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Livestock Handling Practices and Barriers to Vaccine Adoption in East Gojam Zone, Ethiopia

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ABSTRACT

Livestock plays multiple roles in supporting communities' livelihood, economic development, and social capital. However, they remain vulnerable to infectious diseases. To address this, a cross-sectional questionnaire-based survey was conducted in the East Gojam zone of Amhara Regional State to assess livestock handling practices and generate relevant information for animal keepers and other stakeholders. The study sites were selected purposively based on livestock production potential, disease incidence, and accessibility. Eighty-one household farmers and twelve professionals were included. Data analyzed with SPSS version 20 software. About 56.8% of the respondents let their animals graze freely, and only 14.8% didn't mix their animals with others. Regarding vaccine uptake to prevent disease, about 56.3% of the respondents didn't vaccinate one or more animal species available in their households. Farmers preferred to vaccinate cattle over other animals ($\chi 2=71.4$, *p*-value=0.000), showing a greater willingness to pay for cattle vaccines and the anthrax vaccine compared to other types. Dogs were the least vaccinated animals. The main reasons for not vaccinating their animals were lack of awareness (54.5%), absence of vaccines (6.8%), being far away from the vaccination point (6.8%), and vaccines not available in small doses (4.5%). Vaccine provision does not guarantee uptake at the community level. Therefore, the vaccine uptake barriers and failure of proper management practices need to be addressed. Vaccine formulations need to be revised to allow vaccination of small numbers without wastage. Home vaccination is required for chickens and pet animals.

1. Introduction

Livestock plays multiple roles in developing countries in supporting communities' livelihood. However, livestock production is affected by the failure of proper management practices and occurrences of many devastating diseases. In Ethiopia, not only livestock but also crop farming is affected, as it mainly depends on animal draught power. So, keeping animals healthy and productive improves not only animal profitability but also crop production and public health. Therefore, the purpose of this study were to identify common livestock management practices, characterize factors that hinder effective vaccine delivery, and generate relevant information for animal keepers and other stakeholders to improve animal welfare and productivity.

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The present study helps to identify gaps in management practices and potential areas for intervention in improving livestock production. The traditional way of animal handling practices is assessed in detail, and available technologies, such as animal vaccines are not properly utilized by livestock owners due to various reasons. The factors hindering vaccine uptake are identified, and possible solutions are recommended.

2. Literature review

African livestock production was seen as a poor investment for development and was ignored for many years. However, it is currently one of the sectors considered for Africa's development strategy (Scoones & Wolmer, 2006). Livestock plays a significant role in rural livelihoods and the economies of developing countries (Herrero et al., 2013). Sustainable livestock production is essential to achieve food security and to improve community livelihoods (Nuvey et al., 2023). Animal health is a prerequisite directly or indirectly for economic development, food security, food quality, global health, poverty reduction, and mitigation of climate change and biodiversity loss (Charlier et al., 2022). Livestock diseases are a priority problem for livestock keepers throughout Ethiopia (Gizaw et al., 2021). The major problem faced by livestock industries is reduced productivity due to the occurrence of diseases (Layton et al., 2017). Animal diseases in production and subsistence settings can have detrimental impacts on consumers, producers, and economies as a whole. A growing global demand for animal-sourced food requires safe and efficient production systems (Kappes et al., 2023).

Farming practices in Ethiopia face many constraints, including the prevalence of diseases and a lack of adequate biosecurity measures (Moje et al., 2023). Biosecurity measures like vaccination is important to prevent disease spread and avoid the significant negative impact of livestock disease on animals and public health. Healthier animals are more productive and are important for farm businesses (Osawe et al., 2022). The chain of zoonosis can be broken through livestock vaccination strategies (Layton et al., 2017), and it can prevent the transmission of foodborne infections to people (Roth, 2011). It serves as a broad biosecurity solution being critical to both human and animal health (Layton et al., 2017). Vaccination is also a very important and safe intervention that can reduce drug resistance by minimizing the misuse of antimicrobials (Roth, 2011; Sander et al., 2020). It is the most effective and profitable means to control infectious livestock diseases (Nuvey et al., 2022). Rabies and rinderpest vaccines are the prominent examples of successful vaccination efforts. Human rabies is nearly eliminated in developed countries through vaccination of domestic animals and wildlife. Rinderpest became the second disease after smallpox to be globally eradicated (Roth, 2011). The application of vaccination and other primary animal healthcare practices are considered a cost-effective method for farmers to prevent and control livestock diseases (Mdlulwa et al., 2021). Prevention is better and cheaper than curing diseases (Nyokabi et al., 2023).

