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Assessment of Biosecurity in the Health and Livestock Sectors: A Concise Bibliography

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ABSTRACT

When it comes to boosting agricultural output and decreasing disease rates, biosecurity is crucial. The purpose of this study was to estimate the bio-security measures put in place on dairy farms in Harar and Dyer Dawar in order to investigate the connections between these measures and the owners' demographic and socioeconomic traits as well as the characteristics of the farms themselves. The present research set out to examine the bio-security state of cattle farms and the variables impacting their bio-security in the eastern areas of Ethiopia, namely in Harar and Dire Dawa. A chi-square test indicated a statistically significant correlation between the locations of the farms and the biosecurity measures put in place. The biosecurity compliance evaluation of the research farms included 124 bio-security procedures. Dairy biosecurity scores ranged from 33 to 74. Biosecurity scores ranged from 27.1% to 61% in terms of ratio or value. Nine out of the twenty-one cow farms that participated in the research had bio-security conformance ratings of "good" since their score percentages were at least 51% (range from 50.3% to 61%). Twelve more farms were classified as "poor" since their percentage scores were below 51% (ranging from 27.1% to 47.4%). The present study divided bio-security into four (4) parts, each with its own mean ± standard deviation: isolation (19.24± 3.91), sanitation (16.64± 6.82), traffic control (16.94± 2.4), and physical management (3.24± 1.06). Only eleven out of ten (11%) spots in Harar city's livestock ranches were deemed to have a "good" degree of bio-security. In addition, eighty-one (81%) of the dairy farms in Diyar Dawa city that were examined had a bio-security adoption level that was deemed "good."

Keywords: Dairy, Isolation, Biosecurity, Sanitation, Preventive medicine, and Traffic controls.

INTRODUCTION:

To ensure the safety of animals and their products in all contexts, biosecurity advocates for a change in mindset and practise that minimizes exposure to potential diseases (Haggag et al., 2018). Biosecurity was characterized as the "deployment of safeguards that reduce the potential for disseminate disease agents by introduction. "In order to decrease risks in all activities involving domestic, captive/exotic, wild, and exotic animals and their products, humans need to adopt a couple of attitudes and behaviors" (FAO, 2008; Monterubbianesi et al., 2019). Once again, biosecurity was characterized as a collection of protocols for managing reduce or eradicate the transmission of illness within the herd and avoid the possibility of bringing new diseases to the farm (Fasina et al., 2012; Can and Altuğ, 2014). Breach of bio-security in livestock management, increased human-wildlife interaction, and human-animal close quarters during animal raising are major contributors to the high prevalence of zoonotic and other infectious illnesses in animals (Brown, 2004; Manuja and Manuja, 2014). As a result, the farm's immediate natural setting is crucial for assessing disease hazards (OIE, 2013; Hayle et al., 2020).

Diseases are more likely to spread if the farm is situated next to other farms, slaughterhouses,

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animal markets, waste disposal sites, hatcheries, or corpse centers. There is an increased danger due to the proximity to rivers and animal transit routes. The Canadian Food Inspection Agency (2011) and Manuja and Manuja (2014) state that in order to minimize the risk of disease introduction and spread, it is important to design barns, buildings, ventilation inlets and outlets, unloading and loading areas, treatment, and isolation or quarantine locations in a specific way. The danger of disease transmission may be reduced by creating separate spaces for young, ill, and new animals, with clearly marked borders. A bio-security design may benefit from the natural barriers and drainage provided by characteristics such as plants, streams, and terrain (Manuja and Manuja, 2014). Biosecurity was based on understanding the transmission of infectious diseases, which included how long infected animals are contagious, how the pathogen is transmitted, how long it survives in the environment, and how it is infected (Mon-terubbianesi et al., 2019). The prevalence of infectious illnesses has a substantial impact on profitability in intensive cattle production. Reductions in growth and/or production rate, diminished fertility, and higher susceptibility to various illnesses may lead to substantial direct and indirect economic losses caused by disease damage (Najdrowski, 2005; Hassen et al., 2022).

Examining routines is one way to measure biosecurity on farms (Delpont et al., 2018). Research on biosecurity on cattle ranches has shown that, on average, few safeguards are put into place (Renault et al., 2018a; Damiaans et al. 2019). The most often mentioned causes of this little biosafety are the anticipated investments of time, money, and effort (Damiaans et al., 2018). Researchers in a number of states found that cattle owners there consistently disregard advice on biosecurity measures (Moore et al., 2008). Studies conducted in various countries on the topic of biosecurity practices and farmers' perceptions have shown that, although many farmers were aware of biosecurity practices, not all of them implemented the recommended protocols for their businesses (Sayers et al., 2013; Laanen et al., 2014; Dewulf et al., 2014; Gunn et al., 2008; Robert-son, 2019; Compo et al., 2017). While some have pointed out that education plays a big role in making sure that livestock industries adopt biosecurity practices to reduce the risk of disease entry and maximize productivity, others have argued that traditionally intensive industries are better at implementing biosecurity than small-holder or extensive industries (Robertson, 2019).

