

Thesis Ref. No: _____



ADDIS ABABA UNIVERSITY
COLLEGE OF VETERINARY MEDICINE AND AGRICULTURE
DEPARTMENT OF VETERINARY EPIDEMIOLOGY AND PUBLIC HEALTH
MASTERS IN VETERINARY PUBLIC HEALTH

MVSc THESIS
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ASSESSMENT OF KNOWLEDGE, ATTITUDE AND PRACTICE OF URBAN DAIRY PRODUCERS IN REGARDS TO HYGIENIC MILK PRODUCTION AND MILK SAFETY REGULATIONS IN FURI, GELAN AND KOYE-FECHE SUB CITIES OF SHEGER CITY ADMINISTRATION, OROMIA, ETHIOPIA.

JUNE, 2025
BISHOFTU, ETHIOPIA

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A thesis submitted Addis Ababa University College of Veterinary Medicine and Agriculture in partial fulfilment of the requirements for the degree of masters in Veterinary Public Health

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As MSc Research Advisor, I certify this thesis prepared by Kirubel Bogale Tekle entitled: Assessment of Knowledge, Attitude and Practice of Urban Dairy Producers In Regards to Hygienic Milk Production and Safety Regulations In Furi, Gelan and Koye-Fecche sub cities of Sheger City Administration, Oromia, Ethiopia. I recommend that it be accepted as fulfilling the thesis requirement for the degree of Master In Public Health.

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As members of the examining board of the final MSc open defense, we certify that we have read and evaluated the thesis prepared by Kirubel Bogale Tekle entitled: “Assessment of Knowledge, Attitude and Practice of Urban Dairy Producers In Regards to Hygienic Milk Production and Milk Safety Regulations in Furi, Gelan and Koye-Fecche Subcities of Sheger City Administration, Oromia, Ethiopia.” and recommend that it be accepted as fulfilling the thesis requirement for the degree of Masters in Veterinary Public Health.

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I hereby Certify that I have read the revised version of this thesis and recommend that it be accepted as fulfilling the thesis/dissertation requirement.

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STATEMENT OF THE AUTHOR

I, Kirubel Bogale Tekle hereby declare that this thesis under the title of Assessment of Knowledge, Attitude and Practice of Urban Dairy Producers In Regards to Hygienic Milk Production and Milk Safety Regulations in Furi, Gelan and Koye-Fecche Subcities of Sheger City Administration, Oromia, Ethiopia.” is my authentic work and has been orchestrated independently in partial fulfillment of the requirement for Masters degree in Veterinary Public Health at Addis Ababa University, College of Veterinary Medicine and Agriculture. This work has not been submitted to any academic establishments to obtain any degree of diploma. All sources of information, data and quotations used in the course of this research have been properly acknowledged and referenced. I take full responsibility for any Shortcomings or errors that may be found in the content of this thesis.

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ACKNOWLEDGEMENT

I am astounded in all modesty to forward my gratitude to all those who have helped me to put these ideas, well above the level of simplicity and into something authentic. I would like to express my distinctive thanks of gratitude to my teacher and advisor Dr. Biruhtesfa Asrade who gave me his intellectual assistance not only in this research but also through lecture hours to do this potentially informative study on the topic “Assessment of Knowledge, Attitude and Practice of Urban Dairy Producers in Regards to Hygienic Milk Production and Milk Safety Regulations in Furi, Gelan and Koye-Fecche Sub cities of Sheger city Administration”. Any attempts at all levels would have not been satisfactorily accomplished without the parental and moral support and guidance of my parents, family and friends; blessed be them. I would also like to thank the managers and owners of FZ micro enterprises, Tadesse Debebe G/tsadik Dairy Project and Dorka Milk and Milk products for their unreserved assistance, guidance and notifications that paramountly aided the efforts of challenging data collection despite their tight schedules.

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LIST OF ABBREVIATIONS

CSA	Central Statistics Agency
EFDA	Ethiopian Food and Agriculture Organization
FAO	Food and Agriculture Organization
FNP	Food and Nutrition Policy
GHP	Good Hygiene Practice
HACCP	Hazard Analysis and Critical Control Point
ILRI	International Livestock Research Institute
KAP	Knowledge, Attitude and Practice
LIVES	Livestock and Irrigation Value Chains for Ethiopian Smallholders
LMP	Livestock Masterplan
MOA	Ministry of Agriculture
NMSA	National Meteorological Service Agency
PPE	Personal Protection Equipment
UNDESA	United Nations, Department of Economic and Social Affairs
WHO	World Health organization

ABSTRACT

This research sought to assess the Ethiopian urban dairy production in the recently orchestrated Sheger City Administration residing in the capital city Addis Ababa with an emphasis on knowledge, attitude and practice of milk producers in regards to safe and hygienic milk production. The study accentuates the perspectives held through urban dairy production to meet the demands of the urban and nearby population while assisting the national efforts towards food security and anchoring the domestic economy. The study further illuminates the noteworthy challenges faced in this industry. 120 dairy producers in the selected sub cities of sheger city (Gelan, Furi and Koyye feche) made up the survey population. Among these milk producers, it was able to observe that 85.7% of them were male and those under the age of 50 years old accounted for 61.8%. Milk producers accounting for 60.7% had possessed a secondary education completion while 43% notified that they were in the business for over five years. Almost all of the dairy producers informed that they are in this production sector solely for market purposes. The results of the study revealed that a significant volume of respondents (87.2%) gave their cognizance toward the vitality of washing hands before engaging in the milking process though only 58% of them informed their consistent practicality. Although a considerable awareness towards safety precautions exists, only 45% informed with the use of sterile materials from milking purposes. The understanding on the necessity of filtering milk before storage exists among 82% of the respondents while 91% of them concede the health liability that comes along with improper hygiene. Only 10% of respondents were aware of the existence of rules and regulations on milk safety although 62% implied receiving training from responsible authorities. Housing conditions were noted satisfactory on the overall, with 62.43%, 26.43% and 11.43% were noted as satisfactory, standard and poor, respectively. While most producers (75.71%) possess a standardly rated roof and drainage system, a lower volume of respondents (15%) had standard feed and water storage. Most producers (56.43%) relied on tap water and 60.7% implied they give water to their animals twice a day. 83% and 97.2% of the producers insisted on the use of standard deworming and vaccination programs respectively. Despite this commitment toward biosecurity, only 14.4% had decontamination procedures at farm gate while 70 % of them fell short on handy pest control measures. Sheger City's urban dairy farming looks promising, but resource accessibility, regulatory awareness, and hygiene standards need to become more proficient. The study recommends the creation of a strong regulatory framework to guarantee food safety as well as focused training initiatives to improve KAP with regard to milk hygiene. To support sustainable growth in the urban dairy industry, it is also advised that veterinary services, increased institutional support, and programs encouraging women's involvement in dairy farming be implemented.

Key words: *Food safety, Milk Producers, Biosecurity, Hygiene Standards, KAP*

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1. INTRODUCTION

Recent information has it that dairy production systems in Urban and peri-urban are gradually replacing and/or becoming complementary to established, traditional milk production systems in Ethiopia. This technique is of a tremendous help for the bridging of the huge tropical gaps between the production and the consumption of milk and dairy products in urban and periurban areas areas where milk and dairy products are heavily consumed.(Alemu, 2022). Dairy production serves both a consistent source of revenue and a way to save money. Additionally, it produces manure, which is physical capital (Prain, 2006). In addition to becoming economically important, the public and private sectors are pursuing the goal of ensuring food safety of the milk supply chain as a major global objective to protect public health. There could be dire consequences to public health if the milk processing is not done in a hygienic manner and milk contaminated with impurities is sold for consumptions. Each year, some 600 million people fall ill after eating food that's been contaminated, a reality that amounts to 27 million years in lost health. (WHO/UNICEF, 2015).

In Ethiopia, urban livestock production is a crucial component of the country's agricultural output. However, there is still a lack of institutional, policy, and technical support aimed at meeting the needs of dairy producers in Ethiopia's urban and suburban settings (Azage, 2004). In Ethiopia, where farm animals and their products are essential sources of food and income, dairy production—one of the sectors of farm animal production systems—may be a significant issue. Additionally, dairy farming has not been fully utilized and promoted in Ethiopia (Sintayehu *et al.*, 2008).The development of the industry is essential since dairy production is essential to the nation's economy and to improving the nutritional status of its people. A thorough grasp of the current and changing circumstances surrounding the production, handling, and consumption of milk and milk products should underpin any efforts to increase the productivity of urban dairy production and enhance its market orientation (Asfaw *et al.*, 2016). Both large-scale urban dairy production systems and market-oriented smallholder systems have enormous expansion potential and could be crucial in reducing the severe urban dairy product scarcity.

Fats, proteins, carbs, vitamins, minerals, and active substances with a role in health protection are among the macro and micronutrients found in milk (Merwan *et al.*, 2018). For a dairy farm industry, cow's milk's composition and microbiological safety are crucial since composition and

foreign bodies have a significant impact on the product's quality and safety. Milk's physical characteristics, chemical makeup, and microbiological load are indicators of its safety and quality in relation to the hygienically normal (Febrehadt *et al.*, 2022).

The majority of milk assortment centers and milk shade units in Ethiopia monitor the relative density of the milk's freshness throughout the assortment, as well as the physical characteristics of the alcohol. Furthermore, titratable acidity and the pH scale were used to assess the quality of milk for processing in milk plants (Zerihun, and Getenesh, 2019).

