

## Descriptive Epidemiology and Seasonal Variation in Prevalence of Milk Fever in KPK (Pakistan)

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**Abstract:** Milk fever is most likely to influence dairy cows near the time of parturition. The animal is immensely challenged to maintain Ca-homeostasis otherwise it may lead to milk fever, that is life threatening and predispose animals to variety of other diseases. At the same time change in climate and varying seasonal conditions may have impact on disease behavior and spread pattern. Keeping in mind all these factors active disease surveillance was conducted to estimate prevalence of milk fever in cattle and buffaloes in the province of Khyber Pakhtunkhwa. Three different climatic clusters were selected on basis of variation in annual mean temperature, annual mean rainfall and altitude. Total of 1217 dairy animals were sampled, 611 lactating cows and 607 lactating buffaloes. The results showed high prevalence of milk fever in cattle (4.6%) than in buffaloes (3.6%), where prevalence of milk fever in exotic breeds of cattle were significantly higher ( $p < 0.05$ ) than other breeds. Prevalence of milk fever was significantly ( $p < 0.05$ ) higher in summer season. Whereas individual climatic elements i.e. temperature, rainfall at different altitudes showed non-significant ( $p > 0.05$ ) impact on the prevalence of milk fever. It can be concluded that milk fever, being a metabolic disorder is mostly affected by nutrition rather than the climate change. But more research in dept is required to understand the complex relationship of climate change and livestock.

**Key words:** Milk fever • Homeostasis • Cattle • Buffaloes • Breed • Prevalence

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### INTRODUCTION

Livestock over the globe occupies 45% of the surface area and is a significant asset with at least value of \$1.4 trillion [1]. Low level of calcium (blood calcium) can lead inability of a cow to rise feet up the ground as calcium is vital for muscles and nerves function, that results into a metabolic disorder termed as milk fever. This is mostly termed as periparturient paresis or periparturient hypocalcemia, since rise is not typically observed in the body temperature [2]. Hypocalcemia has been known in cows for almost about 215 years and the clinical signs for it have not changed since it was described in the mid-19<sup>th</sup> century by the Victorian veterinary surgeons [3].

Generally milk fever (hypocalcemia) field incidence occurs from 0–10%, but some time it may exceed 25% for calving cows. In some studies conducted on milk fever the cows calving incidence has reached 80% [4]. In cattle Hypocalcemia is probably one of the common metabolic disorders affecting them. It's mostly associated with parturition just occurring before, during or after calving immediately, but in dry cows it has been reported and mostly, at mid lactation. The hypocalcemia incidence has been reported higher in the dairy cows than in beef cows, it also increases with age and yield [5]. Economically milk fever is an important disease that can reduce dairy cow's productive life by 3.4 years. Mostly in untreated cases of milk fever, 60-70% cows die [6].

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The climate change impact on the health of farm animals have not been studied intensely. But it can be understood that as in humans, climate change, particularly global warming, expected to affect greatly the health of animals directly as well indirectly. Where direct impact is in the form of temperature correlated diseases, fatality and morbidities during extreme weather conditions [7]. Although the livestock susceptibility to heat stress varies according to life stage, specie, genetic potential and nutritional status. But at higher altitudes rising temperatures are in general have greater effect than at lower altitudes on livestock. Research has found that local breeds are frequently quite well adapted to the local extreme weather [8] and in USA reductions in dairy cow performance has been found to be associated with climate change projected by [9]. Elevated temperatures and reduced feed intake deposits ceiling on milk yield in cows and in the tropical areas it may be half to one 3<sup>rd</sup> of the modern cow breeds potential [10]. That will ultimately cause a high level of energy deficits which leads to decrease in the fertility, longevity and fitness of the dairy animals [11].

Despite the fact that in developed countries, there exist proper strategies for disease monitoring and their control, however, in Pakistan, very modest data regarding prevalence of clinical milk fever is available. Therefore, this study was conducted to find the prevalence of clinical milk fever and the climate (temperature, rainfall and season) change impact at different altitudes in cattle and buffaloes of Khyber Pakhtunkhwa (Pakistan).

