International Journal of Agriculture and Biosciences 2025 14(2): 252-257.
https://doi.org/10.47278/journal.ijab/2024.217

RESEARCH ARTICLE
eISSN: 2306-3599; pISSN: 2305-6622

Knowledge, Attitudes and Practices of Smallholder Farmers Regarding Foot and Mouth Disease in Cattle in Punaga Village, Takalar Regency: A Descriptive Study

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ABSTRACT

Foot and Mouth Disease (FMD) is a serious problem capable of causing significant economic losses to farmers. Therefore, this study aimed to provide an overview of knowledge, attitudes, and practices (KAPs) of smallholder farmers regarding FMD in Punaga Village, Takalar Regency, as well as assess the awareness about the etiology, treatment, and control measures. Data were collected from 48 farmers through a questionnaire covering KAPs related to FMD and analyzed descriptively. The results showed the overall score for Knowledge was 5.7±0.16, Attitude and Practice was 2.02±0.29 and there was a significant association between knowledge level and education level of the respondents ($P<0.05$). Furthermore, respondents with low education were approximately 70% less likely to have high knowledge compared to those with medium education. Although most respondents had experience on FMD and were aware of the potential of FMD to cause livestock death and agreed with the necessary control measures such as self-quarantine and the necessity of routine veterinary visit, all farmers still had a high interest in obtaining further information about this disease, particularly regarding the treatment and prevention. The results are expected to provide valuable insights for designing more effective FMD intervention programs in the region, considering the importance of improving knowledge as well as changing the attitudes and practices of farmers.

Keywords: Foot and Mouth Disease, Knowledge, Smallholder Farms, South Sulawesi

Article History
Article # 24-895
Received: 15-Oct-24
Revised: 14-Dec-24
Accepted: 24-Dec-24
Online First: 08-Jan-25

INTRODUCTION

Foot and Mouth Disease (FMD) is known to affect cloven-hooved animals such as cattle, sheep, goats, pigs, and deer (Li et al., 2022). This highly contagious acute disease is caused by a virus from the Picornaviridae family, specifically the Aphthovirus genus, recognized for being small in size and lacking an envelope (Alexandersen et al., 2003). FMD virus is classified in seven serotypes (O, A, C, SAT 1, SAT 2, SAT 3, and Asia 1) (Tesfaye et al., 2020) that vary in their genetic and antigenic characteristics (Zhang et al., 2021). The virus spreads to various organs supporting its replication, including the udder, heart, foot, tongue and oropharynx (Sarsana & Merdana, 2022). The symptoms of FMD include fever, hypersalivation, foot lesions, lameness, and ruptured vesicular lesions in the mouth and mammary glands (Ismail et al., 2023). The disease has an incubation period of 2–14 days. The disease is rarely fatal in adult animals (1–5%), but high in young calves, lambs, and piglets (20% or more) (WOAH, 2021). However, the morbidity and mortality rates of FMDV depend on a number of parameters, including animal species, breed, production type, age, immunity, viral dose, and animal movement. (Jemberu et al., 2020).

FMD is also referred to as a transboundary disease with significant economic impacts, including severe weight loss in beef cattle and substantial reductions in milk production among lactating animals, as well as high morbidity rates near 100% (Rasmussen et al., 2024). The high rate of disease spread has been found to initiate the occurrence of serious

Cite this Article as: Nursakilah T, Mutawadiah, Ismail I, Yusuf S and Purba FY, 2025. Knowledge, Attitudes, and Practices of Smallholder Farmers Regarding Foot and Mouth Disease in Cattle in Punaga Village, Takalar Regency: A Descriptive Study. International Journal of Agriculture and Biosciences 14(2): 252-257. https://doi.org/10.47278/journal.ijab/2024.217

A Publication of Unique Scientific Publishers

social issues (Osmani et al., 2021). For example, FMD is transmitted by direct contact between infected and susceptible animals (Paton et al., 2018), indirect contact through humans, equipment, and transportation from affected areas (Colenutt et al., 2020), as well as airborne spread due to the respiratory activities of infected animals (Brown et al., 2022).

Specific and effective treatments for FMD are lacking, but treating symptoms, preventing secondary infections, and enhancing recovery capacity are necessary to control measures, particularly in endemic regions (Brito et al., 2017). Vaccination has historically been recognized as the principal FMD control technique, because control of animal movements is difficult and there are frequently insufficient resources to compensate owners for supporting livestock culling (Mashinagu et al., 2024). FMDV immunity can be developed through serotype-specific vaccination, prior exposure to the virus, or maternal antibodies (Buckle et al., 2021). Veterinarians, specifically in rural regions, should be able to identify and determine treatment priorities for cattle infected with FMD according to disease stage (Purba et al., 2024).