Research and development interventions are very limited for urban livestock production in general and dairy production along with dairy feed and milk safety and quality in particular, in contrast to rural livestock production in the nation, which has recently placed a great emphasis on development to satisfy the livelihood of livestock farmers. There are currently very few published studies, especially on milk safety and quality in the recently established Sheger city Administration and urban dairy production. In order to fill these gaps, this study was created to evaluate urban dairy production methods and assess the safety measures and practices towards safe milk production and its processings in the sheger city administration, Ethiopia.

In Ethiopia, foodborne infections are a serious public health concern that affect people's personal health as well as the country's economy. A crucial source of nutrition, milk is especially susceptible to contamination, which poses a serious health danger, particularly in urban/suburban settings like Sheger City. Even while Ethiopia has achieved progress in food safety through programs like the National Food Safety Master Plan (2025–2029), there are still valid and substantial concerns about the unregulated milk industry, which is brightly marked by inconsistent handling methods. The purpose of this study is to assess how urban milk production and processing activities interact to affect milk safety in Sheger City Administration. Its specific goal is to evaluate milk producers' knowledge, attitudes, and practices in milk processing facilities. The study aims to identify areas where interventions might successfully improve milk safety and lower the risk of foodborne illnesses associated with milk intake in Sheger City Administration by looking at the producers' knowledge, attitude and practices. Ultimately, this research serves as a critical step in safeguarding public health and bolstering consumer confidence in the milk supply chain.

Objective of The Study:

The study's main goal is to produce up-to-date data on the knowledge, attitudes, and hygiene practices of milk producers at urban milk production facilities in the selected sub cities of Sheger city administration about food (milk) safety and milk safety regulations along with assessing constraints and institutional services to urban dairy production within the study area.

2. LITERATURE REVIEW

2.1. Dairy Production In Urban Settings

One of the most popular methods of producing milk in the tropics and subtropics is urban dairy production. This system includes the production, processing, and marketing of milk and milk products in urban settings. Urban dairying is one important agricultural production sub sector that contributes to reducing the notable demand-supply gap for milk and milk products in urban settings (Omore *et al.*, 2013). Previously, consumer hubs with their dairy sheds and the marketing and processing players and processors connected to them were what defined urban dairying (Thorpe *et al.*, 2013). By creating jobs and income, lowering poverty, and improving human nutrition and health, the urban dairy production system advances wider economic growth (Grace *et al.*, 2018).

The importance of urban dairy production has increased over the last decade (Gebremichael *et al.*, 2014). The urban milk production system includes both commercial and smallholder farms in the vicinity of Addis Ababa and other regional communities (Azage, 2004). According to a recent study by the Addis Ababa Agricultural Bureau, there are over 10,000 small, medium, and large dairy farms in and around Addis Ababa city, Ethiopia. From these dairy farms, 34,649,450 liters of milk were produced per year (AAIC, 2023).

Urban dairy production systems are under pressure from a number of new issues, ranging from disease control to management concerns. The level of competition for limited resources, and rising economic demands all seem to have an exacerbating contribution to these difficulties (Gelana, 2021). The challenges faced by farms functioning under these systems also include the supply and growing prices of feed, fluctuating customer demand for dairy products, competitiveness with imported products, limited land availability, difficult waste disposal, and inadequate veterinarian care (Sawin and Jatwani, 2020).

At every point in the commodity chain, urban dairy production systems are complex, incorporating many technologies and a range of production, processing, and marketing activities. Every system function of urban dairy production is impacted by a variety of biological, economic, and social factors and how they interact (Abebe, 2018).

Making as much milk as possible with the available feeds in relation to the costs of maintaining farm livestock is essential to a dairy business's profitability (Garcia, 2009). Ethiopia produces a very little quantity of milk annually. It is expected to reach approximately 1.5 million tons per year at a growth rate of only 1.4% per year. Nonetheless, the estimated human population is growing at a rate of more than 3% every year (UN DESA, 2022). This estimated population increase is stated as an igniting factor for urban dairy producers' driven interest in penetrating the demand sphere to supply efficiently (grace *et al.*, 2018). Urban and peri-urban regions are home to intensive dairy farming that is recognized as the cornerstone of a more commercially driven husbandry system. Direct relationships between producers and consumers, as well as merchants, processors, and partner companies, form the foundation of milk product marketing and retail (Ayele *et al.*, 2012).

Urban dairy production holds a position of great vitality in attaining the nation's dairy necessities particularly in supplying the urban community. Although this industry is encompassed with non negligible and paramount bottlenecks, the potential to enhance productivity while assuring food safety and foster sustainable urban dairying still exists especially if multisectorial collaboration is strengthened (Kebede, 2013).

2.2. Food safety In Milk Production

In the dairy production sector, food safety is a great deal of interest to the global scientific community. The significance of this agricultural sector in Ethiopia is demonstrated through its substantial deliverance in the sustenance of rural and urban communities while taking an impactful share in national food Security (Ayele *et al.*, 2019). With that being said, the complexity and challenges rising from multiple infrastructural and socio economic factors to assure quality and safety of milk products is still of paramount gravity.

Milk production in Ethiopia has a great deal of constructive impact in the national economy and meeting the national nutritional necessities as it is a country described as the largest livestock producer in Africa (FAO, 2021). Even with this immense potential, the drawbacks often generated from insufficient managerial procedures, veterinary healthcare system and poor animal nutrition, the sector's development is notably hindered (Abera *et al.*, 2019).

The nutritional nature of milk always makes the product on the edge of contamination concern and could further be exacerbated by factors like unsafe handling practices and absence of cold chain infrastructure (Tesgaye *et al.*, 2020). This has been illustrated by Abera *et al.* (2020) about the presence of disease causing bacteria like *E. coli* and *salmonella* in the raw milk and milk products dispensed to the local market postulating a pressing public health concern. The most obvious and mostly observed malpractices like unsanitary milking environment and milking procedure accompanied by inadequate storage conditions comes about as a liability to public safety. Furthermore, the mass tendency towards consumption of unpasteurized milk proliferating from customary preferences and limited access to pasteurization (in rural communities) significantly aggravate the occurrence of severe food borne diseases like *Tuberculosis* and other zoonotic diseases (Mekonnen *et al.*, 2021; Molla *et al.*, 2018).

There are multiple structural obstacles compromising milk safety and putting public safety at risk most of which are profoundly related to infrastructure deficit (cold chain, storage and transportation) (Tadesse and Ayele, 2020; Getachew *et al.*, 2019). On top of that, milk safety protocols can not be standarly met among smallholder producers because of knowledge and awareness shortfall. It would alleviate a huge volume of pressure in the best interest of public and product safety to capacitate producers with the right volume of intellectual assets about sanitary practices, diseases control and other precaution measures (Asfaw *et al.*, 2021).

The line of interest of many governmental and non governmental entities to outdo the setback in food safety of Ethiopian milk production has been designed in a way that addresses matters of enhancement of production systems, reinforcing institutional frameworks with consistent capacity building (FAO, 2021). Evidently, projects like Dairy Value Chain Development work towards vital elements of dairy production like quality assurance and hygiene practices and market access (ILRI, 2020).

In rural areas where the complexity of food safety concern is magnified, studies suggest integrating affordable and innovative solutions to mitigate the burdens while simultaneously exerting considerable efforts towards community based advocacy and workshops (Gebremedhin *et al.*, 2019; Molla *et al.*, 2018). Overall, it is very important to recognize the need for the right

volume of financial and intellectual commitment towards education, quality control and technological adoption to guarantee safe and sustainable milk production.

2.3. Prospects and Restrictions on Urban Dairy Production

Like any production sector, urban dairy production has its share of potential and also limitation factors affecting its performance in both directions. With reflection to its prospects, urban dairy production is receiving a multifaceted recognition and assistance. Primarily, frameworks like Livestock Master Plan (LMP) designed by the Ethiopian government not only perceive dairy production as a vital subsector but also provide a vivid summarization on determining factors like market infrastructure and genetic modifications (Shapiro, *et al.*, 2017).

This is indicative of the fact that urban dairy production covers a potentially significant ground in major cities like Addis Ababa and subordinate cities. The direct relationship between rapid urbanization and population growth with the rising demand of dairy products to meet nutritional necessities of the community further magnifies the role of urban dairy production. This could be evidently expressed in the assertive suggestion of the Central Statistics Agency stating that the urban population growth edging no less than 4% indicates the need for an equivalent level of broadening for animal source food production like milk. There are no better entities to deliver in accordance to demand than urban dairy farms due to their juxtaposition (CSA, 2021; Bereda *et al.*, 2014).

Urban dairy production is also far more than just an alternative auxiliary activity as it has the capabilities to provide a viable source of livelihood. There are several studies with figurative justifications that point out smallholder urban dairy producers predominantly reside on the income generated by milk product sales anchoring household financial necessities (Yilma *et al.*, 2011).

When we see the restrictions towards urban dairy production, they range from physical factors to non tangible limitations like policy fragmentation and price instability. First and foremost, the fact that urban dairy production is in close proximity to cities, the access to ample production vicinity and pasturland is already severely constrained leading to producers being highly dependent on commercial feed and byproducts. This puts a considerable amount of pressure on

the profitability of the urban dairy business making sustenance and further expansion an unlikely and challenging assignment (Sintayehu *et al.*, 2008). The burden of land scarcity is not only affecting future advancements but also directly and negatively influencing the waste management system posing threats of environmental pollution and public health risks (Mekonnen *et al.*, 2018).

