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Study On Prevalence of Acidosis in Dairy Cattle's Farms in Zabul Province

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ABSTRACT

Cattle are large ruminant animals, and family farmers keep them for economic income. Acidosis is a condition characterized by a decrease in the alkalinity of body fluids due to an increase in acid hydrogen ions. It occurs when organic acids accumulate physiologically, leading to a drop in rumen pH below normal levels. This study was conducted in the center of Zabul province to determine the prevalence of acidosis in dairy cows in 1403. A total of 40 dairy cows were randomly selected for the study, and a pH Meter Test was performed to assess the prevalence of acidosis. Overall, the incidence of acidosis was (42.5%). According to age, the prevalence of the disease was (50%, 46.15%, and 30.77%) in cattle aged 2-4, 5-7, and above 8 years, respectively. The prevalence of the disease based on farms was higher in ZA-QL-CF-005 farm (50%) than in the surveyed farms. According to breed, the prevalence of disease was higher in hybrid cattle (47.61%) than in local breed cattle. Additionally, the prevalence of disease was higher in concentrate-feed cattle (53.33%) compared to those on other diets. The findings of the study showed that the prevalence of disease is high in the mentioned areas. Therefore, in order to reduce this problem, it is recommended that farm owners manage the combination of nutrients and diet. The findings indicate that acidosis is a significant health concern among dairy cows in the study area. Proper feeding practices, regular monitoring, and improved farm management are recommended to reduce the occurrence of acidosis and improve the health and productivity of dairy cows.

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INTRODUCTION

Acidosis, also referred to as rumen overload, toxic indigestion, or lactic acid indigestion, is a disorder caused by excessive fermentation of carbohydrates in the rumen. This condition commonly occurs when diets contain high levels of concentrate or mixed feed, leading to increased acid production and a reduction in rumen pH to acidic levels (pH 5-5.4) (Roy et al., 2019). As the rumen environment becomes acidic, beneficial rumen bacteria are suppressed or destroyed, while lactic acid-producing bacteria, particularly Lactobacillus species, survive and multiply (Kleen et al., 2013). The increased production of lactic acid further lowers rumen pH, thereby exacerbating acidosis. Acidosis is characterized by an increased concentration of

hydrogen ions in body fluids, resulting in a decreased blood pH, In severe cases, blood pH may drop below 6.6, which can impair the central nervous system due to reduced bicarbonate buffering capacity(Attia, 2016). Although laboratory confirmation is required for diagnosis, common clinical signs of acidosis in cattle include anorexia, lameness, diarrhea, and lethargy. Acidosis is an important metabolic disorder in dairy cows that commonly occurs when animals are fed excessive amounts of carbohydrates, particularly grains and concentrate feeds, causing a decrease in rumen pH. This condition disrupts normal rumen fermentation and may lead to increased production of lactic acid and volatile fatty acids (Danscher et al., 2015).

Acidosis is often described as a decrease in rumen pH; however, many researchers consider it not a disease itself but a symptom of excessive rumen acidity (Marchesini et al., 2013). The abnormal accumulation of organic acids and the resulting reduction in pH below normal levels negatively affect rumen microbial activity, as well as animal health and productivity Acidosis can cause several clinical signs in dairy cows, including reduced appetite, decreased milk production, diarrhea, weight loss, reduced cud chewing, and general weakness. In severe cases, affected animals may develop dehydration, metabolic disturbances, and other serious complications (Szenci et al., 2020). Studies have shown that a reduced rate of volatile fatty acid (VFA) absorption leads to a decrease in rumen pH due to two main reasons, accumulation of VFAs in the rumen and reduced bicarbonate influx from the bloodstream (Mirzad et al., 2021).

Acidosis is more accurately defined as a disorder of rumen fermentation in which rumen pH is lower than normal due to an imbalance between microbial production, microbial utilization, and the absorption of volatile fatty acids (VFAs) in the rumen. Under normal conditions, approximately (30-50%) of the acids produced in the rumen are neutralized by saliva, while urea passing through the rumen wall binds with ammonia.(Golder & Lean, 2024). In addition, a small proportion of acids is transported further along the digestive tract. Despite these mechanisms, about (21-50%) of the acids produced remain in the rumen and must be absorbed through the rumen wall. One of the main causes of ruminal (stomach) acidosis is a reduced absorptive capacity of the rumen epithelium, which results in an inability to maintain a stable rumen pH (Jaramillo-López et al., 2017).

