



Research Article

Epidemiological Analysis of Udder Edema in the Goat Population of Faisalabad, Pakistan

Shahabaz Ul Haq¹, Khurram Ashfaq¹, Arsalan Khan^{2*}, Adeel Khalid¹, Shahrood Ahmed Siddiqui^{3,4}, Raheela Taj⁵, Asad Ullah⁶, Hidayatullah Soomro⁷ and Muhammad Wasim Usmani^{8*}

¹Department of Clinical Medicine and Surgery, Faculty of Veterinary Science, University of Agriculture, Faisalabad, Pakistan; ²Veterinary Research and Disease Investigation Center, Dera Ismail Khan, Pakistan; ³Vaccine Production Unit, Tandojam, Sindh, Pakistan; ⁴Livestock and Fisheries Department, Government of Sindh, Pakistan; ⁵Institute of Chemical Sciences, University of Peshawar, Pakistan; ⁶College of Veterinary Science and Animal Husbandry, Abdul Wali Khan University, Mardan, Pakistan; ⁷Department of Veterinary Medicine, Shaheed Benazir Bhutto University of Veterinary and Animal Sciences, Sakrand-67210, Pakistan; ⁸Department of Veterinary Pathology, Faculty of Veterinary and Animal Sciences, Ziauddin University, Karachi, 75050, Pakistan.

Shahabaz ul Haq and Khurram Ashfaq contributed equally to this work and are co-first authors.

Abstract | Udder edema in goats is a condition that significantly impacts animal welfare and dairy production. This study aimed to analyze the epidemiological and semiotic aspects of udder edema in the goat population of Faisalabad, Pakistan. A cross-sectional study was conducted at the OPD clinic of the University of Agriculture, Faisalabad, over a one-year period in 2018. Sixty goats, comprising clinically diagnosed cases of udder edema and healthy controls, were enrolled. Data were collected through structured interviews and physical examinations by veterinary professionals. Stratified random sampling was used for selecting the study subjects. The study identified 60 cases of udder edema, predominantly in the Beetal breed, suggesting a breed-specific predisposition. Age was a significant factor, with most cases occurring in goats aged between 3.6 and 6 years. Bilateral udder involvement was more common, seen in 44 cases. The study also found a significant correlation between the condition and specific dietary elements, notably the use of wheat straw as roughage and Barseem alone as fodder. Chronic mastitis was identified as a significant complication in goats with udder edema. The study concluded that breed, age and specific dietary practices are key factors in the development of udder edema in goats. The findings underscore the need for tailored management strategies, particularly in terms of nutrition and monitoring of high-risk groups.

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***Correspondence** | Arsalan Khan, Veterinary Research and Disease Investigation Center, Dera Ismail Khan, Pakistan; **Email:** drarsalankhandvm@gmail.com

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Keywords | Epidemiology, Goat population, Mastitis, Non-contagious diseases, Udder edema



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Introduction

The goat is considered to be among the earliest domesticated animals, and genetic research

indicates that this occurred approximately 10,000 years BCE. Primarily, goats are utilized for their flesh, skin, milk, and hair. Additionally, some households regard these as unconventional household companions

(Naderi *et al.*, 2008). With an anticipated population of 78.2 million goats, Pakistan ranks third in terms of goat population diversity (Moaeen-ud-Din *et al.*, 2022). Punjab province is home to 37 percent of the nation's population and is recognized for seven notable goat breeds: Beetal, Daira Din Pannah, Nachi, Barbari, Teddi, Pahari, and Pothwari. Goats are classified as small farm animals in comparison to larger animals like cattle, camels, and horses, but they are considerably larger than poultry, rabbits, guinea pigs, and beekeepers. Primary uses of Beetal in Punjab include the production of flesh and milk. This is also referred to as the Lahori goat. It is regarded as having a high level of fertility, milk production, epidermis quality, and overall size. Goats are responsible for the production of 748 thousand tons of flesh and 965 thousand tons of milk in Pakistan (Moaeen-ud-Din *et al.*, 2022). Livestock husbandry contributes to the valuation of approximately 60% of the value added in agriculture by Pakistani companies, or approximately 11.22% of the country's GDP (Hashmi *et al.*, 2021).