Furthermore, urban dairy production, particularly the informal sector, is also detrimentally impacted by volatile market behavior that demonstrates seasonal fluctuation which could reduce revenue. (SNV, 2015). To cope up with potential financial distress, access to finance is no easy task for urban dairy producers as they often come short of equivalent collaterals (Yigerem *et al.*, 2014). Although there are shallow and often verbal commitments on policy levels to support livestock production and its derivatives, harmonization and consistency in regards to implementation remains stagnant as the essential stakeholders possess fragmented and unclear functional protocols to operate with (Shapiro *et al.*, 2017).

All things considered, it is very important to clearly understand the vitality of the sector and the potential it has towards attaining food security and national self sustenance. It is correspondingly important to have a complementary and parallel public and private investment in the dairy value chain to meet Ethiopia's urban milk demand projected to exponentially grow over the next decade. (ILRI, 2020). A comprehensive revitalization of policies, innovation and investment patterns is mandatory to achieve sustainability in urban dairy production in Ethiopia.

2.4. Interventions Towards Milk Safety

There is a noteworthy discrepancy observed between the level of progress in urban dairy production and food safety regulatory framework that creates a room for challenges of quality control and public health safety concerns to propagate (FAO, 2019). These regulations have the responsibilities of assuring production, processing and distribution phases of milk and milk products meet the standard safety requirements. This responsibility is essentially laid upon Ethiopian food and drug authority while it functions under the Ministry of Agriculture and Ministry of Health. This responsible entity executes and designs safety standards and protocols while being the principal authority to conduct monitoring and certifying food products (EFDA, 2020). The functionality of this organ is questionable on account of limited technicality.

The legal substructure of national food safety that obligates the inclusion of strategic measures like Hazard Analysis and Critical Control Points (HACCP) and Good Hygiene Practices (GHP) in all food production establishments is clearly marked under Food and Drug Administration proclamation No. 1112/2019. Resembling the inefficacy of the authority responsible, implementation of this legal outline in the urban dairy sector remains incompetent (Mekonnen *et al.*, 2021).

It is also clear from an examination of Ethiopian Veterinary Drug and Feed Administration and Control Proclamation No.728/2011 that ASFs are not covered by its provisions, which pose serious risks to food safety. Additionally, it solely covers commercially manufactured veterinary medications and animal feed, items that cross national borders, and it ignores human health issues in favor of concentrating solely on animal health.

The latency in enactment of the already established regulations majorly arises from the unsteady coordination among the responsible entities. This defective consonance makes the work ought to be either redundantly exhaustive or inconsistent (ILRI, 2020). In addition to that, the regular microbial quality control procedures not being performed in accordance to the right frequency and timeliness due to lack of sufficient diagnostic laboratory infrastructure compromises the right implementation of monitoring and corrective actions (Alemu *et al.*, 2022). Furthermore, monitoring and regulation of food safety is challenged by producers lacking appropriate documentation like registration and licensing (Tesfaye *et al.*, 2018).

Potentially curative commitments are seen from certain strategies like the National Dairy Development Strategy and Livestock MasterPlan (LMP) to improve the regulatory surface. There are also non governmental organizations and governmental agencies like USAID taking part in the progressive work towards safe food production and capacity building among dairy producers (MoA, 2018). This commitment is showing a promising outcome as demonstrated in a study from Addis Ababa where the receptivity and compliance of urban dairy producers is shown to be comparatively higher following training and technical support (Francesconi *et al.*, 2019). A Food and Nutrition Policy (FNP) that recognizes food safety and nutrition as a governmental duty was also swiftly developed by Ethiopia's federal government.

Table 1. Evaluation of Ethiopia’s 2018 Food and Nutrition Policy Relevant to Food Safety

STRENGTH	LIMITATIONS
→ Food safety is recognized as important: it is one of only seven objectives.	→ The key legal challenge is the lack of a single consolidated federal law (i.e., there is no Ethiopia National Food Safety Law)
→ It provides an overarching framework covering the key dimensions of food safety throughout the entire food system	→ It does not provide guidance for establishment of an autonomous body to coordinate food safety activities of the various agencies and ministries with functions related to food safety.
→ It emphasizes the need to build food safety capacity at national, regional and institutional levels.	→ Food safety activities have inadequate institutional arrangements and limited resources for implementation.
→ It recognizes the need to empower communities by improving consumers’ food safety literacy and ability to create informed choices.	→ Existing food safety institutions have only limited authority to deliver or enforce food safety regulations and standards.

2.4.1. Knowledge and Attitude Towards Food Safety Interventions

Despite the numerous steps taken by governments and international organizations to safeguard food, consumers and food handlers continue to play a more crucial role because their actions and behaviors have a big influence on the production and consumption of safe food (Negassa *et al.*, 2022). The knowledge gap existing about food safety regulation immensely affects the whole food production process even up to posing a significant threat to consumer health. This knowledge and awareness deficit about food safety regulations is clearly highlighted in studies suggesting the general understanding about national food safety interventions is very limited

among dairy producers (Duguma and Janssens, 2016). These producers and their general attitude to rules and regulations predominantly depend on multiple factors ranging from cultural practices to educational and socio-economic status. There are studies indicating that despite the general awareness about the eminence of hygiene and its collateral benefits of better quality products, producers seem to fall short of practicality most probably due to incapacitated enforcement and inadequate training (Tegegne *et al.*, 2013).

2.5. Sanitary Practices in Milk Production

The production of milk must be hygienic for consumer safety. There are no set hygiene guidelines that milk producers in Ethiopia must adhere to. The manufacturing system, modified procedures, degree of awareness and resource availability all affect the sanitary conditions (Zelalem, 2003). A crucial and essential component of producing safe and appropriate milk and milk products is using effective handling techniques during milking. It has been demonstrated that inadequate sanitation procedures can lead to the contamination of milk with harmful or undesired microorganisms, as well as chemical or physical risks. The performance of milking processes and the cleanliness of milking utensils and equipment are the two main elements that can readily affect the quality of dairy products (Gonfa *et al.*, 2001). The milk spoils quickly due to the introduction of extra bacteria brought on by poor cleanliness. You must maintain proper cleanliness both when milking and when handling the milk afterward to guarantee that milk stays fresh for a longer period of time (lore *et al.*, 2006). The procedure of producing high quality milk is challenging (pandey, 2011).

2.5.1. Personnel hygiene and Sanitary Processing

Regardless of whether the animals are milked by hand or by machine, proper hygiene is crucial (Barbuddehe *et al.*, 2008). This calls for the following: the milking machine and milk storage equipment, such as milk churns, must be maintained clean and in good shape; the milk must be chilled right away after milking, ideally to 4°C; the milkers' hands and clothing must be clean and they must be in good health. This calls for milk cooling tanks or mechanical refrigeration.

2.5.2. Processing Units and Equipment Handling

Efficient production of high-quality milk depends on the milking environment being kept hygienic (Zerihun and Getenesh, 2019). Unsanitary milking facilities often harbor flies, which can contaminate milk and cause spoiling. Some cow dung or urine particles may fall into the milk during defecation while milking (Mbabazi, 2005). Dirt such as feces and soil affixed to the outside of the teat is the primary way that germs are transported from the farm environment to the milk; also microorganisms affixed to the outside of the teats can enter the teat canal and result in mastitis (Driehuis *et al.*, 2008). Mastitis and milk contamination are more likely to occur in practices that expose the teat end to organic bedding source and moist, muddy pens (Ruegg, 2008). The production of high-quality milk depends on the barn's hygienic conditions. It's critical to have bedding that is comfortable, dry and clean to reduce the growth of harmful microbes (Gurmessa, 2015). To produce milk and milk products of a suitable quality, a suitable and hygienic living environment is necessary (Asaminew, 2007). Cows are housed in the winter and pastured in the summer in temperate climates. Feed and bedding materials used in cow housing may be a source of contamination. Feces and dung are significant causes of pollution in both house and pasture situations. One of the most crucial hygienic procedures needed to guarantee clean milk production is cleaning the cows' udder before milking (Zerihun *et al.*, 2019). This is crucial since the milking cows' udder may come into direct touch with the ground feces, urine and feed rejects. To stop various kinds of germs from getting into the milk, the udder and flanks must be cleaned and cleared of manure, bedding, and soil particles (Ruegg, 2006).

Workers who handle milk (milkers) have the potential to directly introduce a variety of organisms, including diseases, particularly if they are irresponsible, ignorant, or deliberately negligent (Ashenafi, 1994). Sneezing and coughing can release organisms from the mouth, nose, hands, and clothes. Since milk men can spread infectious diseases like *tuberculosis* it is crucial that they are in excellent health (Kurwijila, 1989). During the milking, cooling, storing and processing stages, sterile milk from a typical cow's udder gets infected. Employees who handle milk should be in good health and understand the value of hygiene. Because microbes from the milkers' hand, cow's udder, and teat wash into the milking equipment and contaminate the milk, milking with wet hands should be avoided. Other places where germs can be found include the milker's and the animal's mouth, nose, skin and unclean hands (Mbabazi, 2005).

