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Comparative analysis of milk production practices: Commercial vs. Household Dairy farming in Haryana, India

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Abstract

This research explores milk production practices in Haryana, India, with a focus on identifying zoonotically undesirable practices in commercial dairy farming compared to smallholder dairy farming. The study employed a multistage random sampling technique to observe and document farming practices, including preparation, milking, and storage. Key findings reveal discrepancies in infrastructure, hygiene, and equipment choices between commercial and household dairy farmers. Commercial farmers generally exhibited better practices, such as maintaining short fingernails and covering their hair, while household farmers displayed room for improvement in personal hygiene. Vaccination and disease monitoring were also more prevalent among commercial farmers. However, both groups need education on milking techniques, udder cleaning, and proper handling and storage practices to enhance milk quality and animal health. This study underscores the importance of targeted interventions to promote safer and higher-quality milk production in the dairy industry.

Keywords: Commercial, Haryana, Household, Milk production and zoonotically undesirable practices

1. Introduction

In view of the longstanding significant disparity between the rising demand for milk and milk products and their production in India, the government has made substantial efforts to boost livestock productivity. These initiatives have led to a notable increase in milk production in the country (Statistics, B. A. H., 2022-2023) ^[1]. While these efforts have enabled the government to meet its food supply targets, they have unintentionally jeopardized the well-being of both dairy animals and their herders, who have been adversely affected by their professional activities. Laboratory results have confirmed that dairy workers are exposed to potentially harmful zoonotic pathogens, which can be transmitted to humans (Palomares Velosa *et al.*, 2021) ^[2]. Furthermore, changes in human behavior, globalization, and climate change create opportunities for these pathogens to evolve into new forms (Statistics, B. A. H., 2022-2023) ^[1]. Each year, unsafe food costs low- and middle-income nations 110 billion USD in lost productivity and medical costs. The health of the plants, animals and environment during the production process has an impact on how safe the food is (World Health Organization, 2023) ^[4]. The health of the dairy herd, the quality of the raw milk, the milking and pre-storage conditions, the available storage facilities and technologies, worker, animal, and environmental cleanliness all have a role in determining the existence of potentially

significant sources of food-borne pathogens in milk (Kenny, M., 2013) ^[3]. Countries with low or middle income such as India are still spending annually on productivity losses and medical expenses due to basic deficiencies such as food safety (World Health Organization & Food and Agriculture, 2022) ^[5]. In such a dire situation, the need for safe and hygienic milk production as a global food source has been an ongoing concern for years. Extensive research has been conducted in recent years regarding the milk production systems adopted by smallholding dairy farmers. Among the leading states in high milk production, Haryana also produces a significant amount of milk at the commercial level. However, there is a lack of data regarding the practices adopted by commercial dairy farmers in the state. Given this context, there is an urgent need for a systematic study in this critical area of concern. Therefore, this article presents a comparative study of the production system of commercial dairy farmers in comparison to smallholding dairy farmers. It is evident that a scientific study is required to assess the practices employed by farmers when handling animals. Hence, the present study was initiated with the specific objective of documenting zoonotically undesirable practices being followed in milk production systems.

Materials and Methods

The current research was conducted in the Haryana districts

of Hisar and Jind in 2018. To ensure a representative sample, multistage random sampling technique was followed. Initially, local veterinarians collaborated to compile a list of peri-urban dairy farmers actively involved in commercial dairying within the vicinity of the district headquarters in both districts. These individuals were classified as peri-urban/commercial dairy farmers. Subsequently, 10 proprietors of commercial dairy farms were randomly selected from each district. We utilized an observation method to meticulously document the farming practices being implemented by these dairy farmers. For this purpose, we designed an observation sheet specifically tailored to record practices that might be potentially harmful to the dairy production process. In addition to the observational data collection, research team visited the selected households of the respondents (10 households from each district) during both the milking process and post-harvest management phases. This allowed to gather comprehensive data for our study. All observations made during these visits were meticulously documented on observation sheet. To supplement data collection efforts, we engaged in direct questioning of the respondents. This approach was particularly useful in gathering information on specific items of interest. In the final phase of our research, we compiled and analyzed the collective data to identify and catalog a list of potentially undesirable practices within the milk production chain. This comprehensive approach provided valuable insights into the dairy farming practices in the studied areas, shedding light on areas that may require improvement or intervention for the betterment of the industry.