Goats are susceptible to a wide range of infectious and non-communicable diseases, similar to other animal species. A relatively prevalent and poorly understood non-communicable disease in dairy goats is urinary edema (Nazeer *et al.*, 2018). A 2 years old goat is participating in the parity for the very first time, but all ages have been impacted. According to conventional wisdom, colostrum is present at birth; however, it becomes completely distended and asymmetrical within a few hours. Chest edema is uncommon, whereas udder edema is visible (Diskin *et al.*, 1999). The animals' groin is comprised of milk-secreting mammary glands. Mammary glands, commonly referred to as udders, are located in the pelvis of small ruminants like sheep and goats (Ghodasara *et al.*, 2012). The precise cause of udder edema remains unknown; however, it might be associated with elevated venous pressure and diminished blood flow to the udder (Melendez *et al.*, 2006). Udder edema typically arises from a substantial accumulation of fluid within the extravascular space of the thorax and the surrounding tissues. Oxidative stress is also implicated in udder edema, according to the majority of evidence (O'Rourke, 2009). The impact of udder edema is notably influenced by the relative concentrations of solutes within cells and between cells (Ankita *et al.*, 2013). The interstitial spaces and blood fluid balance are maintained by the interaction of osmotic and hydrostatic pressure. The

endothelial barrier inhibits the passage of fluids and solutes when both permeability and pressure are at baseline (Huppert *et al.*, 2019).

The precise etiology of udder edema remains uncertain; however, several variables may contribute to the condition: weight at gestation, age at which kidding occurs, sex of offspring, season of gestation, shoulder height, and the customary surge in body weight during the final trimester of pregnancy (Al-Ani and Vestweber, 1986; Melendez *et al.*, 2006). There seems to be a correlation between a larger prevalence of udder edema and both retained placenta after kidding and superior hereditary milk production capacity (Hage *et al.*, 1998). Pre-partum calorie, sodium, or potassium intake that is excessive may also increase the risk of edema. Udder edema could potentially arise due to the differential vulnerability of specific steroidogenic enzymes to oxidative stress. Elevated dietary potassium (K) intake may worsen edema via the renin-angiotensin system, which increases the excretion of K in conjunction with sodium and water retention (Kamble *et al.*, 2016). A range of potential hazards that may contribute to postpartum udder edema in dairy goats have been documented in the works of Roger (2009) and Radostits *et al.* (2010).

Udder edema manifests in both acute and chronic forms, namely physiological. Typically painless, physiological (acute) edema manifests in two distinct clinical phases: initially, there is a gradual obstruction beneath the epidermis, followed by cloudy, colostrum-filled udders. As the process progressed, favorable edema developed symmetrically. Udder edema has the potential to develop into a chronic condition that endures throughout the lactation period (Al-Ani, 1986). Inadequate exercise during parturition, genetics, nutritional management, and obesity are all predisposing factors. It appears that a decrease in blood protein levels at birth decreases the incidence. A high sodium chloride ingestion may exacerbate the severity of the disease, according to a number of studies. Unstimulated uterine edema is frequently observed in high-yielding dairy goats following birth and late death. Although complete control is unattainable, employing foods that are high in energy, such as dry maize flour and potassium and sodium salts (Harris and Springer, 2003), can be beneficial.

Postpartum uterine edema is a well-known and

significant condition that affects the mammary system. Goats commonly exhibit physiological udder edema and congestion both prior to and following parturition. Although uterine compression is a typical occurrence during parturition, there are instances when it can manifest as edema of the teat, abdomen, and udder. While edema typically subsides within one to two days after kidding, severe and persistent cases may impede the infant's ability to suckle or breastfeed (Radostitis *et al.*, 1994). Additionally, the distended udder is highly vulnerable to damage. Extreme circumstances may also result in the degradation of the udder wall, which can cause pendulous udders and an even more severe form of illness. This situation appears to be economically significant and is frequently reported (Avais *et al.*, 2020). An annual considerable number of these types of animals are admitted to veterinary facilities after their lives were irreparably damaged by the remedies offered by quacks. As a consequence, valuable animals are frequently slaughtered, and in some cases, fatalities ensue (Comin *et al.*, 2004). A review of the literature indicates that while diseases affecting the udder and teats are well documented in cattle and buffaloes, relatively little is known about small ruminants. Substantial financial detriment ensues from the presence of any clinical udder and teat ailment (Sharun *et al.*, 2021).