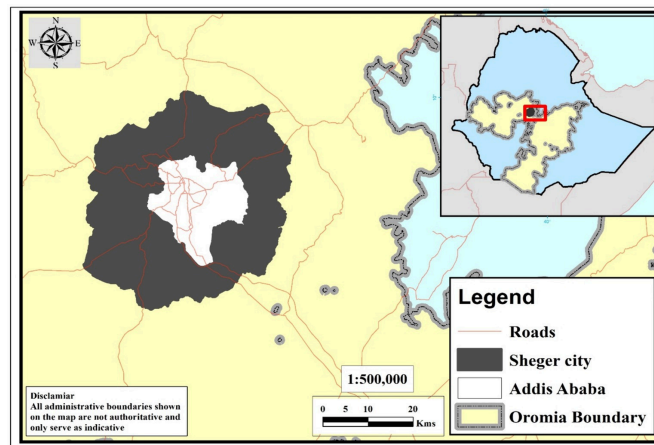
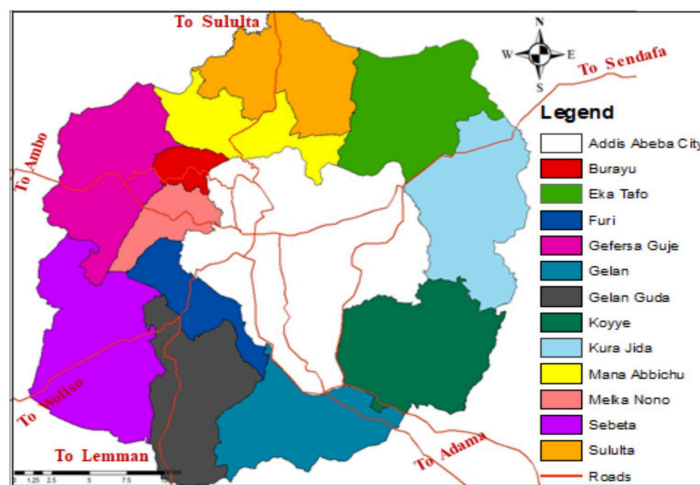
Numerous germs may originate from milking utensils that have not been thoroughly cleaned and sterilized (Kurwijila, 1989). A number of bacteria can grow well on milk droplets that are left on the surface of milking equipment (Banwart, 1989). After use milk equipment is not thoroughly cleaned and sanitized. Many microorganisms, including pathogens, can develop thanks to the nutrients that milk residues left on tools and utensils surfaces provide (Bryan,1983).

Milk bacterial burden rises throughout transit and if the equipment used is in the desirable form and shape, the bacterial counts rise as well, causing the milk to deteriorate before it gets to its destination (Grillet *et al.*, 2007). Equipment used for milking should be simple and accessible to clean. Equipment made of stainless steel and aluminum is generally preferred (Zerihun and Getenesh, 2019). Furthermore another main source of microbial contamination can be water (Mbabazi, 2005), care should be made to stop drainage that could allow pollutants and human water to enter the source if the water is from an open source (Jay, 1992).

3. MATERIAL AND METHODS

3.1. Description of Study Area

Situated in the center region of Ethiopia, close to the capital city of Addis Ababa, Sheger City is part of the Oromia Regional State. The Oromia Regional State just created the city of Sheger in October 2022 as part of a thorough and ambitious strategy. In accordance with the Oromia National Regional State's plan to redraw the borders of dysfunctional and dispersed urban centers in order to maximize their viability, Sheger City was created by combining Sululta, Laga Tafo Laga Dadi, Gelan, Sebeta, Burayu, Kolobo, and the 41 nearby rural kebeles. The city, which occupies 160,892.8 hectares, is divided into 36 districts (Aanaas) and 12 city divisions (sub-cities). The selected towns for this research are Gelan, Furi and Koyye.



Source: Geneti *et al.*, 2024

3.2. Study Design and Population

Workers from formal and informal milk production facilities (farmers), in the Sheger city administration's Gelan, Furi, and koyye Sub-cities made up the target study population. These sub cities were chosen in accordance with their capacitated and uplifting urban agricultural practices that aligns with the national innovative initiative; “Bounty of the basket” (yelemat terufat). Workers were chosen from using a systematic simple random selection technique. Information for this study was obtained from employees of these facilities including the owners and observational managers. The sample size for data collection through dairy farmers survey was a total of 120 urban dairy producers being selected from the three study sites. Then random simple sampling techniques were utilized to determine samples from each sub-city intended to be included from each sub-city. Milk processors from selected milk production facilities were integrated in a cross-sectional survey.

3.3. Sampling and Data Collection

A total of 120 respondents were able to be addressed in the questionnaire survey considering a recent survey undertaken by Addis Ababa Agricultural Bureau suggesting 10,164 small, middle and large scale dairy production in and around the city (Kebede *et al.*, 2024) . Having that as the estimated baseline population size, a structured questionnaire was used to collect data on milk producers’ knowledge, attitudes, and hygienic practices toward food safety interventions. Interviews were conducted with chosen producers/distributors in each sub- cities to gather information on the following topics: impediments to urban dairy farming, Knowledge, attitude and practice towards hygienic milk processing practices and food safety protocols, socioeconomic characteristics of the respondents, housing systems, feeding and watering systems, Biosecurity and diseases, waste management system and institutional support and extension services. Direct observation of handler hygiene status and practices will also be used to assess the handlers' levels of hygiene knowledge, attitude, and practice. Food handling cross-contamination, hand washing, storage, and other subjects will also be covered in the questions.

3.4. Data Analysis

The information gathered for the study—which included information from questionnaire surveys was cleaned, categorized, and saved in a Microsoft Excel file. Version 14 of the STATA software was used to conduct the statistical analysis of the data. To summarize the data, descriptive statistics were employed.

4. RESULT

4.1. Socio Demographic Characteristics

The socio demographic information obtained shows a larger proportion of male (85.7%) in possession of the observed dairy production centers compared to females (14.29%) which is observed in a much lower volume. The information obtained also depicts that the majority of the producers interviewed are either 50 years old or younger (61.8%) in comparison to those over 50 years old (37.86%). The majority of dairy farmers (60.7%) completed secondary school, followed by primary school (19.2%). The information obtained shows that among the farmers encountered, those with non-agro business education in college account (12.3%), and those with agro education account (7.8%).

The majority of the producers were in the business for 5 years or more (43%) followed by those in the business for 3-5 years (22%) and 1-2 years (19%). Those in the business less than a year account for 16%. This could signify that there is a growing interest in the business perhaps in parallel to certain national interest and initiatives to uplift urban agriculture. These areas seemingly serve the purpose of providing the majority of the milk necessity to the sub cities newly established sheger city administration and perhaps to the capital as well. Almost All of the producers are in the dairy production sector for the purpose of putting the product in the market and only one producer is in the sector for personal and family use. The information is summarized in table 2 below.

Table 2: Socio-Demographic Characteristics

Variables	Number of respondents	%
Sex		
Male	103	85.7%
Female	17	14.29%
Age		
Over 50 years old	45	37.86%
Under 50 years old	75	61.81%
Education status		
Primary school	23	19.2%
Secondary school	73	60.7%
Collège (non agrobusiness)	15	12.3%
Agro Education	9	7.8%
Exp. in dairy business		
<1 year	19	16%
1-2 years	23	19%
3-5 years	26	22%
5 years or more	52	43%
Purpose of production		
Personal consumption	1	1%
Market dispensary	119	99%

4.2. Dairy Housing Condition

All of the dairy production farms observed have utilized a Stanchion housing technique and they are found in a significant distance to the main residence of the farms although it is found within the same vicinity. In this segment of the study it was able to obtain information about the farm hygiene and it suggests that most of the farms meet the average requirement of hygiene rated as satisfactory (62.43%). Those with remarkable farm hygiene and quality and rated as standard accounts for 26.43% while 11.43% of the farms observed lack proper farm hygiene and rated as poor. An investigation that further explored the farm hygiene was house cleaning frequency. In this investigation, those farms that are cleaned twice a day (51.71%) account the larger frequency while those cleaned once a day, three times a day and those cleaned more than three times a day account for 22.86%, 15.71% and 10% respectively. The study further indicates that 75.71% of the farms are structured with a standard roof and drainage system while 17.86% are rated satisfactory and 6.43% are rated poor. The majority of the farm property (79%) was put into use for only the dairy cattle while some of the farms (21%) were not proposed for just the dairy production and other livestock owned the same farm property. The study specifies about the light and fresh air access and suggests that a significant majority of the facilities (82.3%) are equipped with standard light fresh air access. Farms with satisfactory and poor access to light and fresh air accounts for 15.7% and 2% respectively. In this segment of the study, it was able to assess the quality of feed and water storage places. Accordingly, farms with standard water and feed storage seemed to be significantly lower (15%) compared to those rated satisfactory (62%) and poor (23%). This result along with the reflection given by the respondents is suggestive of lack of appropriate consultation and knowledge about the complementary relationship between the necessity of standard light and fresh air access to productivity, safety and wellbeing of the entire production area. More or less, it is possible to generalize that housing conditions and farm hygiene are promisingly satisfactory but there are areas of correction yet to be implemented.

Table 3: Dairy Housing Conditions

Variables	Number of respondents	%
Farm Hygiene		
Standard	32	26.43%
Satisfactory	75	62.43%
poor	13	11.43%
House Cleaning Frequency		
Once a day	27	22.86%
Twice a day	62	51.43%
Three times a day	19	15.71%
More than three times a day	12	10%
Roof and Drainage system		
Standard	91	75.71%
Satisfactory	21	17.86%
poor	8	6.43%
Animal Diversity		
Only dairy animals	95	79%
Other livestock	25	21%
Light and Fresh Air Access		
Standard	99	82.3%
Satisfactory	19	15.7%
Poor	2	2%
Feed and Water Storage Quality		
Standard	18	15%
Satisfactory	74	62%
Poor	28	23%

4.3. Water Access

In this section of the study, it was discovered that the farmers had different sources of water utilized for the purpose of cleaning farm utensils, farm vicinity and for animal consumption as well. Among the sources, tap water (56.43%) was nominated the primary source of water. Consequently, tanker water (31.43%) and river water (12.14%) was also put into a considerable volume of use. The majority of the respondents provided the information that they provide water twice a day (60.7%) while 9.29% of the producers had given water to the dairy animals once a day. Those producers that gave free access to water accounted for 24.9%. 5.4% of the respondents did not have an accurate frequency to give and were not sure on how many times they give water to the dairy animals. In general the result signifies that most of the producers found it necessary to provide adequate water in the right amount of frequency for productivity and wellbeing of their animals. They also provided the information that there is not much of a water shortage within their farm as they are in possession of sufficient water access throughout the year (80.71%) while some (19.29%) said that they are adequately equipped with sufficient water sources during the rainy season (summer).