Goat feedlots in central Ethiopia were the subject of a study on biosecurity measures (Alemayehu & Leta, 2014). Cost, value, significance, workload, lack of trans- sparency, and expertise are only a few of the limits and obstacles highlighted by these research as factors affecting farmers' bio-security measures adoption. It is helpful to understand the perceived relevance, effectiveness, and cons-traints of biosecurity measurement from the perspective of farmers in order to advise them and help them make behavioral adjustments. Our ability to converse with the farmers would be much enhanced by this. In order to better understand the bio-security situation between the Harar and Dire Dawa study regions, as well as to prioritize important bio-security sites on dairy farms, this work was carried out.

Analyzing Existing Research

Many other definitions of the word bio-security have been proposed. When it comes to animals, the focus is usually on "management measures" that lessen the likelihood of an infectious disease introduction (Caldow, 2004; Brennan and Christ-ley, 2012). According to Bellini (2018), biosecurity is defined as "a set of management and phys- ical measures designed to reduce the risk of intro-duction, establishment & spread of animal diseases, infections or infestations to, from and within an animal population" in the OIE Terrestrial Animal Health Code. Examples of certain types of It is commonly believed that improved biosecurity practices are necessary to promote animal welfare and boost the financial sustainability of the dairy business, since there has been a rise in common livestock illnesses in recent years. In their 2004 Animal health and welfare strategy, Great Britain emphasized that pet owners should take responsibility for their animals' well-being and that veterinarians should take the lead in providing proactive disease control services (Defra et al., 2004). According to many studies (Gunn et al., 2008; Derks et al., 2012), as well as others

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(Garforth et al., 2013; Bekere et al., 2022), veterinarians are among the most important and trustworthy sources of knowledge on biosecurity for crops.

Preventing the introduction of pathogens to cattle on dairy farms, preventing the spread of pathogens among cattle within a dairy farm, and preventing the exit of pathogens between cattle farms or from dairy farms to other animal populations are the three main goals of biosecurity in dairy cattle, which aims to reduce the risks associated with diseases and pests (Anon, 2014). By creating jobs, funding education and training, increasing opportunities for trade in livestock and animal products, and giving raw materials to industry, combating livestock illnesses in underdeveloped nations may make a significant contribution to poverty reduction. It was discovered that animal infections were one of the main factors affecting livestock productivity. Loss of biodiversity and important genetic resources may occur as a consequence of their eradication, which can range from decreased production and limited access to markets to the eradication of whole flocks and herds. It may not take long for certain infectious illnesses that are only now appearing to spread from animals to people and from a regional to a global level of importance (Bellini, 2018; Gammada et al., 2022).

As a result, farm-level biosecurity entailed a set of management practices aimed at reducing or controlling the introduction, transmission, and eventual export of infectious disease agents that could harm human health, the environment, and the economy. Keeping food items intact is a crucial part of ensuring food safety on farms.

a few, and of having the greatest quality, that is crucial in order to ensure the safety and well-being of customer (Cook, 2013). Avoiding endemic illnesses like digital dermatitis, Johne's disease, infectious mastitis, and enzootic bovine leucosis is just as essential as avoiding catastrophic or exotic animal diseases when it comes to biosecurity (Bickett-Weddle and Ramirez, 2004). The discovery of new illnesses, as the Schmal-lenberg virus in 2012 in Europe, necessitates adjustments to bio-security protocols (Brennan et al., 2012). Therefore, biosecurity precautions are essential for the recently-occurring pandemic (COVID-19) in order to contain it. Health management methods, or bio-security plans, include things like formally identifying potential hazards and conducting risk assessments on individual farms. The problems are channeled into a series of protocols or directions for appropriate operation by these plans. According to Noordhuizen and Cannas da Silva (2009) and Stankovi and Zlatanovi (n.d.), there are protocols for general hygiene procedures, entrance procedures, procedures for animals, cars, professionals, and cattle, disease diagnostics and animal treatment, and good medicine application practice. Bekere et al. (2022), Islam et al. (2020), Joerger (2016), and Ber-gevoet et al. (2004) all agree that the quality of management choices depends on the continual examination of new information and technology in a dairy farm.

The time of farm managers is often the most scarce resource (Holland et al., 2014), hence it's vital to determine which critical management areas should get more emphasis from dairy producers. For livestock producers to achieve economic success, it may be necessary to regularly maintain facilities or equipment. Additionally, the fundamentals of management and decision-making remain crucial (Campe et al., 2015). The dairy farm's profitability was shown to be positively affected by management decision-making, farm size, milk production levels, and milking technologies employed. There is a lack of bio-security measures and certain procedures are seldom implemented on cattle farms, according to research (Sayer et al. 2013). Although cattle producers in the UK and Ireland see bio-security as important, a study conducted by Brennan and Chris-tley (2013) indicates that less strategies are being used to ensure bio-security. An anticipated deficit in milk production occurred at Daily milk consumption was estimated at 290 million liters in 2011, with a very low average of 19 liters per person in Ethiopia, and is projected to reach 375 million liters by 2020, representing a 4% annual growth rate. This amounts to 128 million liters of milk. Consumption (Private, 2015). These points to an increase in the demand for dairy products, which calls for a larger dairy farm. The cornerstones of a

