



## Survey of Herd Management on Conventional Dairy Farms in North Algeria

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### HIGHLIGHTS

- Most dairy farmers in Mostaganem province, Algeria feed their cows a basic ration of oat hay and straw, while only 32% use corn silage.
- Mastitis was the most common disease reported by farmers, with a culling rate of 23%, highlighting the need for improved herd health management practices.

### Abstract

A survey was conducted to evaluate husbandry practices and herd health management in dairy farms in Mostaganem province, located in north Algeria. Data was collected through face-to-face interviews with 56 farmers, followed by a visit to the production environment of the dairy cows. The results showed that 64% of farmers feed their cows a basic ration of oat hay and straw, while 32% use corn silage. On average,  $9.85 \pm 0.32$  kg of concentrate was distributed per dairy cow. Most farms didn't have efficient forage production, while only 21% of them produced all the necessary forage. The average milk production per cow on the surveyed farms was  $18.19 \pm 0.45$  L, with a lactation length of  $293.5 \pm 1.65$  days. The cows were milked using a portable milking machine in poor hygienic conditions. Estrus detection was performed occasionally by farmers, and natural breeding was the main method of insemination, occurring at a rate of 63%. The voluntary waiting period was on average  $76.6 \pm 3.56$  days, and the average calving interval was  $14.35 \pm 0.2$  months. The culling rate in dairy farms was 23% on average, with the most common reasons for culling being mastitis and age at a rate of 23% and 21% respectively. The main diseases reported by the farmers were mastitis (82%), followed by lameness (57%). All surveyed farmers vaccinated their herds against only rabies and foot-and-mouth disease. This survey can help to identify the challenges and potential opportunities for improving dairy farm productivity and welfare in the Mostaganem province. The agricultural and economic sectors should work with farmers towards improving dairy farming techniques and practices, using efficient feeding systems and enhanced technology of dairy herd management, providing training and education to farmers, and resolving herd health issues to increase the economic efficiency of the dairy industry.

**Keywords:** Algeria, Cow, Dairy, Farms, Management, Survey

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## 1. Introduction

Dairy cow farming plays a vital role in the development of Algeria's dairy sector, agriculture, and food safety. Proper management of feeding, reproduction, production, and herd health has a significant impact on a dairy farm's economy and performance. To run a successful dairy farm, trained employees with husbandry knowledge are necessary, as farmers must be able to identify estrus, predict calving times, diagnose health and metabolic issues, and maintain milk quality and herd welfare. Despite the Algerian government's efforts to increase milk production through subsidies and support for breeders, milk collectors, processors, calf births, veterinary care, vaccination against foot-and-mouth disease, and the production of fodder and irrigation, the country's milk production remains low. Algeria has a cow population of 932,875 (MADR 2021), but only produces 2.5 billion liters of fluid milk per year, while demand is estimated at 4.5 billion liters (USDA 2022). In comparison, Canada, with a cow population of 977,800, produces 9.51 billion liters of milk (CDIC, 2021). and Austria, with a smaller cow population of 524,000, produces 3.82 billion liters (SA 2021). The low economic benefit and productivity in Algeria's dairy cattle industry can be attributed to several factors, such as a lack of forage, both in quantity and quality, prevalent diseases, inadequate herd health programs, and a lack of technological support. Poor heat detection, ineffective management practices and policies, and seasonality of production, as identified by Kaouche-Adjlane (2015), can also hinder productivity. Improved management skills and precision technology, which can reduce labor needs and enhance herd management, may help address these issues. The use of advanced technology in dairy farming is increasing as it enables farmers to better monitor and manage their cows, reduce labor needs, and improve herd management. These technologies provide farmers with advanced capabilities for managing their herds more efficiently. Research has shown that precision technology can help to improve the efficiency and productivity of dairy farms (Bewley 2010; Eastwood et al. 2012; Eastwood et al. 2015). As the complexity of cow management continues to increase, the use of these technologies is becoming increasingly important for improving management skills (Edwards et al. 2014; Bewley 2016). However, there is a lack of data on dairy farm management and performance in Algeria, specifically in the Mostaganem province, as well as limited research on the production systems in place. This may make it difficult to gain insight into the specific challenges and opportunities facing the dairy industry in Mostaganem. Surveys can help identify the major problems limiting the productivity and welfare of dairy cattle and identify potential avenues for improvement, which can guide Algeria's agricultural and economic sectors in setting priorities.

