Indus Journal of Agriculture and Biology (IJAB)

Volume 1, Number 1, 2022, Pages 15 – 24

Journal Home Page

https://ijab.online/index.php/Journal/index

Importance of Livestock and Blackleg Disease Spread in Livestock After Flood

Muhammad Jamil[1], Mubarik Ali[2], Norina Jabeen[3], Jaweria Gul[4] & Naimat Ullah[5]

[1]PARC Arid Zone Research Centre, Dera Ismail Khan, 29050-Pakistan
[2]Department of Biotechnology, Shaheed Benazir Bhutto University, Sheringal, Dir, Pakistan
[3]Animal Science Institute, National Agricultural Research Center, Islamabad-54000-Pakistan
[4]Rural Sociology Department, Institute of Social Sciences, University of Agriculture Faisalabad, Pakistan
[5]Department of Parasitology, University of Veterinary and Animal Sciences Lahore-54000-Pakistan

ARTICLE INFO

Article History:

Received:	February	25, 2022
Revised:	March	20, 2022
Accepted:	April	10, 2022
Available Online:	May	30, 2022

Keywords:

Flood, impacts, Livestock, infectious disease, Blackleg

ABSTRACT

Background: *Livestock plays a pivotal role in the global agricultural system, with farm animals significantly contributing to the socio-economic and nutritional needs of humans. Floods, being one of the predominant natural disasters, impact livestock health, productivity, and grazing, thereby affecting the human population dependent on them.* ***Objective:*** *This review was undertaken to determine the effects of blackleg disease on animals in the aftermath of the 2022 flood.* ***Methods:*** *A comprehensive examination of the literature was conducted, focusing on the significance of livestock, the types and effects of floods on the livestock industry, and a deep dive into the etiology, symptoms, and impact of blackleg disease.* ***Results:*** *Floodwaters can disturb soil habitats, releasing the dormant spores of the bacterium Clostridium chauvoei, responsible for blackleg disease. Although the flood may have receded, the aftermath can still be conducive to the spread of blackleg, primarily among cattle, with symptoms ranging from gassy swellings under the skin to sudden death. The disease has potential ramifications for the livestock industry, as it affects young, fast-growing cattle under two years old.* ***Conclusion:*** *The 2022 flood has exposed livestock, especially cattle, to heightened risks of blackleg disease. Such disruptions emphasize the need for continuous monitoring, vaccination, and interventions to safeguard livestock health and by extension, human food security and economic stability in livestock-dependent regions.*

Corresponding Author's Email: jamilmatrah@gmail.com

INTRODUCTION

There are different causes of animal mortality in the globe, but among them, infectious diseases are the top one. Among the infectious diseases which causes animals mortality is the blackleg disease which spread in animals after flood. The flood of 2022 has caused severity death of animals in Pakistan due to this disease.

OBJECTIVES

The aim of current review of literature was to determine the effects of blackleg disease in animals after the flood of 2022.

Significance of animals

Allah made both living things and non-living things in the globe. Animals are utilized for a variety of things, including food production, companionship, and scientific research. Different products such as wool, hides, skin, and hoofs used to make different products for the benefit of human. Animals can used since the creation of creatures for transport and agriculture purposes by human. According to estimates, livestock provide 30% of the food and agricultural needs of humans in the form of meat, milk, carbs, and proteins. There are numerous varieties of milk. Some are based on the quantity of milk fat in the final product, while others are based on the kind of processing done [1-2]. Whole milk or full-fat milk are other names for fresh milk. Fresh milk is still a low-fat food in spite of this. It is a good calcium source as well. For a number of reasons, even though they are sometimes disregarded, meat, milk, eggs, and other animal products, such as fish and other seafoods are very crucial in establishing food security [3].

Importance of farm animals

Farm animals are essential to a sustainable agricultural system, particularly for smallholder farmers, who make up the majority of farmers worldwide [4-5]. Farm animals also contribute other resources including manure for fertilizers, on-farm electricity, and other byproducts, as well as economic diversity and risk distribution [6]. A significant number of resources, including water and land, have been saved as a result of improved management techniques and genetic selection during the past few decades, and the carbon footprint of animal production has decreased significantly [7].