These changes create conditions favorable for the development of ruminal acidosis. Researchers have identified three primary causes of acidosis. The first is excessive consumption of non-structural carbohydrates, including large quantities of grains, highly concentrated mixed feeds, finely processed grains, and improper combinations of different grain types and amounts (Christodoulopoulos, 2025). The second cause is inadequate buffering capacity in the rumen, resulting from increased VFA production, reduced salivary secretion associated with decreased chewing activity, low crude protein levels, and insufficient neutral detergent fiber (NDF) content. The third cause is poor grain management, such as irregular feeding patterns and sudden changes in rumen composition. The combined effect of these factors significantly increases the risk of rumen acidosis (Garg & Sherasia, 2015).

The destruction of the rumen mucosa during acidosis is a major complication, as it allows large numbers of anaerobic bacteria, such as Arcanobacterium and Fusobacterium necrophorum, to cross the rumen wall and enter the bloodstream (Mirzad et al., 2021). This

bacterial translocation can lead to systemic infections, including pneumonia, pyelonephritis, and endocarditis. Animals may also develop polioencephalomalacia, a condition caused by thiamine (vitamin B_1) deficiency. In such cases, microorganisms enter the bloodstream, colonize the liver, and are then transported to other organs, including the kidneys, heart, and lungs (Nagar et al., 2024). Acidosis affects not only the rumen but also results in abomasal disorders, indigestion, and lameness (laminitis). At low rumen pH, endotoxin production increases, contributing to the development of lameness. Overall, increased rumen acidity in cattle is a complex disorder involving digestion, nutrition, physiology, management, and economic factors. If this condition persists, it can negatively affect animal health, milk production, reproductive performance, and lifespan (DïNçer & Gül, 2020).

Ruminal acidosis is a complex condition characterized by increased rumen acidity in cattle, resulting from disruptions in the gastrointestinal system. From a production and economic perspective, ruminal acidosis leads to reduced milk yield and weight gain, increased medication and veterinary costs, impaired reproductive performance, and a shortened productive lifespan of cows(Alam et al., 2014). If the condition persists, it poses significant risks to animal welfare, milk production, breeding efficiency, and overall farm income The major risk factors for acidosis include sudden increases in concentrate feeding, insufficient dietary fiber, irregular feeding, and improper formulation of the diet. Prevention requires a balanced diet with adequate fiber, gradual introduction of concentrate feeds, proper feeding management, and regular monitoring of the health and productivity of dairy cows. (Vallejo et al., 2020).

1. Acidosis is a serious problem in dairy cows and requires early recognition and treatment to prevent severe complications and even sudden death.
2. Major complications of acidosis include laminitis, liver abscesses, bloat, displacement of the fourth stomach compartment, and death.
3. In Zabul Province, the incidence of acidosis is increasing due to inadequate nutrition, poor feed management, and low public awareness.
4. Other contributing factors include poor animal husbandry, improper feed formulation, frequent dietary changes, high levels of rapidly fermentable carbohydrates, and feeding human food waste to cattle.
5. Poor hygiene and inadequate cattle management further increase the risk, leading to reduced milk production, poor animal health, and significant economic losses for farmers.

MATERIALS AND METHODS

This study was designed as a field and laboratory-based investigation, with the aim of determining the incidence of acidosis among cattle on farms in Zabul Province. A questionnaire was used for data collection, while standard laboratory procedures and routinely available laboratory equipment and materials were used for laboratory assessments. To ensure methodological consistency, validity, and reproducibility of the results, all relevant procedures

were conducted under standardized and controlled conditions. These measures were implemented to maintain the accuracy, reliability, and scientific quality of the collected data.

Study Area

This study was conducted in Zabul Province, Afghanistan, from January 1, 2025, to September 15, 2025, with the objective of mitigating economic losses associated with acidosis. Zabul Province is situated near the border of Kandahar Province, approximately 335 km from the capital city, Kabul. The province is located at a latitude of 32.19°N and a longitude of 67.18°E. It has an elevation of approximately 1,743 meters above sea level and experiences an average of 26.8 rainfall days per year. The mean annual rainfall is 15.67 mm, and the mean annual temperature is 18.29°C.