In this study, we present the findings of a survey of dairy farms in the Mostaganem province of northern Algeria. The study aimed to evaluate husbandry management practices that impact animal productivity and welfare, such as feeding and reproductive management, milk production, elements of herd health management, and primary herd health issues.

## 2. Materials and Methods

### 2.1. Study region

The province of Mostaganem is situated in the north of Algeria and is made up of two regions: the plateau and the Dahra highlands. These regions are further divided into four distinct morphological divisions: the low valleys in the west, the Dahra Mountains, the Mostaganem plateau, and the valleys in the east.

The province has a total agricultural area of 177,310 ha, with 132,268 ha being usable agricultural land, 42,870 ha being irrigated agricultural land, and 15,970 ha being designated for the growth of fodder crops such

as vetch, oats, corn, sorghum, barley, and oats. The province is home to a total of 31,900 cattle, including 21,100 dairy cows (DSA, 2021).

## 2.2. Data collection

A survey of dairy cattle farms in the Mostaganem province was conducted from January 2020 to March 2021 using a stratified random sampling method to select the farms (Thrusfield 2018). A total of 56 farms with 1,141 cattle, including 641 dairy cows, participated in the survey. The survey aimed to gather data on dairy farm management and performance by conducting interviews with the farmers and visiting the barns to observe and discuss the various practices used in the dairy herds. The questionnaire was divided into sections on feeding management, reproduction management, the milking system and production, treatment during the drying off period and dry period treatment; culling rate; and herd health management. This work did not involve the use of animals for laboratory studies. There is no violation of animal rights.

## 2.3. Statistics analysis

The data collected from the survey was analyzed using XLSTAT (2019) software. In the study, each farm was considered the experimental unit, and the variables in the questionnaire were coded and their frequencies determined. Descriptive statistics and the chi-square ( $\chi^2$ ) were the statistical methods employed for data analyses. Mean, standard deviation, standard error and frequency was calculated.

## 3. Results

### 3.1. Feeding management

The majority of farmers in the study (64%) provided a basic ration of oat hay and straw for their dairy cows, while only 32% of farms distributed corn silage (Table 1).

**Table 1.** Main fodder in the feed ration of farms.

Feed ration composition	Farms (%)
Oat hay and/or wheat straw	64
Oat hay, wheat straw, and corn silage	32
Oat hay, wheat straw, sorghum	4

Many farmers did not use nutritional formulations specifically tailored to cattle performance; 52% of farmers had no crop production and purchased all of their cattle's forage, while 27% of farmers had partially effective crop production and purchased some of their forage. Only 21% of farmers had efficient forage production, with oats, sorghum, barley and alfalfa being the most common forage crops. Analysis of the results by chi-square test indicates a statistically significant effect ( $P < 0.05$ ) between the origin of roughage (purchased or self-produced) and the ration distributed to the herds. To adjust the basic rations distributed, the farmers resort to concentrates depending on the availability and market prices of feed.

In terms of grazing, less than half of the farmers surveyed (45%) practiced seasonal grazing, which typically occurred in the spring when green grass was abundant.

The average amount of daily concentrate feed provided to cows on the farms studied was  $9.85 \pm 0.32$  kg per cow, and only 5.3% of farmers supplemented their cows' diets with salt licks and multivitamins. The timing of feed distribution varied, with 32% of farms distributing feed before milking, 64% during milking, and 4% after milking.

