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Refrigeration Deficits and Mitigation Strategies in Fresh Milk and Meat Vendors: A Case Study of Qardho Central Market, Puntland, Somalia

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Keywords:

Cooling System,
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Vendors,
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Market,
Storage Solutions.

Objective: This study aims to investigate the challenges related lack of storage and Solutions in Fresh Milk and Meat vendors in Qardho, Punt land Somalia. **Methods:** This study utilized a descriptive study design at Qardho Central Market, involving 127 vendors selected through a purposive sampling technique. Data collection was carried out by five trained university students, and analysis was performed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistical methods, including frequencies and percentages were applied to summarize the findings in alignment with the study objectives. **Results:** The findings indicate that 96.1% of vendors have unsold products by the end of their operating hours, with milk vendors (54.1%) reporting higher unsold products than meat vendors (45.9%). Only 23.6% of vendors have access to storage facilities, leading to daily spoilage for 91.3% of respondents. Financially, 34.6% of vendors reported losing more than \$20 per day due to spoilage. Other challenges include fluctuating livestock prices, lack of business premises, and low demand. Regarding solutions, 92.9% of vendors believe that a designated storage area and shared refrigeration could reduce spoilage and improve business operations. However, willingness to contribute to storage costs varies: 66.2% of meat vendors are willing to contribute, whereas only 33.8% of milk vendors agree. Additional suggested solutions include financial support, cooperative business models, and proper storage facilities. **Conclusion:** The lack of storage facilities significantly impacts the fresh milk and meat vendors in Qardho, leading to high spoilage rates and financial losses. Establishing shared refrigeration, financial support mechanisms, and business cooperatives could mitigate these challenges and enhance vendors' profitability and market sustainability.

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INTRODUCTION

Livestock farming is fundamental to Qardho's economy, greatly enhancing employment, commerce, and food security. Yusuf (2011) observes that livestock constitutes roughly 40% of Somalia's Gross Domestic Product (GDP) and 80% of its foreign currency revenue, highlighting its economic significance. This sector aids countless pastoralists and intermediary sellers engaged in the trading of fresh milk and meat. Nevertheless, obstacles such as persistent droughts, limited veterinary services, and insufficient infrastructure impede the sector's output. Yusuf underscores the necessity for strategic investments in animal husbandry to shift from reliance on aid to self-sustaining economic growth.

Middle milk and meat sellers function as essential mediators between pastoralists and consumers, facilitating the flow of fresh products within the community. Mohamed (2011) emphasizes that these suppliers have obstacles, including inadequate refrigeration, market volatility, and transportation issues, which impact product quality and cost. Enhancing animal nutrition, disease management, and broadening market access could augment

economic rewards for both pastoralists and vendors. Enhancing supply chain infrastructure, such as improved roadways and cold storage facilities, would mitigate post-harvest losses and augment profit margins.

Hygiene procedures among meat and dairy vendors are essential for public health and commercial viability. Mohamud (2022) examined the knowledge of meat hygiene among slaughterhouse employees and meat vendors in Bossaso, indicating that although there is a reasonable comprehension of hygiene principles, the execution of appropriate practices is insufficient. Similarly, a study by Momanyi (2010) on milk hygiene practices in Somalia revealed that the informal structure of the milk market chain, marked by insufficient cleanliness and refrigeration facilities, heightens contamination risks. It is imperative to tackle these concerns via training programs, policy interventions, and infrastructure development to improve the quality of fresh products and sustain the livelihoods of intermediary merchants.

Milk and meat traders in Qardho encounter significant difficulties in product storage owing to insufficient cold storage facilities and harsh

temperatures. According to Qaran Jobs (n.d.), in numerous regions of Somalia, including Qardho, fresh milk possesses a shelf life of merely a few hours without refrigeration, resulting in significant deterioration. Similarly, Issack (2021) stresses that small-scale meat sellers face challenges in preserving product freshness due to inadequate cold storage, compelling them to sell rapidly or incur financial losses. These challenges adversely impact vendors' profitability and exacerbate food insecurity by restricting access to safe, high-quality items.