Indonesia experienced FMD recurrence in April 2022 after being recognized as free from FMD by the World Organisation for Animal Health in 1990 (Chen et al., 2022). In developing countries, the agriculture sector plays a vital role in the livelihood of rural communities. Considering that livestock management in Indonesia is traditionally practiced (Suarsa et al., 2024), gathering important information from farmers is essential for the prophylaxis, control, and eradication of an infectious disease such as FMD. When developing and introducing control and prevention programs, it is crucial to evaluate knowledge, attitudes, and practices (KAPs) (Balkhy et al., 2010). Farmers with a strong understanding of disease as well as good attitudes and practices toward farming are better equipped to recognize early symptoms and take appropriate preventive or control measures, thereby reducing the impact on livestock (Kustiningsih et al., 2023).

Communication between farming communities and veterinary authorities is critical to ensure that farmers are aware of disease. Over the years, no investigations on KAPs relating to FMD outbreaks have been conducted in South Sulawesi. Therefore, this study aimed to describe KAPs of smallholder farmers associated with FMD in Takalar Regency, South Sulawesi. The results are expected to provide valuable insights for improving disease management and livestock welfare at the farm level. By gaining a deeper understanding of these factors, more effective educational and training strategies can be developed to enhance the abilities of farmers to prevent and control FMD.

MATERIALS & METHODS

This study was conducted from December 2023 to January 2024 in Takalar Regency, South Sulawesi, Indonesia, at geographical coordinates 5°031'-5°0381'N, 119°0221'-119°0391'E. According to the national census, Takalar Regency has a population of 304,856 people, an area of 566.51km^2 and 36,374 livestock heads. The specific study site was Punaga, considered to be among the villages with the highest number of FMD cases. The criteria for respondents were smallholder farmers in the region whose cattle had previously been affected by FMD.

A comprehensive questionnaire containing multiple response questions grouped into two sections was designed to assess KAPs regarding FMD in herds. The first section comprised questions related to knowledge and awareness of FMD, while the second consisted of questions on attitudes and perceptions towards FMD and prevention methods. Certain questions were designed to define the general knowledge about disease, clinical signs, and modes of transmission. Additionally, questions on attitudes and practices were developed to evaluate the perceptions of farmers regarding disease prevention and control measures. A common scoring method was used for this KAP questionnaire as follows: (1) 1 point for correct and 0 for incorrect answers in the Knowledge Section, (2) 1 for positive and 0 for negative options in the Attitude and Practice Section, the score ranges were 0~10 for Knowledge, and 0~5 for Attitude and Practice.

In the study context, a survey was conducted at the farm site in the presence of a local veterinarian. Based on information gathered from the local authority, the number of farmers found in this region of Punaga Village was approximately 50 people. A total of 48 smallholder farmers participated in the survey and were interviewed using Indonesian and local languages, depending on the preferences of respondents. After training all interviewers, farmers were engaged and interviewed based on their willingness to participate in this study on the farmland.

Collected data were stored in an Excel worksheet (Microsoft® Excel® 2021 MSO) and analyzed with SPSS version 27 to conduct descriptive statistics for each variable of interest. A chi-square test was performed to determine the relationship between variables representing the KAP of respondents towards FMD and demographic factors, followed by an odds ratio to quantify the strength of the association between the two variables. Results of the contrast analysis were considered statistically significant at $P \leq 0.05$.

RESULTS

According to Table 1, the demographic data of respondents in this study included age, sex, education level, number of cattle owned, and farming experience. Among the respondents, 73% (n=35) were male and 27% (n=13) were female, while the majority were over 45 years old (68.8%, n=33), followed by those aged 36-45 years (27.1%, n=13), 26-35 years (2.1%, n=1), and 15-25 years (2%, n=1). Furthermore, the education levels varied as 37.5% (n=18) did not have formal education, 35.4% (n=17) completed elementary school, 16.7% (n=8) concluded junior high school, 8.3% (n=4) graduated from high school, and only 2.1% (n=1) had a diploma or bachelor's degree. Regarding the number of cattle owned, 75% (n=36) had 1-10, 20.8% (n=10) had 11-20, 2.1% (n=1) had 21-30, and 2.1% (n=1) had more than 30 cattle. The majority of respondents possessed more than 10 years of farming experience (93.7%, n=45), while 4.2% (n=2) had 6-10 years of experience, and 2.1% (n=1) had only 1-5 years of experience.