### 3.2. Reproduction management

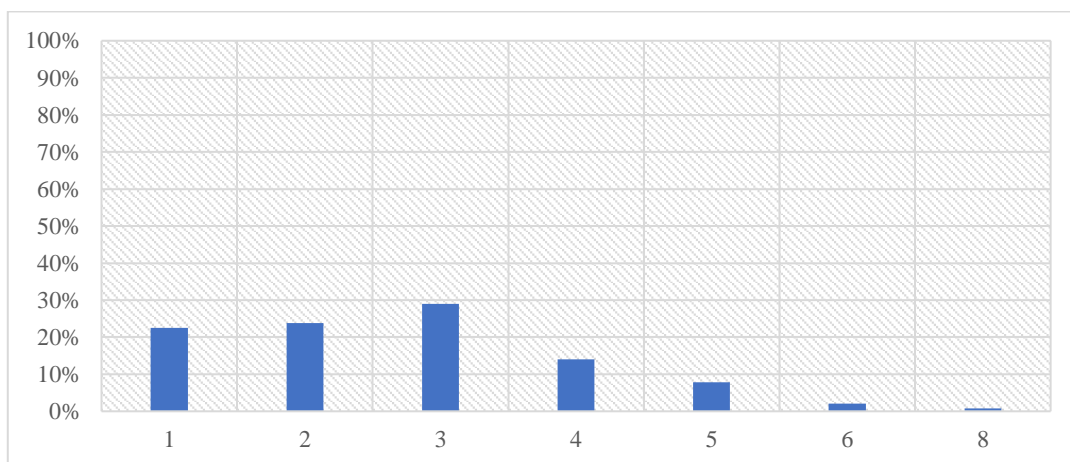
Natural breeding was the most commonly used method of inseminating cows on the surveyed farms, with 63% of farmers using this method exclusively and the vast majority of these farmers (87.5%) used bulls from their farms for reproduction. Artificial insemination was used by a small percentage of farms (14%) and was performed only by veterinarians. Some farmers (23%) used a combination of artificial and natural insemination methods. Nearly 89% of surveyed farmers used a voluntary waiting period (VWP) after calving and before cow insemination, with an average VWP of  $76.6 \pm 3.56$  days.

Direct observation was used by 95% of farmers to detect cows in estrus, with 96% of these farmers occasionally observing cows without a specific program and 4% having a daily detection program at least once a day for an average of 15 minutes. However, bulls were allowed to roam freely among the cows on 5% of the farms studied. None of the surveyed farms used indirect estrus detection or pregnancy diagnosis methods excluding heat detection. The average calving interval on the farms was  $14.35 \pm 0.2$  months, and the majority of farms (98%) had a non-seasonal calving period. Only a small number of farmers (9) had a calving pen and isolated pregnant cows for 1-2 weeks before calving.

### 3.3. Milk production

The milking method used on the farms studied was mechanical in 93% of cases and manual in 7% of cases. None of the farms featured a milking parlor or an automatic milking system. Dairy cows were milked twice a day, early in the morning and late in the afternoon, using portable milking machines under non-hygienic conditions. The Montbéliarde was the main breed raised in surveyed dairy farms. The average daily milk yield per cow on the surveyed farms was  $18.19 \pm 0.45$  L, and the average lactation length was  $293.5 \pm 1.65$  days. Figure 1 shows that 29% of the dairy cows on the studied farms were in their third lactation.

In terms of milking hygiene, 54% of farmers cleaned the cow udders before milking, while 46% only cleaned the udder teats. The main liquid used for udder hygiene was water. Teat dipping was practiced on only 1 farm before and after milking, and the fore-stripping technique was used by a small number of farmers (5%) before milking. However, most farmers did not follow any milking hygiene practices and did not use gloves or milking clothes.



