant risk factor for the occurrence of FMD (3, 7, 12).

Gelagay (unpubl. data, 2008) observed significant variations in the prevalence of FMD between pastoral (14.5%; 95CI: 13.2–15.8) and highland mixed farming systems (6.38%; 95CI: 5.4–7.3). In the present study, we observed a slightly higher seropositivity in districts closer to the migratory pastoral communities of Afar (21.3–46.1%) and Somali (6.4%) states than in the interior districts. This fact suggests a possible association between important livestock movement and FMD transmission. However, further studies are necessary to assess how seasonality and differences in resource availability affect animal movements and disease circulation. Such knowledge may be used as preliminary information to predict potential areas of FMD presence in order to design action plans to prevent spreading of the disease.

The present study showed a significantly higher prevalence ($p < 0.05$) in the lowlands than in the highlands in the sampled animals. The logistic regression showed the altitude was a significant risk factor to FMD occurrence. In the Ethiopian lowlands, animals have to trek long distances for hours between watering points and grazing areas, which leads to enhanced contact and transmission of FMDV between animals of different origins.

An age effect was also observed in the present study and confirms what has been observed in previous studies (5, 13, 14). The lowest prevalence was found in animals less than two years of age and increased about three fold in animals older than four years revealing that age was also a significant risk factor. Possible reasons to explain these differences are the prevailing passive maternal immunity in young animals that are usually maintained near encampment, and the higher probability for infection with increasing age due to repeated exposures to the virus.

## ■ CONCLUSION

The present study suggests that foot and mouth disease virus is circulating in the East and West Hararghe zones of Eastern Oromiya Regional State, though at different levels of frequency. Although the prevalence detected was lower than that reported in other areas of the country, it could increase under the effect of uncontrolled movements within the country and across borders. According to the extensive livestock movement pattern, prioritized and alternative control and surveillance strategies such as targeted surveillance, early disease recognition, rapid disease reporting system and possibly prophylactic vaccination of targeted populations are needed. In addition, understanding the volume and pattern of livestock movement and associated risks are fundamental in elucidating the epidemiology of the disease. Further studies are also necessary to ascertain and characterize the extent of circulating FMDV serotype(s) in the livestock population of these areas.

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## *Résumé*

**Yahya M., Hailemariam Z., Amare L.B., Rufael T.** Séroprévalence de la fièvre aphteuse dans les élevages traditionnels des zones Est et Ouest du Hararghe, Ethiopie

Des traces sérologiques d'exposition au virus de la fièvre aphteuse (VFA) ont été analysées chez des bovins conduits traditionnellement dans 21 districts des zones Est et Ouest du Hararghe dans l'état régional d'Oromia, en Ethiopie, par le biais d'une enquête transversale menée entre novembre 2008 et mars 2009. Les sérums prélevés à partir de 504 bovins ont été testés pour les anticorps contre le VFA à l'aide d'un Elisa commercial. Les anticorps dirigés contre le VFA ont été détectés à un taux de prévalence global de 11,6 p. 100 [intervalle de confiance à 95 p. 100 (IC95) : de 8,6 à 14,5 p. 100]. Dans Hararghe Ouest, la séroprévalence a été significativement ($p < 0,05$) plus élevée (25,7 p. 100 ; IC95 : de 19,6 à 31,9 p. 100) que dans Hararghe Est (1,4 p. 100 ; IC95 : de 0,0 à 3,3 p. 100). Le lieu [*odds ratio* (OR) 0,87], l'altitude (OR 0,62) et l'âge (OR 1,12) se sont révélés être des facteurs importants de risque d'infection. La séroprévalence du VFA a été significativement ($p < 0,05$) plus élevée (36,2 p. 100) chez les bovins des basses terres que chez ceux des régions montagneuses (3,4 p. 100). En outre, les bovins des districts où prédominaient les agropasteurs et ceux plus proches des communautés pastorales et agropastorales des états régionaux du Somali (6,4 p. 100) et de l'Afar (de 21,3 à 46,1 p. 100) ont présenté une séropositivité plus élevée. L'étude a révélé que le VFA circulait dans ces zones à une fréquence relativement faible qui pouvait toutefois augmenter en raison des mouvements libres des animaux dans la région et au-delà des frontières. Compte tenu du système de production extensif de l'élevage et des difficultés à contrôler le mouvement du bétail, des stratégies de lutte alternatives impliquant une surveillance ciblée, le renforcement de la reconnaissance précoce de la maladie et de sa déclaration, ainsi que la vaccination prophylactique sont proposées comme options possibles de contrôle de la FA dans ces régions. D'autres études sont également recommandées pour déterminer le volume et la structure des mouvements du bétail, et pour caractériser les sérotypes du VFA circulant dans ces zones.

***Mots-clés :*** Bovin – Virus de la fièvre aphteuse – Test Elisa – Immunodiagnostic – Morbidité – Ethiopie.

## *Resumen*

**Yahya M., Hailemariam Z., Amare L.B., Rufael T.** Seroprevalencia de la fiebre aftosa en ganado bajo manejo tradicional en las zonas este y oeste de Hararghe, Etíopia

Se estudió la evidencia serológica de exposición al virus de la fiebre aftosa (FMDV) en ganado bajo manejo tradicional en 21 distritos de las zonas este y oeste de Hararghe en el estado de Orimiya, Etíopia, a través un estudio transversal, llevado a cabo entre noviembre 2008 y marzo 2009. Sueros colectados de 504 animales fueron controlados usando ELISA comercial. Se detectaron anticuerpos contra FMDV con una tasa de prevalencia general de 11,6% [intervalo de confianza de 95% (IC95): 8,6–14,5%]. En Harargue del oeste, la seroprevalencia fue significativamente ($p < 0,05$) más alta (25,7%; IC95: 19,6–31,9%) que en Harargue del este (1,4%; IC95: 0,0–3,3%). Ubicación [*odds ratio* (OR) 0,87], altitud (OR 0,62) y edad (OR 1,12) demostraron ser factores de riesgo significativos. El ganado controlado en las tierras bajas presentó una seroprevalenia de FMD significativamente ($p < 0,05$) mayor que los de las tierras altas (3,4%). Aún más, el ganado en los distritos dominados por agro pastoralismo y en aquellos cercanos a las comunidades pastorales y agropastorales de los estados de Somali (6,4%) y Afar (21,3–46,1%) mostraron una mayor seropositividad. El estudio encontró que el FMDV circuló en las áreas con una frecuencia relativamente baja, la cuál puede sin embargo aumentar debido a movimientos no restringidos de los animales dentro de la región y a través de las fronteras. Debido al sistema de producción de ganado extensivo y a dificultades en controlar el movimiento del ganado, se sugieren estrategias alternativas de control, involucrando supervisión enfocada, mejoramiento de la detección y reporte tempranos de la enfermedad, y vacunación profiláctica, como opciones factibles para el control de la fiebre aftosa en estas áreas. Se sugieren también estudios ulteriores para confirmar el volumen y patrón del movimiento del ganado y caracterizar la circulación del FMDV en estas áreas.

***Palabras clave:*** Ganado bovino – Virus de la fiebre aftosa – ELISA – Inmunodiagnóstico – Morbosidad – Etíopia.