

Maternal Health Condition and Lying Behavior in Grazing Milk Cows: Comprehensive Analysis

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Abstract

Many cows face difficulties during the shift from pregnancy to lactation, which results in a high frequency of postpartum illnesses. There is a significant study vacuum relating the laying habits of pastured milk cows, despite the fact that changes in lying behavior might be a sign of sickness. In order to address these issues, the study describes the lying behavior dairy cows engage in grazing during the first three weeks following calving and investigates the connections across lying behavior and transition illnesses. During winter calving, cows were registered as they calved, and laying behavior was recorded at one-minute intervals using electronic data recorders. Cows were divided into three health categories: healthy, lame, and unwell, diseases were recorded up to 21 days after calving. Individuals in the ill group were subdivided between those, who had one clinical health incident and those who had several. The analysis of lying behavior took into account variables including parity and health state. It is different for primiparous and multiparous dairy cows to lie when they are grazing. More time is spent lying down in multiparous cows than primiparous cows, which have more lying sessions. Given that primiparous cows have several clinical conditions, illness has an impact on lying behavior. Multiparous cows who exhibit clinical lameness tend to lie down more frequently, whereas cows that exhibit clinical lameness experience shorter and more prolonged spells. Finding and managing postpartum illnesses in pastured dairy herds can be facilitated by an understanding of these relationships.

Keywords: Maternal cow, Grazing Dairy Cows,Lying Behavior, Lameness pain, protective behavior, reproductive health.

INTRODUCTION

Maternal conditions have the potential to impact a cow's tendency to disloyal behavior, mastitis, metabolic abnormalities such as ketosis or milk fever, and other infections. Cows that are distressed or miserable might settle down less, which can be an indication of a medical problem. A dairy cow's behavior throughout the calving process is crucial, and stress can have a significant effect on it. Increased stress levels could interfere with a cow's laying time and level of relaxation due to maternal illnesses including difficult calving and difficulties beyond calving (1). Dairy cow herds grazing on grasslands are commonplace around the world, and their daily care varies from being semi-nomadic to operate, depending on strict supervision during intense grazing. Production specified person is prioritized in many areas, particularly those where grazing is essential for the families and the community's nourishment or where each animal's nutritional condition is a significant aesthetic feature. The monetary value of landis an important factor in pasture-based agricultural systems in temperate climates (2). Pasture-based dairy cow milk farming techniques in temperate climates employ grass, an inedible feeding resource used by individuals



to generate nutritious nutrition, particularly products high in proteins, such as beef and milk. Potential extreme weather, environmental concerns, and rising food and feed demand also demonstrate the importance of selfsufficient farming systems. The feed utilized by these methods needs to be obtained from nearby dairy farms or producers (3). Essentially the perspectives of food security, environmental health, and economic viability, sustainable intensification in dairy farming grows more and more crucial. In pasture-based dairy farming, providing grazing cows with superior pastures is essential to attain high production efficiency. In grass-dominated pastures, maintaining high fodder production and quality necessitates rigorous management and heavy P and N fertilizer treatments. Input-dependent grazing systems have the potential to acidify the soil, pollute water due to NO3 leaching, and emit greenhouse gases CO2, CH4, and N2O (4). In the majority of mammals, maternal performance is the sample of actions utilized maternal efforts to guarantee the reliant children's health and well-being. Several researchers have described maternal behavior in cattle as the cow's supply of dairy products and nursing, robust social contacts, and defense against obvious harm or predators. In a sense, these behaviors might be tallied as the cow's ability to invest in labor, time, and resources in defending and raising female calves (5). The effectiveness of a cow's mothering capacity is critical to the growth and nutrition of cow methods of rising, a calf from birth after lactation. In rangeland conditions, such as observed throughout North America, the majority of calf fatalities it occur throughout 24 to seven days of life. The maternal behavior of the cow is a significant factor in determining the survival of the newborn during the first week of subsequent calving (6). In calves raised in groups, relationships continue to develop. It is interesting to determine perhaps calves can remain with the maternal cow in a contemporary dairy herd. In agricultural environments, raising more calves can improve production, simplify management, and enhance welfare. Consequently, the bonds between the cow and the calf as well as the circumstances essential to its growth are crucial. The cow's behavior of licking her newborn calf to remove amniotic fluids is triggered by the fluids themselves. In both sheltered and organic circumstances, infant and milk cow interacted in the first 6 hours after giving birth has been effectively observed (7). In this study, we indicated that a comprehensive strategy that incorporates adequate nutrition, fertility control, and illness prevention is essential to preserve maternal health in grazing milk cows.