The deficiency of dependable electricity and adequate cold chain infrastructure in Qardho intensifies the issue. According to Dahiya (2023) asserts that establishing cold storage enterprises in Somalia is challenging due to inconsistent power supply and elevated operational expenses. This situation compels numerous milk and meat dealers to depend on conventional preservation techniques like salting or drying meat, which restricts their capacity to offer fresh products. Moreover, constrained transportation alternatives necessitate that vendors expedite product sales, thereby amplifying waste and diminishing profit margins. In the absence of strategic investments in storage facilities and transportation logistics, vendors in Qardho will persist in facing product losses and variable revenues.

Innovative storage techniques may alleviate these issues. (Witoon, 2024) examines a study from Louisiana State University, revealing that the application of a water-soluble chitosan coating on raw eggs can substantially prolong their shelf life. A comparable method may be investigated for meat preservation in Qardho. Moreover, investing in solar-powered refrigeration may offer a substitute for the erratic energy grid, assisting milk and meat vendors in minimizing spoilage and enhancing profits. Resolving these storage challenges is essential for augmenting food security, maintaining local markets, and improving the livelihoods of vendors in Qardho.

Objectives of the Study

1. To determine the Demographic Characteristics of the Fresh Milk and Meat vendors in Qardho Central Market.
2. To assess the Storage Challenges Faced by the Fresh Milk and Meat vendors in Qardho Central Market.
3. To examine Possible solutions to address the Storage Challenges Faced by the Fresh Milk and Meat vendors in Qardho Central Market.

RESEARCH METHODOLOGY

Study Design

This research adopted a descriptive study approach, suitable for evaluating storage difficulties and potential remedies for fresh milk and meat traders in Qardho, Puntland, Somalia. The descriptive design methodically identifies, analyzes, and interprets the issues encountered by vendors, including inadequate refrigeration, elevated spoilage rates, and financial losses. Furthermore, it examines prospective solutions, encompassing technology interventions, regulatory suggestions, and alternative preservation techniques.

Data Collection Tools and Procedures

The study was carried out in the Qardho district of Puntland, Somalia, initiated by the local economic development forum to address the issues sellers encounter due to inadequate storage for fresh milk and meat. To accomplish this, the institution employed five enumerators who collected data via the KOBO Toolbox. Before the commencement of data collection, the enumerators received comprehensive training to guarantee their complete understanding of the survey's objectives, the content of the questionnaire, and ethical considerations. This seminar emphasized the need to secure verbal consent and safeguard participant confidentiality. The research employed a systematic questionnaire consistent with its aims. The survey's comprehensiveness facilitated the acquisition of

diverse relevant information, encompassing demographic data, storage difficulties, and possible remedies. The revenue department of Qardho Municipality reports that there are 82 vendors of fresh meat and 100 vendors of fresh milk at the central market and adjacent minor markets. As a result, 70% of these vendors were incorporated into this analysis.

Study Population

The study included all vendors of meat and milk, specifically those offering fresh meat and milk, situated at the Central Market, Kaambo, Qoryacad, and Calanley Mini Market.