Effective livestock vaccinations have the potential to raise prosperity and food security in the countries (Hopker et al., 2021). Safe and effective animal vaccines are essential to modern society. Given the importance of vaccination to prevent the occurrence of outbreaks of infectious diseases, it increases the benefits of livestock farming and minimizes the risks associated with livestock production, like food safety issues, zoonotic diseases, and environmental contamination. Vaccination is significantly associated with better economic benefits for dairy farmers (Osawe et al., 2022). Veterinary vaccines will continue to be an important tool to protect human and animal health, food safety, and food security. So, it must be accessible and affordable (Roth, 2011).

In livestock-dependent families, livestock vaccination, in addition to direct benefits gained from reduced livestock mortality, increased milk production, and savings by reducing antibiotic treatments; households use the increased income for different household expenditures like child education, food, and health care. Thus, it contributes to poverty alleviation at the household level, and to achieving sustainable development goals (Marsh et al., 2016). However, the livestock production system has not yet improved due to low improved technology utilization practices, and still, the level of technology adoption is not yet optimal (Bassa, 2021). Therefore, the livestock management practices in the area are investigated by a questionnaire-based survey that is crucial to identifying gaps for further interventions in improving livestock production.

3. Materials and methods

3.1. Description of the study area

The study was conducted in the East Gojam zone of Amhara Regional State, located in the Blue Nile basin of Ethiopia. The four woredas, namely: Enemay, Sinan, Awabel, and Gonchasiso Enese, and two kebeles from each woreda were selected in this study. The zone is characterized by different agro-ecologies, highland (Choke Mountains) to lowland areas (Abay gorge), and the altitude ranges from 800 to 4200 meters above sea level. The rainfall pattern is mainly a unimodal type, and the annual rainfall varies from 900 to 1800 mm while there is a short rainy season during February and March in the highland agroecology. The annual temperature of the zone ranges from 7.5 ^oC to 27 ^oC. East Gojam zone is known for its high potential area for crop and livestock production in the region (Ferede *et al.*, 2020). It has a livestock population of 2,185,995 cattle, 1,225,349 sheep, 315,053 goats, 79,534 horses, 18,714 mules, 473,619 donkeys, 1,087,572 poultry, and 126,520 beehives. It covers about 9.73% of the regional livestock population (CSA, 2021). The major management system practiced in the area is extensive.

3.2. Study design and data collection

A cross-sectional study design was employed from October 2024 to June 2025 to assess the livestock management practices, characterize factors that hinder effective vaccine delivery, and generate information for animal keepers and other stakeholders to control and prevent infectious diseases. The study woreda and kebele were selected purposively in consultation with experts from the zonal livestock and fisheries development office, where livestock production potential and disease incidence were high, and based on accessibility. However, the zone was classified into three strata based on agroecology, sample woredas representing each agro-ecology were selected, and Sinan from the highland, Enemay and Awabel from the midland, and Gonchasiso Enese from the lowland were included purposively for this study. A structured and semi-structured questionnaire was prepared, and a survey was conducted for data collection. Eighty-one household farmers who have livestock production experience, and twelve professionals for the questionnaire-based survey that need technical knowledge were participated in this study.

3.3. Ethics approval and consent to participate

Human participants involved in this questionnaire-based survey participated according to the ethical standards and principles of the research practice of the Ethiopian Institute of Agricultural Research. In addition, before the study was conducted, an informal consent was obtained from all participants after explaining the purpose of the study.

3.4. Data analysis

Data collected during the questionnaire survey were coded and entered into a Microsoft Excel spreadsheet and analyzed with descriptive statistics of the SPSS version 20 software package. Descriptive statistics were used to calculate frequencies and percentages. The chi-square test was used to analyze the association between different parameters. *P-value*<0.05 at a 95% confidence level was considered significant.