Table 4: Source and Water Access for the Dairy Production

Water source	Number of respondents	%
Tap water	68	56.43%
Stored/tanker water	38	31.43%
River stream water	14	12.14%
Watering frequency		
Twice a day	73	60.7%
Once a day	11	9.29%
Free access	30	24.9%
Unknown	6	5.4%
Water access		
All year/sufficient	97	80.71%
Rainy season (summer)	23	19.29%

4.4. Biosecurity Measures

Based on the information provided by the respondents, it was able to create an understanding that most of these producers abide by the standard deworming procedures (83%) while certain negligence impediment was observed to meet standard deworming requirements (17%). Resembling the attitude and practice towards deworming procedures, a significant volume of respondents (97.2%) also abide by standard vaccination frequency. Only 2.8% failed to meet this necessity. This study shows the higher volume respondents (87.2%) paying a remarkable attention to biosecurity measures with appropriate use of personal protection equipment as they make contact with the farm and farm animals. When investigating the therapeutic measures taken for the farm animals, 66% of the respondents provided the information that they strictly adhere to professional veterinary services and call for a veterinarian for treatment of sick animals. But, 34% responded that they know the signs and symptoms of certain ailments and they provide drugs and other traditional treatments by themselves. It was observed that only 14.4% of the producers used decontamination procedures during entry to farm units by beach foot bath while the remaining 85.6% did not follow any decontamination procedures. Furthermore, the majority of the people (70%) did not follow standard pest and rodent intrusion control and the farms have loose fences that allow intrusions that can not only compromise the health and wellbeing of farm animals but also have the potential that might affect product quality. Only 30% of the producers have either a well constructed intrusion control mechanism or made structural correction after encountering such imparites.

Table 5: Biosecurity measures of the farm

Variable	No of respondents	%
Standard Deworming		
Yes	100	83%
No	20	17%
Standard Vaccinations		
Yes	116	97.2%
No	4	2%
Appropriate Use of Personal Protection Equipment		
Yes	105	87.2%
No	15	12.8%
Treatment of Sick cow only by Veterinarians		
Yes	79	66%
No	41	34%
Decontamination at Farm/Processing Unit Entry		
Yes	17	14.4%
No	108	85.6%
Standard Pest and Rodent Intrusion Control		
Yes	36	30%
No	84	70%

4.5. Waste Assortment and Management

The study revealed about 59.1% of the respondents have provided the information that they collect waste twice a day while those who perform this task once a day and more than twice a day accounted for 32.2% and 8.7% respectively. All of the respondents do solid waste collection through manual collection methods with equipment like shovels and wheelbarrows. There are no respondents that resided with automated waste collection apparatus. This could be highly related to either economic constraints and lack of knowledge on the availability of such apparatus. The majority (94%) of the producers conduct a liquid waste collection through a drainage system while there are some (6%) that utilize gutter systems. Despite the respondents' constant remark about lack of commodious waste disposal areas for a substantial volume of waste, they make use of a variety of waste disposal techniques. Among these, 53% of the respondents informed that they use dumping areas while those that dispose in holes accounted for 39%. There are also about 8% of respondents that recycle the wastes in forms like dung cakes and fertilizers.

Table 6: Type of Waste and Waste Management

Variables	No of respondents	%
Waste collection Frequencies		
Once a day	39	32.2%
Twice a day	71	59.1%
More Than two times a day	10	8.7%
Mode of collection of solid wastes		
Manual collection (shovels and wheelbarrows..)	120	100%
Mechanical collection (automated system)	-	-
Mode of collection of liquid wastes		
Drainage system	113	94%
Gutter system	7	6%
Mode of removal of wastes		
Holes	47	39%
Recycling (dung cake, fertilizer...)	9	8%
Dumping areas	64	53%

4.6. Knowledge and Attitude Towards Milk Hygiene

In this segment of the study, there were several interrogative statements that were found vital to assess the level of awareness about milk hygiene and the potential faults that may affect the safety and quality of milk. Throughout the investigation, it was able to understand that 87.2% of the respondents are well aware of the vitality of washing hands before milking while 12.8% are either hesitant or negligent to this hygienic practice for milk hygiene. This is found with great similarity to producers' response about the importance of clean water in milk production, where the majority (89.1%) found it very necessary while 10.9% are not well aware of it. In the final steps of milk production, 82% of the respondents have a thorough understanding about the

importance of filtering milk. The knowledge about the potential spoilage of milk or milk products because of dirty and tarnished equipment substantially exists among the respondents as 79% are well aware of the matter. The respondents provided the information about the relationship between unclean udder and contaminated milk. It shows that 70.2% of the respondents understand that milk can be contaminated while being obtained from unclean udder. The remaining 29.8% are not well aware of this important relationship. After collection of milk, the majority of the respondents (57%) are not well off the right temperature a raw milk should be kept at but they suggested that it is in their preference to store it in a cooler area. Only 43% of the respondents stated their knowledge about the best temperature a raw milk should be kept at. A significant volume of the respondents (81.2%) are well aware that milk can be a host medium that germs can reside in while 18.8% respondents the contrary. To eliminate these germs, it is under the recognition of 87% of the respondents that a boiling method is put to use. Most of the respondents (91%) are aware of mastitis and its collateral consequences in the safety and productivity of milk. Most of these producers associate mastitis with symptoms like swelling and redness of the udder and teats.

Maintaining hygienic practices is found to be crucial by all of the respondents. Despite that, the majority of the respondents (87%) said that there is the need for extra labour involved in activities like clean containers. With the production steps and procedures they perform, 61% of the respondents feel confident that the milk they produce and handle is in safe manners while the remaining 39% are doubtful of their milk handling procedures. If methods are shown to fail to meet the standards and changes are required, 77.3% of the respondents are willing to make a guided adjustment to their production imparities while 22.7% are shown to be hesitant. The reason they stated their resistance in making changes to their production style is the fear that it may require them to exceed their expenses and the financial pressure that comes along with it. According to the respondents, 91.2% of them noticed that improper hygiene has a direct and negative impact on the consumers health. When milking, 69.4% of the respondents think that cleanliness is more important than speed while the remaining 30.6% prioritize being more agile and speedy than taking sanitation precautions. Supportingly, the majority of the respondents (67.1%) suggested that there is a direct and proportional relationship between a hygienic production with an uplift in market value and quality of milk. A significant volume of respondents (98.2%) suggested that if provided, they are willing to receive training to enhance

their personal hygiene practices. The producers predominantly (77%) agree that the safety of the milk they produce is their responsibility. The respondents' interest in advancing their production facilities to a more modern, automated; one with utter safety protocols is seen through their response suggesting that only 11.6% think conventional approaches are adequate for safe milk production while the remaining 88.4% think the contrary.

Table 7: Knowledge and Attitude towards Milk Hygiene

Variable	Response Category	No of respondent	%
Are you aware of how crucial it is to wash your hands before milking?	Yes	105	87.2%
	No	15	12.8%
Do you know how important clean water is to the production of milk?	Yes	107	89.1%
	No	13	10.9%
Do you know that milk needs to be filtered before being stored?	Yes	98	82%
	No	22	18%
Are you aware that milk can be spoiled by tainted equipment?	Yes	95	79%
	No	25	21%
Are you aware that milk can get contaminated by unclean udders?	Yes	84	70.2%
	No	35	29.8%
Are you aware of the best temperature (in degrees) to keep raw milk?	Yes	52	43%
	No	68	57%
Do you know what mastitis is and how it affects the safety of milk?	Yes	109	91%
	No	11	9%
Are you aware that dangerous germs can be found residing in raw milk?	Yes	97	81.2%
	No	23	18.8%

Do you know that the majority of dangerous germs are eliminated when milk is boiled?	Yes	104	87%
	No	16	13%
Do you think it's crucial to maintain hygiene when processing milk?	Yes	120	100%
	No	-	-
Do you believe there is extra labor involved in utilizing clean containers?	Yes	105	87.1%
	No	15	12.9%
Do you feel confident that your milk handling is safe?	Yes	73	61%
	No	47	39%
If your methods were shown to be harmful, would you be prepared to change them?	Yes	93	77.3%
	No	27	22.7%
Do you believe that a consumer's health can be impacted by improper hygiene?	Yes	109	91.2%
	No	11	8.8%
When milking, is cleanliness more crucial than speed?	Yes	83	69.4%
	No	37	30.6%
Do you think that better hygiene raises the market value and quality of milk?	Yes	81	67.1%
	No	39	32.9%
Would you be open to receiving training to enhance your personal hygiene habits?	Yes	118	98.2%
	No	2	1.8%
Do you consider the safety of the milk you produce to be your responsibility?	Yes	92	77%
	No	28	23%
Do you think conventional approaches are adequate for safety?	Yes	14	11.6%
	No	106	88.4%

4.7. Practices Towards Milk Hygiene

As an attempt to assess the safe practices of producers within the study area, about 58% of them reported that they always wash their hands before milking procedures. Following that, about 65.1% stated that they always clean the udder before they start milking. The remaining 34.9% do not adhere to this procedure everytime they start milking procedures. Only 55% of the producers use sterilized material for milking purposes. A substantial quantity (95% of respondents) of response has been observed when producers were asked if they immediately wash and disinfect milk storage containers after use. Reportedly, Only 5% of the respondents stated they fail to meet this safety requirement “immediately”. The majority of respondents (78.2%) state that they store milk in a cool place or refrigerator. 90.7% of the respondents recognize the safety hazard that comes along with milking cows with obvious symptoms of mastitis and avoid obtaining milk from those animals. According to the respondents, 77.14% of them Clean the milking area on a daily basis. 81% of the respondents recognize the need for transporting milk in sealed containers.