Importance of ruminant animals

If managed properly, grazing can also improve the health and biodiversity of grasslands. Ruminants like buffalo, cattle, goats, and sheep efficiently transform the forages from grasslands into high-quality animal products. This is significant because grassland pastures, which house over a billion people and span more than 25% of the Earth's land surface, predominantly consist of marginal or non-arable land [8-10].

Role of Animals products

Animal products provide a crucial source of high-quality, balanced, and highly bioavailable protein as well as a number of essential micronutrients, such as zinc, iron, vitamins B-12 and A, all of which a huge section of the world's population is deficient [11]. So, maintaining a nutritionally balanced diet is mostly dependent on the moderate consumption of items derived from animals, particularly in developing nations [12].

Flood

One of the most significant natural disasters that can completely damage the physical and economic environment has nearly always been a flood. Floods may occasionally occur suddenly throughout the world due to physical causes and human activities, or they may occur seasonally in the same region. Flooding is a prevalent disaster in the globe [13].

Types of flood

There are different types of flood as reported by many researchers in the globe. Flash flood, coastal flood and river flood are the major one. The livestock losses caused by each type of flood. An unwarranted disaster is a flash flood. A cloud burst may strike one location while leaving another many kilometers away unaffected. Because of this, it is impossible to determine when a river will overflow its banks [14].

Effect of flood on livestock industry

The most frequent and likely type of natural disaster to strike both wealthy and developing nations is flooding. The populations affected by flooding face serious direct and indirect health hazards [15]. While the flood results in significant losses of human life or suffering, the losses to animals are much greater. Lack of drinking water, fodder, and feedstuffs are only a few of the detrimental repercussions of the flood on the livestock industry that have a significant negative impact on cattle health and output. Flood-related nutritional deficiencies prevent animals from growing, reproducing, and working as efficiently as possible [16-17]. Animal feed security becomes of the utmost importance to livestock farmers at that point. Livestock must have enough of food and clean water during the floods. Crop livestock systems in emerging nations contribute significantly to the livelihoods of millions of people while producing sizable amounts of both crop and livestock food products. These include dealers, market intermediaries, and processors in addition to livestock farmers. Currently, mixed systems generate over 50% of the world's cereals, 75% of the milk, 55% of the lamb, and 65% of the beef in developing countries [18]. Agriculture is typically linked to the rearing of livestock. Animals losses occur in two areas of Pakistan are shown in figure 1 [19].