4. Results and discussion

Eighty-one household respondents were involved in this study, and about 37% of them can read and write, and most of them (97.8%) were male. The educational level and sex of household farmers included in the study are indicated in Table 1.

Table 1. Socioeconomic characteristics of study participants

Variables		Frequency	Percent
Sex	Male	79	97.5
	Female	2	2.5
Educational level	Illiteracy	20	24.7
	Read and write	30	37.0
	Elementary	22	27.2
	Secondary	7	8.6
	Preparatory and above	2	2.5
Age	18-27	5	6.5
	28-37	11	14.3
	38-47	25	32.5
	48-57	25	32.5
	>57	11	14.3

Source: Own research

Education level across locations concerning town was statistically significant ($\chi 2$ = 15.701, *p*-value= 0.003). Educational status of respondents from peri-urban were better compared with those from rural part. No respondent had a preparatory and above level of education who came from a rural part of the study kebeles. Though family size of respondents concerning town was not statistically significant, there were no family size of nine and above in peri-urban areas.

Some risk factors that may be involved in disease occurrence are described in Table 2 below. About 56.8% of the respondents in this study take their animal for free grazing, and only 14.8% of them keep their animal separately and it was lower than the report of Moje and his colleagues, a quarter of the dairy farmer (25.8%) avoided mixing their cattle with other herds (Moje et al., 2023). This may be related to animal management practices in the area, as they use communal grazing land. Communal grazing is directly linked with exposure and disease transmission. Since it is where animals from different households graze together (Ahmed et al., 2018). About 48.1% of respondents keep their animals together with others; this is lower than the report from farming practices of highland Ethiopia, 74.2% of them mix their herd with other herds (Gizaw et al., 2016). Regarding farm cleaning practices, 88.9% of the respondents clean the barn at least once a day, which is greater than the report of Moje and his colleagues, hygienic aspects of the farms showed that 77.4% of the dairy farms appeared to clean the barn daily (Moje et al., 2023). And, also 56.9% of the respondents from Southern Ethiopia clean a barn once every day (Abayneh et al., 2020). All of the respondents didn't use protective equipment to clean the barn and performed with bare hands. This is a critical issue that may serve as a pathogen transmission pathway from animal to human. Animal manure serves as a source of human pathogenic organisms. So, humans can be exposed to those pathogens from poorly managed animal feces (Penakalapati et al., 2017).

Table 2. Some risk factors across locations

Some risk factors		Location concerning towns		Total
		Peri-urban	Rural	
Animal grazing practice	Free grazing	6 (42.9%)	40 (59.7%)	46 (56.8%)
	Cut and carry	4 (28.6%)	17 (25.4%)	21 (25.9%)
	Tethered	3 (21.4%)	9 (13.4%)	12 (14.8%)
Way of animal keeping	Together with others	6 (42.9%)	33 (49.3%)	39 (48.1%)
	Separately	1 (7.1%)	11 (16.4)	12 (14.8%)
Housing system	Housed together with humans	5 (35.7%)	25 (37.3%)	30 (37.0%)
	Separate house	9 (64.3%)	42 (62.7%)	51 (63.0%)
Barn cleaning practices	Once	12 (85.7%)	60 (89.6%)	72 (88.9%)
	Twice	1 (7.1%)	3 (4.5%)	4 (4.9%)
	Once in 3 days	0 (0.0%)	2 (3.0%)	2 (2.5%)
	Once in 4 days	0 (0.0%)	1 (1.5%)	1 (1.2%)
	Once in summer & once every 3 days in winter	0 (0.0%)	1 (1.5%)	1 (1.2%)

Source: Own research

Based on the interview response, the disease occurrence was affected by different determinant factors. Traditional types of livestock production, keeping animals together with others, free grazing practice, and watering away from home were indicated as predisposing factors mathematically. It is presented in Table 3. Way of animal-keeping practice was the main factor, and 77.5% of cattle owners responded that keeping cattle together with other animals in the field was the predisposing factor for disease occurrence. It is comparable with the finding of Ahmed and his colleagues from Northern Tanzania, shared grazing among herds is correlated with higher disease risk (Ahmed et al., 2018). The disease occurrence was also associated with location, and it was higher in rural than peri-urban areas. It may be related to the production system practiced and the lack of awareness about the availability of animal health technologies.