Table 1: Demographic Characteristics of Respondents (n=48)

Characteristics	Frequency	%
Age		
15-25 years	1	2.0
26-35 years	1	2.1
36-45 years	13	27.1
≥45 years	33	68.8
Sex		
Male	35	73.0
Female	13	27.0
Education Level		
No formal education	18	37.5
Elementary school	17	35.4
Junior high school	8	16.7
High school	4	8.3
Diploma/Bachelor's degree	1	2.1
Number of Cattle Owned		
1-10 cattle	36	75.0
11-20 cattle	10	20.8
21-30 cattle	1	2.1
≥30 cattle	1	2.1
Farming Experience		
1-5 years	1	2.1
6-10 years	2	4.2
≥10 years	45	93.7

A summary of knowledge and awareness of farmers (n=48) regarding FMD is presented in Table 2. All the respondents had heard about FMD and confirmed certain cases among their herds in the past 12 months. However, only 37.5% (n=18) reported a virus as the cause of FMD, while 62.5% (n=30) were unfamiliar with the etiology.

Table 2: Knowledge and awareness of respondents (n=48) regarding FMD

Characteristics	Frequency	%
Farmers had heard of FMD (anytime in the past)		
Yes	48	100
No	0	0
Farmers had confirmed FMD cases in the past 12 months		
Yes	48	100
No	0	0
Knowledge of FMD etiology		
Virus	18	37.5
Do not know	30	62.5
Knowledge of FMD clinical signs		
Excessive salivation	47	97.9
Sores on the tongue	11	22.9
Lesions on the gums	47	97.9
Lesions on hooves	48	100
Knowledge of potential sources of FMD transmission		
Newly introduced animals	9	18.8
Neighboring livestock groups	44	91.7
Infected sources (People, equipment & vehicles)	2	4.2
Contaminated feed	1	2.1
Do not know	4	8.3
Farmers know FMD can cause death in livestock		
Yes	48	100
No	0	0
Knowledge of Sources of FMD Information		
Veterinarian/animal health officer	40	83.3
Television	40	83.3
Community leaders/relatives/friends	39	81.3
Livestock traders	3	6.3

Regarding the clinical signs of FMD, all respondents identified lesions on cattle hooves (n=48) as a symptom, 97.9% (n=47) mentioned excessive salivation and lesions on the gums, while 22.9% (n=11) reported sores on the tongue. The majority of farmers (91.7%, n=44) stated that the transmission of FMD could occur through neighboring livestock groups, while 18.8% (n=9) believed that newly introduced animals could bring FMD into herds. Other transmission routes, such as people, equipment, and vehicles from infected sources and contaminated feed, were mentioned by 4.2% (n=2) and 2.1% (n=1), respectively.

During the survey, all respondents reported that FMD is capable of causing livestock mortality. The primary sources of information about FMD for farmers were veterinarians or animal health officers and television (83.3%, n=40), followed by community leaders, relatives, and friends (81.3%, n=39), and livestock traders (6.3%, n=3).

An overview of attitudes and practices of farmers (n=48) towards prevention and control measures for FMD is presented in Table 3. The assessment showed that 75% (n=35) of respondents experienced livestock deaths due to FMD. About 91.7% (n=44) reported FMD cases immediately to the local authorities, while 6.3% (n=3) reported a few days after, and 4.2% (n=2) quarantined infected livestock. To ensure protection against contracting disease, most respondents opted for self-quarantine measures (62.5%, n=30), while 8.3% (n=4) avoided buying livestock from risky sources, and 37.5% (n=18) took no action. The majority (93.8%, n=45) agreed that routine visits from veterinary authorities are necessary to control FMD, and all respondents (n=48) expressed interest in receiving more information about disease. An investigation was conducted to gather information on treatment (64.6%, n=31), prevention methods (56.3%, n=27), and care procedures for infected livestock (14.6%, n=7).