Table 8: Practices Towards Milk Hygiene

Variables	Response Category	No of respondents	%
Do you always clean the udder before milking?	Yes	78	65.1%
	No	42	34.9%
Are your milking tools sterilized?	Yes	54	45%
	No	66	55%
Do you immediately wash and disinfect milk storage containers after use?	Yes	114	95%
	No	6	5%
Do you filter milk after milking?	Yes	98	82%
	No	22	18%
Do you store milk in a cool place or refrigerator?	Yes	94	78.2%
	No	26	21.8%
Do you refrain from milking cows who have obvious symptoms of mastitis?	Yes	109	90.7%
	No	11	9.3%
Do you clean the milking area daily?	Yes	93	77.14%
	No	27	22.86%
Do you transport milk in sealed containers?	Yes	97	81%
	No	23	19%

4.8. Knowledge and Attitude towards Milk Safety Regulation and Institutions Services

This segment of the study revealed the producers' awareness on availability, practicality and necessity of milk safety protocols and regulations in Ethiopia. According to the respondents, only 10% of the respondents are aware of certain laws and regulations on milk safety in Ethiopia. This could be potentially considered as an impeding factor that sets back the effort made towards a national food safety. Although the majority of the respondents lack the knowledge about the general milk safety laws put in to work in Ethiopia, 56% of them stated that they know certain legal requirements for milk hygiene and handling during production. This gap could be addressed through a more structured and detailed training and guideline by responsible entities. It has been notified in the investigation that 62% of respondents have received milk safety training or guidelines by either governmental or non governmental organization suggestive of the efforts being made. This is shown feasible in the study as 98% of the respondents are willing to collaborate with regulators to improve milk safety in their area. Knowledge and attitude of producers towards milk safety regulations and institutions services has been summarized below in table 9.

Table 9: Knowledge and attitude towards Milk Safety Regulations and Institutional Services

Variables	Response category	No of respondents	%
Are there any milk safety laws in Ethiopia that you are aware of?	Yes	12	10%
	No	108	90%
Do you know which government organization—such as the EFDA or the MoA—is in charge of regulating the safety of milk?	Yes	8	7%
	No	112	93%
Do you know the legal requirements for milk hygiene and handling during production?	Yes	65	54%
	No	55	46%
Has the government or non-governmental organizations ever provided you with milk safety training or guidelines?	Yes	46	38%
	No	74	62%
Do you believe milk safety regulations are necessary to protect consumers?	Yes	97	81%
	No	23	19%
Do you think it is fair for the government to penalize producers/distributors who violate safety regulations?	Yes	61	51%
	No	59	49%
Should all milk producers and distributors be licensed or registered with authorities?	Yes	91	76.2%
	No	29	23.8%
Would you collaborate with regulators to improve milk safety in your area?	Yes	118	98%
	No	2	2%
Do you think there is sufficient and regular access to extension services?	Yes	62	52%
	No	58	48%

4.9. Constraints towards Urban Dairying

There are different categories of major constraints notified by respondents that they think is either holding them back from aspired productivity and further expansion of their businesses or perhaps even jeopardizing their existing businesses. Among the constraints notified, low quality, unreliability and high cost of water and feed is frequently reported. Furthermore, there are several constraints stated under the category of land and space, animal health problems and market and policy. The table below shows these constraints along with their ranks and frequency reported.

Table 10: Constraints Towards Urban Dairying

Tier	Major constraints	Frequency reported	%	Rank
Water and Feed	Low quality, unreliability, and high cost	86	72%	1
Land and space	Poor housing facility and lack of space	17	14%	2
Animal health problems	Diseases and insufficient and swift veterinary services	11	9%	3
Market and policy	Low access to finance, price volatility, weak regulation	6	5%	4

5. DISCUSSION

5.1. Sociodemographic Characteristics

Urban dairy production comes off with great vitality to Ethiopia's urban population through household income, food security and even employment opportunities. But men control a substantial portion of this industry, and women are frequently underrepresented in ownership, decision-making, and resource access. Sociocultural expectations, institutional barriers, and women's restricted access to financial and technical resources are the primary reasons for the dominance of men in urban dairy farming. In Ethiopia, women often occupy less prominent roles such as milking and caring for animals, while men tend to own dairy cattle and handle milk sales, according to a 2009 study by Belete et al. Complementing the findings of this study, this gender role disparity also exists in urban settings. Furthermore, large initial investment as well as logistical skills including access to transportation, urban markets, and cold chain infrastructure is oftentimes required in Ethiopia's urban dairy industry. Women are conceivably excluded disproportionately through these restrictions as a result of their reduced mobility and conflicting domestic duties (Tangka *et al.*, 2000). These drawbacks are not always narrowed down by the urban domain; on the contrary, they may be worsened by the volume and complexity of operations.

Ethiopia's urban dairy industry has demonstrated significant demographic changes in recent years when we consider the age distribution of its members. According to climbing volume of data, in particular interest to metropolitan and peri urban areas like the Addis Ababa, Mekelle, Bahir Dar and Hawasssa, people under the age of 50 years old are taking over the industry (Bereda *et al.*, 2014; SNV, 2019). The entrepreneurial dynamism and adaptability of younger people, especially those between the ages of 25 and 49, is one of the main drivers. Technological, policy-driven, and socioeconomic variables all play a part in this development. The skills and technicality of being more receptive to corporate expansion, market integration, and innovation enhanced the involvement of this age group in the business while being further amplified by their competence and access to information, and better education than previous generations to navigate the highly commercialized urban dairy industry (Tegegne *et al.*, 2013).

The growing interest towards youth focused vocational training programs and agri-projects have also made their positive impact as young entrepreneurs have taking their effectual sum of benefits from market connections, financial access and guidance offered by initiatives like the Livestock and Irrigation Value Chains for Ethiopian Smallholders (LIVES) and the bridge project hosted by SNV. The tendency of the younger generation seemed to be considering dairy production as a feasible economic outlet rather than just a subsistence. Thanks to these measures, while collaterally reduced entry barriers. As this study suggests, there is a growing involvement of interested individuals aged under 50 years old in Ethiopian urban dairy business. Their prominent involvement is creating a positive contrast to urban dairy production while bilaterally being assisted by advanced educational opportunities and initiative that seemed to be having inspirational effects. Meanwhile, it is very imperative that youth focused training, policies and fundings with inclusive qualities must be addressed in the right volume and deliverance.

The Country's food chain is a demonstrating platform for the great values of urban dairy production with particular regards to large cities like Addis Ababa and Mekele. A noteworthy development in this consideration could be the substantial participation and predominance of producers with a secondary school background. This is a subject that has attracted numerous research interests, all of which have consistently divulged a high percentage of producers with a secondary education (Ahmed *et al.*, 2017; Tegegne *et al.*, 2013). In resemblance to the findings of this study, it is no accident that secondary-educated individuals predominate in Ethiopia's urban dairy industry. It illustrates how the management and entrepreneurial needs of urban cattle production meet with the completion of a basic level of education.

The urban dairy producers are the frontline providers for the high demand of fresh milk resulting from exponential population growth and dietary preferences in the metropolitan market areas (Ahmed *et al.*, 2017; Sintayehu *et al.*, 2008). Milk is often dispensed off to private processors, co-operatives or the consumers themselves in these urban environments, reflecting high commercialization as opposed to household consumption. Ethiopian urban dairy farmers are market-oriented and driven by institutional support, urban demand and financial incentives. This sets them apart from rural subsistence farmers, who are more likely to produce dairy products for home consumption. Ethiopia's urbanization and agricultural development are reflected in the commercialization of urban dairy farming.

5.2. Dairy Housing Conditions

Distinct from the findings of this study which depicts the information about farm hygiene predominantly being stated as satisfactory, the majority of Ethiopia's urban dairy farms still have suboptimal housing and hygiene conditions, which concerningly compromises public health, productivity, and animal health. With considerations of certain studies, they show a frequent reporting that congested and inadequately aerated dairy housing structures along with insufficient cleanliness and waste disposal characterizes most urban dairy production systems. (Mekonnen *et al.*, 2021; Tadesse *et al.*, 2019).

The unsuitable structural integuments of the dairy housing being built with low quality raw products that are brittle results in a nonstandard flooring and roofing result and also comes along with exposure of farm animals to harsh weather and diseases carrying pathogens (Gebrekidan *et al.*, 2020). A large number of urban dairy farmers are not formally trained in contemporary animal husbandry and biosecurity protocols. This leads to irregular cleaning schedules and little access to light and fresh air access along with poor storage quality. (Mekonnen & Asmamaw, 2023). In this study area, these decisive elements of housing quality (animal diversity, roof and drainage system, housing cleaning frequency and storage quality) are generally found to be satisfactorily met in comparison to certain research findings.