The prevalence and intensity of udder edema are greater in pregnant goats compared to non-pregnant goats, with the incidence and severity being more conspicuous in aged goats. Alternatively stated, the specific condition may pertain to a ruminant that has encountered chest edema in the past (Ghudasara *et al.*, 2012). The ingestion of prenatal diets rich in sodium chloride can induce udder edema either prior to or following delivery. Although complete control over this circumstance is unattainable, it is prudent to restrict the consumption of high-energy foods like maize meal and salt (which contains sodium and potassium) (Okkema and Grandin, 2021). Additionally, early and pre-milking have been shown to decrease the incidence of clinical and subclinical mastitis and udder edema in goats (Compton and McDougall, 2008).

A study by Singh *et al.* (2021) found that inflammatory edema of the udder could be significantly reduced through the daily oral administration of a diuretic mixture containing potassium nitrate and magnesium sulfate and the application of cold water to the udder

for one hour. The management of udder edema presents challenges due to the potential development of udder lesions and inflammation. Additionally, it may diminish milk production. Diuretics including furosemide, bumetanide and torasemide are effective in the treatment of this condition. The optimal diuresis is achieved with diuretics in the circulatory system due to their plasma half-life, which ranges from one to four hours. Further measures to combat this disease include abdominal massage and physical activity (Davison, 1997). Although recovery has been confirmed as the prognosis, early intervention increases the likelihood of success. Goat-arthritis-encephalitis virus (CAE) are the etiological agent of udder rigidity.

We provide acknowledgment of inherent limitations that may have influenced our study, including observational nature of the cross-sectional design and potential biases in sample selection. Nevertheless, despite these limitations, the research offered significant contributions to the knowledge of this condition as it relates to small ruminants.

Consequently, the objective of the present study was to conduct an analysis of epidemiological and semiotic aspects of udder edema.

Materials and Methods

Study design

The present investigation utilized the cross-sectional framework to examine the frequency and determinants of uterine edema among the goat inhabitants of Faisalabad, Pakistan. In 2018, research was conducted for the duration of one year.

Study area and population

The study was carried out in OPD clinic of University of Agriculture, Faisalabad. The study enrolled the cohort of sixty goats, consisting of clinically diagnosed cases of udder edema as well as healthy controls.

Selection of data

Structured interviews and physical examinations were utilized to gather the data. The clinical evaluations conducted by veterinary professionals on goats centered on the determination of whether udder edema was present or absent. Concurrently, responses to pre-designed questionnaire concerning the housing

conditions, breed, age and reproductive history of the goats were obtained from their owners.

Clinical evaluation

A general health examination, a specific examination of the udder and where applicable, additional diagnostic procedures such as ultrasonography comprised the clinical evaluation. To maintain data collection consistency, an equivalent level of clinical scrutiny was applied to both affected and unaffected goats.

Sampling methodology

Sixty goats were selected using the stratified random sampling technique, which ensured a varied representation in terms of breeds, ages and health conditions. The objective of this methodology was to furnish an all-encompassing synopsis of the udder edema condition in the area.

It is pertinent to mention here that the control group and udder edema group were meticulously matched with respect to diet, management practices, breed, age and udder edema through the implementation of stratified random sampling and comprehensive questionnaires. Adopting this methodology guaranteed a rigorous comparison and bolstered the credibility of our results.

Design of questionnaires

The purpose of the questionnaire was to collect comprehensive data from goat owners. The assessment comprised various factors, such as management practices, nutritional habits, prior health concerns and inquiries specifically pertaining to udder health.

Statistical analysis

Descriptive statistics were computed on the data using Microsoft Excel. This involved determining prevalence rates, mean, standard deviation and standard error of mean (SEM). Inferential statistical tests, including logistic regression and chi-square, were employed to ascertain relationships between udder edema and a variety of factors using SPSS 25.0 version.

Ethical considerations

The research was carried out in adherence to ethical principles established by Animal Ethics Committee of University of Agriculture, Faisalabad. All goat

owners who participated provided informed consent, which guaranteed the preservation of their anonymity and confidentiality.

Limitations

The research acknowledges the potential biases that may arise during sample selection and data interpretation, as well as the inherent limitations of a cross-sectional design, which are based on observation.