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successful dairy industry, particularly in developing nations, are bio-security measures, which were, however, not well implemented. Inadequate preparation for achieving biosecurity in such a setting may have beneficial and detrimental effects on cattle health, leading to economic losses and public health risks (Van Schaik et al., 2002). In this era, bio-security refers to the management levels achieved in order to decrease the danger of introducing serious pathogenic diseases to herds, avoid financial losses, and preserve people's health (Cal-dow, 2004).

Although bio-security knowledge may be prevalent, its implementation on farms is often lacking, according to previous research that analyzed the success of bio-security in different agricultural operations (Mee et al., 2012). A variety of procedures and policies are put in place to ensure that no disease-causing agents are allowed to enter or leave a site where there are farm animals. This practice is known as biosecurity. Unfortunately, the most challenging part of executing a bio-security strategy is not establishing control procedures that lead to a biosecure farm; rather, it is determining which control measures to utilize and how to apply them (Villarroel and Vet, 2014). Biosecurity measures are necessary for public and occupational health because certain illnesses are zoonotic, meaning they may be transferred from animals to people.

MATERIAL AND METHODS:

Locations and Study Area

Researchers in Ethiopia and Bangladesh worked together in milking sheds to conduct the current study. At an elevation of 1,276 meters above sea level, the city of Diyar Dawa is situated in the lowlands. In addition to being the capital of the East Hararghe region of Oromia region and a walled city in eastern Ethiopia, Harar is also the regional metropolis of the Harari area. Situated at a height of 1,884 m.a.s.l., about 524 kilometers from Addis Ababa, the city is expected to have a population of 231,000 in 2014 (CSA, 2013; Dairy et al., 2016). These two cities serve as the hubs of milking in eastern Ethiopia, and they are home to private commercial dairy farms. The large rural districts that surround these contemporary dairy farms also contribute to the nation's milk and dairy product supplies (CSA, 2013; Dairy et al., 2016). The milking sheds were a collection of privately held dairies with varying numbers of Holstein Fresian and cross-bred dairy cows.

Research Approach and Plan

The study was designed to gather information from all dairy farms in Dire Dawa and Harar cities. It was a cross-sectional census survey. That being the case, sampling is useless. Before beginning to collect data for this planned study, we made sure to include all dairy farms by searching the official registration of dairy-farms, consulting with local veterinary health authorities, or utilizing the snowball technique. It was asked that owners or their managers take part. to take part in the research after giving their verbal permission, and the necessary data was collected. It was also recorded how many dairy proprietors declined to take part.

According to a study by Megersa et al. (2011), farms were categorized as smallholder farms with less than 10 animals, medium farms with 11 to 51 animals, and big farms with 51 animals or more based on herd size and production level.

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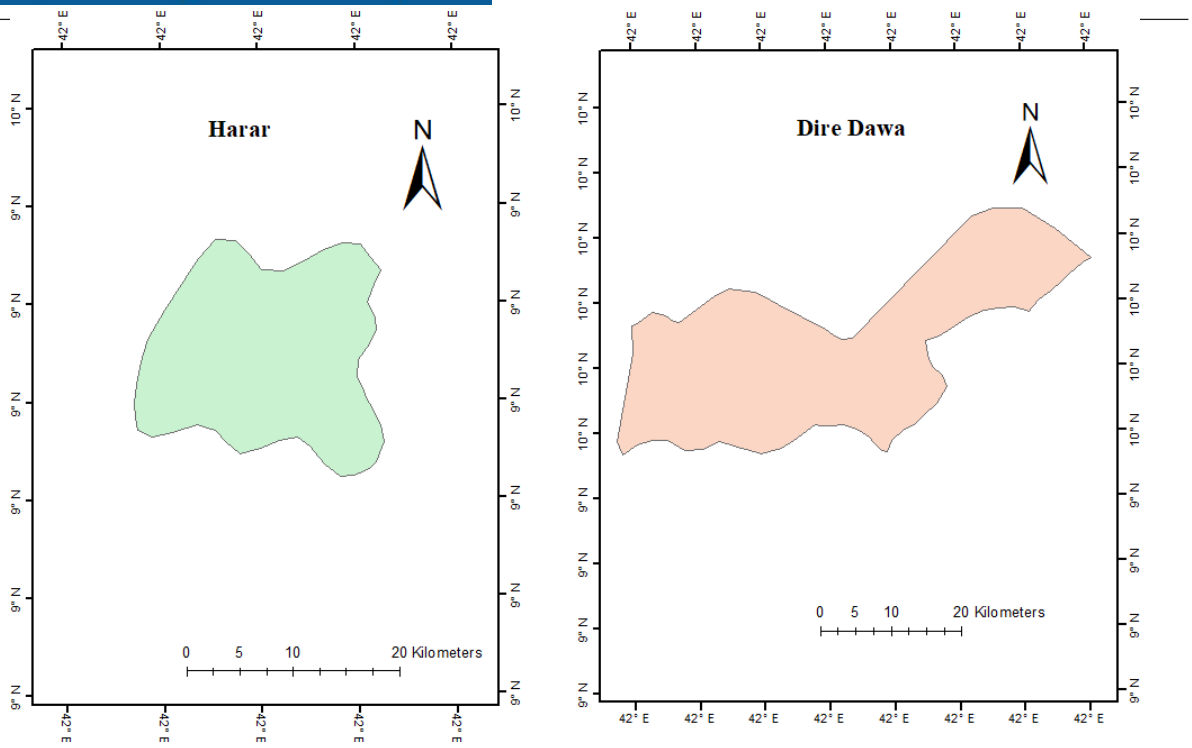