Results

Milk production practices

The results of the observation regarding undesirable dairy farming practices are described under different subheadings - preparation, milking and storage.

- 1. Preparation:** The practices followed by the farmers are described in further sub heads – including environment and equipment.

Environment

As evident from Table-1, it is clear that a majority (82.5%) of the observed dairy farms were having permanent shed, but less than half of them were having cemented floor. A large majority of commercial respondents were running their dairy farms in a permanent shed. More than half the numbers (55%) of observed dairy shed were located in areas with a foul smell. More of commercial dairy sheds were placed in areas with a foul smell. It can be seen that 85 per cent of respondents were allowing animals in the shed after/before milking. During the observation it could be seen that 67.5 per cent of shed be thoroughly cleaned after every milking while less than half the number (47.5%) of respondents were keeping the floor of the shed clean and dry.

Equipment

Table 1 illustrates the choices made by respondents in terms of milk handling and storage practices. It is evident that a limited number of respondents (32.5%) opted for aluminum or stainless steel cans for milking and milk storage, while

half of the respondents (50%) preferred plastic containers. Breaking it down further, we find that 20% of household respondents and 45% of commercial respondents used aluminum or stainless steel cans, whereas 30% of household respondents and 50% of commercial respondents opted for plastic containers. Surprisingly, none of the household respondents employed a "strip cup" for testing milch animals for mastitis, with only a mere 5% of respondents overall using such a device.

Examining the overall picture presented in Table 1, it is apparent that a very small proportion (5%) of respondents maintained a separate "strip cup" for mastitis testing. A significant majority (92.5%) of respondents adhered to the practice of promptly cleaning all utensils after milking. Among household respondents, 65% rinsed utensils with cold water before scrubbing them with a brush. In contrast, all commercial respondents (100%) consistently rinsed utensils with cold water both before and after scrubbing. Only a small fraction (10%) of household respondents used hot water and detergent to scrub utensils, while 60% of commercial respondents utilized hot water and detergent for this purpose. In the commercial category, 40% opted to merely brush utensils without the use of hot water or detergent, reflecting a less stringent cleaning approach.

Table 1 also highlights that after rinsing, 55% of household respondents and 35% of commercial respondents followed the practice of allowing utensils to dry on a rack in the sun. Additionally, 85% of household respondents and an even higher percentage of commercial respondents (90%) consistently cleaned all containers immediately after emptying milk. Interestingly, none of the respondents reported having milking machines on their dairy farms.

Considering these findings, it is recommended that extension agencies adopt a Hazard Analysis and Critical Control Points (HACCP) approach to identify and promote practices that can substantially reduce microbial contamination. This, in turn, can lead to improvements in milk quality and a reduction in the risk of zoonotic diseases. For instance, a straightforward campaign promoting the use of hot water and detergent for utensil washing can be highly effective. Similarly, educating farmers about the importance of not allowing animals to sit immediately after milking can significantly reduce the incidence of mastitis.

- 2. Milking:** Observations on the practices employed by farmers during milking can be categorized into three key areas: Animal Health and Hygiene, Personal Hygiene, and Milking Techniques.

Animal Health and Hygiene

During our interviews with farmers, we gathered valuable insights into their practices related to animal health and hygiene. Here are the key findings:

Vaccination

Surprisingly, less than half (45%) of the household respondents reported vaccinating their animals against diseases. In stark contrast, a significant majority (90%) of commercial respondents preferred immunizing their animals.