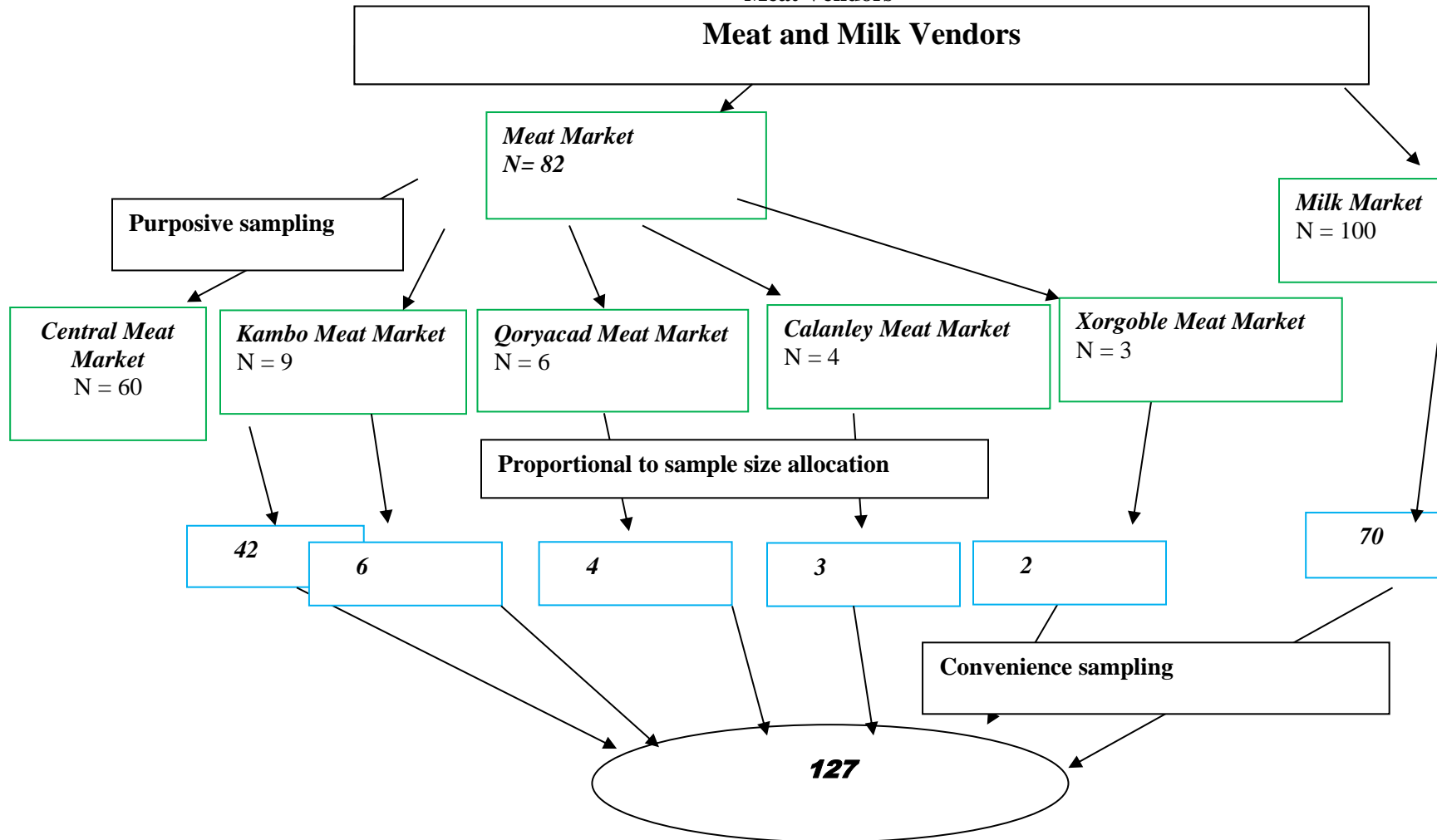
Sampling Technique

This study employed a convenience sampling method, selecting 127 vendors from Qardho Central Market according to their availability and willingness to participate. Convenience sampling was selected for its practicality, cost-efficiency, and capacity to rapidly collect data from easily accessible respondents.

Sampling Procedure

The study focused on a cohort of 182 individuals engaged in the sale of fresh meat and milk. To acquire a representative yet feasible sample, 70% of the entire population was chosen, adhering to the sample size calculation technique proposed by Mugenda & Mugenda, which advocates for sample sizes that reconcile precision with practicality. The application of this percentage yielded a sample size of around 127 individuals ($0.70 \times 182 = 127.4$), considered adequate for meaningful analysis and generalization of findings within the study's context.

Figure 1: Diagram of the Sampling Procedure for the Study on the Challenges Related to Lack of Storage and Solutions in Fresh Milk and Meat Vendors



Data Processing and Analysis

Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS), utilizing descriptive statistics such as frequencies and percentages to summarize the findings by the study's objectives. SPSS was chosen for its proficiency in handling structured data and performing statistical analyses.