Collection of the Data

Fig. 1: Representing the Maps of the study area.of a biosecurity plan. The 3rd category was farm cha-

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A questionnaire based survey was under taken to study the frequency of used of different biosecurity measu- res. Information about bio-security was obtained thro- ugh on farm observations & interviews taken with owners & workers using a structured questionnaire. In the questionnaire contained 124 questions, mainly closed & semi-closed.

Questionnaire design

The question paper was divided into four (4) sections and the 1st question set consisted of gender, age, ma- rital status, & occupation, education level, experiences, previous training in dairy-farm management, mem- bership of a dairy farm cooperative, demographic and socio-economic characteristics of the farm owners, and knowledge of bio-security among others. The 2nd part was awareness of disease control and bio-security such as owners' understanding of livestock diseases, know- ledge of bio-security, sources of bio-security in-for- mation, and the importance of bio-security & presence racteristics such as farm area, year of establishment, farm size (m2), presence of buildings on the farm, pre- sence of cattle barns, number of cattle (herd size), and cattle breed. The last category was bio-security mea- sures such as isolation, traffic control, sanitation as defined by the FAO, (2008), and animal health man- agement which was developed to collect data on bio- security practices. Before starting the field work, the questionnaire was pretested and the questions were adjusted accordingly. The investigators among small samples of dairy farmers carried out pre-testing of the questionnaire. Adjustments were made by replacing some words, deleting irrelevant questions, and refor- mulating and splitting some questions as (Kouam, 2018).

Analysis of Data

Data collected in the work were stored in Micro-Soft Excel spreadsheets & analyzed used Statacorp sta- tistical software version 20. They were analyzed used descriptive statistics to analyze frequencies and per- centages. Goat's farms were classified on the basis of bio-security status according to the method described by the Wijesinghe *et al*. (2017) with thin modification. A total of 124 marks were allotted in the questionnaire according to the strength & importance of bio-secu- rity. The total mark achieved by each farm was conver- ted into a percentage and a farm above or equal to 51% was said to have "good bio-security" and below 51% poor biosecurity. The conglomerate of respondents' de- mographic and socio-economic and farm character- istics with bio-security compliance was assessed using Fishers exact tests statistics. The statistical significant conglomerate was tell to exist when $P < 0.05$.

RESULTS:

Demographic Features of the Farm Owners

Total of the 21 dairy-farm owners were interviewed in this work. From the respondents, 13 (71%) were Male while 6 (30%) were Female. Of the interviewed, 12 (60%) were older than 44 years age, 17 (85%) were married, and 14 (74%) had higher education level. Re- garding their occupation, 16% were civil-servants, 31% were traders & 56% had occupations other than the two (2). 61% of the owners had experience of one to ten (10) years while 41% had more than ten (10) year's experience. 85% didn't have previous training on farm management, only 6% were producers of dairy co-operatives and 36% claimed to have knowledge of bio-security.

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Table 1: Demographic and socioeconomic characteristics cattle farm owners.

Socioeconomic characteristics	Number	Percentage (%)
Gender		
Male	13	71
Female	6	30
Age (years)		
31 – 45	8	40
>45	12	60
Marital status		
Married	17	85
Not Married	3	15
Education Level		
Secondary education	5	25
Higher education	14	74
Occupation		
Civil servant	3	16
Trader	6	31
Others	11	56
Experience (years)		
One to ten (1-10)	12	61
More than ten (10>)	8	41
Previously training on the cattle farm management		
No	17	85
Yes	3	15
Producer of a dairy farm cooperative (s)		
No	19	95
Yes	1	6
Knowledge regarding biosecurity		
No	13	65
Yes	7	36

Aware on Disease-Control & Biosecurity

As represented in **Table 2**, from 20 farm owners inter- viewed 16(81%) disclosed their under-standing of goat diseases particularly those affecting dairy cows. Mejo- rity respondents replied that prevention of diseases was cheapest method whereas 84% of them said pre- vention was less-time consuming while 15% described treatment was less costly. Majority of owners inter- viewed (65%) responded did not have knowledge on biosecurity while the remaining 35% claimed.