The study (8) examined the behavior of cattle comprises an intricate web of behavioral patterns. Individual cow behaviors to environmental and social difficulties include having food, deceptive behavior, and engaging in activities. Growing developments in sensor and video imaging equipment have made the ability to capture behaviors related to eating, activity, and reproduction. These are useful markers of animal well-being and health, and several manufacturers supply a broad selection of technologies appropriate for automated milking systems (AMSs) and other commercial applications. The profitability of farms can be increased by using such equipment to record dairy cow behavior in detail. In dairy farmsidentifying rumination behavior increases the loss of milk and sickness operating costs. The study (9) introduced the management of the herbage allowance (HA) during the lactationgestation phase in cows eating native grasslands increasing the weighing measurements of the calves at weaning. These gains were linked to higher foliage volume, improved body condition score (BCS), and improved energy expenditure in the bovine. These factors may have an impact on grazing and maternal behaviorwhen flushing (FL) and temporary suckling restriction (TSR) are used. The study intended to evaluate the effects of HA on live weight (LW), BCS, milk production, glucose, IGF-1, and hormone levels in cattle and cows, as well as the proportion of frequent grazing behaviors and maternal conduct from 10 to 70 days in comparison with TSR through the gestationlactation period. The investigation (10) discussed the Strong interactions among mother-calf couples and the feeding behavior of newborns is critical to the longevity of the youngster because the cow gives the calf nutrition (milk). defense against predatory creatures, and a variety of essential abilities for life. Comprehensive factories can acquire precise and reliable information regarding animal behavior with the use of technologies. Tri-axial acceleration sensors and vicinity recorders were employed in the investigation to track the amount of time cow-calf pairs spent nursing and interacting closely, respectively. The study investigated the connection between these two behaviors as



well as the shared aspects of circadian fluctuations. The research (11) focused on the hardest and most unpleasant processes for dairy cows' calving, which entails managing ecological and management-related stresses to psychological and mental alterations. It has been suggested in recent years using knowledge of cow behavior during calving might help to ensure that the animals are managed effectively. The purpose of the paper was to summarize and discuss about the behavioral changes that take place around calving time. Additionally, the interaction between environmental factors, management techniques, and calving behavior in dairy cattle maintained in both pasturebased and intensive indoor production systems. First, give animmediate overview of the notion of maternal behavior and the parturition process. Next, the paper discussed the behavioral alterations that take place in both dystocic and normal deliveries around parturition. The study (12) explained that numerous factors, such as physiological arbitration, breed, age, mate, donor genetics, and general handling techniques are known to impact the conduct of pregnant cows. Though some maternal behaviors remain unaltered, the behavior of the dairy cow has evolved from female cow primordial wild ungulate predecessors after millennia of varied degrees of domesticated processes.Cowcalf animal farms specialize in the effects of maternal behavior on the growth and well-being of the calf given that generally, the cow was the sole one entrusted with nurturing the infant until it was considered suitable to be detached. The difficulty of measuring behavioral features, especially in large contexts, makes it difficult to investigate the extent of this impact, while several distant surveillance instruments have been created in recent years. The study (13) examined that after birth, gradually the female cow and calf's relationships develops. Identifying the rules of behavior behind its development is critical, and investigating commonalities with other creatures can assist in the evolution process. When a cow gives birth, female cows are naturally separated from the herd, and the resulting attachment between the cow and her calf grows until they can recognize one another. Although cows do not twin, they do raise their twin offspring. The cow may react to other calves if the youngster is lost at delivery or shortly thereafter, and under some conditions, the cow may form a mother relationship with an alien calf. The study (14) explained the methods used to measure the dry matter intake (DMI) of nursing beef cattle on pasture are too expensive, time-intensive, and intrusive to be used on farms for commercial purposes. The study was conducted to investigate the possibility of creating and validating a model that uses non-invasive animal measures to forecast grazing and suckling cattle calves' DMI. The model might be used in a commercial farm scenario. 104 measurements taken on the validation consisted of 106 maternal sources, cattle or cattle-dairydataset utilized to create the model. Researchers looked at the possibility of using thermal imaging, grazing behavior, linear type scoring, and body measures in conjunction with energy sinks and known conceivable adjustment factors to forecast DMI. The study (15) focused on the high rate of illness in the weeks following calving indicating that many cows struggle to adjust to pregnancy to lactation. Even though dishonest behavior changes can serve as a sign of disease, no research has examined interesting relationship between milking cows raised outside. The purpose of this study was to characterize the lying behavior of dairy cows that were on pasture for the first three weeks following calving and to ascertain the relationships between the terminal disorders and unethical conduct. Compared to healthy non-lame cows, medically lame calves had less and longer-lasting lying spells each day.