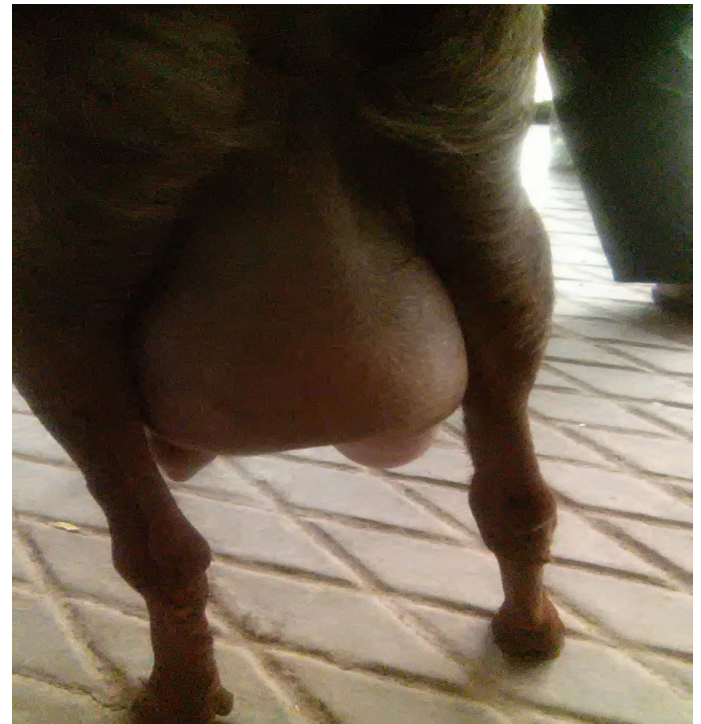


Figure 1: Pre-parturient udder edema in dairy goat.

Results and Discussion

Our study identified 60 cases of udder edema in goats in the Faisalabad region (Figures 1, 2, 3 and 4). The prevalence data are categorized based on species, age, weight, number of kidding occurrences and the number of kids delivered. Beetal breed exhibited significant predisposition with 50 cases out of 60 affected does examined ($p < 0.05$), suggesting a strong breed-specific predisposition. The data also indicates that age was significant factor, as 28 of the goats were between 3.6 and 6 years old ($p < 0.05$). The higher p -values for body weight, kidding number and number of kids delivered indicated that there was no significant association with the condition (0.174, 0.248 and 0.150, respectively). This suggested that these characteristics had reduced probability of exerting significant influence on the observed condition in the does (Table 1). The results of a correlation analysis revealed that among 46 postpartum cases, majority (28 does) encountered



Figure 2: *Post-parturient udder edema in dairy goat.*



Figure 3: *Unilateral udder edema in dairy goat (left half).*

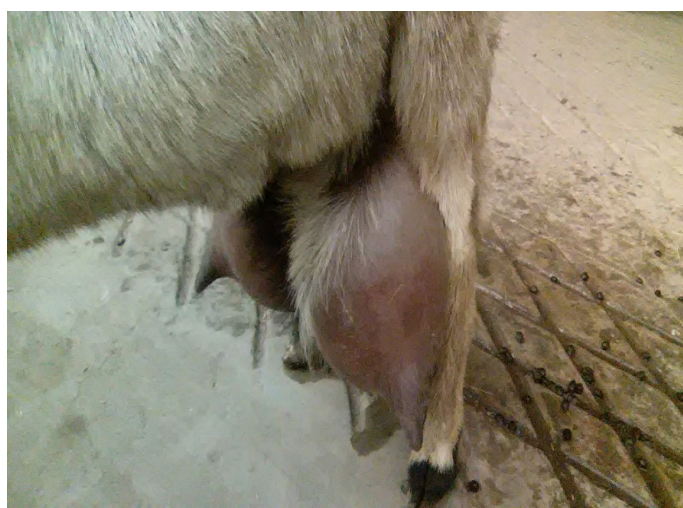


Figure 4: *Bilateral udder edema in Teddy breed kidding for the 1st time.*

mammary edema within 2-4 hours after giving birth ($p < 0.05$). The incidence of edema between 4.1 and 48 hours and after 48 hours post-kidding was diminished and correlation was not statistically