Disease Monitoring

Approximately 55% of household respondents conducted regular checks to monitor their animals for various

contagious diseases. In contrast, a small minority (10%) of them opted to seek assistance from qualified veterinary practitioners. The preference for professional veterinary care was notably higher among commercial respondents. These findings shed light on the disparities in vaccination practices and disease monitoring between household and commercial farmers during milking.

Personal hygiene

Table-2 reveals some noteworthy insights regarding personal hygiene among individuals involved in milking cows. While it appears that all the individuals participating in the milking process exhibited good health, the same cannot be said for the majority of household respondents, with a staggering 90% not meeting the criteria for being

considered visibly clean. When it comes to maintaining short fingernails, nearly three-quarters of all observed dairy farmers adhered to this practice. In contrast, only half of the household respondents followed this hygienic habit, and among commercial farmers, the percentage adhering to short fingernails was even higher. Notably, a mere 5% of commercial respondents, and a negligible percentage among all respondents, were observed with long hair that was left uncovered, indicating a generally low prevalence of this practice. In summary, the findings from Table-2 underscore the importance of personal hygiene, with a clear need for greater attention to cleanliness among household respondents. However, the majority of dairy farmers exhibited better hygiene practices, particularly in maintaining short fingernails and covering their hair.

Table 1: Practices followed by farmers during preparation for milking

Environment				
Sr. No.	Practices	Number of respondents following the practice		
		Household (n=20)	Commercial (n=20)	Overall (n=40)
		N (%)	N (%)	N (%)
a)	A permanent shed.	15 (75)	18 (90)	33 (82.5)
b)	Cemented floor.	6 (30)	12 (60)	18 (45)
c)	Shed is placed in areas with a foul smell	9 (45)	13 (75)	22 (55)
d)	Animals are allowed in the shed after/before milking	20 (100)	14 (70)	34 (85)
e)	The shed be thoroughly cleaned after every milking.	11 (55)	16 (80)	27 (67.5)
f)	When not in use, the floor of the shed be kept clean and dry.	12 (60)	7 (35)	19 (47.5)
Equipment				
Sr. No.	Practices	Number of respondents following the practice		
		Household (n=20)	Commercial (n=20)	Overall (n=40)
		N (%)	N (%)	N (%)
a)	Aluminium or stainless steel cans are used for milking and storing milk.	4 (20)	9 (45)	13 (32.5)
b)	Regular plastic containers used.	6 (30)	14 (70)	20 (50)
c)	A separate "strip cup" for testing cows for mastitis prior to milking is kept.	0 (0)	2 (10)	2 (5)
d)	Clean all utensils as soon as possible after milking.	17 (85)	20 (100)	37 (92.5)
e)	Utensils and containers- Rinse with cold water	13 (65)	20 (100)	33 (82.5)
f)	Scrub with a brush using hot water and detergent (un-perfumed liquid soap).	2 (10)	12 (60)	14 (35)
g)	Rinse with cold water.	4 (20)	20 (100)	24 (60)
h)	Place on a rack to dry in the sun.	11 (55)	7 (35)	18 (45)
i)	Store containers and utensils in a safe, clean and well-ventilated room when not in use.	14 (70)	11 (55)	24 (60)
j)	Clean all containers immediately after emptying milk.	17 (85)	18 (90)	35 (87.50)
k)	Milking machines	0 (0)	0 (0)	0 (0)