RESULTS

Demographic Characteristics of the Respondents

Table 1 presents a detailed analysis of the demographic characteristics of the study respondents, covering aspects such as age, gender, education level, experience, marital status, family dependents, business location, and customer volume. All respondents were female, with the majority (56.7%) aged 45 and above, while 31.5%

fell within the 35–44 age group. Regarding marital status, 70% were married, while 11.8% were widowed, and another 11.8% were divorced, reflecting a range of marital backgrounds. Educationally, a significant proportion (71.7%) were illiterate, with 24.4% having a primary education, indicating generally low educational attainment. In terms of family support, 82.8% of respondents had more than five dependents, while 14.2% supported 3–5 individuals. Business experience varied among respondents, with 57.5% having more than six years in business, 28% possessing 4–6 years of experience, and 17.3% having 1–3 years. In customer volume, 53.7% served 10–20 customers daily, 40.9% had fewer than 10, and 17.3% served more than 20 customers per day. This distribution highlights the diverse experience levels and business capacities within the sample.

Table 1: Demographic Characteristics of the Respondents

Variable	Labels	Total	Business activity	
			Fresh Vendor	Meat Fresh Vendor Milk
Sex	Female	127(100%)	57 (44.9%)	70 (55.1%)
Age	18–24	2 (1.6%)	2 (1.6%)	0
	25–34	13 (10.2)	9 (69.2%)	4(30.8%)
	35–44	40(31.5)	12 (30.0%)	28(70.0%)
	45 years and above	72 (56.7)	34 (47.2%)	38(52.8%)
Marital status	Divorced	15(11.8%)	7(46.7%)	8 (53.3%)
	Married	90(70.8)	37(41.1%)	53(58.9%)
	Single	7(5.5%)	4 (57.1%)	3(42.9%)
	Widowed	15 (11.8%)	9(60.0%)	6(40.0%)
Level of education	Not educated	91(71.7%)	52(57.1%)	39(42.9%)
	Primary school	31(24.4%)	15 (48.4%)	16 (51.6%)
	Secondary school	3(2.4%)	1(33.3%)	2(66.7%)
	University degree	2 (1.6%)	2(100%)	0
How many dependents rely on the income you earn from your business	1–2	3(2.4%)	0	3(100%)
	3–5	18 (14.2%)	6(33.33%)	12(66.7%)
	More than 5	105 (82.8%)	51(48.6%)	54(51.4%)
How long have you been in this business?	Less than 1 year	4(3.1%)	2(50%)	2(50%)
	1–3 years	22(17.3%)	15(68.18)	7(31.8%)
	4–6 years	28(28%)	11(39.3%)	17(60.7%)

	More than 6 years	73(57.5%)	29(39.72%)	44(60.3%)
Where is your business located?	Central Market	112 (88.2%)	42(37.5%)	70(62.5%)
	Calanley	3(2.4%)	3(100%)	0
	Kaambo Mini market	6(4.7%)	6(100%)	0
	Qoryacad Mini market	4(3.1%)	4(100%)	0
	Xorgoble Mini market	2(1.6%)	2(100%)	0
On average, how many customers do you serve daily?	10–20	53(53.7%)	22(41.5%)	31(58.5%)
	Fewer than 10	52(40.9%)	21(40.4%)	31(59.6%)
	More than 20	22(17.3%)	14(63.6%)	8(36.4%)

Given the information presented in Table 2, it is clear that vendors selling fresh meat and milk at Qardho Central Market face significant challenges. A remarkable 96.1% of vendors reported that they had products that were not sold by the time their business hours came to an end. This suggests that the vast majority of vendors have difficulty managing their inventory, which may be the result of a variety of factors including inconsistent demand, ineffective marketing, or problems with spoilage. It is interesting to note that 54.1% of fresh milk vendors reported having unsold products, whereas 45.9% of fresh meat vendors reported having unsold products. With this information, it appears that milk may have a lower demand than meat.

By relying primarily on personal consumption (27.6%) and selling at a discounted price (26.08%), vendors can effectively manage products that have not been sold. A lack of effective strategies for minimizing loss and maximizing revenue is indicated by the fact that personal use and discounting are the primary methods of operation. Furthermore, only 23.6% of vendors reported having access to storage facilities for products such as milk and meat that had not been sold. When it comes to those who have access, the majority of them use either their refrigerators (36.7% of them)

or shared storage spaces (63.3% of them), which may not be the best conditions for maintaining the freshness of their products. This limited access to appropriate storage is a key factor contributing to financial losses, and 96.1% of vendors consider the storage methods they are currently using to be ineffective.