significant. The majority of pre-partum patients encountered edema within the first twenty-four to forty-eight hours after giving birth, demonstrating a significant correlation ($p < 0.05$). After 48 hours prior to parturition, edema was uncommon and not significantly correlated (Table 2). The study observed that udder involvement was primarily bilateral, impacting both halves in 44 cases ($p < 0.05$). In few goats, single half of the udder was affected and lacked the significant correlation ($p > 0.05$). This indicated that bilateral udder involvement is a more substantial factor in the condition under investigation (Table 3). The examination of feed constituents revealed that conditions under investigation were significantly correlated with two of the substances: 'Wheat straw' as roughage ($p < 0.05$) and 'Barseem alone' as fodder ($pp < 0.05$). The higher p-values for alternative fodder combinations and roughage varieties indicated that correlations were not as significant. The category of common salt exhibited significant correlation ($p < 0.05$) in the absence of salt supplementation, whereas moderate salt supplementation yielded the higher p-value. In the context of concentrates, no individual type exhibited a correlation that was deemed highly significant, as indicated by p-values varying between 0.06 and 0.12 (Table 4).

Table 1: Dairy goats suffering from udder edema.

Traits	Break up of affected does (n=60)	p-value
Breed	Beetal	50
	Desi	4
	Kamori	4
	Teddy	2
Age of does (years)	1.5-3.5	24
	3.6-6	28
	>6	8
Body weight (kg)	25-30	16
	31-40	30
	41-60	14
Kidding No.	1 st	13
	2 nd	11
	3 rd	24
	>3 rd	12
No. of kids delivered at current kidding	1	8
	2	49
	3	3

**indicated the significant values.*

Table 2: Temporal pattern of occurrence of udder edema with respect to kidding in dairy goats suffering from udder edema.

Post-partum cases (n=46)	Timing (hours) of occurrence of udder edema with reference to kidding	No. of cases	p value
	2-4	28	0.05*
	4.1-48	16	0.12
	After 48	2	0.15
Pre-partum cases (n=14)	24-48	12	0.04
	After 48	2	0.21

Table 3: Unilateral-bilateral edema of left and right udder halves in dairy goats suffering from udder edema.

Udder involvement	No. of cases	p-value
Both halves	44	0.048*
Left udder	9	0.073
Right udder	7	0.125

Table 4: Types of fodder, roughages, concentrates and common salt supplementation during the pre-partum period in dairy goats suffering from udder edema.

Feed constituents	Nature of Feed	No. of cases	p value
Fodders	Barseem alone	30	0.05
	Barseem+greenwheat+oat	2	0.20
	Barseem+maize	2	0.20
	Barseem+oat+brassica	2	0.20
	Barseem+brassica	3	0.15
	Maize alone	7	0.10
	Alfalfa alone	3	0.15
	Sorghum +maize	2	0.20
	Maize +Alfalfa	3	0.15
Roughages	Lucern +berseem	7	0.10
	Wheat straw	52	0.03*
	Grass dried	6	0.10
	No roughages	2	0.20
Common salt	No salt supplementation	45	0.04*
	2 teaspoon salt supplementations	15	0.08
Concentrates	No concentrate	14	0.07
	Bread crumbs	7	0.10
	Grated chickpeas	4	0.12
	Wheat bran	16	0.06
	Mumnee	4	0.12
	Cottonseed cake	6	0.10
	Commercial vanda	9	0.09

Table 5: Detailed nutritional analysis of goat diet in relation to udder edema.

Dietary component	Forage type	Protein content (%)	Fat content (%)	Fiber content (%)	Mineral content (%)
Forage	Barseem (Clover)	15-18	2-4	25-30	2-3
Roughage	Wheat straw	3-5	1-2	40-50	1-2
Supplement	Mineral mix	-	-	-	Varies
Additional feed	Concen- trate mix	12-16	3-6	10-15	5-7

A comprehensive dietary analysis was conducted on the goats involved in the study, with particular attention given to the nutritional composition of their diet. The nutritive values of the forage types and roughage consumed were further elaborated, and essential nutritional components such as protein, fat, fiber, and minerals were quantified. These details are critical in order to comprehend the correlation between diet and udder edema (Table 5). It has been hypothesized that specific nutrition strategies for dairy goats are significantly associated with udder edema. A significant correlation was observed between the use of wheat straw as roughage (53 cases, $p < 0.05$) and feeding Barseem alone as forage (34 cases, $p < 0.05$), and development of udder edema. On the contrary, there was no substantial correlation observed between the condition and utilization of wheat bran concentrate (Table 6).

Table 6: Constituents of pre-partum feed and amount and frequency of common salt supplementation in dairy goats suffering from udder edema.