Table 3. Disease occurrence affected by different determinant (predisposing) factors:

Determinant factors		The disease occurred (%)		
		Cattle	Sheep	Equine
Type of livestock production	Traditional	47 (61.0)	46 (63.0)	42 (61.8)
	Semi-intensive	25 (32.5)	23 (31.5)	21 (30.8)
	Intensive	5 (6.5)	4 (5.5)	5 (7.4)
Way of animal keeping practice	Together with others	38 (77.5)	36 (75.0)	33 (75.0)
	Separately	11 (22.5)	12 (25.0)	11 (25.0)
Animal grazing practice	Free grazing	44 (57.9)	43 (60.6)	39 (58.2)
	Cut and carry	20 (26.3)	18 (25.4)	17 (25.4)
	Tethered	12 (15.8)	10 (14.0)	11 (16.4)
Point of watering	Away from home	56 (72.7)	54 (74.0)	50 (73.5)
	At home and nearby	14 (18.2)	13 (17.8)	11 (16.2)
	Both	7 (9.1)	6 (8.2)	7 (10.3)
Woreda (agroecologies)	Enemay	20 (26.0)	19 (26.0)	15 (22.1)
	Awabel	20 (26.0)	16 (21.9)	17 (25.0)
	Sinan	17 (22.0)	19 (26.0)	16 (23.5)
	Goncha	20 (26.0)	19 (26.0)	20 (29.4)
Location concerning towns	Peri_urban	13 (16.9)	14 (19.2)	13 (19.1)
	Rural	64 (83.1)	59 (80.8)	55 (80.9)

Source: Own research

The method of disease diagnosis made in each veterinary clinic is mainly based on the clinical signs and symptoms observed (83.3%), and the remaining, 16.7%, supported with laboratory tests. The major diseases identified in the area based on farmers' and veterinarian responses are presented in Table 4.

Table 4. Preliminary survey of major animal diseases in the study area

Species	Diseases	Frequency (%)
Cattle	Anthrax	11 (25.0%)
	Blackleg	9 (20.5%)
	Bovine Pasteurellosis	11 (25.0%)
	Foot and mouth disease	3 (6.8%)
	Lumpy skin disease (LSD)	9 (20.5%)
	Fascioliasis	1 (2.3%)
Shoat	Ovine Pasteurellosis	13 (41.9%)
	Verminous pneumonia	3 (9.7%)
	Fascioliasis	3 (9.7%)
	Shoat Pox	9 (29.0%)
	Pestides petitis ruminants	3 (9.7%)
Equine	Anthrax	10 (45.5)

Species	Diseases	Frequency (%)
	African horse sickness (AHS)	7 (31.8%)
	Strangle	4 (18.2%)
	Epizootic lymphangitis	1 (4.5%)
Chicken	Newcastle disease (NCD)	11 (61.1%)
	Coccidiosis	1 (5.6%)
	Infectious bursal disease (IBD)	2 (11.1%)
	Pullorum diseases	2 (11.1%)
	Fowl cholera	2 (11.1%)
Canine	Rabies	7 (87.5%)
	Mange and lice infestations	1 (12.5%)

Source: Own research

Commonly practiced disease prevention and control methods in the area are vaccination (50.7%), therapeutic measures (43.2%), and traditional medicines (6.1%). However, only 38% of the respondents were willing to vaccinate their animals from Negele-Arsi, Shashemene, and Hawassa in Ethiopia (Teffera & Megerssa, 2025). Another study conducted in central Ethiopia showed that nearly all of the respondents (97.9%) gave medical treatments for sick cattle, and 57.1% of them vaccinated their herds regularly (Moje et al., 2023). The lower utilization of animal health technologies in this study may be related to the difference in awareness of the usage of these technologies. Bassa also reported that the level of livestock production technology adoption is not yet optimal in our country (Bassa, 2021).