**Figure1.** Distribution of dairy cows according to their number of lactations.

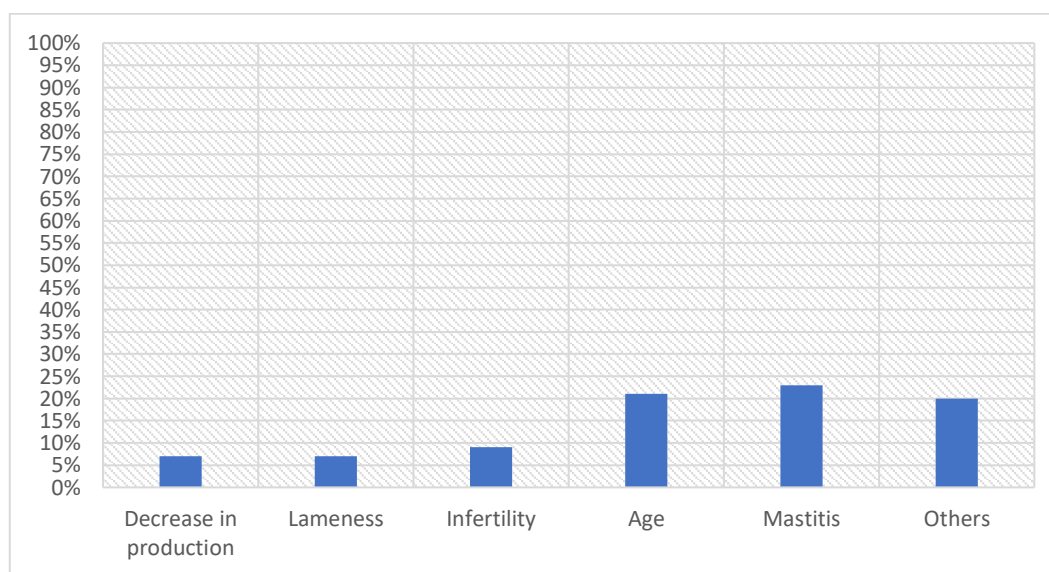
### 3.4. Drying off and calf weaning

Dairy cows on the surveyed farms were gradually dried off, with an average dry-off period of  $62.1 \pm 0.55$  days. The dry-off period was 60 days in 79% of farms and more than 60 days in 21% of the surveyed farms.

Newborn calves on all of the assessed farms received colostrum for an average of  $5.92 \pm 1.7$  days before being fed exclusively cow's milk; no farmer used a milk replacer. Calves were weaned at an average age of 5 months. A small minority of 5 farmers weaned their calves at or before 2 months of age, while 51 farmers weaned their calves after 2 months (8 weeks). In general, calves were fed a fattening diet of concentrated feed and wheat straw.

### 3.5. Culling rate

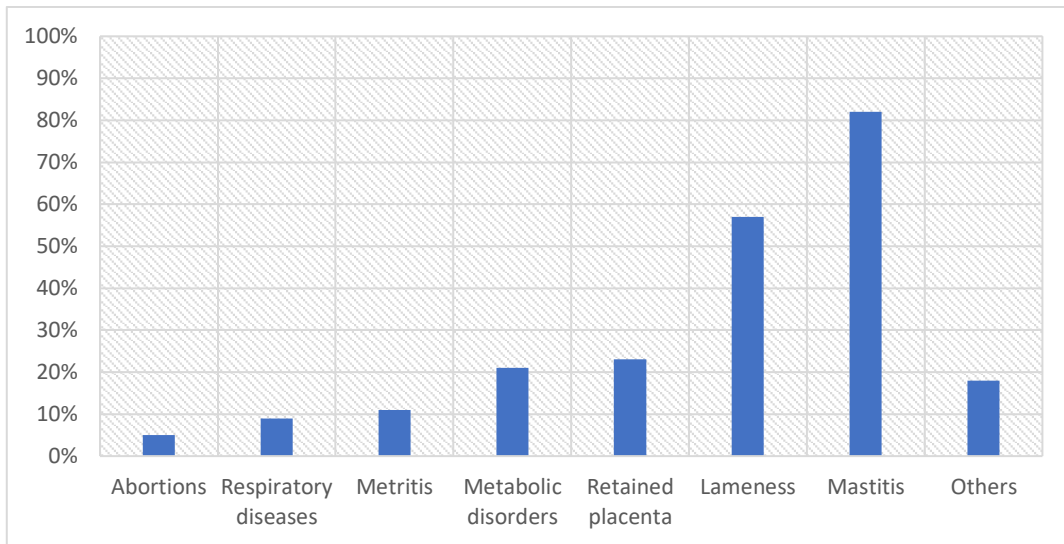
All of the surveyed farmers culled cows occasionally, without any annual objectives. The average culling rate for dairy cows was 23%. The main reasons for culling were mastitis (23%) and age (21%), followed by infertility (9%). The other reasons for culling included brucellosis, tuberculosis, dystocia, chronic cachexia and traumatic reticuloperitonitis (Figure 2).