Feed type	Common feeding strategies	No. of cases	p value
Roughages	Wheat straw	53	0.002*
	Grass dried	4	
	No roughages	3	
Concentrates	Wheat bran	19	0.413
	No concentrate	15	
	Various others	26	
Fodder	Barseem alone	34	0.049*
	Various combinations	12	

Chronic mastitis was identified as the significant complication among goats undergoing parturient udder edema. More specifically, chronic mastitis

developed in one out of every two afflicted goats in Flock 1. This condition was noted in both goats exhibiting udder edema in Flock 2. Both Flocks 4 and 5 contained a single goat that presented with udder edema; these goats subsequently developed chronic mastitis in both cases. The observed pattern suggested noteworthy correlation between udder edema during parturition and subsequent onset of chronic mastitis in the goats afflicted (Table 7). The study identified two significant characteristics, namely body weight ($p < 0.05$) and kidding number ($p < 0.05$), which exhibited the robust correlation with condition under investigation. Nevertheless, no statistically significant correlations were observed between the number of kids delivered, rectal temperature, pulse rate, respiratory rate and pulse rate (Table 8). With 46 cases, bilateral udder involvement was the most prevalent, according to the data. The occurrence of unilateral udder cases was relatively infrequent, amounting to 14 in total, with 6 cases affecting the left udder and 8 cases affecting the right udder. Twenty cases involve the left udder, while fourteen instances involve the right udder, out of total of sixty cases. The left and right udders have fovea replenishment times of approximately 43-46 seconds and 44-48 seconds, on average (Table 9). The study identified significant correlations between the condition and roughage and forage types that were provided. There was significant correlation observed between the use of wheat straw as roughage (53 cases, $p < 0.05$) and Barseem alone as sustenance (34 cases, $p < 0.05$). Nevertheless, the correlation between concentrates and the condition was not statistically significant. Neither wheat bran nor other forms of concentrates (19 cases) exhibited a strong association with the condition.

Table 8: Values of cardinal parameters and signalment of dairy goats suffering from udder edema.

Characteristics	Range of values	p-value
Breeds	Beetal, Kamori, Desi, Teddy	---
Age (years)	1.5-9	0.054
Weight (Kg)	25-60	0.049*
Kidding	1-6	0.044*
No. of kids delivered	1-2	0.762
Rectal Temperature (°F)	101.8-104.8	0.562
Pulse rate/min	110-144	0.772
Respiratory rate per minute	36-60	0.404

Table 9: Unilateral and bilateral edema of left and right udder halves and udder skin fovea refill time of dairy goats suffering from udder edema.

Characteristics	Left udder	Right udder	Total cases
Unilateral cases	6	8	14
Bilateral cases	46	46	46
Total cases	20 (Average Fovea Refill Time: ~43-46 sec)	14 (Average Fovea Refill Time: ~44-48 sec)	60

The increased demand for dairy goat products intended for human consumption has contributed to the dairy goats' increased significance in recent decades. In contrast to sheep and cattle, the dairy goat industry has contributed significantly to the global goat population growth over the past decade. Goat milk comprises a greater proportion (2.3%) of global milk production than sheep milk (1.3%) (Castro *et al.*, 2023). There are variations among dairy goat breeds with respect to milk production and composition. For instance, the Majorera breed yields 550 kg of average milk per day, which is 3.94% fat and 3.9% protein (Fresno *et al.*, 2009), whereas the Saanen or Alpine breed produces 700 kg of typical milk (Arnal *et al.*, 2018). The metabolic health of a dairy goat during pregnancy is critical for determining the quantity and value of its milk (Stelletta *et al.*, 2008; Matthews 2016). Similar to cows, milk-producing goats experience substantial fluctuations in their energy demands during the lactation period and are highly susceptible to negative energy balance (NEB) (Simões and Gutiérrez, 2017). The occurrence of metabolic disorders in the postpartum period can potentially affect the well-being of animals, the nutritional composition of milk, and production. Consequently,

Table 7: Complications sequelae of udder edema in 5 flocks of goats in Faisalabad over period of one year.