Table 2: Practices followed by farmers during milking

Animal health and hygiene				
Sr. No.	Practices	Number of respondents following the practice		
		Household (n=20)	Commercial (n=20)	Overall (n=40)
		N (%)	N (%)	N (%)
a)	Vaccinate animals against zoonotic diseases.	9 (45)	18 (90)	27 (67.5)
b)	Check animals periodically for all types of contagious diseases.	11 (55)	14 (70)	25 (62.5)
c)	When a cow is suspected being sick, contact a qualified veterinary practitioner immediately.	2 (10)	16 (80)	18 (45)
d)	Milk is consumed and/or sold from cow under antibiotic therapy.	5 (25)	9 (45)	14 (35)
Personal hygiene				
Sr. No.	Practices	Number of respondents following the practice		
		Household (n=20)	Commercial (n=20)	Overall (n=40)
		N (%)	N (%)	N (%)
a)	Person involved in milking cows is healthy and clean.	2 (10)	12 (60)	14 (35)
b)	Fingernails are short	10 (50)	16 (80)	26 (65)

c)	People with long hair cover their heads.	0 (0)	1 (5)	1 (2.5)
d)	Smoking during milking time.	3 (15)	1 (5)	3 (7.5)
Techniques for milking cows				
Sr. No.	Practices	Number of respondents following the practice		
		Household (n=20)	Commercial (n=20)	Overall (n=40)
		N (%)	N (%)	N (%)
a)	Wash hands thoroughly with soap and clean water before milking.	4 (20)	14 (70)	18 (45)
b)	After washing hands dry with a clean towel immediately before milking.	7 (35)	15 (75)	22 (55)
c)	Wash the udder with warm clean water with disinfectant.	12 (60)	6 (30)	18 (45)
d)	Dry udder using a dry towel.	0 (0)	4 (20)	4 (10)
e)	Before milking, test for mastitis using a strip cup.	0 (0)	0 (0)	0 (0)
f)	If mastitis is detected, then that cow be milked last.	19 (95)	18 (90)	37 (92.5)
g)	Once begin, milk quickly and completely, without interruption.	14 (70)	19 (95)	33 (82.5)
h)	When milking, be sure to squeeze the teat.	14 (70)	20 (100)	34 (85)
i)	When finished, "strip" the animal to get the last drops out of the udder.	12 (60)	19 (95)	31 (77.5)
j)	After an animal is done, dip the teats in a teat dip.	0 (0)	1 (5)	1 (2.5)
k)	Make sure that the animal remains in a standing position for at least one hour after milking.	3 (15)	9 (45)	12 (30)

Table 3: Practices followed by farmers during handling and storage of milk

Handling				
Sr. No.	Practices	Number of respondents following the practice		
		Household (n=20)	Commercial (n=20)	Overall (n=40)
		N (%)	N (%)	N (%)
a)	When transferring milk between containers, pour the milk directly from one container into the other instead of scooping it with a cup or bucket.	17 (85)	20 (100)	37 (92.5)
Storage				
Sr. No.	Practices	Number of respondents following the practice		
		Household (n=20)	Commercial (n=20)	Overall (n=40)
		N (%)	N (%)	N (%)
a)	Filter milk (Use a white filter cloth or strainer) Immediately after milking and prior to storage.	7 (35)	17 (85)	24 (60)
b)	Disinfect, wash and dry the cloth/strainer after use.	0 (0)	0 (0)	0 (0)
c)	Store milk without chemicals in a cool, clean room set aside for milk only.	0 (0)	11 (55)	11 (27.5)
d)	Store milk at high temperatures.	0 (0)	0 (0)	0 (0)
e)	Mix warm (morning) milk with cool (evening) milk.	0 (0)	0 (0)	0 (0)
f)	If this is not possible, cool the warm milk by placing The container in cold water before mixing.	0 (0)	0 (0)	0 (0)
g)	Deliver milk to the market as soon as possible, Preferably in the cool morning or evening.	20 (100)	20 (100)	40 (100)
Cooling Milk in the shade / in a cold water bath or stream				
a)	Loosen the lids of the cans to allow warm air to escape.	5 (25)	16 (80)	21 (52.5)
b)	Keep the lid closed if there are insects or dust in the area, to avoid contamination.	5 (25)	17 (85)	22 (55)
Heating milk before storage (pasteurization)				
a)	Immerse the milk can in boiling water for at least 30 minutes.	0 (0)	2 (10)	2 (5)