Table 2: Rate of livestock owners aware of animal disease-control & biosecurity.

Awareness	Number	Percentage (%)
Owners under-standing of animal diseases		
Yes	16	80
No	4	20
The cheap method		
Treatment	0	0
Prevention	20	100
Less-time consuming		
Treatment	3	15
Prevention	17	84

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Knowledge on biosecurity		
Yes	6	35
No	13	65
Source of biosecurity information		
Veterinary	3	15
Internet	2	10
Professional	2	10
Not aware	13	64
Importance of the bio-security		
Very important	9	45
Important	4	20
Don't know	7	35
Presence of the Bio-security plan		
Yes	1	5
No	19	95

Farm Characteristics

Each 10 (51%) of the farms were situated in Harar & Dire Dawa and majority of dairy-farms, nine (45%), were established according to Ethiopian Calendar (Eth. Cal.) between the years 2001 and 2005 whereas each 4 (20%) were made on the years 1996 to 2000 and the years 2006 to 2010. All of the farms were esta- blished on areas lower than 5002 m^2 in size. A great majority of cattle farms (6 that is 35%) were esta- blished on areas of less than 1001 m^2 while 13 (61%) had sizes between 2002 and 5001 m^2. All of the farms had buildings in the farm, however, 4 (24%) described there were no cattle-barns. Majority (66%) of dairy- farms comprised <101 animals and of Holstein Frie- sian breed.

Table 3: Features of the animal-farms established in Harar & Dire Dawa towns.

Features	Number	Percentage (%)
Farm location		
Harar	10	50
Dire Dawa	10	50
Year of the establishment (Ethiopian Calendar)		
1991 - 2000	6	30
>2000	14	70
Farm size (m^2)		
<2000	8	40
>2000	13	61
Presence of the buildings		
Yes	20	100
No	0	0
Presence of cattle barn(s)		
Yes	15	75
No	5	25
Number of the cattle		
<100 animals	13	65
100-150 animals	7	35
Breed of the livestock		
Holstein Friesian	13	65
Crossbred	7	35

Biosecurity Status

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Total of the 35 bio-security practices were included to assess implementation level of the traffic-control com- ponent of bio-security measure (**Table 4**). The biosecu- rity score ranged from 12-21 and the percentage varied from 34.3% - 60% and number of farms with "Good" bio-security level for the traffic-control were 9 and that of "Poor" level were 11 and with regard to the iso- lation component, 32 bio-security practices were selec- ted and used to evaluate the adoption level. The bio- security score and percentage of isolation component varied from 11-27 and 34.4%-84.4%, respectively. Only 3 dairy farms gained "Good" in the implement- ation of the isolation component of bio-security mea- sure while the remaining 17 were "Poor". Alarmingly sanitation practices, a total of 46 bio-security practices were chosen & evaluated. The bio-security score & percentage of sanitation practices extended from 3-25, ad 6.5% – 54.3% in that order. The implementation level was "Good" for 5 farms & "Poor" for 14 farms. Fin-ally, 12 bio-security practices were considered for the estimation of animal physiology management. The bio-security score ranged from 1-5 and percentage extended from 8.3% - 41.7% and the adoption score was evaluated as "Poor" for all the 21 cattle-farms included in the work.

Traffic control system

The traffic-control component of bio-security practices with high adoption levels (> 90%) were included; no vehicles frequently move off-property, go-to-property, sale yard, abattoir &/or show & then return, no equip- ment used for different activities, no sharing of eq- uipment & machinery with other farms, no more than one (>1) main entry point to the farm, locating animal entry areas away from the rest of the storage, not gra- zing resting pastures recent spread with wastes, work from young to old animal, separation of material for young and old animals and when entry animals the lorry & truck didn't enter the stable. The least imple- mented measures (less than 20%) were, no driveway, transfer information including animal health records for all new animals, outgoing animals moved off the farm with information on animals health status, keep- ing records of cattle movements, presence of entry restriction sign post, use own vehicle to transport visi- tors, record presence to the routine, maintaining and monitoring heath records for individual animals, use own vehicle for animal movements, no purchase of replacement animals is done and availability of visitors logbook. The respective range of the traffic-control component for dairy-farms was 12 to 21 and 16.94 ± 2.4 with a maximum score of 35 points.

Table 4: Level of bio-security practices of the traffic-control bio-security component.