Regarding vaccine availability, about 16.6% of the respondents have no vaccine in their area. It was due to the vaccine manufacturing plant being far away and a lack of appropriate transportation system. Currently, zonal and woreda veterinarians are responsible for introducing vaccines to their area. Over all, about 52.5% of the respondents use all available livestock vaccines. However, 70% of the respondents use those vaccines from the Enemay woreda. Regarding location, peri-urban respondents (71.4%) were better mathematically in utilizing available livestock vaccines compared to the rural part (Table 5). It is in agreement with the study of many scholars, farm location were identified as a determinant factor for adopting technologies, and rural farmers face more barriers than urban and peri-urban areas (Robi et al., 2024; Sopeju et al., 2025). In this study, though 4 out of 5 respondents in the age group (18-27) were willing to vaccinate their animals, it was not statistically significant ($\chi 2= 2.876$, p-value= 0.719). The level of education was also not associated with the usage of available livestock vaccines. However, other scholars reported that larger proportions of younger respondents (100%) are more willing to vaccinate their animals as compared to other age groups; and respondents with higher levels of education were willing to vaccinate from Negele-Arsi, Shashemene, and Hawassa study areas (Teffera & Megerssa, 2025).

Table 5. Vaccine usage in the area

Variables		Do you use all available livestock vaccines		$\chi 2$ (p-value)
		Yes (%)	No (%)	
Woreda	Enemay	14 (70.0)	6 (30.0)	7.55 (0.056)
	Awabel	6 (28.6)	15 (71.4)	

Variables		Do you use all available livestock vaccines		χ2 (*p*-value)
		Yes (%)	No (%)	
	Sinan	11 (57.9)	8 (42.1)	
	Goncha	11 (55.0)	9 (45.0)	
	Total	42 (52.5)	38 (47.5)	
Education level	Illiterate	11 (55.0)	9 (45.0)	1.32 (0.857)
	Read and write	14 (48.3)	15 (51.7)	
	Elementary	11 (50.0)	11 (50.0)	
	Secondary school	5 (71.4)	2 (28.6)	
	Preparatory	1 (50.0)	1 (50.0)	
Age	18-27	4 (80.0)	1 (20.0)	2.876 (0.719)
	28-37	6 (54.6)	5 (45.4)	
	38-47	12 (50.0)	12 (50.0)	
	48-57	14 (56.0)	11 (44.0)	
	>57	4 (36.4)	7 (63.6)	
Location concerning town	Peri-urban	10 (71.4)	4 (28.6)	2.4 (0.118)
	Rural	32 (48.5)	34 (51.5)	
Type of livestock production	Traditional	28 (57.1)	21 (42.9)	5.97 (0.051)
	Semi-intensive	14 (53.8)	12 (46.2)	
	Intensive	0 (0.0)	5 (100.0)	
Animal grazing practice	Free grazing	24 (53.3)	21 (46.7)	1.68 (0.919)
	Cut and carry	12 (57.1)	9 (42.9)	
	Tethered	6 (50.0)	6 (50.0)	
Previous outbreak occurrence on their farm	Occurred	7 (41.2)	10 (58.8)	0.99 (0.318)
	Not occurred	34 (54.8)	28 (45.2)	

Source: Own research

Farmers prefer to vaccinate cattle than other animals. Whereas, dogs were the least likely to be vaccinated from the animals available in the households. It may be related with it is difficult to bring to a vaccination point. Some respondents (6.8%) said that chicken and pet animals are too unmanageable to bring them, and being far away from the vaccination point. This finding was comparable with the report of Yoak and his colleagues, a significant portion of respondents indicated that they were unwilling to travel for vaccinating their dogs (Yoak et al., 2021). This demonstrates the importance of door-to-door or home vaccination. And, about 56.3% of the respondents didn't vaccinate one or more animal species available in their household. It is described in Table 6.