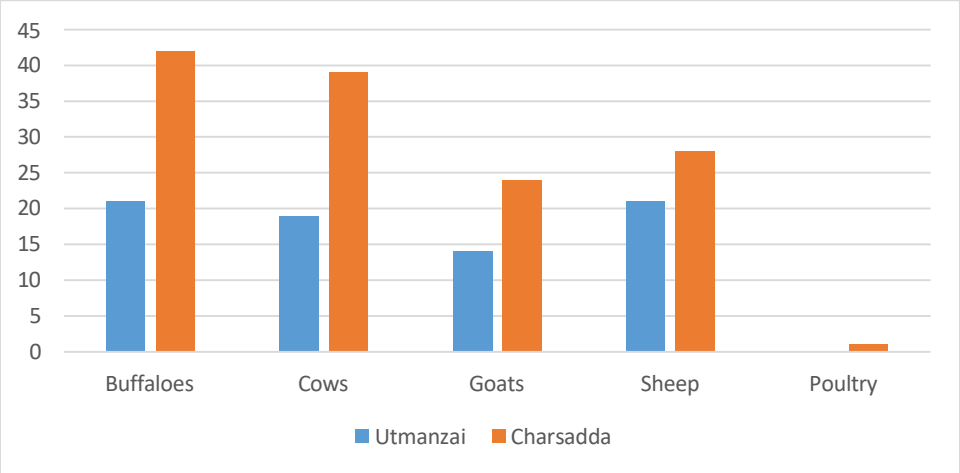

Figure 1. : Livestock losses in Utmanzai and Charsadda Khas, Pakistan

Effects on livestock performances

Flood changes the physiology of livestock, which lowers productivity and production. According to a study published to analyze the effects of climate change on milk production. It has been reported that high-yielding Holstein-Friesian cattle decline the milk production during unfavorable environmental conditions [20]. The quantity and quality of pasture decreased to such an extent during the dry seasons that livestock might not get enough energy to maintain their body weight. Loss of body weight and a decrease in milk production are the results of this. Therefore, the decreased and likely insufficient nutritional supply restricts the growth rate of broilers and layers, as well as egg output and egg mass [21-22].

Effect on Feed Availability

Hidosa and Guyo, reported both quality and quantity of feed reduce due to flooding. It is anticipated that the flooding will increase the sensitivity to livestock feed [23]. When cultivating different varieties of grass in low land areas, the hot and dry seasons have the biggest impact on biomass yield [24]. Had reported that the lack of food and shelter poses a hazard to the animals that have survived these floods. These animals are stressed and immune-suppressed due to lack of food and shelter, making them more vulnerable to infectious infections.

Effects on Livestock Health

Flooding has had an effect on the animals' performance and health both directly and indirectly. The results demonstrated that the introduction of vector-borne, soil-related, flood-related, and humidity-related factors had a direct impact on animal health. The researchers found that the flood also altered microbial ecosystems, which in turn had an indirect effect on animal health performance [25-26].

Effect on Pastoral Livelihood

Livestock output and pastoral livelihoods are more closely tied to rangeland productivity. In addition, this rangeland has been negatively impacted by floods in the lowlands, which causes droughts to reoccur frequently and cause animal mortality. It is obvious that livestock mortality has an impact on pastoralists' livelihoods [27].

Effects of flood on drinking water of animals

Over the past few decades, increasing urbanisation has largely been to blame for a rise in the frequency of floods and the damage caused by urban flood events. Since faeces are likely to be present in floodwater when urban flooding occurs in regions with combined sewer systems, those who are exposed to pathogens in these waters may be at risk for health problems [28]. Floods have a significant negative effect on the ecosystem. The present devastating flood and severe rains have had a significant negative impact on the Nowshera district (80%) [29]. The research area's drinking water sources were impacted by flooding water as shown in figure 2 [19].

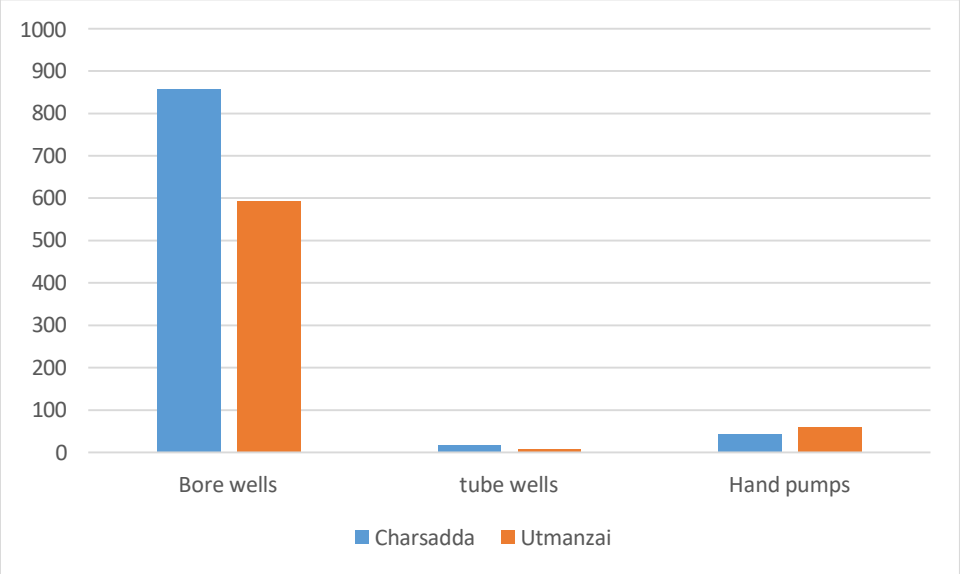

Figure 2. Contaminated Water sources in Utmanzai and Charsadda Khas villages of Pakistan