**MATERIALS AND METHODS**

**Study Area:** The present study was conducted in rural areas of the province Khyber Pakhtunkhwa (KPK) and FATA region of Pakistan. That is situated between 31° 15' and 36° 57' North latitude and 69° 5' and 74° 7' East longitude. The Province has open range of climatic and physical conditions. Although located in a temperate zone, climate of the KPK province varies greatly from region to region. Agriculture is the main source of livelihood in this region. The average annual rainfall varies from 25-58 inches. There are about 6568516 lactating buffaloes and 6059041 lactating cows in this province of the country [12].

**Study Population and Sampling Method:** Study population was the lactating cattle and buffaloes of KPK and FATA region (Fig. 1). Where the different breeds of cattle and buffaloes were studied (Table 1) at different altitudes. Multistage cluster sampling technique was used to select three climatic clusters (Fig. 1), those initially consisted of eight randomly selected districts and then single village from each selected district. Where the animals included in the study were not suffering from any other apparent disease.

**Sample Size Determination:** For estimation of clinical milk fever prevalence, since no related work was done in the study area, therefore sample size was drained by considering the prevalence of 0-10% from the study of [13] with 5% precision and at 95% confidence level using the formula given below, described by [14].

Table 1: Prevalence of Milk fever in relation to various factors in Khyber Pakhtunkhwa.

Parameters	Variables	Level	*MF Prevalence	P-value
Host specie	Cattle/Buffaloes	Cattle	4.6% (28/611)	0.403
		Buffaloes	3.6% (22/606)	
Breed variation	Cattle breeds	Zebu cattle(achai)	2.7% (1/37)	0.007
		Cross bred	4.0% (13/321)	
		Exotic Breeds*	9.7% (11/113)	
		Non descriptive	2.1% (3/140)	
	Buffalo breeds	Nili Ravi	3.8% (15/391)	0.137
		Azakheli	2.6% (3/113)	
		Non descriptive	3.9% (4/102)	
Climate	Climatic regions	Semi-Arid	4.0% (303)	0.827
		Sub-Humid	4.7% (343)	
		Humid Region	3.9% (571)	
Season	Winter	(Dec-March)	18.0% (9/50)	0.00001
	Summer	(Apr-June)	36.0% (18/50)	
	Monsoon	(July-Sep)	32.0% (16/50)	
	Post Monsoon	(Oct-Mid Dec)	14.0% (7/50)	

\*Milk fever. [(Local language name in buffaloes (Tako) in cattle (charmaikh)].

