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Sero-prevalence, risk factors and distribution of foot and mouth disease in Ethiopia

Nejash Abdela

School of Veterinary Medicine, College of Agriculture and Veterinary Medicine, Jimma University, P. O. Box. 307 Jimma, Ethiopia

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ABSTRACT

Foot and mouth disease (FMD), world's most important highly infectious and contagious trans-boundary animal diseases, is responsible for huge global losses of livestock production as well as severe impacts on international trade. This vesicular disease is caused by foot and mouth disease virus of the genus Aphthovirus, family Picornaviridae. Currently FMD is major global animal health problem and endemic in Africa including Ethiopia. This paper systematically reviewed the sero-prevalence reports, associated risk factors and distribution of FMD in Ethiopia with the main aim of making compressive document on prevalence, risk factor and distribution of the disease thus helping as a basis for designing effective control strategies. FMD is widely distributed in Ethiopia and its prevalence varies from place to place with seropositivity that ranges from 5.6% to 42.7% in cattle and from 4% to 11% in small ruminant and in 30% in ungulate wildlife. In Ethiopia endemic distributions of five of seven serotypes, namely serotypes O, A, C, SAT1 and SAT2 have been documented. The dominant serotype being reported recently is serotype O and serotype C has not been reported in the country since 1983. However, serotype C specific antibody was detected in cattle indicating that circulation of serotype C viruses in the country may have gone unnoticed. The most common risk factor associated with FMD infection in Ethiopia includes production system, geographic location, species, age of animals, contact with wildlife and season of the year, mixed animal species and Breed. Conclusively, this paper revealed as FMD is posing a major threat in different area of the country thereby causing substantial economic losses through morbidity, mortality and restriction of international trade. Thus, demanding for great attention as its occurrence is may affect the export earnings of the country thereby threaten the livelihood of farmers and economy of the country at large.

Contents

1. Introduction

Agriculture represents the backbone of the Ethiopian economy by contributing up to 45% to the total GDP and by employing about 78% of the workforce in the country (Martins, 2014). Ethiopia has

E-mail address: nejash.abdela@gmail.com

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the largest the largest livestock population in Africa with Cattle being the dominant livestock species accounting for approximately 54 million heads (CSA, 2013). According to Behnke and Metaferia (2011) livestock contribution to the national economy is estimated at 19% of the total GDP, 45% of the agricultural GDP, and about 20% of the country's export earnings. The contribution of livestock to the national economy particularly with regard to foreign currency earnings is through exportation of live animal, meat and skin and hides (Ayele et al., 2003).

Despite having the largest the largest livestock population in Africa, the country is not benefiting from this sector as development of this sector is hampered by different constraints that include wide spread endemic disease caused viral, bacterial, and parasitic infestation, Lack of appropriate disease control policy and lack of appropriate veterinary services and lack of attention from government. Livestock diseases are among the important technical constraints that have hindered the development of the sector by decreasing production and hampering trade in animal and animal products. (Jilo et al., 2016; Abdela, 2016). Among health constrain infectious and contagious trans boundary animal diseases like Foot and mouth disease (FMD) is endemic and has major socio-economic significance in the country as witnessed by (Molla et al., 2010; Bayissa et al., 2011; Jenbere et al., 2011; Mekonen et al., 2011; Mohamoud et al., 2011; Ayelet et al., 2012; Abunna et al., 2013; Yahya et al., 2013; Alemayehu et al., 2014; Desissa et al., 2014; Duguma et al., 2014; Zerabruk et al., 2014; Beyene et al., 2015; Belina et al., 2016; Tesfaye et al., 2016; Mishamo, 2016; Wagari 2016).

Foot and mouth disease (FMD), which is also known as Aphthous fever, is the disease caused by foot and mouth disease virus (FMDV) of the genus Aphthovirus, family Picornaviridae (OIE, 2012a,b; Margo et al., 2013). It is a highly contagious trans-boundary disease that affects all cloven hoofed domestic and wild animals (Andrews et al., 2004; FAO, 2007; Margo et al., 2013). Few, if any, animal diseases have a greater impact than foot-and-mouth disease (FMD).it is one of the world's most important highly infectious animal diseases that is responsible for huge global losses of livestock production, enormous control costs and severe impacts on trade, as well as frequent and highly disruptive large-scale epidemics (Margo et al., 2013; Jemberu et al., 2015; Knight-Jones et al., 2016).

There are seven different serotypes of FMD, each with a diversity of topotypes, genetic lineages and strains, namely: O, A, C, South African Territories (SAT) 1, SAT 2, SAT 3, and Asia 1 (OIE, 2012a,b; Brito et al., 2015). Serotypes O and A are widely distributed, whereas serotypes SAT 1, SAT 2, and SAT 3 are normally restricted to Africa, and serotype Asia1 to Asia (Jemberu et al., 2015). FMDVs are endemic in Ethiopia since its first recorded in 1957 (Gulima, 2011) and a large number of outbreaks are reported every year (Ayelet et al., 2012). Endemic distributions of five of seven serotypes of FMDV are maintained in the country and Serotypes O, A, C, SAT1 and SAT2 were responsible for FMD outbreaks during 1974–2007 (Sahle et al., 2004; Gelaye et al., 2005; Ayelet et al., 2008; Legess, 2008; Ayelet et al., 2009; Negusssie et al., 2010). Recently Jemberu et al. (2015) identified as serotypes O, A, SAT 2 and SAT 1 were the causal serotypes of the outbreaks during the year 2007–2012. Serotype is O the most dominant serotype in the country (Jemberu et al., 2015; Ayelet et al., 2009).