Effect of flood on livestock grazing

Livestock grazing is a long-standing agricultural practice on terrestrial grasslands all over the world. In addition to having a direct impact on plant productivity, livestock grazing also indirectly affects the soil biota through a number of mechanisms [30].

Drivers of disease threats

There are two types of drivers which caused diseases in animals. In terms of their radical and extensive effects on the development of infectious illnesses in animals and plants, two modern mechanisms stand out. The first is climate change, which has a significant impact on how disease organisms are distributed while also making agriculture in some areas more susceptible to drought, salinity, flooding, and other extreme weather occurrences. This phenomenon presents difficulties for border controls, food supply chains, and trade patterns, but it is also a driving force behind the creation of both national and international regulatory systems [31].

Infectious diseases

In Pakistan, the amount of rainfall fluctuates greatly from year to year. This impacts the upper catchments of the major rivers and depressions coming from the Bay of Bengal, causing unusually high flood peaks and widespread flooding.

Numerous illnesses can have detrimental effects on livestock as they grow during and after damp weather. Flood-affected farmers should examine their livestock for any odd signs of sickness. Some important diseases emerge in animals are given below [32].

Blackleg

Blackleg, also known as quarter ill or black quarter, is an acute infectious disease that affects cattle, occasionally affecting sheep and pigs. Young, fast-growing cattle under the age of two are most frequently afflicted by blackleg. Bacterial spores from polluted settings enter the animal through tiny wounds or are swallowed, which is what causes the disease. The signs of this condition might not appear right away and they might take some time to develop. Floods' erosion and movement create ideal circumstances for blackleg spore survival. Fever, severe depression, gassy swelling under the skin or in the muscles even before death, or sudden death frequently accompanied by fast bloating of the corpse are examples of common symptoms [33-34].

Etiology

The bacterium Clostridium chauvoei, which causes blackleg, is anaerobic, extremely pathogenic, endospore-forming, and gram-positive. It generates endospores with a lemon-like shape and needs enriched conditions to develop.

Table 1. Toxins produced by bacteria, Clostridium chauvoei

Toxins	**Cellular effects**	**Mechanism of action**
Flagella	increased pathogen spread	Motility of bacteria
Hyaluronidase	reduction of extracellular matrix	hyaluron cleavage
Neuraminidase	Reduction in rigidity of cell membrane and loss of cellular attachments	Cleavage of sialic acids
DNase	Degradation of DNA	Cleave DNA phosphodiester bonds
Hemolysins	Cytolysis	Pores formation in cell membrane

Abreu *et al*. (2017)

Epidemiology

Occurrence

Between the ages of six months to two years, non-vaccinated cattle are most commonly affected by blackleg, while cases occasionally affect animals older than this. Most animals in good nutritional health and frequently on pasture are affected by the disease. The bacteria can be recycled by faeces contaminating the soil and growing easily in the intestinal tracts of cattle. C. chauvoei quickly produces spores when exposed to the environment, and these spores may persist in the soil for a very long time (several years) [35].

Source of infection and mode of entry

A soil-borne infection is blackleg. There is considerable debate around the entry point for the organisms into the body. It is assumed that the entrance point occurs through the alimentary mucosa following consumption of tainted feed or in connection with the eruption of teeth. The bacteria can be present in the spleen, liver, and digestive system of healthy animals, and

contaminated feces or the decomposition of animal carcasses can contaminate pastures and soil. When factors like trauma or malnutrition lead spores that are not normally stuck in normal tissues to grow, true blackleg might result [36].