Animals

The study involved dairy cows divided into three groups based on different criteria. The first group was categorized by age 2-4 years, 5-7 years, and over 8 years, determined through dental examination. The second group was classified by breed, including local and crossbred dairy cows. The third group was organized by diet, Cows were feed either a concentrated feed, a non-concentrated feed, or a combination of both (oil seed cakes).

Methodology

In this study, (40) dairy cows were selected from four farms, ZA-QL-CF-001 (90/10), ZA-QL-CF-007 (75/9), ZA-QL-CF-003 (74/9), and ZA-QL-CF-005 (96/12) using Slovin's formula ($n = N / (1 + Ne^2)$). All cows on each farm were first numbered, and then (40) animals were randomly chosen using the Simple Random Sampling method. Rumen samples were collected following the method of (Roy et al., 2019). A sterilized rubber stomach tube, 180-200 cm long, was inserted through the cow's mouth into the rumen to collect rumen contents. The pH of the samples was subsequently measured in the laboratory using a pH meter.

Rumenal pH Meter Test

In this study, RPHMT was used to assess the rumen contents of cows, following (Murugeswari et al., 2018).Under hygienic conditions, a sterilized gastric tube was inserted into each cow's mouth, and 30 ml of rumen contents was collected into a clean glass container. The sample was sealed and transported to the laboratory within 15 minutes to prevent changes. In the laboratory, the pH of each sample was measured using a pH meter. The stomach tube was immersed in the rumen contents for two minutes until a stable reading was obtained, and the rumen pH was recorded.

Statistical Analysis

All data were initially collected in Excel format and then entered SPSS software version 24. One-way ANOVA, Descriptive Statistics was employed to compare means across different groups, with a general confidence interval set at (95%). The significance level for all comparisons was determined at (P<0.05).

FINDIGS

The study was conducted on 40 dairy cows selected from four farms located in Qalat, the capital city of Zabul Province. The selected farms and animals were included in the study based on the defined research objectives. Relevant data were collected from the dairy cows through direct observation, questionnaire-based information, and laboratory examinations, where applicable. The collected information focused on factors related to the occurrence of acidosis in dairy cows. All data were recorded systematically and analyzed according to the objectives of the study to determine the occurrence of acidosis among dairy cows in the selected farms.

Prevalence of Acidosis in Diary Cattle Based on Age

The study results showed a significant difference in the incidence of acidosis based on age (P<0.05). Among cattle aged 2-4 years, 7 out of 14 were positive, with an incidence rate of (50%). In cattle aged 5-7 years, 6 out of 13 were positive, with an incidence rate of (46.15%). Cows over 8 years of age were less frequently affected, with 4 out of 13 positive, resulting in an incidence rate of (30.77%).

Table 1. *Age-wise Prevalence of Acidosis in Diary Cattle*

Age / Years	Total No. of Cows Observed	Infected Cows	Prevalence (%) ± SE
2-4 Years	14	7	50±0.138
5-8 Years	13	6	46.15±0.143
Above 8 Years	13	4	30.77±0.142
Total	40	17	42.30±0.423

Prevalence of Acidosis in Diary Cattle Based on Breed

The study showed that the incidence of acidosis was higher in crossbreeds dairy cows compared to local breeds. In crossbreed cows, 10 out of 21 were positive (47.62%), while in local cows, 7 out of 19 were positive (36.84%). Statistical analysis confirmed that this difference was significant (P<0.05).

Table 2. *Breed-wise Prevalence of Acidosis in Diary Cattle*

Breeds	Total No. of Cows Observed	Infected Cows	Prevalence (%) ± SE
Local Breeds	19	7	47.62±0. 113
Hybrid Breeds	21	10	36.84±0.111
Total	40	17	42.22±0.224

Prevalence of Acidosis in Diary Cattle Based on Type of Food

The study showed a significant difference in the incidence of acidosis based on feed type (P<0.05). Among cows feed concentrated mixed feed, 8 out of 15 were positive (53.33%). Cows feed oil seed cakes had 5 out of 13 positive (38.46%). Cow's feed unmixed (non concentrate) feed were the least affected, with 4 out of 12 positive (33.33%).