Biosecurity practices	Yes (%)	No (%)
Not infested with wild animals	10 (50)	10 (50)
Presence of parking lot	9 (45)	11 (55)
No driveway	3 (15)	17 (85)
No additions to the herd	8 (40)	12 (60)
Source animals directly from the herd of origin	10 (50)	10 (50)
Transfer information including animal health status records for all new animals	0 (0)	20 (100)
Outgoing animals moved off the farm with information on animals health status	0 (0)	20 (100)
Keeping records of livestock (cattle) movements	0 (0)	20 (100)
Have and follow a movement plan	11 (55)	9 (45)
Closing gates & seeing visitors by the appointment	9 (45)	11 (55)
No Exchange of production material (drinkers, feeders, buckets, and tools) between farm	19 (95)	1 (5)
No vehicles frequently move-off property, or show & then return	20 (100)	0 (0)
No equipments used for the different works	20 (100)	0 (0)
Not allowing frequent visits to the farm area	9 (45)	11 (55)
No sharing of equipments & machinery with other farms area	20 (100)	0 (0)
Notify non-professional visitors, professional visitors and drivers of permitted areas of access to	7 (35)	13 (65)

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them and transport vehicles prior entry		
No more than one (>1) or more main gate in the farm	19 (95)	1 (5)
Presence of entry restriction sign post	1 (5)	19 (95)
Use own vehicle to transport visitors	0 (0)	20 (100)
Record presence to the routine	0 (0)	20 (100)
Locating animal loading sections	20 (100)	0 (0)
Maintaining and monitoring heath records for individual animals	0 (0)	20 (100)
Management of sick animals after healthy ones	17 (85)	3 (15)
Not grazing resting pastures presently spread with the waste	20 (100)	0 (0)
Use own vehicle for animal movements	0 (0)	20 (100)
Work from young to old animal	19 (95)	1 (5)
Separation of material for young and old animals	19 (95)	1 (5)
When loading cattle's the lorry &/or truck did not enter in the stables	20 (100)	0 (0)
No purchase of replacement animals is done	1 (5)	19 (95)
Nonprofessional visitors are not allowed to enter into farm	8 (40)	12 (60)
Availability of visitors logbook	0 (0)	20 (100)
Visitors do not have direct access point to the stables or barns	10 (50)	10 (50)
Absence of the freely moving cats & dogs	9 (45)	11 (55)
Presence of permanent rodent control	15 (75)	5 (25)
Presence of own feed and milk collection trucks	6 (30)	14 (70)
Total score of the traffic-control bio-security practices	35	
Minimum – Maximum biosecurity score of dairy-farms	12-21	
Mean ± Standard deviation biosecurity score of dairy-farms	16.94 ± 2.4	

Isolation

More than 90% of farmers disclosed or applied isola- tion bio-security measures such as no-pasture area, fence off-dead-animal pits & garbage-tips, fencing-off stock access to water courses, no maintain contact of pre-weaned calves with the older cattle, maintain no contact of dry cows with lactating cows, no mixing of different species, separate calves & young stock from the older animals. Bio-security practices of the isolation component with the least adoption levels were (< 20%) included; farm located > 501 m from the main road, farm located > 501 m from residential area, pre-sence of maternity pen and calving takes place in a separated calving box or maternity pen. The range, mean and standards deviation of isolation score of biosecurity component for the dairy-farms was 11 to 27 and 19.24 ± 3.91 respectively with a maximum score of 32 points.

Table 5: Ratio of bio-security practices of the isolation bio-security component.

Biosecurity practices	**Yes (%)**	**No (%)**
Not infested with wild animals	10 (50)	10 (50)
Presence of parking lot	9 (45)	11 (55)
No driveway	3 (15)	17 (85)
No additions to the herd	8 (40)	12 (60)
Source animals directly from the herd of origin	10 (50)	10 (50)
Transfer information including animal health status records for all new animals	0 (0)	20 (100)
Outgoing animals moved off the farm with information on animals health status	0 (0)	20 (100)
Keeping records of cattle movements	0 (0)	20 (100)
Have and follow a movement plan	11 (55)	9 (45)
Closing gates & seeing visitors by the appointment	9 (45)	11 (55)
No Exchange of production material (drinkers, feeders, buckets, and tools) between farm	19 (95)	1 (5)
No vehicles are frequently move off property, or show & then return	20 (100)	0 (0)
No equipments used for different activities	20 (100)	0 (0)
Not allowing frequent visits to the farm	9 (45)	11 (55)

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No sharing of equipments & machinery with other farms	20 (100)	0 (0)
Notify non-professional visitors, professional visitors and drivers of permitted areas of access to them and transport vehicles prior entry	7 (35)	13 (65)
No more than one (>1) or more main gate in the farm	19 (95)	1 (5)
Presence of entry restriction sign post	1 (5)	19 (95)

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Use own vehicle to transport visitors	0 (0)	20 (100)
Record presence to the routine	0 (0)	20 (100)
Locating of the animal entry areas	20 (100)	0 (0)
Maintaining and monitoring heath records for individual animals	0 (0)	20 (100)
Management of sick animals after healthy ones	17 (85)	3 (15)
No grazing of the resting pastures presently spread with the waste	20 (100)	0 (0)
Use own vehicle for animal movements	0 (0)	20 (100)
Work from young to old animal	19 (95)	1 (5)
Separation of material for young and old animals	19 (95)	1 (5)
When passing animals the lorry &/or truck did not enter the stables	20 (100)	0 (0)
No purchase of replacement of the animals is done	1 (5)	19 (95)
Nonprofessional visitors are not allowed to enter into farm	8 (40)	12 (60)
Availability of visitors logbook	0 (0)	20 (100)
Visitors do not have direct access point to the stables or barns	10 (50)	10 (50)
Absence of freely moving cats and/or dogs on the farm	9 (45)	11 (55)
Presence of permanent rodent control	15 (75)	5 (25)
Presence of own feed and milk collection trucks	6 (30)	14 (70)
Total score of the traffic-control bio-security practices	35	
Minimum – Maximum biosecurity score of dairy-farms	12-21	
Mean ± Standard deviation biosecurity score of dairy-farms	16.94 ± 2.4	