**Figure 2.** Culling reasons on surveyed farms in Mostaganem Province.

### 3.6. Dominant diseases in surveyed farms

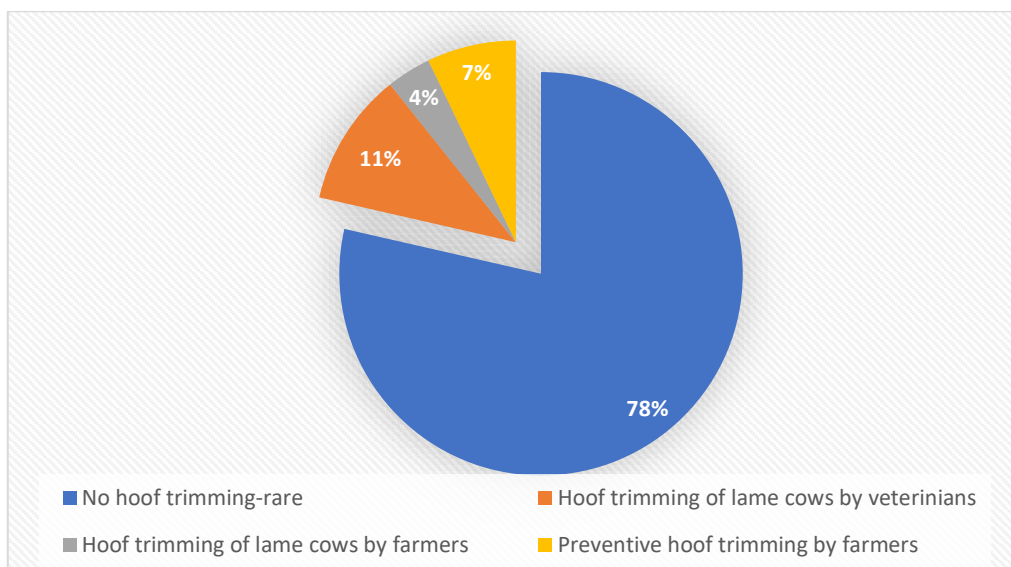
The most frequently reported disease among the surveyed farmers was Mastitis, with a prevalence rate of 82%. Lameness was the second most common disease, affecting 57% of the surveyed herds, followed by placental retention (23%) and abortions (5%). The other diseases included abomasal displacement, traumatic reticuloperitonitis, dystocia and infertility (Figure 3).



**Figure 3.** Dominant pathologies on dairy farms in the Mostaganem Province.

### 3.7. Herd health management

On most of the farms surveyed (90%), animals that were purchased were quarantined as a preventative measure. Around half of all farms (46%) used deworming therapy, but no farmers utilized coprology analysis. According to a plan developed by the agricultural services office, all of the surveyed farmers vaccinated their herd against just two diseases: rabies and foot-and-mouth disease. In terms of hoof trimming, the majority of farmers (79%) did not perform either preventative or curative trimming. A small percentage of farmers (3%) performed curative trimming on cows with lameness, while veterinarians treated lame cows on 11% of farms, and only 7% of farmers practiced preventative hoof trimming (Figure 4).



**Figure 4.** Hoof trimming practices in surveyed farms.

In regards to dry-off therapy, the study found that 11% of farmers used intramammary antibiotics, 67% used them routinely on all cows and 33% used them on cows with previous mastitis. The chi-square test of antibiotic use indicated a statistically significant effect ( $P < 0.05$ ). When mastitis occurred, the vast majority of farmers (89%) used intra-mammary antibiotics. Of these, 84% used less than 5 intramammary injections, while 16% used between 5 and 10 intramammary injections. None of the farmers admitted to using antibiotic therapy or self-administered anti-inflammatories on their herd.

#### 4. Discussion

Proper feeding and nutrition management is important for the health and productivity of dairy cows. On the farms surveyed, a single diet was provided to lactating cows, with no consideration for their nutritional needs. The diet consists of separate portions of fodder and concentrate. In contrast, a study by Contreras-Govea et al. (2015) found that 52% of farms in Michigan and Wisconsin feed multiple diets to their cows, based on factors such as stage of lactation, milk production, and body condition score. These farmers also group their cows according to their nutritional needs.

On the surveyed farms in Mostaganem province, none of the farmers used a total mixed ration (TMR) to feed their lactating cows. Instead, they distributed separate portions of oat hay, wheat straw, and an average of  $9.85 \pm 0.32$  kg of concentrate per cow. This is similar to the feeding practices of other regions in Algeria (Boukhechem et al. 2019; Meskini et al. 2020). However, this is in contrast to the feeding practices of 80% of Dutch farms with conventional feeding systems, which use a TMR or partial mixed ration (PMR) feed by mixer wagons. These Dutch farms also use 2 to 5 roughages in the formulation of their rations, with grass silage being the most important in the majority of the rations (Bisaglia et al., 2012).