Mode of transmission

In cattle, the disease typically develops without a history of trauma, whereas in sheep, a wound infection almost invariably occurs. Local lesions may develop as a result of infections in skin wounds sustained during docking, shearing, and birth, as well as lesions on the navel [37].

Clinical signs and histopathological findings

Blackleg is often an acute or subacute illness, and many animals pass away rapidly or hardly ever survive for more than 36 hours from the onset of clinical sickness. There may occasionally be chronic conditions. Lameness, anorexia, lethargy, recumbence, and inability to move are the major symptoms of blackleg in the livestock as reported by many researchers in the globe [38]. Clinical symptoms may include one or more of the following as shown in figure 1 while histopathological findings are shown in figure 2.

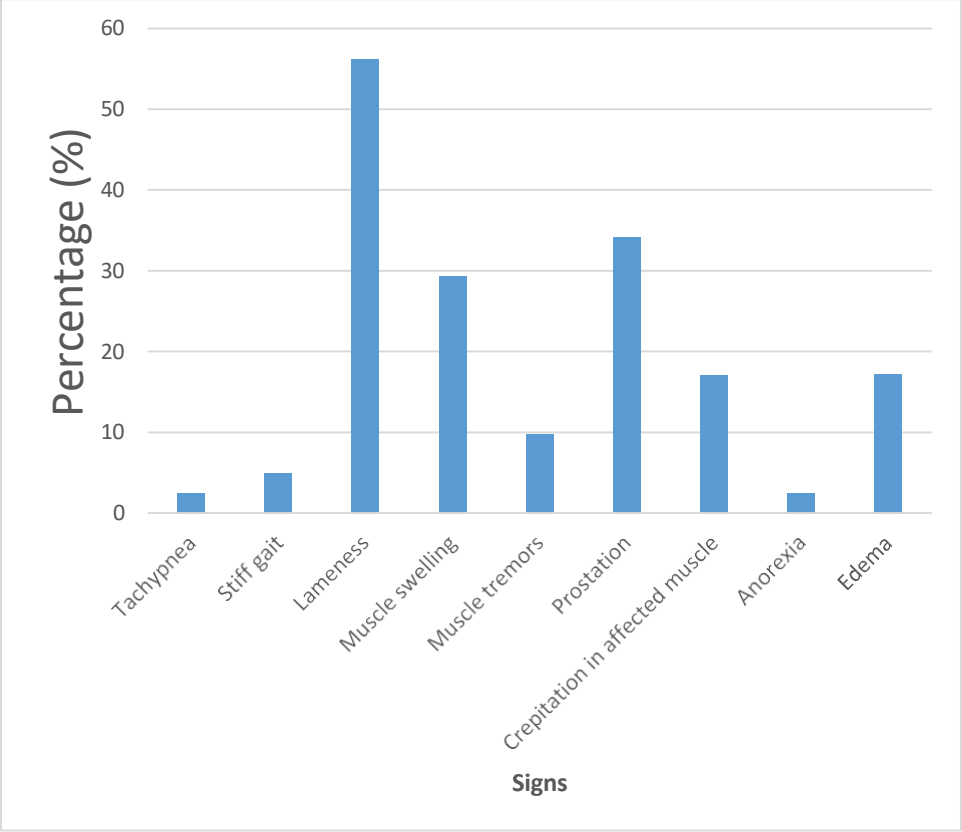

Figure 1. Major clinical signs of blackleg in livestock

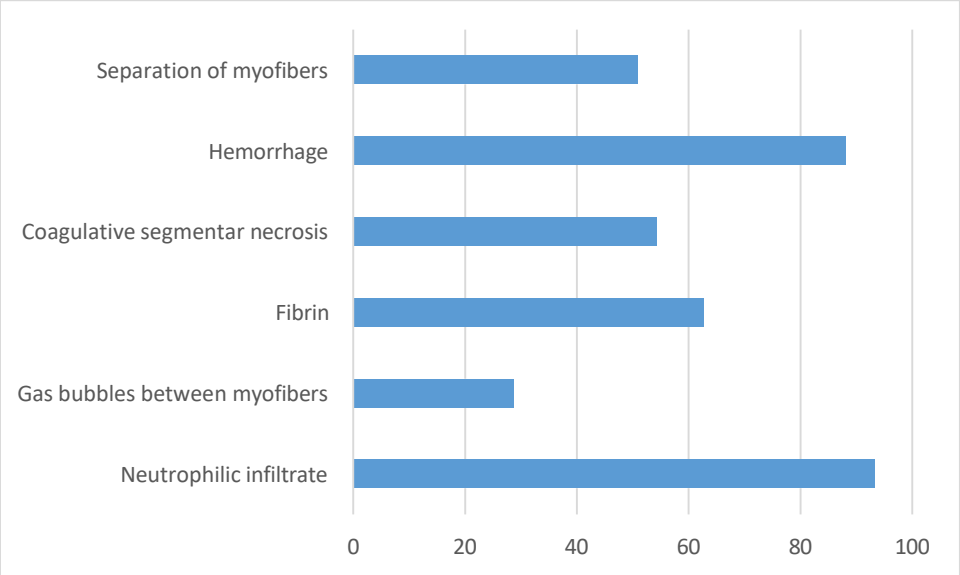

Figure 2. Histopathological findings in the muscle of blackleg infected animals

CONCLUSION

After the flood waters have subsided, cattle can develop blackleg in dry conditions. Floodwaters can reveal disease-causing spores by upsetting the soil. The spores may subsequently be spread into places where cattle graze by the floodwaters. Although blackleg is typically linked to cattle, other ruminants can also contract the disease.