Table 3: Attitudes and practices of respondents (n=48) regarding the prevention and control of FMD

Characteristics	Frequency	%
Farmers experienced livestock deaths due to FMD		
Yes	35	75.0
No	12	25.0
Actions taken when FMD cases were detected		
Report to the authorities immediately	44	91.7
Report after a few days	3	6.3
Quarantine infected animals	2	4.2
Measures to protect livestock from FMD		
Self-quarantine	30	62.5
Avoid buying from risky sources	4	8.3
No action was taken	18	37.5
The necessity of routine veterinary visits		
Yes	45	93.8
No	3	6.3
Interest in receiving more FMD information		
Yes	48	100
No	0	0
Information investigated		
Treatment	31	64.6
Prevention methods	27	56.3
Procedures to care for infected animals	7	14.6

The association between knowledge, attitudes and practices scores towards FMD and demographic variables is presented in Table 4. In the whole study population, the overall score for Knowledge was 5.7±0.16 (range: 0~10), Attitude and Practice was 2.02±0.29 (range: 0~5). The assessment found that there was a significant association between knowledge score and education level of the respondents ($\chi 2=16.353$, $P=0.002$). Other variables (age, sex, number of cattle owned, and farming experience) showed no statistically significant associations with knowledge or attitude-practice scores.

Table 4: Distribution of knowledge, attitudes and practices score of respondents (n=48) towards FMD according to demographic variables

Characteristics	Knowledge			Attitude and Practice		
	Score	χ2	P	Score	χ2	P
Age		4.587	0.205		1.448	0.694
15-25 years	-			-		
26-35 years	-			-		
36-45 years	5.71±0.33			2.00±0.26		
≥45 years	5.65±0.20			2.02±0.16		
Sex		0	1		0	1
Male	5.68±0.19			2.04±0.16		
Female	5.70±0.32			2.00±0.26		
Education Level		16.353	0.002		3.859	0.425
No formal education	5.53±0.27			1.84±0.21		
Elementary school	5.62±0.28			2.00±0.23		
Junior high school	5.75±0.46			1.69±0.32		
High school	5.65±0.48			2.39±0.39		
Diploma/Bachelor's degree	-			-		
Number of Cattle Owned		NaN	NaN		NaN	NaN
1-10 cattle	5.65±0.19			1.98±0.16		
11-20 cattle	5.68±0.36			2.04±0.29		
21-30 cattle	-			-		
≥30 cattle	-			-		
Farming Experience		1.007	0.604		2.095	0.351
1-5 years	-			-		
6-10 years	5.47±0.55			2.53±0.55		
≥10 years	5.71±0.17			2.02±0.14		

Furthermore, the odds ratios for education levels compared to knowledge levels was calculated to provide insights into how the likelihood of having high knowledge varies across education groups (Table 5). The result indicated that respondents with low education were approximately 70% less likely to have high knowledge compared to those with medium education.

Table 5: The odds ratio for education levels compared to knowledge levels (n=48)

Rate	Comparison	Odds Ratio
0	High Education vs. Low Education	NaN
1	High Education vs. Medium Education	NaN
2	Low Education vs. Medium Education	0.307692

'Low education': ElementarySchool, 'Medium education': High School, 'High education': Diploma/Bachelor. NaN: insufficient data or zero counts in one or more categories, preventing calculation of the odds ratio.

DISCUSSION

The demographic data showed that men predominantly experience access to and control over resources as well as the associated benefits due to greater participation in livestock groups. In accordance to Nadhira & Sumarti (2017), women often do not fully control livestock farming, and decision-making by female remains primarily at the household level. In addition, livestock farming is dominated by elderly farmers (≥45 years), which may be related to a higher level of ignorance about the disease compared to the younger group. This difference may be attributed to varying access to new information and openness to learning across different age groups. Older respondents tend to have more negative attitudes, which are directly influenced by knowledge (Kustiningsih et al., 2023).

The educational backgrounds of respondents were predominantly limited to no schooling or only elementary education. There was a significant association between knowledge level and education level of the respondent. Moreover, respondents with low education were approximately 70% less likely to have high knowledge compared to those with medium education. Higher education level has a more impressive ability to grasp and adopt appropriate farming practices, which is consistent with the previous findings. (Delgado-Demera et al., 2024). It is correlated with better awareness of effective FMD control measures as well as a greater need for specific information to enhance the understanding and management of disease (Athambawa et al., 2021). Farmers with higher education levels may have better access to information and preventive practices, which can reduce livestock mortality caused by FMD, thereby signifying the crucial role of education in influencing preventive actions.