A high percentage of surveyed farms had no crop production. This may be due to a lack of land dedicated to forage production, with an average of only  $0.6 \pm 1.42$  ha (Meskini et al. 2022). In the study, only about 32% of farms included corn silage in the rations for their cows. This is a higher proportion compared to the 3.3% reported in a survey of farms in northern Algeria (Boukhechem et al. 2019), but lower than the prevalence of corn silage use on farms in Minnesota. In Minnesota, corn silage is the most common source of forage used in the formulation of total mixed rations (TMR) for dairy cows. All rations given to lactating dairy cows in Minnesota are formulated to meet their nutrient requirements (Endres & Espejo 2010).

In the region studied, a small number of farmers supplemented the rations of their cows. This is in contrast to farmers in Australia, who often include by-products (such as wheat mill mix/millrun, molasses, and oil/fat), buffers and modifiers (such as limestone, magnesium oxide, and sodium bicarbonate), ionophores, and antibiotics in the rations of their cows (Bramley et al. 2012).

Effective reproduction management is important for the productivity of the dairy herd. A small number of farmers in Mostaganem province used artificial insemination, which is similar to the situation on farms in the M'zab Valley in southern Algeria (Bensaha and Arbouche 2014). This differs from the situation in southern Brasilia, where artificial insemination is the most widely used breeding method and most farmers use self-replacement of their herds (Balcão et al. 2017).

The farmers in the surveyed area did not give sufficient attention to estrus detection and only a small number used the recommended daily observation method of checking for estrus three times per day for 20 minutes (Firk et al. 2002). None of the surveyed farms used a sensor system for detecting cows in estrus, unlike Dutch farmers, who used activity meters and pedometers for this purpose at rates of 41% and 70%, respectively

(Steenefeld and Hogeveen 2015). These devices have been shown to improve the accuracy of estrus detection (Hockey et al. 2010; Kamphuis et al. 2012) and investments in activity meters can be profitable (Rutten et al. 2014).

On average, the voluntary waiting period among the examined farms was  $76.6 \pm 3.56$  days. The voluntary waiting period is typically expected to be 60 days long and uniform within and between herds. However, a study conducted in Ohio found that the average voluntary waiting period was 56.6 days, with a range of 30 to 90 days, and did not vary by breed (DeJarnette et al. 2007). In the Mostaganem region, farmers mostly used non-return of heat as their method of pregnancy diagnosis, while in the United Kingdom, 77% of farmers used ultrasound for this purpose (Tzelos et al. 2020).

The average calving interval in the region studied was longer than the 12-month interval reported by Benidir et al. (2020) in eastern Algeria. Only 9 out of the surveyed farmers in the region used a calving pen, which is a pen designed to provide a comfortable and hygienic environment for cows giving birth. The use of a calving pen is recommended to reduce stress for the cow and calf and to maintain optimal hygiene (Svensson et al. 2003; Mee 2008).

The milking systems used on the surveyed farms were mainly mechanical, with cows being milked using car milking machines. None of the farms had a milking parlor or automated milking systems, which is a common feature on many farms in developed countries (Holly et al. 2019; Kristensen et al. 2015). The average daily milk yield on the surveyed farms was 18.19 liters per cow, which is comparable to the milk yield in Relizane province (17.4 L/cow, as reported by Meskini et al. 2021a), but lower than the milk production recorded in the United Kingdom (28.27 L/cow, as reported by Fujiwara et al., 2018), Canada (32.6 kg/cow, as reported by Tse et al., 2018), and the states of Wisconsin and Michigan (37.5 kg and 31.8 kg/cow, respectively, as reported by Contreras-Govea et al. (2015).

Ensuring proper milking hygiene is important for the health and safety of the cows and the quality of the milk produced. Additionally, environmental bacteria such as coagulase-negative staphylococci have been identified as a major germ responsible for subclinical mastitis in this region (Meskini et al. 2021b). The farmers in the region studied did not follow any milking hygiene protocols, unlike producers in Canada who typically follow milking procedures such as fore-stripping, washing and wiping the teats, using single cow towels, and applying post-milking teat disinfection (Belage et al. 2017). Mastitis was the most common disease on the surveyed farms, and it was also the most common pathology on dairy farms in Ethiopia, occurring at a rate of 52% (Duguma 2020).