It is concerning that 91.3% of vendors experience daily spoilage as a result of inadequate storage conditions. This is a significant increase from the previous percentage. Not only does this have an impact on their profit margins, but it also impairs their capacity to consistently satisfy the demands of their customers. 34.6% of vendors reported that storage-related spoilage contributes more than \$20 to their daily losses, indicating that the impact is significant from a financial standpoint on their business. Because of this, there is an immediate and pressing need for improved storage solutions that can assist vendors in lowering their waste levels and improving their bottom line. Last but not least, the fact that all of the vendors are in complete agreement (one hundred percent) that the lack of appropriate storage solutions hinders the expansion of their businesses is indicative of systemic problems within the market that need to be addressed to ensure the market's long-term viability.

Table 2: Storage Challenges Faced by Meat and Milk Vendors

Variable	Labels	Business activity		
		Total	Fresh Meat Vendor	Fresh Milk Vendor
At the end of your operating hours, do you usually have any unsold meat/milk left?	Yes	122(96.1)	56(45.9)	66(54.1)
	No	5(3.9)	1(20.0)	4(80.0)
If yes, how do you manage the unsold meat /milk left?	Donate to charity	10(8.2)	7(70.0)	3(30.0)
	Frying	16(13.1)	16(100.0)	0(0.0)
	Personal/Family consumption	35(27.6)	20(57.1)	15(42.9)
	Refrigerate overnight, and then sell	14(11.0)	1(7.1)	13(92.9)
	Sell at a discounted price	34(26.08)	12(35.3)	22(64.7)
	Traditional method	13(10.2)	0(0.0)	13(100.0)
Do you have access to storage facilities for unsold meat/milk?	Yes	30(23.6)	5(16.7)	25(83.3)
	No	97(76.4)	52(53.6)	45(46.4)
If yes, what type of storage facility do you use?	Personal refrigerator/freezer	11(36.7)	1(9.0)	10(91.0)
	Shared storage with other sellers	19(63.3)	4(21.1)	15(78.9)
How effective is your current storage method in reducing the financial losses you face?	Effective	5(3.9)	2(40.0)	3(60.0)
	Ineffective	122(96.1)	55(45.1)	67(54.9)
How frequently do you experience spoilage of meat/milk due to inadequate storage?	Daily	116(91.3)	53(45.7)	63(54.3)
	Rarely	11(8.7)	4(36.4)	7(63.6)
	Never	0(0.0)	0(0.0)	0(0.0)
How much does storage-related spoilage contribute to your daily financial losses?	Less than \$10	28(22.0)	8(28.6)	20(71.4)
	\$10–\$20	55(43.3)	21(38.2)	34(62.8)
	More than \$20	44(34.6)	28(63.6)	16(36.4)
Does the absence of proper storage solutions limit your business growth?	Yes	127(100.0)	57(44.9)	70(55.1)
	No	0(0.0)	0(0.0)	0(0.0)
Besides the storage challenges mentioned above, what other business difficulties do you experience which could lead you to financial losses?	Fluctuating livestock prices	11(8.7)	11(100.0)	0(0.0)
	Lack of proper business premises	19(15.0)	0(0.0)	19(100.0)
	Very low demand	32(25.2)	18(56.3)	14(43.6)
	Lack of proper storage	65(51.2)	28(43.1)	37(56.9)

Table 3 analyzes prospective solutions to the storage issues defined in the initial table. A significant majority of vendors (92.9%) claim that allocating a designated storage room and offering a

communal refrigerator might substantially mitigate spoilage and improve their business operations. This substantial support indicates that merchants acknowledge the significance of a refrigerator in

enhancing their conditions. However, an analysis of the willingness to pay the running expenses of these shared facilities reveals significant disparities between meat and milk merchants. A significant 66.2% of fresh meat suppliers are prepared to split the expenses of a communal refrigerator, although merely 33.8% are against it. Numerous vendors are willing to contribute between \$0.18 and \$0.32 per kilogram daily. Conversely, fresh milk vendors exhibit a diminished propensity to share costs, with merely 33.8% consenting to contribute and a substantial 82.1% refusing to participate. Among those ready to donate, milk vendors have also agreed to pay between the range of \$0.04 to \$0.18. This disparity suggests that milk vendors may encounter heightened financial limitations.