Sanitation

No found higher adoption levels of the sanitary bio-security measures (greater than 90%). The least imple- mented measures (less than 21%) were asking visitors to wash their hands before and after contact with your livestock (5%), presence of protective clothing for visi- tors, encourage 'come clean (0%), go clean' practices for visitors (0%), ensuring visitors cleaning and disin- fection after visits (0%), if lent, clean down equipment and vehicles before use on farm (5%), provide clean down equipment or facilities for visitors to clean boots and equipment's (5%), clean vehicles and equipment prior to moving from one farm to the other, provision of protective clothing for visitors (0%), have written instructions for cleaning and disinfecting different types of equipment (0%), have written sanitation, disinfection procedures and schedules for all animal holding areas/facilities (0%), specific cleaning and sanitizing protocols for higher-risk practices (e.g. AI & treatment of sick animals) (11%), nonprofessional visi- tors use farm-specific foot wear (0%), nonprofessional visitors use farm-specific clothing (0%), check for visitors use of a disinfection footbath, professional visitors wear or dressed in herd-specific protective clo- thing (5%), presence of dis-infection footbaths at the gate (0%), presence of car-wash dip at the gate (0%) and presence of disinfectant footbaths between pre- mises (0%). The range of bio-security score was 3-25 and the mean bio-security score of the farms was 16.64 ± 6.82 for a maximum level of 46 points.

DISCUSSION:

In this study, a rather limited sample size was used. Rather of sending out questionnaires to the farms, the scientists there made the experiment list themselves. This was a crucial component. Although doing farm visits would provide more trustworthy data on bio-security methods, the researchers acknowledge that this approach is more resource- and time-intensive than just sending out questionnaires. Furthermore, obtaining farmers' consent to visit their fields was not always a walk in the park. Twenty of the fifty dairy farmers surveyed were eager to take part in the experiments, but the other six were adamantly opposed for various reasons. This study examines dairy farms from a demographic and socioeconomic perspective, as well as farm characteristics and awareness of disease prevention and biosecurity measures. It then compares these factors to the overall level of

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biosecurity adoption and uses Fisher's exact test to draw conclusions.
Because of differences in culture, environment, and training and technical assistance across regions, the degree of biosecurity was shown to be significantly associated with the location of the farm (Fishers exact value = 9.91; $p<0.005$), out of all the characteristics examined. In Harar town, out of ten (10) cow farms, just one (11% of the total) was found to have a "Good" level of bio-security implementation. In Dire Dawa town, eight out of ten (81%) dairy farms studied for cattle had a "Good" level of bio-security adoption. There was no mention of the role of education in implementing bio-security measures in the paper. While several studies have shown the significance of research in protecting against biological threats (Robertson, 2019; Wolff et al., 2017).
Dairy producers see biosecurity as crucial, despite the poor adoption of bio-security procedures. Although veterinarians have been identified as one of the most important and trustworthy sources of biosecurity information for farmers, only 15% of participants in this study cited them as a source. This contradicts previous research (Gunn et al., 2008; Derks et al., 2012). Out of 21 dairy cow farmers in Harar and Dire Dawa, the majority preferred bio-security (Control) over treating diseases on-farm, citing its lower cost (101%, n = 21) and lower time consumption (86%, n = 18) as reasons. Additionally, a small percentage of farmers (46%, n=10) thought that even a little amount of bio-security measures may have a significant impact. In contrast to the findings of Mee et al. (2012), the interviewees showed that a larger percentage of people are unaware of bio-security measures (65%, n = 13). Among those who are aware of bio-security measures, 45% are veterinarians (14%, n = 3), 11% are internet users, and 11% are professionals. In contrast to the findings of Collineau and Stärk (2017), the interviewees mainly consulted private veterinarians (93%, n=52) and articles/professional press (77%, n = 43) when seeking information about bio-security measures. According to this study, there is a statistically significant difference between the study areas (locations). In Dire Dawa, it is implemented adequately, but in Harar, it is poor. This suggests that biosecurity awareness is lacking and that its implementation is poor in the farm area as well (Mee et al., 2012). Farms raising dairy cow in the Ethiopian cities of Harar and Dire Dawa were surveyed to provide a baseline for bio-security measures. While Sayers et al. (2013) focused on a variety of factors—including access to facilities, environment, culture, and training and technical support—in this investigation, just one of these—the research area—was related with or influenced bio-security status.