5.3. Water Access

The well being of farm animals, milk output and their feed consumption could be adversely affected by determining components like access to adequate and clean water. However, this vitality seems to be uneven among Ethiopian dairy farms. This setback is suggested to have risen from issues with unreliable urban water supply, infrastructure constraints and seasonal fluctuation. The dependency of numerous urban dairy production facilities on municipal water access pressurize the production capabilities and compromise the product safety as the water supply is frequently erratic and rationed especially during dry seasons (Yilma *et al.*, 2011). In these sets of conditions, with consideration to management techniques, it's possible to observe a variation in watering frequency. It is vividly explained in researches that a large volume of urban dairy production facilities do not meet the optimal requirement of watering frequency (Mekonnen & Hoekstra, 2016) due to logistical limitations despite the fact that it is advised for

producers to provide sufficient in the recommended frequency (3-4 times a day) (NMSA, 2001). This is also the case in this study, as 60.7% of the respondents have been notified that they provide water twice a day. Furthermore, more than 60% of urban dairy farmers in Addis Ababa and the surrounding areas said they had trouble getting their dairy animals access to clean, enough water, according to a survey conducted by Duguma and Janssens (2016). This concern is further exacerbated by improper distribution and storage mechanisms resulting in contamination and loss of water. This has a practical potential to jeopardize the health and hinder the productivity performance of the farm animals. It is very important to employ sufficient innovative techniques and investments in rainwater harvesting, urban water infrastructure and intellectual guidance on the watering techniques to add dairy productivity in these urban settings.

5.4. Biosecurity Measures

In dairy production, biosecurity is essential for preventing and controlling disease, especially in urban areas with high animal densities and human-animal interactions. Essential biosecurity measures like deworming, vaccination, personal protective equipment (PPE), decontamination techniques, and rodent and pest management are not always implemented efficiently in Ethiopian urban dairy farms. The scientific community could unanimously agree on the gravity of importance routine deworming and vaccination has to reduce the spread of infection and parasitic diseases in dairy production. This vitality is noted to be inadequately met throughout Ethiopia's urban dairy production system in research investigations as most of them lack veterinary outreach, run short on farmer awareness and financial limitations. (Berhanu *et al.*, 2015; Mekonnen *et al.*, 2020). For example, Tadesse *et al.*, (2019) found that less than half of the dairy farms in Addis Ababa that were assessed followed the recommended immunization schedule, and only 42% regularly performed deworming. It can be said that it's promisingly pleasant that the discoveries of this particular study brought forth a different remark that has a significantly higher observation on standard deworming and vaccination.

The use of personal protective equipment is discovered to be an important element in dairy production for mutual safety of farms personnels and farm products yet being a neglected component. This statement is supported by figurative information suggesting that only 35% of urban dairy farm workers notified the appropriate use of boots, protective apparels and gloves during work hours. This could bring about a great risk of transmission of zoonotic diseases

according to the research investigation by Gizaw *et al.*,(2021). But in this case, more than average of the respondents' volume (87.2%) reported the appropriate use of PPEs in their production sites.

There are very few effective decontamination practices, such as footbaths, sanitizing equipment, and limiting access to animal habitats. Fekadu and Abunna (2023) claim that the lack of organized cleaning procedures aids in the transmission of infections both within and between herds, particularly in farms close to residential areas where biosecurity violations are frequent. This is one critical point where corrective interventions need to be implemented towards the weakly established pest and rodent control techniques as they have significant involvement as a disease vector for illnesses like salmonellosis and leptospirosis. This reality was depicted in a survey study conducted by Alemayehu *et al.*, (2022) that suggest that only about 28% of urban dairy production facilities located in central Ethiopia are in possession of active rodent control mechanisms and even out of this figure, fewer implemented preventive actions in fly and other pest control.

In this study, it was observed that more than half of the respondents (66%) reside in professional veterinary services when encountering illness among their dairy animals. This is found in contrast to other research that suggests that the owners of many urban dairy farms in Ethiopia tend to the animals' health more often than professional vets. This propensity towards treatment of animals without a professional knowledge, guidance and procedure is suggested to be ignited from the lack of the understand on the potential devastating effect it has on the health and wellbeing of animals and product quality, being timid about the potential expense of veterinary healthcare or may be limited access to veterinary services (Admasu *et al.*, 2016; Megersa *et al.*, 2011). Inappropriate diagnosis and unfitting treatment are just some of the concerns that could proliferate from the reliance on drugs that don't require prescriptions, traditional form treatment (Kebede *et al.*, 2020). There are researches that highly correlate the unacceptable use of medications like antibiotics without the right volume and dosage known by science and veterinary healthcare professionals with widespread and frequently observed failure in later treatments and also with disease recurrence (Mekonnen *et al.*, 2012; Beyene, 2015). To make things worse, the matter is further aggravated with ill-patterned recording and follow up (Tadesse & Sisay, 2017). As promising and curative as ethnoveterinary techniques are claimed to be by some producers, the effectiveness of these therapeutic methods does not have adequate scientific

conclusions and descriptions in terms of dosage and mode of administration making it a debatable matter (Mesfin *et al.*, 2019). Having this as a preliminary understanding, it is important to highlight on the essentiality of a more organized and reachable veterinary healthcare service, farmer education and a structured regulatory work to protect public safety and animal health in Ethiopia's rapidly elevating urban dairy industry.

5.5. Waste Assortment and Management

It is agreeable as seen in multiple scientific and non scientific platforms that Ethiopia's urban dairy farming is showing a significant growth in the past few years aiming to meet the urban areas' rising demand in milk and milk products. This growth, though, is not supported to further accelerate at the right pace due to factors like inefficient waste management systems with collateral problems on environmental and human health. This was evidently signified in a study conducted by Alemayehu *et al.*, (2020) uttering that most of urban dairy farms in Ethiopia do not possess a well organized waste disposal system resulting in erroneous waste disposal. This has its great share of abruptly the environmental well being posing a considerable health hazard. Solid and liquid wastes like urine, manure and other residues can be named as those that could often get mixed up and make management and recycling a difficult task. Over 70% of urban dairy farms in Addis Ababa and the surrounding cities do not separate waste at the source, according to Getabalew *et al.*, (2022).

There are several encouraging instances where waste sorting and biogas systems have been implemented by cooperatives or development projects with encouraging outcomes (Habtamu *et al.*, 2020). This study reveals a complementary observation to the above statement where most producers in these study areas make assortments to the waste types and have a different collection mechanism for both solid and liquid waste. But the existence of minimal know-how which needs to be revitalized to handle waste in sustainable manners among the urban dairy producers is vividly expressed in scientific studies (Woldemariam and Tadesse, 2014). To levitate the pressure posed by this problem, it is important to recognize the need of investment on infrastructure, anchored and supportive legislative framework backed by farmer education. It is also equivalently important to recognize the potential benefits of turning waste into resources and bracing the supportive relationship between urban dairy production and urban crop cultivation to build on a resilient circular economy.

5.6. Knowledge, Attitude and Practice Towards Milk Hygiene

It was suggested in several studies that the degree of awareness towards milk and milk product safety (hygiene) among dairy producers residing urban and peri urban domains shows a significance variation. Resembling the findings of this study, although the information and awareness about appropriate milking procedures and disease control mechanisms is well disseminated among most dairy producers, there seems to be a shallow practical commitment (Yilma *et al.*, 2011; Lemma *et al.*, 2019). To further exemplify the matter, there is negligence observed from dairy producers when distributing raw milk for consumption prioritizing business opportunities and customer preference despite being well aware of the potential of raw milk in spreading certain diseases like salmonella and tuberculosis (Tolera *et al.*, 2020). This signifies a disarticulation between knowledge and practicality.

The attitude towards safe and hygienic milk production is also shown to be in a significant divergence among urban dairy producers. While some demonstrate applaudable receptivity and acknowledgement to cleanliness and safety procedures like pasteurization (Yilma and Faye, 2006), there are many producers and even consumers that retained the long presumed attitude that raw milk has more benefits in regards to naturalness and nutrient density. This fosters the leniency to take pre handed safety precautions towards unsafe milk handling procedures (Garedew *et al.*, 2012). On top of that, with the already imperiled and inconsistent veterinary supervision and regulatory mechanism, there are some producers with the perception that there are financial and time burdens that come along with meeting hygiene standards and often label it as unnecessary.

Among the practical facets in regards to milk hygiene that require accuracy and cautiousness are the processes of milking, storing and during transportation. A study by Alemayehu *et al.*, (2018) reveals a routine that ought to be corrected. It indicated that exceeding 70% of urban dairy farmers rely on unclean plastic containers for milk storage. This could be a significant error that could exert its devastating effects on milk safety and even public health safety as these materials could harbor harmful bacteria. Many producers in this study reported that they perform appropriate udder cleaning before milking but there were also some observed cleaning udders with unsterile towels that are most likely contaminated. Furthermore a significant volume of producers in this study claimed they store collected milk in either a cool place or refrigerator but

the sufficiency of a cold chain infrastructure is still inadequate especially when transit to urban markets is put to consideration (Haile *et al.*, 2021). This a matter to be stressed and addressed through training and extension services as they are a vital tool to saturate practical knowledge. It has been demonstrated that they actually have a constructive influence and some improvements were observed from producers that took part in milk safety training in regards to handwashing before and after milking and the use of sterile and stainless steel containers for storage (Asfaw *et al.*, 2016). However, many urban dairy producers have never received professional training, and the programs' coverage and consistency are limited. Integrated extension services that mix behavior change communication and technical training are highly needed in this environment.