Notwithstanding their receptiveness to solutions, the efficacy of existing storage systems continues to be a substantial issue, with an alarming 96.1% of suppliers categorizing them as ineffective. This indicates that current procedures are insufficiently meet the storage and preservation requirements of the products, resulting in ongoing deterioration. The prevalence of spoiling remains a significant concern, exhibiting a comparable daily trend as illustrated in Table 1. Approximately 97.6% of merchants state that appropriate storage of their products would enable them to sell those items the following day. This conviction underscores the imperative for enhanced storage conditions, as superior preservation techniques could diminish losses and bolster consumer confidence in product quality.

Table 2: Possible Solutions to Address the Storage Challenges Faced by the Meat Vendors

Variable	Labels	Business activity		
		Total	Fresh Meat Vendor	Fresh Milk Vendor
Would designating a specific storage area and providing a shared refrigerator for meat/milk sellers reduce spoilage and benefit your business?	Yes	118(92.9)	57(48.3)	61(51.7)
	I do not know	9(7.1)	0(0.0)	9(100.0)
	No	0(0.0)	0(0.0)	0(0.0)
If a shared refrigerator is provided, are you willing to contribute to the operational costs (e.g., electricity, maintenance, salary)?	Yes	71(55.9)	47(66.2)	24(33.8)
	No	56(44.1)	10(17.9)	46(82.1)
If yes, how much would you be able to pay for one kilogram/one litre per day?	\$0.04-\$0.18	25(35.2)	1(4.0)	24(96.0)
	\$0.18-\$0.32	36(50.7)	36(100.0)	0(0.0)
	\$0.32-\$0.46	3(4.2)	3(100.0)	0(0.0)
	\$0.46-\$0.6	7(9.9)	7(100.0)	0(0.0)
If no, please select the reason	I cannot afford to contribute	40(71.4)	10(25)	30(75.0)
	I have my refrigerator	16(28.6)	5(31.2)	11(68.8)
Do you believe that meat/milk kept in a refrigerator and well-preserved will still be bought from you the next day?	Yes	124(97.6)	54(43.5)	70(56.5)
	No	3(2.4)	3(100.0)	0(0.0)

Figure 2 illustrates the preferences of Fresh Meat Vendors and Fresh Milk Vendors regarding various options to enhance storage conditions and mitigate business problems. The most favoured remedy was Proper Storage, emphasized by 37 Fresh Meat

Vendors and 47 Fresh Milk Vendors. The Business Cooperative was the least favoured option, with 8 Fresh Meat Vendors and 6 Fresh Milk Vendors acknowledging its significance. Financial support was significantly more crucial for Fresh Milk

Vendors, with 17 expressing its necessity compared to 12 Fresh Meat Vendors. These data indicate a significant focus on appropriate storage options and financial assistance.

Figure 2: Additional Solutions to Improve the Storage Conditions and Address the Challenges



DISCUSSIONS

The investigation reveals that a significant challenge is the inadequate cooling system (freezers and refrigerators). The analysis revealed that 96.1% of vendors reported having unsold inventory at the end of their operation hours. Vendors predominantly manage unsold inventory by personal consumption (27.6%) and discounted sales (26.08%). This reliance on individual consumption and discounting indicates a lack of effective strategies for waste minimization and income improvement. As a result, the firm operators experience losses that negatively affect their financial stability. This discovery corresponds with (Somcool, 2023). In developing countries, the absence of cold storage contributes to more than 45% of food spoilage, leading to substantial economic losses for farmers and communities. Many vendors operate without adequate refrigeration, essential for maintaining the freshness of perishable goods like meat and milk. This deficiency leads to decay and poses health risks to consumers. The lack of refrigeration substantially reduces the shelf life of these products, resulting in financial losses for suppliers. This indicates that the

storage problem represents a national barrier affecting the socio-economic welfare of small-scale fresh milk and meat vendors. This demonstrates that the problem of insufficient refrigeration is pervasive, impacting not only dairy and meat merchants but also consumers of vegetables and perishable goods, signifying a larger challenge for Somalia and low-income countries in general.