MATERIALS AND METHODS

The animal's mineral status has a significant impact on maternal health and lying behavior, which varies throughout the year based on several variables such as growth, feed quality, behavioral patterns, environmental conditions, lameness discomfort, and lactating status, and is shown in Figure (1).

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Figure (1). Flow of Materials and Methods (Source: Author)

MATERNAL HEALTH CONDITION OF GRAZING MILK COW

A grazing cow's general health depends on acquiring sufficient nourishment. During pregnancy of cows or breastfeeding have higher dietary needs, particularly for energy, protein, vitamins, and minerals. Managing grazing is essential to ensure that animals have access to high-quality feed. The cows' nutritional indicators are directly impacted by the quantity and quality of cattle feed obtainable.

Behavioral pattern

In general, hormones around the time of parturition initiate and influence maternal behavior in ruminants; individual variations with deficits are possible to clarify the range of behavioral manifestations. The pattern of behaviors demonstrated by mother mammals to ensure the health and well-being of her dependent children is recognized as maternal behavior in the majority of mammals. Providing milk and nursing the calf, as well as shielding it from obvious risk or predators, are considered aspects of a cow's maternal conductthese actions might be combined with the capacity of the cow to devote maternal stage, energy, and resources to protecting and rearing female calves (16).

Reproductive Health

The external genitalia and other external characteristics of males and females enable simplicity of detection. Heifers demonstrated indications of attraction towards the bull during the estrus cycle. Several initiatives are frequently involved in the initial performance, including watching, following, gathering, and striving to raise the cow. Compared to heifers, steers are mounted frequently and exhibit greater raising behavior. The accumulating behavior is influenced beyond gender in addition to the season (winter versus spring). According to their findings, springtime climbing behavior was greater when compared to those over the winter (17).

Protective Behavior

The majority of new calved cows particularly those of the indicus breed are regarded as hazardous and aggressive cows of the primary causes of cattle injuries is the maternal aggressiveness of mothers guarding their young. Several individuals have proposed that the change is perhaps due to their temperature changing and causing neurotic



responses, or it could be attributed to their increased mother's protective inclination combined with their willingness to remain vigilant. The response of the cows to individuals maintaining the calves in the early newborn periods was shown to be influenced by their temperament. This research implies that behavioral patterns remain predictive of cow behavior; however, the variation in aggression at reproduction among specific breeds of beef cattle appears to have a genetic basis (18).

Role of Motherhood

Strong relationships occur between mothers and their calves. They tend to be around their offspring and the mother and calf pair can recognize themselves through fragrances and vocalizations. The calf's social and emotional development depends on it. Bonding between cows and calves is a natural and taught trait. The process of grooming during and after suckling preserves the genetic relation between the calf and mother, even if the calf and mother are required to reconnect through vision, odor, and sound. To avoid premature rebreeding, this bond specifically nursing maintains the postpartum anoestrus in cows for around eight weeks (19).

LYING BEHAVIOR OF GRAZING MILK COWS

Environmental Factor

The structural integrity of the digital skin may be adversely impacted by atmospheric variables including temperatures and humidity, which can promote the development of ulcers, bacterial colonization, and disease progression. The most significant variables included the variety of lying and the level of comfort and quality of the lying surface, such as the bedding. Cows involve healthy, comfortable places for sleeping, consequently bedding that's particularly difficult or hydrated may deter animals from lying. Cows' lying behavior can be influenced by environmental enrichment, such as having scratching posts or other items that stimulate their minds. Cows are satisfied and occupied, it could be lying regularly (20).

Health Indicators

A considerable decrease in lying time could occur as an indicator of discomfort, inflammation, and medical problems. Lameness or other disorders may be associated with standing for long periods. Frequent and solidified fertilizer is an indicator of a healthy cow. In general, cows remain comfortable, organic stance with their body weight distributed throughout all four limbsand the primary causes of cattle elimination are health problems such as mastitis, lameness, and decreased fertility along with problems with low-efficiency and quantity of milk(21).