Techniques for milking cows

The study found that 20% of household respondents and 70% of commercial respondents used soap and clean water to wash their hands thoroughly before milking. Proper hand hygiene is crucial for preventing contamination and ensuring milk safety. Surprisingly, 15% of household respondents and only 5% of commercial respondents admitted to smoking during milking. Smoking can introduce contaminants into the milking environment and should be discouraged. A significant difference was observed in hand-drying practices. While 35% of household farmers preferred drying their hands with a clean towel after washing, a higher percentage of commercial farmers, 75%, followed this

practice. Proper hand drying helps maintain cleanliness. All household respondents reported washing the udder with warm clean water, whereas 60% of commercial respondents did the same. Cleaning the udder is essential to prevent the transfer of dirt and bacteria into the milk. Only 10% of respondents preferred drying the udder using a dry towel. Interestingly, none of the household respondents followed this desirable practice, but one-fifth of commercial respondents did. Proper udder drying is crucial for maintaining milk quality. During milking, 70% of household respondents preferred squeezing the teat, while all commercial respondents used this technique. Proper teat handling is essential to avoid injury and ensure milk flow.

When finished, majority of respondents were stripping the animal to get the last drops. None of household respondent used teat dips while 5 per cent of commercial respondents were doing this. Only a handful number of household respondents were keeping their animals in a standing position for at least one hour after milking. Similarly, less than half of the commercial respondents were making sure that the animal remains in a standing position for at least one hour after milking.

3. Handling and storage of milk

Handling

During the process of transferring milk between containers, it was observed that the majority of both commercial and household respondents opted for the practice of pouring milk directly from one container into another, as opposed to using a cup or bucket for scooping.

Storage

In the case of storage practices, it was noted that a significant majority (85%) of commercial respondents preferred to strain milk immediately after milking. They typically employed a white filter cloth or strainer for this purpose. Conversely, among household respondents, this practice was not as prevalent. It's important to mention that, according to recommended guidelines, after each use, the cloth or strainer should be properly disinfected, washed, and then thoroughly dried. However, it was observed that none of the respondents, whether commercial or household, adhered to this practice.

Furthermore, it was interesting to find that none of the household farmers perceived the need to store milk, while among commercial respondents, 35 percent acknowledged that they never stored milk. In both groups, there was a prevailing preference for delivering milk to the market as promptly as possible.

Substantial majority of commercial respondents prefer to keep the lids of their milk cans slightly loose, allowing warm air to escape. Additionally, it was noteworthy that only two commercial respondents reported immersing milk cans in boiling water for a minimum of 30 minutes as a hygiene practice. These findings underscore the importance of enhancing our regular extension programs, particularly emphasizing the critical need to maintain hygiene standards in and around farms. To achieve this, consistent promotion of the use of recommended soaps and detergents for personal hygiene and equipment cleaning are needed. Furthermore, practices like udder cleaning in accordance with established guidelines and preventing animals from sitting after milking should be actively encouraged. These measures collectively aim to reduce the incidence of mastitis and improve overall milk quality. In conclusion, the research highlights the necessity for ongoing education and awareness campaigns within the farming community to foster better hygiene practices. By implementing these recommendations, we can contribute to the overall health and productivity of our dairy industry.

Conclusion

In conclusion, study on milk production practices in dairy farming has unveiled several key insights. It is evident that there is room for improvement in various aspects of dairy

farming, including infrastructure, hygiene, and equipment choices. Promoting better practices such as proper shed maintenance, utensil cleaning, and mastitis prevention should be a priority for dairy farmers. Additionally, there are disparities between household and commercial farmers in terms of vaccination, disease monitoring, and personal hygiene, highlighting the need for targeted education and intervention. Milking techniques, such as hand washing and udder cleaning, also require attention to enhance milk quality and animal health. Finally, proper handling and storage practices, as well as the promotion of hygiene, should be emphasized in extension programs to ensure safer and higher-quality milk production in the dairy industry.

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