A considerable proportion of respondents (23%) indicated the need for financial assistance, citing economic challenges stemming from recurrent natural catastrophes, such as floods that have destroyed their equipment, including dwellings and storage facilities. These findings align with (DREF, 2020). Which States On 27 April, significant rainfall in Qardho and its seasonal river catchments resulted in severe flooding, profoundly affecting Qardho City, which has a population of 120,000 individuals (about 20,000 houses). The extensive flooding resulted in damage to infrastructure, including road networks and telecommunications, as well as communities, leading to fatalities and population displacements, contamination of water sources, disruption of livelihoods, social services—particularly health—and market operations. The

households most impacted were located in the high-flood risk lowlands and required immediate humanitarian aid. This indicates that Fresh Milk and meat sellers are still recuperating from the losses incurred due to recurrent natural catastrophes and require financial support to sustain their enterprises.

The vast majority of vendors, which accounts for 92.9% of the total, believe that designating a storage area and providing a community refrigerator might considerably reduce the amount of food that goes bad, improve their business operations, and reduce the amount of money that is lost regularly. This discovery is consistent with the investigation that was carried out by (CPD, 2024). The use of solar-powered refrigerators has significantly improved the livelihoods of female milk vendors in central Somalia, particularly in the Adado and Dhusamareb districts of Galmudug state. It was discovered that prior to the acquisition of refrigerators, sellers experienced daily losses of up to ten dollars due to the deterioration of milk. This was due to the fact that they lacked sufficient storage facilities to maintain unsold milk. Because of this spoiling, their revenue was reduced, and the continued existence of their businesses was put in jeopardy. Consequently, this demonstrates that the issues posed by the absence of a cold chain system are a concern that affects the entire nation and calls for policy and planning from both the government and businesses. Additionally, the utilization of the tactics that have been done in the places that have been described above could be an appropriate answer for the vendors of fresh milk and meat in Qardho.

CONCLUSION

This study highlights the urgent difficulties encountered by female vendors of fresh meat and milk at Qardho Central Market and its adjacent micro markets. The demographic profile of the responders indicates a majority of older, married, and predominantly illiterate women with substantial familial obligations. Despite possessing extensive experience in company, many continue to function

under restrictive regulations that hinder their growth and profitability.

A significant problem found is the elevated incidence of daily deterioration resulting from insufficient storage facilities. A substantial 96.1% of vendors indicated possessing unsold inventory after the business day, while 91.3% encountered daily spoiling, resulting in considerable financial losses frequently surpassing \$20 per day. The absence of efficient storage options adversely impacts business margins and hinders vendors' capacity to constantly fulfil client demand. Existing coping techniques, including personal consumption, discounting, and conventional procedures, are insufficient and indicate a deficiency in systematic interventions. Furthermore, a limited number of merchants possess adequate storage facilities, and those that do predominantly depend on shared or personal refrigerators, which are frequently inadequate. All respondents concurred that the lack of adequate storage impedes their business expansion. Notwithstanding these hurdles, the survey indicates a robust willingness among merchants, particularly meat sellers, to embrace communal solutions. A significant majority (92.9%) endorse the concept of communal storage facilities, and numerous meat vendors are prepared to assist with operational expenses. Nevertheless, milk vendors seem to be more financially limited, exhibiting a diminished willingness to donate despite recognizing the advantages.

The study underscores the pressing necessity for pragmatic initiatives, specifically communal fridge facilities and cost-effective storage solutions. Mitigating storage issues would not only diminish spoilage but also empower women entrepreneurs, enhance their financial stability, and bolster the sustainability of the informal food sector in Qardho.

Recommendations

- Implement communal refrigeration and cold storage facilities to minimize rotting of fresh milk

and meat, hence ensuring product quality and extending shelf life.

- Offer financial support, including microloans or grants, to vendors impacted by persistent floods to facilitate the reconstruction of their companies and the procurement of necessary storage equipment.
- Improve market infrastructure by developing flood-resistant storage and commercial facilities to safeguard vendors against future calamities.
- Provide training sessions on optimal storage methods, financial management, and company sustainability to enhance vendors' efficiency and profitability.
- Promote governmental and NGO involvement in delivering policy assistance, financial support, and investment in market infrastructure to foster sustainable small-scale enterprises in Qardho.
- Encourage the establishment of networks and cooperatives among fresh meat and milk vendors to foster collaboration and mutual assistance in addressing shared difficulties.

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