Most farmers isolated the newly purchased animals. It is important for farmers to be aware of the potential risks and to take precautions to prevent the spread of diseases within their herd. However, a study in the northwest of England found that 70% of farmers purchasing new animals from other farms inquire about the seller's farm's disease history before making the purchase (Brennan and Christley, 2012). The diseases of greatest concern for these farmers were bovine viral diarrhoea (BVD), bovine tuberculosis, leptospirosis, Infectious Bovine Rhinotracheitis (IBR), and various respiratory diseases. Additionally, 73% of these farmers recorded herd health information about their animals, including diagnoses and test results. In contrast, Canadian farmers were more likely to vaccinate newly acquired cattle (56.8%) than to isolate them (38.7%) or screen for diseases (25%), according to a study by Denis-Robichaud et al. (2019).

Approximately half of the farmers in the surveyed area used deworming prevention measures, while farmers in the United States typically use anthelmintics once or twice a year, in the spring and fall seasons,



after observing a decline in productivity or body condition (Gasbarre et al. 2001). In Saskatchewan, 79% of farmers used internal parasite control as part of their routine management plan, and also to control external parasites (Scott et al. 2019).

Trimming is not conducted regularly on most of the farms in the surveyed region. However, Manske et al. (2002) recommend trimming at least twice per year because most hoof lesions discovered during trimming will recover after a few months, and the prevalence of lame cows and hoof lesions decreases after trimming.

Dairy farms should immunize their cattle against common infections such as BVD, IBR, Bovine Respiratory Syncytial Virus (BRSV), Parainfluenza-3 (PI3), clostridial infections, and leptospirosis to prevent or control disease outbreaks. However, several studies (Derdour et al. 2017; Kaddour et al. 2019) have found that BVD and IBR are present in Algerian dairy herds, even though none of the farmers vaccinated their herds against any of these common infectious agents, excluding rabies and foot and mouth disease. The vaccination program needs to take into account the infectious disease problems in the region as well as other factors.

In Mostaganem province, farmers occasionally culled dairy cows, with the common reasons being mastitis and age. This is similar to the situation on Estonian farms, where the main reasons for culling were hoof/claw disorders (26.4%) and udder disorders (22.6%), according to Rilanto et al. (2020). These findings suggest that improving herd health management, including measures to prevent and treat mastitis and infertility, could potentially reduce the culling rate and improve the overall productivity and efficiency of dairy farms.

The dry-off method used on the farms was the progressive method, which is similar to a study conducted in northern Algeria (Hamlaoui et al. 2021). The average dry-off period was 62.1 days, which differs from the situation on 83% of farms in the United Kingdom, where the average length of the dry period was 56 days and farmers stop milking abruptly, regardless of the milk production level at dry-off (Fujiwara et al. 2018).

Most of the surveyed farmers weaned their calves very late, unlike the situation on Australian farms where weaning typically takes place before 13 weeks (Klein-Jöbstl et al. 2015) or on Swedish farms where weaning occurs at about 8 weeks (Pettersson et al., 2001).

During the dry period, only 11% of the surveyed farmers used intra-mammary antibiotics to prevent mastitis in the next lactation, compared to the 78% of farms found to use such antibiotics in a study by Fujiwara et al. (2018), in combination with internal or external teat sealants.

## 5. Conclusions

This research identified several key points that could improve the efficiency of dairy farms in Algeria's Mostaganem Province. The study emphasizes the importance of adopting improved dairy farming practices to ensure the success of the dairy industry in the region. To support this goal, the agricultural and economic sectors should consider several factors when designing and implementing policies and extension programs, such as helping farmers to adopt enhanced dairy farming techniques and improve their farming practices; promoting the use of efficient feeding systems for dairy production and improving silage use; encouraging the adoption of technologies and sensor systems to manage the farm; providing training programs to help farmers improve their dairy farming and production skills; improving and controlling herd health programs and addressing health issues that impact economic efficiency; additionally, it will be important to consider farmers' attitudes and knowledge of these issues, including reproductive and feeding management, disease management, and herd health, to support the success of these recommendations.

In future studies, we recommend including data on forage production, artificial insemination performances, and the weaning practices of calves. One limitation of this study was that many farmers did not have regular records of their herd's zootechnical performances, so we were unable to assess the other performances of the farms. Additionally, we were unable to quantify the economic losses resulting from diseases and farmers' decisions and practices. To provide a more comprehensive understanding of dairy farms in Algeria, we recommend conducting a study on a smaller group of farmers and closely tracking herd performances and the economic status of the farms.

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**Conflicts of Interest:** The authors declare no conflict of interest.

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