Traffic Bio-security

There was a high rate of adoption (>90%), which included the following: not using vehicles for transportation (often to and from the property, abattoir sale yard, or show, and back again), not reusing or sharing equipment or machinery, not having more than one main entrance to the farm, keeping animal loading areas separate from the rest of the stock, not grazing resting pastures, which spreads waste, working from young to old animals, keeping materials for young and old animals separate, and ensuring that the lorry or truck didn't enter the stable when loading animals. The percentage of plans using an insect and/or rodent management strategy was higher (75%) than in (Can & Altuğ, 2014), at 46%. There is one entrance restriction sign post (5% of the time), no one uses their own vehicle to transport guests (0% of the time), no one keeps track of livestock movements (0% of the time), no one knows what happens to the animals that leave the farm (0% of the time), and no one keeps records of new animals (including information about their health). 0 percent, 40 percent, and 60 percent of the time, adding to the herd is dependent on the animals' health state. There is no direct route to the barns or stables for 51% of guests. This finding differs with (Da-miaans et al., 2020), which reported that 64% of stable access was controlled by a locked gate and that visitors were required to introduce themselves before entering. Eleven participants had bad statuses and nine had excellent statuses, making traffic component biosecurity the second most implemented by status.
Don't share all of your agricultural machinery and equipment with other farmers, and When it comes to moving off property, going to an abattoir, or a performance, and then returning, no vehicles are ever 100% performed. Having rodent control on hand all the time is an improvement over 64%. Hygiene and Biosecurity

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While previous studies have shown that fewer than one-third of visitors used protective gear, none of the cultivars in this investigation did so (Can and Altug, 2014; Nore-mark et al., 2010). Less than 41% of producers said they provide protective clothes for visitors, whereas 33% of cultivars offered such clothing. Most visitors (5% of the total) failed to adequately adhere to the measures based on wearing farm-specific apparel and footwear. Nineteen out of twenty-five (95%) of the visitors are not professionals and do not carry herd-specific protective gear. Unfortunately, only 5% of guests really followed the rules about wearing boots and clothes appropriate for the farm. Officials from the herd often wear outfits designed for that particular herd.

19.4 percent do not use protective gear, which is equivalent to (Damiaans et al., 2019). Hygiene was the second-least adopted bio-security component, after sanitation, with 15 farmers rated its implementation as bad and 5 as acceptable. Cattle Health Management Out of all the cultivars surveyed, 13 (65) do not vaccinate their cattle before introduction to the herd, and 7 (35% of the total) do so routinely, which goes against the grain of veal farms (Damiaans et al., 2019). All farms were determined to be in a "Poor" condition, making health management the least implemented bio-security component. Distancing yourself Protecting biological resources Keep young animals and calves far from older ones (95 percent), avoid mixing species (95 percent), enclose areas where animals have died (95 percent), and block access to water sources (95 percent). The following rules should be adhered to: pre-weaned calves should not be handled by older cattle, dry cows should not be handled by lactating cows, 17 cattle should not be pastured near other cattle, a well-maintained border fence should surround the farm, and 18 cattle should not be pastured. Even though there was a possibility of direct and indirect contact to the herd, eleven out of twenty farmers (or 55%) believed they isolated ill animals and nine (or 45%) couldn't apply isolation. According to Can & Altuğ (2014), the majority of farmers failed to segregate cattle that were transferred from another farm. The illness history of the recently acquired animals was known to only a small number of producers. Noremark et al. (2010) found a similar trend, with 60% of farmers introducing new calves into the herd without first isolating them. It has been shown that farms do not have a documented strategy for implementing biosecurity measures (Milanovic, 2019). There was an improvement above the 20% indicated by (Damiaans et al., 2019) when it came to purchasing replacement calves from herds with known health status, totaling 12%. Only three farmers were deemed to have low status, while the other seventeen were deemed to have high status, indicating that the isolation components of bio-security were better implemented.

CONCLUSION:

The study offers valuable insights into the demographics and socioeconomic status of dairy farm owners, as well as farm features, disease control awareness, and biosecurity. However, future research should be larger and more comprehensive, particularly in Harar, where only one out of ten farms had good biosecurity status. It would be beneficial to advise or educate farmers to develop a bio-security strategy, since we saw no such thing at the farm. Having a confined herd or flock and regularly screening animals for blood or other diagnostic diseases when they are purchased. The well-being of their company, their animals, and the general public may all be protected if farmers have a documented strategy for implementing bio-security measures. If farmers want their biosecurity plans to work and their animals to be healthy and productive, they should focus on developing, implementing, and maintaining good farm management practices—the part of biosecurity that we found to be the least effective. Policymakers in Ethiopia should prioritize biosecurity concerns on animal farms, particularly dairy farms, and reach out to farmers via training or other regulatory measures, as there has been little research or training on the topic. To better understand the training needs of farming communities, particularly those in Harar, it is important to collect baseline data on the implementation of bio-security measures on farms. This will allow researchers to track the level of "bio-security uptake" by farmers and inform future demographic and sociological studies.

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