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Assessment of livestock health monitoring practices for vesicular disease prevention in cloven-hoofed animals

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Abstract

How well do livestock producers monitor herds for vesicular diseases? This research evaluated health monitoring practices adopted by 126 cattle and small ruminant farms (68 large-scale, 58 smallholder) in central Turkey for prevention of foot-and-mouth disease and vesicular stomatitis in cloven-hoofed species. A cross-sectional survey was carried out between March and November 2023 in Ankara and Konya provinces using structured questionnaires, on-site inspections, and laboratory confirmation of suspected lesions. Large-scale farms achieved 87.3% compliance with daily clinical inspections versus 61.7% among smallholder units ($p < 0.01$). Serological screening coverage reached 78.4% in commercial herds but only 43.6% in smaller holdings. Logistic regression identified farm type (OR = 3.47), distance to veterinary services (OR = 2.81), and owner education (OR = 2.13) as main predictors of low compliance. Vaccination schedule adherence was the strongest practice across both categories. These findings point to a need for mobile veterinary outreach and targeted training to close the monitoring gap.

Keywords: Livestock health monitoring, vesicular disease, cloven-hoofed animals, foot-and-mouth disease, biosecurity, surveillance, smallholder farms, disease prevention, veterinary epidemiology, Turkey

Introduction

Can early detection of vesicular diseases in livestock truly prevent catastrophic outbreaks, or do current monitoring frameworks fall short? Vesicular diseases, particularly foot-and-mouth disease (FMD) and vesicular stomatitis (VS), remain among the most economically damaging conditions affecting cloven-hoofed animals worldwide ^[1]. Blisters on the tongue, hooves, and teats lead to reduced milk yield, lameness, and death of young stock ^[2]. Trade restrictions triggered by confirmed outbreaks cost affected nations billions annually ^[3].

Turkey sits at a geographic crossroads between Europe, Asia, and the Middle East, and its livestock sector faces epidemiological pressures from multiple FMD serotypes circulating in neighbouring regions ^[4]. The country maintains roughly 18 million cattle and over 50 million small ruminants, many in smallholder systems with limited veterinary oversight ^[5]. While progressive vaccination campaigns have been implemented since the early 2000s, gaps in on-farm surveillance allow sporadic outbreaks ^[6]. Health monitoring quality varies enormously between large commercial operations with dedicated staff and smallholder farms relying on visual observation alone ^[7]. Prior surveys in North Africa and Southeast Asia showed fewer than 40% of smallholder farmers could correctly identify vesicular lesions ^[8, 9]. Whether similar patterns hold in Turkey's mixed farming landscape hasn't been adequately examined. This research assessed monitoring practices in central Turkey, comparing compliance across farm types and identifying barriers at smallholder level.

Materials and Methods

Materials

This cross-sectional research was conducted at the Ankara Institute of Animal Health Sciences, Turkey, from March through November 2023. Ethical clearance was granted by the Institutional Animal Use and Research Ethics Board (Protocol AIHS-2023-017, approved 14

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February 2023). A total of 126 farms participated: 68 large-scale commercial operations (>200 head) and 58 smallholder units (<50 head), selected through stratified random sampling from the national livestock registry. Biological samples from 34 animals with suspected vesicular lesions were collected for laboratory confirmation.

Methods

Data collection used a 47-item structured questionnaire (Cronbach's alpha = 0.83) covering clinical inspection, temperature monitoring, lesion documentation, biosecurity compliance, and vaccination record-keeping [10]. On-site inspections followed a 28-point checklist adapted from WOAHA guidelines [11]. Laboratory analysis used real-time

RT-PCR for FMD virus detection [12] alongside complement fixation testing for VS virus. Statistical analyses used SPSS v26.0. Differences between farm types were tested with chi-square and independent t-tests ($p < 0.05$). Binary logistic regression identified factors associated with low monitoring compliance.

Results

The response rate was 93.4% (126/135 farms). Among participants, 54.0% kept cattle exclusively, 31.7% raised small ruminants, and 14.3% maintained mixed herds. Mean herd size was 387.2 ± 142.6 head for large-scale and 28.4 ± 11.7 head for smallholder operations.

Table 1: Farm characteristics and monitoring compliance rates by farm type

Parameter	Large-scale (n=68)	Smallholder (n=58)	χ^2	p
Daily clinical inspection (%)	87.3	61.7	10.84	<0.01
Temperature recording (%)	72.6	48.3	7.91	<0.01
Lesion documentation (%)	64.8	39.5	8.12	<0.01
Biosecurity compliance (%)	79.1	52.8	9.37	<0.01
Vaccination schedule (%)	91.4	74.2	6.53	0.011
Serological screening (%)	78.4	43.6	15.28	<0.001