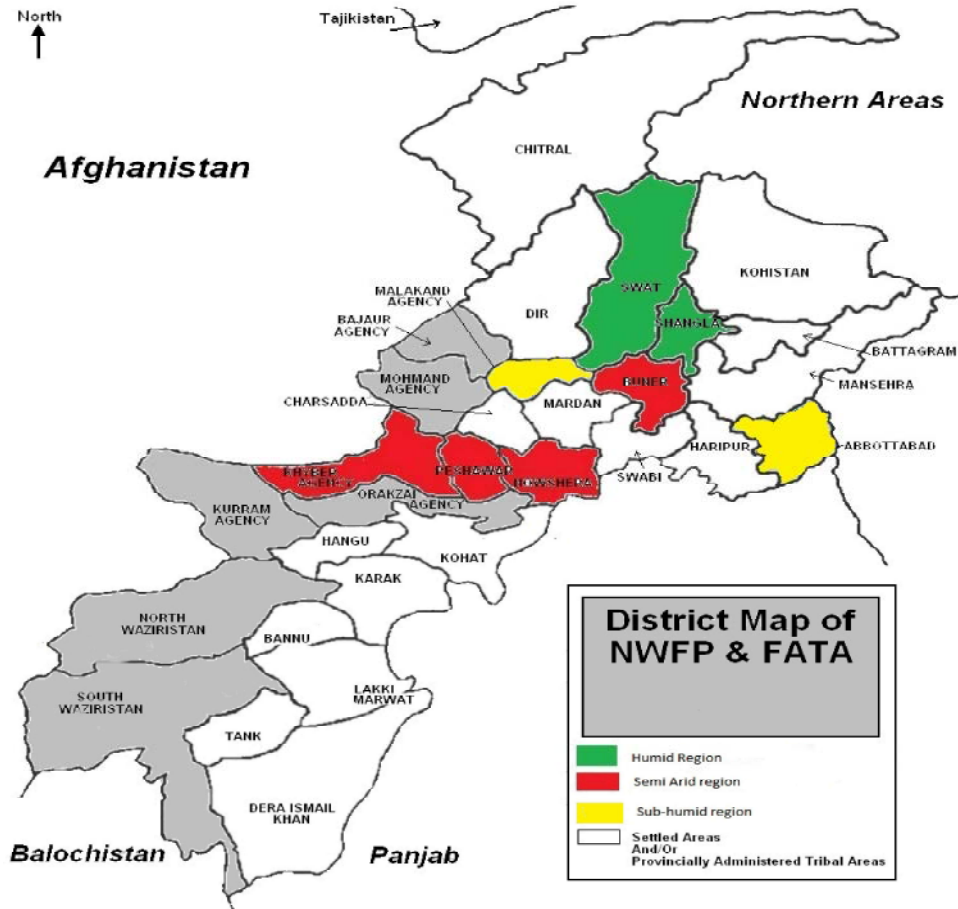


Fig. 1: Showing different Climatic regions and districts sampled for study.

$$n = 1.96^2 P_{exp} (1 - P_{exp}) / d^2$$

(Where:  $P_{exp}$  = Expected prevalence of milk fever and  $d^2$  = Degree of freedom.)

Hence, the minimum sample size (with 10% prevalence) mandatory was 138 lactating cattle and buffaloes in each cluster.

**Study Design and Methodology:** Active disease surveillance based study was conducted. Where two field surveys at equal intervals were conducted to collect the requisite information relating the disease studied. For this purpose a predesigned structured questionnaire was used to collect the data. For clinical milk fever local language names (Table 1) were used while interviewing farmers. Total of 367 smallholder dairy farmers were interviewed.

**Statistical Analysis:** The statistical analysis of the pooled data was performed by SPSS (Version 16.0). Descriptive statistic of the data was calculated and chi square test

was used to find the correlation between the categorical variables at 5% precision and level of 95% confidence interval.

## RESULT

The present study was conducted in the KPK province of Pakistan. Total of 367 rural smallholder dairy farmers were interviewed. This studied was conducted from Aug-2012 to Jul-2013. All the dairy animals were free from any other detectable disease and were surveyed twice at equal intervals during the study period of one year. Total dairy animals included and observed from the target population were 1217 heads, cattle (611) and buffaloes (606). The prevalence of clinical milk fever was quantified at different levels i.e. specie, breed, altitude, seasonally and at different climatic regions.

The overall prevalence was calculated 4.10%. Whereas the milk fever prevalence in cattle was 4.6% higher than in buffaloes 3.6%. There was a significant

Table 2: Prevalence of milk fever in cattle and buffaloes of KPK at different climatic conditions

District Name	Overall Prevalence	*MF in Cattle	MF in buffaloes	A.A.M. Temp(F)	Avg. Annual. Rainfall(mm)	Altitude (ft)	P-Value
Swat	5.8 (9/173)	10.5(4/38)	3.7 (5/135)	64.16	1400-1700	3228	0.586***
Abbotabad	6.0 (10/151)	7.6(4/52)	6.0(6/99)	62.51	500-1000	4134	
shangla	1.5 (2/130)	1.1(1/91)	2.5(1/39)	58.67	1400-1700	4800	
Malakand	3.6(7/192)	1.8(2/111)	6.1(5/81)	66.59	500-1000	2349	
Peshawer	4.4 (6/137)	4.4(4/90)	4.2(2/47)	73.51	250-500	1178	
Nowshera	2.9 (6/204)	4.8(5/104)	1.0(1/100)	73.16	250-500	925	
Buner	4.5(5/110)	12.8(5/39)	0.0(0/71)	71.33	250-500	2260	
k.Agency**	4.2 (5/120)	3.4(3/86)	5.8(2/34)	74.16	250-500	3510	