Table 3. *Type of Food Consumed-wise Prevalence of Acidosis in Diary Cattle*

Type of Foods	Total No. of Cows Observed	Infected Cows	Prevalence (%) ± SE
Concentrate	15	8	53.33±0.121
Oil Seed Cakes	13	5	38.46±0.133
Non Concentrate	12	4	33.33±0.133
Total	40	17	41.70±0.387

Prevalence of Acidosis in Diary Cattle Based on Farm

The study showed that the incidence of acidosis differed among the farms, with ZA-QL-CF-005 having the highest rate. In ZA-QL-CF-005, 6 out of 12 cows were positive (50%). In ZA-QL-CF-001, 4 out of 10 cows were positive (40%), while ZA-QL-CF-003 had 3 out of 9 positive (33.33%), and ZA-QL-CF-007 had 4 out of 9 positive (44.44%). Statistical analysis confirmed that these differences were significant (P<0.05).

Table 4. *Farm-wise Prevalence of Acidosis in Diary Cattle*

Farm Name	Total No. of Cows Observed	Infected Cows	Prevalence (%) ± SE
ZA-QL-CF-001	10	4	40±0.163
ZA-QL-CF-005	12	6	50±0.150
ZA-QL-CF-003	9	3	33.33±0.166
ZA-QL-CF-007	9	4	44.44±0.175
Total	40	17	41.94±0.654

DISCUSSIONS

The results of this study showed that, in Zabul Province, the incidence of acidosis was (42.5%) across four farms (ZA-QL-CF-001, ZA-QL-CF-007, ZA-QL-CF-005, and ZA-QL-CF-003). (McCann et al., 2016). Reported an overall acidosis incidence of 38.70% in cattle farms across 32 districts of Winnipeg Manitoba State, Canada, where cows were feed 1.0 kg/day of cooked rice. In another study conducted near New Delhi, India. Garg & Sherasia, (2015) found a higher incidence of acidosis 42.87% while evaluating ration balancing practices in cattle. The incidence of acidosis in the present study was as high as 42.87%, and these findings are consistent with those reported in previous studies.

In Tehran, Iran, Behzad Khorrami (2021) reported a 50% higher incidence of acidosis in cows feed cooked rice. Similarly, a study conducted in cattle farms in Canada to diagnose ruminal lesions associated with acidosis recorded an overall disease incidence of 65% (Plaizier et al., 2008). The findings of the aforementioned studies differ from those of the present study and are therefore not comparable. Differences in acidosis incidence may result from factors such as feed quality and management, housing systems, farm practices, environmental conditions, veterinary services, public awareness, and the complexity of agent-related factors

Therefore, age, together with feeding practices and production level, may contribute to differences in the occurrence of acidosis among dairy cows(Yogananda et al., 2024).

In the present study, the incidence of acidosis varied by age, with cows aged 2-4 years, 5-7 years, and over 8 years showing rates of 50%, 46.15%, and 30.76%, respectively. A study in Veterinary Collage Bangalore, India, on 100 dairy cows aged 2-6, 6-8, and 8-10 years reported acidosis incidences of 17.5%, 8.88%, and 5.71%, respectively (Mirzad et al., 2021). These results differ from those of the present study and may be due to factors such as better diet management, periodic professional supervision, and lack of simultaneous provision of different feed types, insufficient clean water, and improper cow grouping. This difference may be related to variations in feed intake, milk production, dietary requirements, and the ability of the rumen to adapt to changes in the diet. Older and high-producing cows may have a higher risk of acidosis because of their greater energy requirements and higher consumption of concentrate feeds. In contrast, younger cows may have a different level of rumen development and adaptation to dietary changes. (Alam et al., 2014).

In this study, acidosis incidence was 47.61% in crossbred cows and 36.84% in local breeds. In a study conducted in the Winnipeg Manitoba of Canada on 320 cows from 13 dairy farms, including Holstein-Friesian and crossbred dairy cows, the incidence of acidosis was found to be 44.6% in Holstein-Friesians and 33.24% in crossbred cows (Li et al., 2012). These results by breed are similar to those reported in previous studies. The higher incidence of acidosis in crossbred cows may be due to factors such as poor nutritional management, traditional feeding practices, excessive consumption of human food waste, a weak immune system, and overfeeding of nutrients aimed at increasing milk production. The higher occurrence of acidosis observed in crossbred cows may be associated with their relatively higher milk production and greater nutritional requirements. These cows may receive higher amounts of concentrate feed to meet their increased energy demands, which can increase the risk of ruminal acidosis, particularly when dietary fiber is insufficient.