In addition, livestock farming was dominated by smallholder farmers owning less than 10 cows, but more than 10 years of experience. Disparities in management practices and awareness levels about animal health between farmers with different livestock numbers and length of experience may influence practices related to FMD. This signifies the importance of considering the scale of farming operations when designing FMD-related educational programs and interventions to ensure that KAPs of farmers regarding disease are effectively enhanced. According to Rahman Aldeyano et al. (2023) and Athambawa et al. (2021), the number of livestock owned significantly impacts knowledge, preventive attitudes, and performance of farmers in managing FMD, while farming experience affects skill and understanding. In the context of a newly identified disease, all farmers regardless of experience are in a phase of adaptation and learning.

The entire respondents were aware of FMD and reported cases in the past 12 months, signifying the high prevalence. FMD rapid spread was associated with the semi-intensive farming system, where cattle were penned at night and grazed during the day, facilitating interaction and spread of the virus. This observation supported the study by Mugezi et al. (2020) which found FMD to potentially spread through both direct and indirect contact during grazing. Despite the awareness, not all farmers knew the cause of FMD, as 62.5% of the surveyed population were unaware of the etiology. This result was

consistent with Osmani et al. (2021), which reported most respondents with limited knowledge, knowing only disease name and some clinical signs.

All respondents experienced FMD in the herds and identified hoof lesions, excessive salivation, and gum lesions as the main clinical signs, which corresponded with the reports of Osmani et al. (2021) and Bayantassova et al. (2023). Regarding FMD transmission, most respondents believed that neighboring livestock could pose a potential threat, while only a few were aware of the risks associated with newly introduced livestock as well as contaminated equipment and feed. This differed from the studies by Osmani et al. (2021) and Bayantassova et al. (2023), which reported the introduction of new livestock as a primary source of FMD infection.

The movement of infected livestock is widely accepted as the most critical medium for the spread of FMD, both within and between regions (Alexandersen et al., 2003). The causative virus often initially enters a country or region through living livestock or contaminated products and is then distributed through movement. Sieng et al. (2022) observed that poor knowledge of disease transmission and inadequate biosecurity measures could contribute to recurring FMD outbreaks in communities. Furthermore, the variation in disease prevalence could be attributed to the difference in the level of farm intensification, biosecurity levels applied, geographical areas, and the location of the farms. (Woldemariyam et al., 2021).

Respondents primarily received information about FMD from television, community leaders, relatives, and friends, as well as veterinarians or animal health workers who actively provided information, animal health services, and vaccinations. Radio and brochures were not reported as information sources, probably due to decreased radio use and a lack of distribution by the government or NGOs. Farmers in this study reported disease cases to the authorities when clinical signs of FMD were observed among the cattle. Immediate reporting is crucial for controlling and eliminating disease by local and regional authorities (Motta et al., 2019). Since farmers view neighboring livestock as a significant potential source of FMD transmission, quarantining infected livestock is a priority to minimize the spread of the causative virus.

Although this survey yielded useful results, it had certain drawbacks. Even while most farmers were aware of the damage caused by FMD, some were hesitant to provide specific information about it, possibly due to a lack of ongoing connection with government authorities and the absence of a regular control program established by the government. In order to control the disease, several farmers lacked fundamental hygienic skills to apply in their herds, despite having raised cattle for decades. Previous research has also demonstrated that communication networks between smallholders and government stakeholders are frequently insufficient, increasing the risk of disease introduction and spread (Hernández-Jover et al., 2019).

Other difficulties were also discovered during this research. Although farmers were observed to immediately report clinical symptoms of FMD to the local veterinary authority, the reporting mechanism within the area was inefficient and reliant on government financial help. Takalar Regency with the 566.51km^2 area and 36,374 livestock heads is still underserved by veterinarians in the Department of Animal Husbandry and Animal Health. These results emphasized the importance of effective and continuous dissemination of information about FMD to all farmers and the necessity of regular visits from veterinary authority. Since farmers are well-positioned to detect disease in their animals because they see them more frequently than animal health professionals such as veterinarians or para-veterinarians (Metwally et al., 2023), accurate knowledge and consistent preventive actions are crucial for controlling and preventing the spread of FMD in the community.

Conclusion

In conclusion, this study found that understanding KAPs of smallholder farmers provided essential data for implementing effective FMD eradication measures in the region. The results showed that while respondents had limited knowledge, however, the majority recognized the critical nature of the disease and agreed on the necessary control measures.

Conflict of Interest: The authors did not declare conflicts of interest.

Acknowledgement: The authors are grateful to farmers in Punaga Village, Takalar Regency, South Sulawesi for the kind cooperation offered during data collection.

Authors' Contribution: All authors contributed to designing, collecting, and analyzing the data, as well as writing and editing the manuscript.

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