\*MF. Milk Fever, \*\*Khyber Agency, Same P-value for all the above listed variables.

(P=0.007) difference in the prevalence of milk fever between different breeds of cattle while amongst buffalo breeds an insignificant (P=0.137) association was found (Table 1). In the cattle breeds the highest prevalence was 9.7% calculated for exotic breeds and the lowest was for non descriptive ones. At the level of climatic clusters there was non-significant (P=0.827) variation regarding prevalence of milk fever (Table 1). While seasonal variation in terms of milk fever prevalence was strongly significant (P=0.00001). Where higher prevalence of 32.0% was observed in summer season and lowest prevalence existed in the season of post monsoon. Inter district milk fever prevalence existed where at the district of Buner the prevalence was 12.8% higher in cattle population. The results showed that altitude, average annual rainfall, average annual mean temperature and altitude have no significant (P=0.586) impact on the prevalence of milk fever regardless of the specie and breeds respectively. But it was found that the prevalence of clinical milk fever varied significantly with changing season and prevalence variation was also observed at breed level in cattle only. Details have been given in (Table 1 and 2).

## DISCUSSION

The results of the study showed that prevalence of clinical milk fever was higher in cattle than in buffaloes milking population (Table-1). The data collected through survey showed the overall prevalence of 4.10% that is fully in accordance with the study conducted in North America where it was 3.45% by [15]. The prevalence of milk fever in zebu cattle (Achai) was significantly (P= 0.007) lower as compared the exotic breeds of cows. This difference may be due to the reason that Zebu cattle are the local native breed of this province because of which it is most suitable to the local climatic conditions than any other breed of cattle. While the difference may also be attributed to the reason of high yield of exotic breeds which is thought to be the main risk factor for milk fever.

These observations are supported by the incidence of hypocalcaemia, from the data set used in meta-analysis by Lean *et al.* [16]. The results of our study were also in agreement with results of [17] who stated that higher susceptibility to milk fever of Channel Island breeds as compared to Holsteins. Similar observations were also discussed by [18]. In buffalo lactating population inter breed variation in prevalence of milk fever (Table-1) was in significant (P=0.137). It may be because of the less difference in the milk yield per animal.

The prevalence of milk fever was found significantly (P=0.00001) higher in summer season followed by monsoon (Table-1). These variations may be addressed due to the heat stress where the animal feel low in terms of energy and specially the exotic breeds and buffaloes specially in this part of the country. This phenomenon of heat stress indirectly affecting animal health in term of milk fever to cope the high demand of calcium was supported by [19-21].

The data analysis showed no significant (P=0.586) impact of climatic factors (average annual rainfall and annual mean temperature) independently. Nor altitude showed any significant impact on the prevalence of milk fever (Table-2). But these factors do have combine significant impact on the prevalence of milk fever. This may be due to the stress of high milk yield and heat stress at the same time, because most of the lactating breeds here are high yielding dairy breeds. These findings were supported by the observations of [22]. Confirming that high milk yield increases sensitivity of cows to thermal stress. [23] Also confirmed the same findings.

## CONCLUSION

In this paper, we briefly reviewed some basics of the composite relationship between climate change and dairy animals in Khyber Pakhtunkhwa. It can be concluded that climate change do have minor impacts on prevalence of milk fever but mostly breed and high milk yield have most

of the impact. Milk fever is a metabolic disorder therefore nutritional management could address it better within different ecological clusters alongside varying altitude.

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