Lameness and pain

A maternal cow has lying behavior may change as an effect of lameness, edema, or muscle injury. A substantial reduction in lying time might be a symptom of pain, discomfort, or medical problems. Lameness in dairy cows has been demonstrated to prolong gestation to the initial treatment interval and calving to conception. Lame cows have a decreased average conception rate at first service, and it takes them an additional 28 days to conceive. The longer latency to conception in lame cows may be related to the irritation caused by pathogenic lameness. Early lameness corresponds with decreased reproductive efficiency than non-lame cows before and after the breeding season. Furthermore, residing lame is related to extended laying periods, which raises the risk of mastitis and intramammary infections. These effects compound to affect the welfare of cows, milk yield, and farm economics. The prolonged duration of lying during lactating may prevent the genital canal from termination, which could cause environmental infections related to gynecomastia to spread throughout the body (22).



Rest after grazing

Maternal cows are required to relax more, throughout the lactation stage. They require a sufficient period to rejuvenate and maintain energy for the fetus's growth. Similarly, the cow encounters to recover after lactation to restore the energy used for producing milk. Social factors can also influence the way individuals rest, given that animals can rest in groups or alone, cows appear to be safer when others in the herd members are around. The cow's body can recuperate to be prepared for the next grazing period and other activities during the rest period that follows grazing (23).

Statistical Analysis

The influence of the treatment group on the time to conception was estimated using a Kaplan–Meier graphic for exhibiting survival estimates and a Cox proportional hazards model. The amount of time spent in each pen before conception and the percentage of time spent on each side of the building were evaluated as possible variables in the statistical analysis of survival, however, it was discovered that they did not affect the model's final parameter estimations. Equation (1) specifies the Cox proportional model.

$$z(d) = z_q(d) \times \exp\left(\beta_1 x_1 \dots \dots \beta_b x_b\right) \tag{1}$$

The variables under test were p, which was represented as $(x1 \dots xp)$ with associated coefficients, $\beta_1 \dots \dots \beta_b$, which represented the time to conception event, was the hazard function, $\operatorname{and} z_q(d)$, which was dependent on the initial hazards (d). After testing in the manner mentioned, the variables were kept in the model when P < 0.05. To assess the model fit and assumptions, delta betas, log-log curves, and Schoenfeld residuals were visually assessed. Only the pairings of cows that were admitted to the research when the number of cow pairs eliminated from the original analysis was less than one, it was used for an additional subset analysis. The purpose of this study was to ensure that the nine pairs of cows that started the trial midway through lactation would not have influenced the results in any way. The aforementioned analyses were repeated, but given that there was not an apparent disparity in the outcomes, the entire dataset was used for the final inference.

RESULTS

Data collection for lying behavior of cows

In the winter months of November through February of 2016–17, data were gathered. The owner of the house pen, the employees of a dairy farm, and the manager of the farm kept records of the feeding habits and management of the cows. The study was conducted to determine the breeds of cows present in various dairy farms and house cages. Both the overall and breed-specific numbers of cows were examined. The association between management and various eating behaviors in various breeds has been studied. By gathering information on milk production, per milking the average daily gain (ADG) of milk was computed. Additionally, the feeding habits of the sick and healthy cows were contrasted.

Evaluating the lying behavior of cows

The average total frequent lying time (h/d) and the number of lying bouts per day based on the seven days of data were found to decrease as fewer consecutive weeks were available in Table (1). By evaluating the integer of laying sessions per day (R2 = 0.75 and 0.8) and the lying time (h/d) using three days of statistics, an accurate estimation of



the overall averages was produced. The accuracy decreased (R2=0.8 and 0.86) when predicts depended on two days, as well as greater (R2=0.96 and 0.98) when predictions were based solely on one day. As a result, the predictions in Figure (2) depended on the number of lying periods, the accuracy of the number of calves per farms and the daily lying time (h/d).