Policy and institutional support remain insufficient to enforce hygiene standards. Although Ethiopia has national dairy development strategies, the implementation at the local level is often weak due to limited resources and inter-agency coordination challenges (MoA, 2020). Small-scale urban dairy farms in particular frequently function informally and are not subject to regular inspections or regulations. The existence of basic understanding about milk safety and hygienic practices does not seem to guarantee the right attitude and practicality in the urban dairy industry. This requires a more methodical and robust regulatory intervention, public health education tailored for the dairy industry and consistently accessible training to narrow the setbacks.

5.7. Knowledge and Attitude towards Milk Safety Regulation and Institutions Services

Urban dairy production is essential to providing fresh milk to the expanding urban population. However, due in large part to a lack of knowledge and lax implementation of milk safety laws, the safety of milk produced in urban areas has come under scrutiny (Yilma *et al.*, 2011). The abundance of technical understanding about milk safety laws and regulations does not seem to be well considered and comprehensively grasped throughout Ethiopia's urban dairy producers according to the findings of this study and other numerous researches. The findings suggest that there are gaps subjected to through appraisal and corrective actions in regards to regulatory frameworks, disease transmission hazards, and fundamental hygiene precautions (Tadesse & Dessie, 2012; Lemma *et al.*, 2020). The dairy industry particularly those producers in the informal structure performing in an unorthodox manner due deficit in official inspection and extension services take up a large proportion of those with low level of awareness about safety

regulations (FAO, 2019). According to Tegegne *et al.* (2013), producers who are more cognizant of the health risks and expectations of their customers are more likely to have positive attitudes on the adoption of hygienic practices. However, many urban dairy producers see laws as onerous rather than helpful if they are not consistently enforced and supported (Gebremedhin *et al.*, 2019). This ill-disposed characteristic is nurtured by incapacitated penalties for defiance and the perception that the institutional system is not organized in a supportive manner resulting in lack of faith towards corporate structures.

To be able to solve issues subordinating compliance and knowledge deficit, it is of a great importance to recognize and strengthen the prospective capabilities of extension and veterinary healthcare services and quality assurance platforms and perhaps elucidate why these services are still at the level of infancy. A major behavioral progress could be achieved on dairy producers if the standards, quality, frequency and accessibility of institutional support services is calibrated effectively. There is direct proportionality observed in studies suggesting that there is an exhibition of higher adherence to safety standards and other driven approaches towards regulation where institutional services are readily attainable (Ahmed *et al.*, 2017).

The lack of harmonization and demarcated responsibilities between ministerial authorities, municipal authorities and dairy cooperative creates an environment where application of safety regulations is futile. This would put an undesirable pressure on monitoring work while leading to atomization of institutional framework. In this state of presence, it would be an even complex task to deliver a consistent communication about best practices (USAID, 2020). If there is a practical commitment to integrate milk safety regulation into an enforceable, change making and panoptic urban food safety regulation, the prerequisites of enhancing cooperation among the responsible entities must be initially met. With consideration of the already existing barriers, there is a gradual but promising uplift in understanding the vitality of producing milk and milk products within the safety threshold. This uplift is starting to declare a collateral understanding prevailing about the threat of zoonotic diseases like tuberculosis. Another factor altering the habitual and unsatisfactory production system is the increasing demand for quality products by consumers (Yilma *et al.*, 2011). This is an illumination on the amount of potential consumer based policy reform has on producers to adhere to quality and safety control standards.

5.8. Constraints Towards Urban Dairy Production

The urban dairy production in Ethiopia, its sustainability and productivity is met with several hindrance points that obstruct its vitality in terms of food security, income generation and job creation opportunities. As observed and frequently nominated in this study, access of feed takes the upper hand in terms of deterrence facing urban dairy production. The deterrence in terms of feed availability is further magnified by its high cost and poor quality. This is figuratively illustrated in studies suggesting that feed surpasses 60% of the overall expenses of urban dairy producers (Mekonnen *et al.*, 2016). What makes it a critical matter is that in urban areas, dairy producers are highly dependent on purchased feed as these production facilities reside in highly populated areas where accessibility of sufficient graze land is elusive. Milk production in urban areas is also met with limited options in regards to water access. As observed in this study, more than 56% of the dairy producers claimed their water access is predominantly thorough municipal water. The insufficiency of water infrastructures to convey water demand of the localities is also noted to be a noteworthy impediment factor for the urban dairy industry (Tegene *et al.*, 2013). These limitations exert their adverse effects on productivity, deliverance and overall product and public safety.

Another significant curtailment to urban dairy production; restricting productivity and product safety through limiting the number of herd size and sanitary management practices is insufficient farm environment resulting in confinement. This is an occurrence observed due to a drastic reduction in land available for urban dairy production post urbanization and real estate development particularly in and around metropolitan cities like Addis Ababa (Yilma *et al.*, 2011). An insufficient farm environment results in unsanitary conditions that brings about another perilous bottleneck to an already scanty health management system (White *et al.*, 2022). To unfold and bring about a positive remark towards disease control to attain aspired productivity and product safety, it is very important to figure out a way where it is possible to swiftly deliver quality veterinary healthcare services through trained animal health professionals (FAO, 2019).

Aside from the health perspective, commercial drawbacks like access restriction to markets and volatile milk price is a worrisome matter for urban dairy producers. They indicate that they are

not acquiring the amount of income they need to sustain and perhaps expand in the dairy business due to lack of a well organized milk marketing infrastructure and are often left with the option to sell their products informally. The most exasperating moments they claimed to dread in certain studies is during times where supply surpasses demand consequently prices fall (Ahmed *et al.*, 2017).

The sector's development is not only being met with market related impairments but its being further hampered by policy associated complications that is not only costing urban dairy producers their productivity but also putting them in a position when they might even be evicted due to paucity in tailored urban agriculture policies (ALPR, 2022).

6. CONCLUSION AND RECOMMENDATIONS

The comprehensive evaluation of urban dairying in Ethiopia and particularly in Sheger City Administration's three sub-cities (Furi Gelan and Koye fecche) demonstrates the significant contribution that it makes to improve urban food security, employment, income, and consumption. The research reveals the immense potential the industry has but is also hampered by a number of challenges that are impeding it from both sustainable growth and in delivering to the market safe, high quality milk. It indicates that men hold the larger volume of ownership in the urban dairy industry but the room for inclusivity of women is growing in days. It can be concluded that attaining a secondary education fosters the receptivity and practicality of modern technologies and techniques. However, the sector's expansion is held back by limited access to technical guidance, poor management capability, and minimal integration into formal markets. The ubiquity of market-driven manufacturing emphasizes the need for improved marketing infrastructure, regulatory support, and financing availability to boost productivity and competitiveness. Most urban dairy farms seem to maintain good housing conditions, such as basic structures with adequate drainage and ventilation. However, there is an undeniable requirement of corrective actions ought to be taken towards feed and water management procedures. Inadequate feed and water management persists as a problem while excessive reliance on municipal water sources may result in inconsistent supply deliveries and potential contamination risks. Certain biosecurity procedures and waste management systems exist but their application across farms remains inconsistent, except for basic practices that include routine vaccinations, pest control measures and waste collection. These shortcomings could raise the risk of infectious diseases and zoonoses that threaten both animal health and milk safety. It is plausible that farmers recognize the need for hygiene practices despite falling short of execution of essential safety requirements. Ethiopian milk safety regulations remain fragmented due to redundant responsibilities and absent national legislation that is enforceable by law. Effective monitoring and enforcement activities together with extension services suffer because there isn't a properly structured independent entity. The institutional deficit worsens due to deficient awareness campaigns and poor interagency coordination while weak inspection capabilities prevent proper enforcement of standards for safe milk production and processing.

Based on the study's observation, the following recommendations are followed:-

- There needs to be a swift development and implementation of revitalized, clear and enforceable national food safety that includes specific legislative content to dairy product safety.
- To oversee milk safety, inspection, enforcement, and extension programs, a separate, well-funded agency must be established.
- Harmonization of multi sectoral joint work needs to be met between ministries, municipal authorities, educational institutions and business enterprises.
- Regular, practical training on sanitary milk handling, biosecurity procedures, waste management, and regulatory compliance should be provided to farmers, processors, and suppliers.
- It is important to utilize all information dissemination platforms to saturate correct knowledge about the health risks accompanied in unsafe milk production and perhaps influence public attitude and behavior.
- Initiatives that uplift the involvement and ownership of women in urban dairy production should be developed equipping women with the financial and technical support they need to foster equitable growth.
- An intellectual investment and community based water management system needs to be encouraged in terms of sustainable water access (collection and consumption) to assure safe productivity for smallholder producers.
- It is very important to create a conducive legal and operative environment for feed production cooperative and feed quality control protocols.
- Advancement of awareness towards improved housing facilities and waste management like biogas and manure recycling is of great importance not only for the safety of the production facilities but also in reduction of environmental pollution.
- Small scale urban dairy producers must be provided with easy and affordable veterinary healthcare through mobile clinics to assure biosecurity necessities are met while accompanied by thorough educational sessions on the use of protective equipment and disease prevention mechanisms.
- It is important to establish an effective dairy product safety verification, monitoring, and certification protocols that can both help in uplifting consumer awareness and become an information asset to inform policy and intervention strategies.

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