Based on the type of feed, this study found that the incidence of acidosis in dairy cows feed concentrated mixed feed was 53.33%. In 2008, a study in the Victoria Australia by Bramley and colleagues on 288 cows fed barley and corn grain reported that 86% of cows fed corn grain and 85% of cows feed barley grain developed acidosis. These results showed a much higher incidence than observed in the present study, and therefore are not directly comparable. The lower incidence in this study may be attributed to the use of legumes to enhance production, the provision of diverse and fast-fermenting feedstuffs, limited access to clean water, and large-scale cattle management.also The low occurrence of acidosis observed in this study may be related to relatively balanced feeding practices, adequate dietary fiber, limited use of concentrate feeds, and proper feeding management in the selected farms. In addition, the gradual introduction of dietary changes and regular feeding practices may have reduced the risk of ruminal acidosis.

Based on the type of feedstuff, this study found that 38.46% of dairy cows feed corn developed acidosis. Morar and colleagues (2022) evaluated the rumen content of cows feed

cottonseed meal at the University of King mechael of Research Farm in Romania and reported an acidosis incidence of 39.45%. These results are similar to the findings of the present study. This study found that, based on the type of feed, 33.33% of dairy cows fed unmixed feed developed acidosis. In 2016, a study in Zagazig University ,Salhia City, Egyptian, on 185 lactating cows feed a high-fat diet assessed rumen content using a pH meter and found an overall acidosis incidence of 17.6% (Attia, 2016). These results differ from those of the present study, likely due to favorable local conditions for disease transmission and the inconsistent use of standard veterinary protocols by farmers.

1. The study may have included a relatively small number of cattle, which could limit the generalizability of the findings to all cattle farms in Zabul Province, Due to time, transportation, and resource constraints, it may not have been possible to include all districts and cattle farms in the province.
2. Information about feeding practices, farm management, hygiene, and previous disease history was mainly obtained from farmers and may therefore be affected by incomplete records or recall bias.
3. Future studies should include a larger number of cattle from more farms and districts to obtain more representative results for Zabul Province. Researchers should investigate the prevalence of acidosis during different seasons to determine whether seasonal changes in feed availability and management affect the disease.
4. Future research should evaluate the nutritional composition of cattle feed, especially dietary carbohydrates, fiber, and concentrate-to-forage ratios, to identify specific dietary risk factors. Further studies should examine feeding frequency, sudden dietary changes, hygiene, water availability, housing conditions, and general farm management practices associated with acidosis.
5. Future researchers should focus on practical and affordable prevention programs, farmer education, proper feed formulation, and improved veterinary services to reduce the prevalence of acidosis and its economic impact on cattle farmers in Zabul Province.

CONCLUSION

The study found that the overall incidence of acidosis in the area was (42.5%). Younger cows (2-4 years) had a higher incidence (50%) compared to older cows over 8 years at (30.76%). Crossbreed cattle showed a higher incidence (47.66%) than local breeds. Among the farms, ZA-QL-CF-005 had the highest incidence. By feed type, cows feed concentrated mixed feed had a higher incidence (53.33%), and cows feed more than four times a day in addition to pasture had an incidence of (50%). These results indicate that acidosis is highly prevalent in the study area. And also it offers important insights into human health, dietary management across different stages of cattle production, and ways to prevent economic losses for livestock producers and local communities. Acidosis is an important metabolic disorder that can affect the health and productivity of dairy cows.The study found that acidosis is an important health concern among dairy cows in the selected farms of Zabul Province. The occurrence of acidosis may vary according to factors such as breed, age, feeding practices, and farm management. Proper

feeding and management practices are recommended to reduce the occurrence of acidosis and improve dairy cow health.

Author Contribution

All authors made significant contributions to this study. Hamat and Hamatzai carried out the authorship and execution of the research project. Hamat, Noori and Nowbahar performed data analysis and interpretation. Data collection was conducted by Hamat, and scientifically supervised the study. All authors reviewed the manuscript and approved the final version.

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Conflict of Interest

All authors express no conflict of interest in any part of the research. The authors alone are responsible for the content and writing of paper.

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Data avialibility statements

The data supporting the findings of this study are available from the corresponding author(hamat) upon reasonable request.

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