Flock No.	Nature of complications	Frequency of complications
1	Chronic mastitis	One of the two goats with udder edema
2	Chronic mastitis	Both goats which developed parturient udder edema developed chronic mastitis
3	Not relevant as one of the goat develop udder edema	
4	Chronic mastitis	The solitary goat with parturient udder edema developed chronic mastitis
5	Chronic mastitis	The solitary goat with parturient udder edema developed chronic mastitis

these issues may cause a delay in the resumption of estrous cyclicity and subsequently affect the supply of milk during lactation (Huang *et al.*, 2023). As a result, the implementation of peripartum health management strategies for dairy goats is critical for their financial viability and overall welfare.

The occurrence of udder congestion during parturition can lead to significant physiological changes, including edema of the abdomen, udder, and teats (Kamble *et al.*, 2016). Udder edema may occur in late pregnancy as a consequence of the large fetus compressing the mammary vein, leading to mammary or ventral edema. Udder edema is induced by an excessive accumulation of fluid in the extravascular compartments of the udder and the surrounding tissues. Pregnancy-related recommendations for mitigating the problem include avoiding excessive sodium or potassium intake and maintaining good physical health. In order to reduce the likelihood of uterine edema, it is recommended to incorporate vitamin E, vitamin A, and beta-carotene into the diet prior to kidding (Kamble *et al.*, 2016).

The udder-related repercussions are highly consequential due to their influence on the financial circumstances of producers. The selection of animals solely on the basis of their production may increase the likelihood of contracting a disease, according to Van Dorp *et al.* (1998). Udder edema, a condition affecting the mammary system, is a prevalent medical condition characterized by an abnormal deposition of fluid in the interstitial spaces. It obstructs the passage of breast milk and creates difficulties for neonates in obtaining nourishment. Frequently, producers encounter challenges during the milking process (Al-Ani and Vestweber, 1986). This condition is associated with myocardial dysfunction that has a multifactorial etiology, encompassing genetic predisposition, impaired blood flow, and dietary adjustments. Avais *et al.* (2020) state that udder edema is a prevalent condition that detrimentally affects the financial health of dairy farms. Important indicators for udder edema in this study include the age at which kidding occurs, the difficulty of delivery, RFM, the delivery of male kids or male twins, feed type and system, additional NaCl intake during gestation, higher milk yields, cool weather, and the length of the doe at the shoulder. The findings corroborated the observations made in the present investigation (Mahmoud *et al.*, 2016). Additionally, he arrived at the conclusion that primiparous animals have a 25% increased likelihood

of developing udder edema, while a higher production capacity raises the risk to nearly 50% (Khan *et al.*, 2017).

In a study comparing the incidence of udder edema in the summer and winter, Melendez *et al.* (2006) found that the probability of developing the condition increased by 3.68 times during the winter months. It can be effectively asserted that the prevalence of udder edema is greater in the winter due to the increased intake of sodium and potassium in comparison to the summer (West *et al.*, 2003; Melendez *et al.*, 2006).

Conclusions and Recommendations

Increased body weight, advancing age, higher parity and delivery of multiple kids were identified as significant risk factors for development of udder edema in goats in this study. Furthermore, the condition was exacerbated by dietary practices including exclusive consumption of Barseem, dependence on wheat straw and absence of sodium supplementation. These observations emphasized the significance of customized management approaches in goat husbandry industry, specifically with regard to monitoring high-risk groups and nutrition. The results established foundation for subsequent investigations, specifically concerning the examination of genetic predispositions and effects of various dietary compositions on the health of goats.

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Novelty Statement

Udder edema in goats refers to the swelling or accumulation of fluid in the udder, which is the mammary gland responsible for producing milk. It's a condition that can affect lactating female goats and can have several causes. Udder edema can range from mild to severe and can impact milk production, overall goat health, and even the quality of the milk produced. In this study, we have investigated the epidemiology of udder edema in goat in Pakistan. The findings of

this study will help to determine udder edema control strategies.

Author's Contribution

Shahbaz Ul Haq and Khurram Ashfaq: Conducted the investigation and research work.

Arsalan Khan: Complete data analysis and helped in writing the original draft.

Adeel Khalid: Data collection and investigation process.

Shahrood Ahmed Siddiqui: Complete data analysis and helped in writing the original draft.

Raheela Taj: Prepared the research plan and synopsis.

Asad Ullah: Complete data analysis and helped in writing the original draft.

Hidayatullah Soomro: Assisted in the investigation process and investigation process.

Muhammad Wasim Usmani: Research design and investigation process.

Data availability

Data presented in this study is available with the corresponding author

Conflict of interest

The authors have declared no conflict of interest.

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