ACKNOWLEDGMENTS

Authors are highly thankful to the concern institute.

REFERENCES

1. Rushen J, De Passille AM. The importance of good stockmanship and its benefits to animals. In: Improving animal welfare: A practical approach. Ed. 2. p. 125-138.
2. Demirbilek SK. Salmonellosis in animals. In: Salmonella-A Re-emerging Pathogen. 2017. p. 18.
3. Born P. Regarding Animals: A Perspective on the Importance of Animals in Early Childhood Environmental Education. Int J Early Childhood Environ Educ. 2018;5(2):46-57.
4. Herrero M, Thornton PK, Notenbaert AM, Wood S, Msangi S, Freeman HA, et al. Smart investments in sustainable food production: revisiting mixed crop-livestock systems. Science. 2010;327:822–5.
5. Otte J, Costales A, Dijkman J, Pica-Ciamarra U, Robinson T, Ahuja V, et al. Livestock sector development for poverty reduction: an economic and policy perspective - livestocks many virtues [Internet]. Rome: Pro-Poor Livestock Policy Initiative, A Living from Livestock, FAO, UN; 2012 [cited 2015 May 2]. Available from: http://www.fao.org/ag/againfo/programmes/en/pplpi/home.html.
6. Smith J, Sones K, Grace D, MacMillan S, Tarawali S, Herrero M. Beyond milk, meat, and eggs: role of livestock in food and nutrition security. Animal Frontier. 2013;3:6–13.