The major reason for not vaccinating their animal was due to lack of awareness (54.5%), and it was comparable with the report of many scholars, who emphasized the benefit of awareness creation for the utilization of improved technologies, and in Ethiopia, farmers lacked awareness of available vaccines that can affect vaccine uptake (Bassa, 2021; Robi et al., 2024). Hopker and his colleagues also reported that common barriers to vaccination were a lack of awareness and a negative attitude to vaccination. So, relevant farmer education should precede immunization programs to avoid awareness problems about vaccination (Hopker et al., 2021). Vaccine uptake can be facilitated by decreasing barriers. An increased awareness can stimulate demand, and this can be achieved through education by a variety of mechanisms, including radio campaigns and product demonstrations (Donadeu et al., 2019). For about 4.5% of the respondents, the barriers to vaccinating their chickens were due to the vaccine not being available in small doses (Table 6). This finding was comparable with the report of Donadeu and his colleagues, the vaccines in packages containing a small number of doses are preferable to smallholder farmers, more cost-effective, and prevent wastage (Donadeu et al., 2019). Farmers being far away from a vaccination point was another reason for not vaccinating their animals. This finding agrees with the report of Catley and his colleagues, reducing travel distance and time by bringing vaccines closer to farmers improves vaccination coverage (Catley et al., 2009).

Table 6. Vaccine preferred and reason for not vaccinating animals

Variables		Woreda				Total (%)	χ2 (*p*-value)
		Enemay	Awabel	Sinan	Goncha		
Which animal vaccine are you more interested in using selectively?	Cattle only	10	19	6	12	47 (59.5)	71.4 (0.000)
	Cattle & sheep	2	1	1	3	7 (8.9)	
	Cattle, sheep & equine	5	0	0	1	6 (7.6)	
	Cattle, sheep, equine & dog	1	0	0	0	1 (1.3)	
	Cattle, equine & chicken	1	1	0	0	2 (2.6)	
	No selection/all animals	0	0	4	0	4 (5.1)	
	Cattle, sheep, equine & goat	0	0	0	1	1 (1.3)	
	Sheep	0	0	8	1	9 (11.4)	
	Dog	0	0	0	2	2 (2.5)	
Do you have animal species not vaccinated before?	Yes	9	15	12	9	45 (56.3)	4.39 (0.222)
	No	11	6	7	11	35 (43.7)	
Animals species not vaccinated before	All animals	1	0	0	0	1 (2.2)	28.81 (0.051)
	Dogs	2	4	6	4	16 (35.6)	
	Donkey	0	3	0	0	3 (6.7)	
	Chicken	3	3	0	4	10 (22.2)	
	Chicken and dog	2	5	6	1	14 (31.1)	
	Sheep	1	0	0	0	1 (2.2)	
Reason for not vaccinating their animals	Lack of awareness	3	9	8	4	24 (54.5)	26.28 (0.093)
	Chicken and pet animals are unmanageable to bring to a clinic	2	0	0	1	3 (6.8)	
	Chicken vaccines not available in a small dose formulation	1	1	0	0	2 (4.5)	

Variables		Woreda				Total (%)	χ2 (*p*-value)
		Enemay	Awabel	Sinan	Goncha		
	Due to a fear of needle contamination	1	0	0	0	1 (2.3)	
	Far away from the vaccination point	0	1	1	1	3 (6.8)	
	No vaccine available for chickens and pet animals	0	1	1	0	2 (4.5)	
	Use traditional medicines	0	0	0	2	2 (4.5)	
	Lack of professionals	0	0	2	0	2 (4.5)	
	Vaccination time is during agricultural activity	0	0	2	1	3 (6.8)	
	The vaccine is not free of cost	1	0	0	1	2 (4.5)	

Source: Own research

The experts interviewed in this study emphasized the need for improving vaccine delivery and efficiency through regular extension service to raise awareness among farmers and the communities (41.7%), ensuring availability of appropriate facilities such as cold-chain infrastructures (16.7%), and time of vaccine administration need to be rechecked (16.7%). This aligns with the finding of multiple scholars who studied on livestock vaccination in Ethiopia. The timing of vaccination is a key determinant of vaccine effectiveness that strongly influences vaccination success and outbreak prevention from Southwest Ethiopia (Aregahagn et al., 2021) (Robi et al., 2024). According to another scholar from the Sidama zone in Southern Ethiopia, there is mishandling and storage of veterinary vaccines that may affect vaccination efficacy. The method of vaccine handling is by far deviated from the standards set by international organizations and vaccine manufacturing company recommendations (Yohannes et al., 2020). Nowadays, to overcome cold-chain barriers, improve vaccine uptake, and unleash the true potential of immunization, innovative solutions in the area of thermostable vaccine formulations (heat and freeze-stable vaccines), alternative advanced delivery platforms, and AI-driven tools are very important to revolutionize veterinary vaccines for improved animal health and welfare, public health, and economic resilience (Fanelli et al., 2022; Raut et al., 2025).