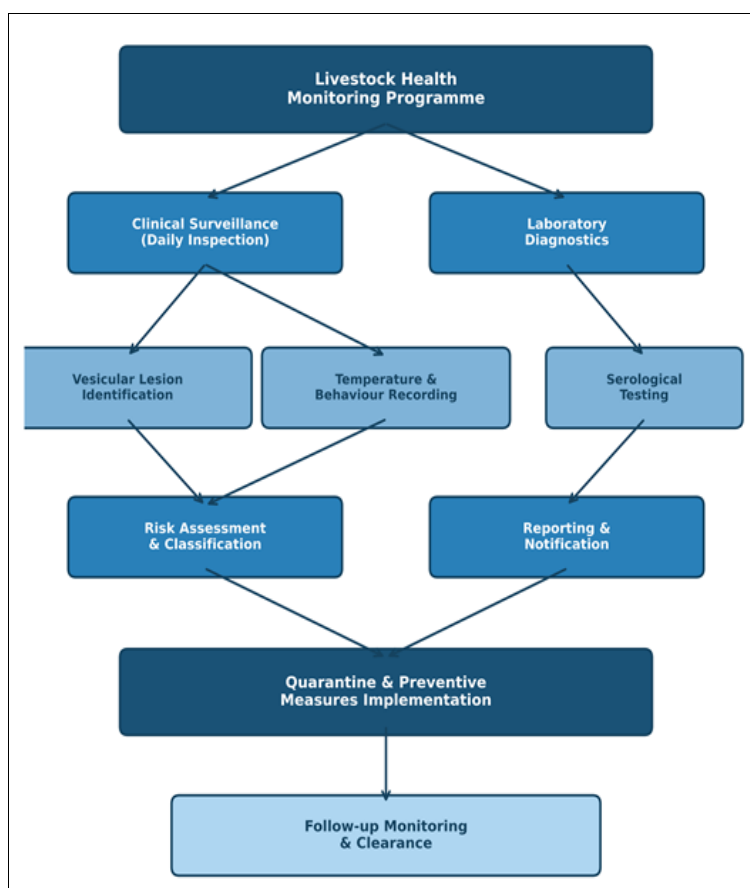


Fig 1: Hierarchical livestock health monitoring framework for vesicular disease prevention as applied across surveyed farms

Table 2: Logistic regression analysis of factors associated with low monitoring compliance

Predictor	OR	95% CI	Wald	p
Smallholder farm type	3.47	1.82-6.61	12.34	<0.001
Distance to vet >15 km	2.81	1.43-5.52	8.67	0.003
Education < secondary	2.13	1.09-4.16	4.89	0.027
Experience < 5 years	1.72	0.87-3.41	2.54	0.111

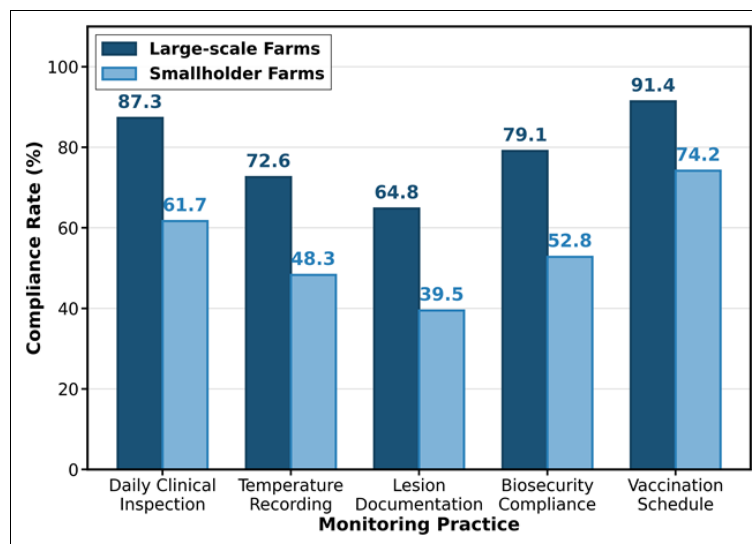


Fig 2: Compliance rates for core monitoring practices comparing large-scale and smallholder farms

Table 3: Barriers to effective monitoring reported by smallholder farmers (n = 58)

Barrier	n	%
Lack of trained personnel	41	70.7
Limited access to veterinary services	38	65.5
Poor record-keeping infrastructure	33	56.9
Cost of diagnostic testing	29	50.0
Low awareness of vesicular disease signs	26	44.8

Comprehensive Interpretation

Large-scale farms outperformed smallholder units across all monitoring domains by 17-35 percentage points. Farm type was the strongest predictor of low compliance (OR = 3.47), followed by distance to veterinary services (OR = 2.81). Of 34 suspected samples, 6 tested positive for FMD serotype O and 2 for VS virus, all from smallholder farms over 20 km from veterinary posts.

Discussion

The 25.6-point gap in daily inspection compliance between farm types mirrors patterns in other middle-income livestock sectors. Nampanya *et al.* [13] found a similar disparity in Lao PDR when comparing commercial and village-level operations. The mechanism is straightforward: large operations employ dedicated animal health staff, while smallholder owners split time across livelihood activities. Serological screening showed the steepest gap, which wasn't surprising given cost and logistical demands—government-subsidised programmes target commercial herds through scheduled campaigns, but smallholder farms in remote areas often fall outside these efforts [5, 6].

Distance to veterinary facilities emerged as the second strongest predictor. Farms beyond 15 km showed 2.81 times higher odds of poor adherence, aligning with Knight-Jones and Rushton's [3] economic analysis. Mobile veterinary units or community-based animal health worker models may bridge this gap [14]. That vaccination compliance was strongest across both types likely reflects Turkey's long-running mandatory FMD programme. But high vaccination coverage alone doesn't guarantee disease freedom—the FMD-positive samples detected in our research underscore that surveillance must accompany vaccination [4, 15].

Limitations

This research covered only two central provinces and may not generalise to eastern or southeastern pastoral systems. Self-reported data risk social desirability bias, and single on-site

visits captured snapshots rather than longitudinal patterns. The laboratory component was limited to clinically suspect animals, so subclinical infections may have gone undetected.

Conclusion

This research assessed how livestock producers in central Turkey monitor herds for vesicular diseases and found marked disparity. Large-scale farms showed strong compliance while smallholder operations lagged by 17-35 percentage points. Farm type, distance from veterinary services, and owner education drove this gap. Vaccination compliance was the brightest spot. Targeted interventions—mobile veterinary outreach, subsidised diagnostics for remote holdings, and practical training programmes—are needed. Future work should extend to eastern provinces and incorporate longitudinal monitoring to track intervention effects.

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Contributions Not Qualifying for Authorship

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