Figure (2). Analysis of lying frequency and bouts (Source: Author)

| Days | \mathbf{R}^2 | |
|------|----------------|-------------|
| | Lying time | Lying bouts |
| 1 | 0.75 | 0.8 |
| 2 | 0.8 | 0.86 |
| 3 | 0.90 | 0.96 |
| 4 | 0.96 | 0.98 |
| 5 | 1 | 1 |

 Table (1). Analytical impact of lying period and bouts (Source: Author)

Measurements of maternal cow bodies

A vital indication of the mother cow's general health and nutritional condition is the body weight of female cows. Periodic weight-taking is frequent throughout healthcare and the duration of the lactating period is shown in Figure (3). In two maternal cows, the weights are collected at various points during the gestational period. It indicates that a pair of combinations of weights is used for time point, which might be used to represent several metrics or individual cows. It reflects the duration of time that occurred after conception or the length of the gestation. Table (2) illustrates the maternal duration concerned, which has 95 days and includes (460 and 462), 100 days (465 and 475), 200 days (472 and 482), and 270 days and comprises (486 and 494).

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Figure (3). Gestational Analysis of maternal cows (Source: Author)

| Gestational period | Ma | Maternal cows (kg) | | |
|--------------------|------|--------------------|--|--|
| | Cow1 | Cow2 | | |
| 95 days | 460 | 462 | | |
| 100 days | 465 | 475 | | |
| 200 days | 472 | 482 | | |

486

494

270 days

Table (2). Numerical values for Gestational Analysis of maternal cows (Source: Author)

Maternal protective behavior

The gestures and behaviors that female animals in the present instance, cows show to defend and provide responsibility for the offspring are referred as maternal protective behavior, are shown in Figure (4). The overall percentages provide an extensive perspective of the distribution of mother protective behavior throughout each category, which includes all primiparous and multiparous cows, as shown in Table (3).



Figure (4). Evaluation of lying time and bouts (Source: Author)



| | Percentage (%) | | |
|---------------------|----------------|-------------|--|
| Maternal protective | Primiparous | Multiparous | |
| behaviour | | | |
| 1 | 58.4 | 27.8 | |
| 2 | 13.4 | 12.2 | |
| 3 | 24 | 39.5 | |
| 4 | 5.3 | 5.5 | |
| 5 | 2 | 12.2 | |

Table (3). Analytical impact of lying period and bout (Source: Author)

Collective behavior activities of cow

Figure (5) illustrates that it could be an indicator of alterations in the cows' nutritional needs, wellness, or environments. The duration of time that a particular assortment of animals occupies to participate in various activities, such as grazing (25%), Feeding (20%), ruminating (15%), drinking (12%), sleeping (16%), eating (5%), and other behavior contain (8%) as it depicts in the Table (4).



Figure (5). Pie chart for cow behaviors (Source: Author)

| Percentage (%) | | | |
|-----------------|----|--|--|
| Grazing | 25 | | |
| Feeding | 20 | | |
| Ruminating | 15 | | |
| Drinking | 12 | | |
| Other behaviour | 8 | | |
| Sleeping | 16 | | |
| Eating | 5 | | |

 Table (4). Numerical values for cow behaviors (Source: Author)



DISCUSSION

In the section, we discussed the condition of the health of the female animal and the laying habits of grazing milk cows are associated elements that have an impact on dairy cows' overall health and production. Cows are needed in lying behavior are an element of their daily routine, and alterations to these behaviors may indicate underlying health problems. In the initial three weeks following calving, primiparous and multiparous cows demonstrated different patterns of lying behavior: the former had more instances of lying and spent a shorter duration on the back than the latter. The illness had an impact on lying behavior, multiparous lame cows exhibited a greater frequency of lying down than non-lame cows, while primiparous cows presenting multiple illnesses after calving expended a longer period lying down in the days that preceded lactation.

CONCLUSION

In this study, we demonstrated that protecting maternal health in grazing milk cows involves an integrated approach that includes proper nutrition, fertility management, and sickness avoidance for the maternal cow. The grazing milk cattle' lying behaviors and the health status of the female animals are interconnected components that impact the overall well-being and production of dairy cows. Lying is an essential component of cows' daily routine, and modifications to these behaviors could indicate indicators of underlying health problems. The nutritional quality of grazing milk cows has an immediate effect on their health. Sufficient availability of grazing of superior quality is necessary for satisfying their dietary requirements. Regular lying behaviors are prevalent in satisfied cattle. As a consequence, we gather data on cows' lying behaviors, assess their lying patterns, evaluate the physical attributes of the females, and analyze their protective behaviors. In the statistical study, the intervention collective's impact on the time to conception was calculated using a Cox proportional hazards model, and survival curves were displayed using a Kaplan–Meier plot. , Future research on the current status of maternal health and laying behavior in milk cows that are grazing can investigate several approaches to expand understanding, develop management techniques, and improve dairy herd health in general.

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