

# Sero-prevalence of Foot and Mouth Disease in Both Small and Large Ruminants in Pakistan

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## ABSTRACT

Foot and Mouth Disease (FMD) is the most prevalent viral disease in cloven-footed animals. FMDV has seven serotypes O, A, C, Asia-1, SAT-1, SAT-2, and SAT-3. The oral cavity, udder, heart, feet, and oro-pharynx are the main sites of replication of FMDV. For the effective control of FMD, we require sensitive and specific diagnostic tools. It is noted that from January to March, a rise in disease outbreaks happened, mainly associated with the movement of livestock during the days of Eidul-Azha. Age, sex, and species are the factors that are associated with the outbreaks of FMD antibodies. FMD mainly causes salivation, anorexia, fever, and vesicular eruption in the mouth, teats, and feet. FMD followed by a decrease in the production of milk, meat, and other animal by-products. Different techniques like Sandwich ELISA, Indirect ELISA, and rt-PCR are used to diagnose this prevalent disease.

### Introduction

Foot-and-mouth disease (FMD) is mainly a disorder of wild and domesticated cloven-footed animals that results in severe losses through mortality, morbidity, and trade restrictions caused by a virus known as *Aphthovirus*, belonging to the family *Picornaviridae*. The smallest virus of animal origin. It is a small enveloped, positive sense RNA genome with seven serotypes: O, A, C, Asia-1, and SAT 1-3. [1]. (FMD) poses a huge threat to livestock across the world, resulting in great economic losses for dairy and the farming industries. This impact is particularly pronounced in low- and middle-income countries like Pakistan, where livestock plays a fundamental role in the agricultural-based economy. This disease affects small ruminants like sheep and goats and large ruminants like cattle.

However, this disease is in-apparent and self-limiting in sheep and goats. Carriers of the FMDV may include sheep and goats. FMD is endemic in Pakistan and three serotypes (A, O, Asia-1) cause outbreaks in cattle and buffaloes [2]. Nomadic livestock populations in Baluchistan and illegal trade of livestock animals across Pakistan's borders result in the ongoing circulation of this FMDV (Foot and Mouth disease virus) in those areas. Although both small and large ruminants are reared together in Pakistan, few outbreaks have been reported in goats and sheep [3].

### Prevalence in Pakistan

Foot and Mouth disease is one of the most prevalent viral diseases of animals in Pakistan affecting many large ruminants. The prevalence of FMD is very common in communal grazing and mixed production systems. However, FMD outbreaks in goats and sheep still remain infrequent and underreported [4]. Small ruminants' population is larger than large ruminants, however; The national project determined at controlling FMD in Pakistan focuses only on the vaccination and the sero-surveillance in bovines, ignoring the role of small ruminants in FMD transmission. Sero-prevalence was recorded in sheep and goats against FMD in this study to understand their potential role in the epidemiology of FMD [5]. It is required to observe the role of sheep and goats to gain complete knowledge about the prevalence of FMD in Pakistan [5].

Disease has also been reported in small ruminants in addition to large ruminants in Pakistan [6]. However, this disease mostly goes undiagnosed in animals because there are very few or mild signs of disease in the affected animals [7]. Non-structural protein ELISA (NSP ELISA) test was performed to detect NSP antibodies which is easy to perform for serological surveillance [8,9]. It can also detect 3ABC antibodies which are present in more concentration than other NSPs [10]. Moreover, these observations show little viral activity of FMD in small ruminants which is confirmed by ELISA. About 28.2% seroconversion of FMDV NSP was recorded, ranging between 11.8% and 32.9%, in various parts of Pakistan [5]. In the same manner, 21% seroconversion was noticed in recently conducted studies in three different districts that are Faisalabad, Khanewal, and Chakwal [11].

In this study goats (25.8%) had higher seroprevalence than sheep (14.3%). Similarly, Nigeria reported higher seroprevalence in goats (15%) than in sheep (9.3%) [12]. This difference in seroprevalence is probably due to the difference in FMDV susceptibility between these species. This may also be due to differences in the behavior of FMDV in both animals. Additionally, the persistence of experimentation is less in goats than in sheep [13]. Overall, observations indicated that small ruminants (sheep and goats) may act as reservoirs of FMDV kept near large ruminants and can also be a possible source of infection for other susceptible livestock [5]. But one thing is that

still large-scale study is still required to consider thoroughly the prevalence of this disease in Pakistan.

### Pathogenesis

Infection occurs in the respiratory tract of cattle, replicates in the pharynx [14], and then proceeds to the epithelium of mucosa-associated lymphoid tissues of the nasopharynx [15]. First of all, FMD vesicles are formed due to viral replication in the stratum spinosum, followed by the rupturing of cells resulting in the formation of small cavities in the epithelial layer. This process goes on proceeding 24 hours and results in the generation of a lot of viral cells in the epithelial layer. The virus also propagates toward the lymphatics [16] and then enters the blood [17], organs, and other tissues of the body like the epithelium of the mouth, coronary band, dental pad, interdigital space of hoof, teats, mammary glands, and snout(pigs) [18]. Udder lesions may proceed towards mastitis in case of secondary infection [19].

### Clinical Signs and Symptoms

FMD is severe in cattle and pigs while mostly remains undiagnosed in sheep and goats. Both anorexia and fever (about 41C) in both cattle and pigs. Vesicles along with fever around the feet, around the mouth, and between the toes, particularly in the tongue, on the lips, in interdigital space, and on the coronary groove [18]. Sudden drop in milk production in case of mastitis in lactating females. In goats and sheep, lesions are less visible or clear than in large ruminants with variable clinical signs [20,21]. Symptoms of vesicles especially on the feet and in the mouth are similar in both wild animals and domesticated livestock [19]. FMD also causes myocarditis, loss of reproductive ability, and chronic heat intolerance, which have received little attention [22].

### Treatment and Control

Treatment is allowed only in those countries in which FMD is endemic. Vaccination, good infrastructure, well-equipped laboratories, and skilled veterinary staff are required to control FMD effectively [19]. Disinfection of infective premises intensified surveillance, and vaccination is required to stop FMD from further propagation. However, in endemic settings, the outbreaks of new viral strains result in difficulties during disease control. If these strains can dominate previous immunity, control becomes more difficult. Different vaccines are used for this purpose, but these can protect animals from those serotypes from which these vaccines have been prepared. In this way, we can stop the propagation of FMD. However, vaccination is the most effective way for control of FMD [19,23].

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