The time of vaccine administration is crucial for vaccination success. About 16.7% of the interviewed experts believe that the timing of vaccination needs to be rechecked for the various agroecological regions of the study areas. This finding is comparable with the report of Catley and his colleagues there was no significant difference in livestock mortality among vaccinated and non-vaccinated herds. This was caused by a number of contributing factors, and incorrect timing of vaccination or an inappropriate vaccination schedule was one of those factors that caused mortality in vaccinated animals (Catley et al., 2009; Yohannes, 2021).

Table 7. Farmer's willingness to pay for an animal species and a type of vaccine

Variables		Frequency (N= 31)	Percentage (%)
Animal species	Cattle	11	35.5
	Sheep	9	29.0

Variables		Frequency (N= 31)	Percentage (%)
	Goat	6	19.4
	Equine	2	6.6
	Dog	2	6.6
	Chicken	1	3.2
Vaccine type	Anthrax	8	38.1
	Blackleg	3	14.3
	Pasteurellosis	4	19.0
	IBD	1	4.8
	Rabies	1	4.8
	NCD	1	4.8
	LSD	1	4.8
	Shoat pox	2	9.5

N-Number of respondents, IBD- Infectious bursal disease, LSD- Lumpy skin disease

Source: Own research

Household farmers were more willing to pay for vaccines for cattle than for other animals, and for the anthrax vaccine than for other vaccine types. It is presented in Table 7. In this study, respondents' willingness to pay for the poultry vaccines was against Newcastle disease only. But, in another investigation conducted in Ethiopia with a similar farming system, smallholder farmers were willing to pay for Newcastle and Gumboro disease vaccines (Terfa et al., 2015). About 25% of the experts interviewed reported they have experienced cases of vaccine failure in shoats (Ovine pasteurellosis and shoat pox) and chickens (Newcastle disease) in two fiscal years. This finding is in agreement with the report of Gelaye and his colleagues, the collected samples from different geographical locations in Ethiopia confirmed that circulating Capripoxvirus isolates were genetically distinct from the vaccine strain (Gelaye et al., 2015). Furthermore, in poultry production, disease outbreaks in vaccinated flocks cannot be totally prevented due to vaccine failure (Birhane & Fesseha, 2020).

5. Conclusions

Vaccines enhance livestock production by preventing disease occurrence, but vaccine provision does not guarantee uptake at the community level. Because about 35.6%, 31.1%, 22.2%, and 6.7% of the respondents didn't vaccinate their dogs, chicken and dogs, chickens, and equine, respectively. Most of the respondents take their animals for free grazing and mix with other herds in the field. 77.5%, 75%, and 75% of cattle, sheep, and equine owners responded that keeping animals together with other animals was considered a predisposing factor for disease occurrence. The major reasons for not vaccinating their animals are due to a lack of awareness of the need for vaccination, being far away from the vaccination point, the absence of a vaccine, and the vaccine not being available in small doses. Therefore, it is essential to address the barriers hindering the uptake of livestock vaccines, and proper management practices need to be implemented. The adoption of animal vaccine technologies can be enhanced through the implementation of several strategies. Farmer training and awareness creation programs are required through routine extension services, optimal vaccine delivery tools like solar, refrigerator, vaccination syringe, and crush at each vaccination point need to be fulfilled, vaccine formulation needs to be revised by vaccine manufacturers to vaccinate a small number of animals without vaccine wastage, appropriate transportation systems should be available for the on-time delivery of vaccines, and better to have home vaccination for chicken and pet animals.

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