The sero-prevalence investigations undertaken so far in the country reported the prevalence that ranges from 5.6% to 42.7% in cattle (Bayissa et al., 2011; Jenbere et al., 2011; Mekonen et al., 2011; Mohamoud et al., 2011; Ayelet et al., 2012; Abunna et al., 2013; Yahya et al., 2013; Desissa et al., 2014; Zerabruk et al., 2014; Duguma et al., 2014; Alemayehu et al., 2014; Beyene et al., 2015; Belina et al., 2016; Tesfaye et al., 2016; Mishamo, 2016; Wagari 2016). The prevalence in small ruminants ranges from 4% to 11% (Sahel, 2004; Beyene et al., 2015) and in 30% in ungulate wildlife (Sahel, 2004).

The studies conducted so far did not cover all corners of the country. However, this vesicular disease is widely distributed in Ethiopia and its prevalence varies from place to place. Recent serological investigation conducted in southern part of Ethiopia (Bayissa et al., 2011; Mekonen et al., 2011; Tesfaye et al., 2016), Western Ethiopia (Desissa et al., 2014; Beyene et al., 2015), central part of Ethiopia (Alemayehu et al., 2014; Wagari, 2016; Belina et al., 2016; Mishamo, 2016), Northern (Zerabruk et al., 2014), Southwest Ethiopia (Gelaye et al., 2009; Molla et al., 2010); Northeast (Shiferaw et al., 2010; Jenbere et al., 2011), Northwest Ethiopia (Mazengia et al., 2010), Eastern Ethiopia (Mohamoud et al., 2011; Abunna et al., 2013; Yahya et al., 2013) and different regions of the country (Ayelet et al., 2008; Ayelet et al., 2009; Negusssie et al., 2010), showed that FMD is posing a major threat in different are of the country thereby causing substantial economic losses through morbidity and mortality. Furthermore, FMD is the most important livestock disease in terms of economic impact on export earnings; about US$ 71026.8 losses is documented by Wagari (2016). According to Alemayehu et al. (2014) in the year 2011 the total annual economic loss due to bulls rejection from international market was estimated to be 3,322,269 USD which is equivalent to 56,345,682.24 ETB (1 USD = 16.96 ETB).

Despite the above situations of FMD in the country there is paucity of comprehensive well documented information that may help in knowing the disease current status at nation level. Therefore, the main objective of this manuscript were to systematically review the sero-prevalence reports from studies undertaken so far with its distributions and risk factors thus, helping as a basis for designing effective control strategies.

2. Sero-prevalence and distribution of FMD in Ethiopia

From historical perspective Foot and mouth disease was first recorded in Ethiopia in 1957 (Gulima, 2011). In Ethiopia reports indicated that during the period of 1957–73, 62 outbreaks of serotype O, 24 of serotype C and 12 of serotype A were recorded (Berson et al., 1972). From record of outbreak investigation in cattle by National Veterinary Institute, between 1982 and 2000, three serotypes: O, A and SAT2 FMDV were identified (Gelaye et al., 2001). Currently FMD is widely prevalent and distributed in all areas of Ethiopia, although the level of the disease prevalence may show significant variations across the different farming systems and agro-ecological zones of the country. Previously the disease used to occur frequently in the pastoral herds of the marginal lowland areas of the country. However, this trend has been changed and currently the disease is frequently noted in the highlands of the country (Tefera, 2010).

Endemic distributions of five of seven serotypes of FMDV are maintained in the country and Serotypes O, A, C, SAT1 and SAT2 were responsible for FMD outbreaks during 1974–2007 (Sahle et al., 2004; Gelaye et al., 2005; Ayelet et al., 2008; Legess, 2008; Ayelet et al., 2009; Negusssie et al., 2010). The most dominant serotype is O, accounting for 72% of the investigated outbreaks occurring in the country, followed by A (19.5%) and Serotype C has not been reported in Ethiopia since 1983 (Ayelet et al., 2009). However, a serotype C specific antibody was detected in cattle (Sahel, 2004; Gelaye et al., 2005; Legess, 2008; Rufael et al., 2008) indicating that circulation of serotype C viruses in the country may have gone unnoticed (Rufael et al., 2008).

Recently Jemberu et al. (2015) identified as serotypes O, A, SAT 2 and SAT 1 were the causal serotypes of the outbreaks during the year 2007–2012. In the past seven years (2009–2015) on average 93 numbers of FMD outbreaks were reported to MoLF annually. The