7. Randolph TF, Schelling E, Grace D, Nicholson CF, Leroy JL, Cole DC, et al. Invited review: role of livestock in human nutrition and health for poverty reduction in developing countries. J Anim Sci. 2007;85:2788–800.
8. Leroy JL, Frongillo EA. Can interventions to promote animal production ameliorate undernutrition? J Nature. 2007;137:2311–6.
9. Duffin KI, Bunting MJ. Relative pollen productivity and fall speed estimates for southern African savanna taxa. Veget Hist Archaeobotany. 2008;17(5):507-525.
10. Metera E, Sakowski T, Sloniewski K, Romanowicz B. Grazing as a tool to maintain biodiversity of grassland - a review. Anim Sci Pap Reprod. 2010;28:315–34.
11. McAfee AJ, McSorley EM, Cuskelly GJ, Moss BW, Wallace JMW, Bonham MP, et al. Red meat consumption: an overview of the risks and benefits. Meat Sci. 2010;84:1–13.
12. Reynolds LP, Wulster-Radcliffe MC, Aaron DK, Davis TA. Importance of animals in agricultural sustainability and food security. J Nutr. 2015;145(7):1377-1379.
13. Buslima FS, Omar RC, Jamaluddin TA, Taha H. Flood and flash flood geo-hazards in Malaysia. Int J Eng Technol (UAE). 2018;7(4):760-764.
14. Sebaihia BW, Wren P, Mullany NF, Fairweather N, Minton R. The multidrug-resistant human pathogen Clostridium difficile has a highly mobile, mosaic genome. Nature Genet. 2006;38(7):779.
15. Lunt ID, Jansen A, Binns DL. Effects of flood timing and livestock grazing on exotic annual plants in riverine floodplains. J Appl Ecol. 2012;49(5):1131-1139.
16. Rehman A, Jingdong L, Du Y, Khatoon R, Wagan SA, Nisar SK. Flood disaster in Pakistan and its impact on agriculture growth (a review). Environ Dev Econ. 2016;6(23):39-42.
17. Bakshi MPS, Wadhwa M, Makkar HPS. Feeding strategies during natural calamities. Indian J Anim Nutr. 2018;35(1):1-21.
18. Herrero MT, Thornton PK, Notenbaert AMO, Msangi S, Wood S, Kruska RL, et al. Drivers of change in crop-livestock systems and their potential impacts on agro-ecosystems services and human well-being to 2030.
19. Yousaf S, Naveed S. Flood (2010) effects on agriculture, livestock, infrastructure and human health: a case study of Charsadda District. J Humanities Soc Sci. 2013;21(1):81.
20. Valtorta SE, Leva PE, Gallardo MR, Scarpati OE. Milk production responses during heat wave event in Argentina. In: 15th Conference on Biometereology and Aerobiology - 16th Int. Congress on Biometeorology. Kansas City: American Meteorological Society, Boston; 2002. p. 98-101.
21. Mader TL, Davis MS, Brown-Brandl T. Environmental factors influencing heat stress in feedlot cattle. J Anim Sci. 2009;84:712-719.
22. Rettberg S. Pathways and dead ends of pastoral development among the Afar and Karrayu in Ethiopia. Eur J Dev Res. 2010;22:660-677.
23. Hidosa D, Guyo M. Climate Change Effects on Livestock Feed Resources: A Review. J Fisheries Livest Prod. 2017;5:259.
24. Wadhwa M, Hundal JS, Bakshi MPS. Nutritional status of animals of flood prone zone of Punjab. Indian J Anim Sci. 2010;80(6):547.
25. Yatoo MI, Kumar P, Dimri U, Sharma MC. Effects of climate change on animal health and diseases. Int J Livest Res. 2012;2:15-24.
26. Grace D, Bett B, Lindahl J, Robinson T. Climate and Livestock Disease: assessing the vulnerability of agricultural systems to livestock pests under climate change scenarios.

27. Said A. Resource use conflict in the middle Awash valley of Ethiopia: The crisis of Afar pastoralism. In: Pastoralists, Ethnicity and State in Ethiopia. London: HAAN Publishing; 1997. p. 123-141.
28. Ashley RM, Balmforth DJ, Saul AJ, Blanksby JD. Flooding in the future – predicting climate change, risks and responses in urban areas. Water Sci Technol. 2005;52(5):265–273.
29. Saeeda A, Zada M, Owais M, Khan. Quality characteristics of potable water collected from different sources in District Nowshera: A case study after flood-2010. J Sci Technol, Univ Peshawar In Press.
30. Schrama M, Heijning P, Bakker JP, van Wijnen HJ, Berg MP, Olff H. Herbivore trampling as an alternative pathway for explaining differences in nitrogen mineralization in moist grasslands. Oecologia. 2013;172:231–43.
31. Tagesu TT, Abdisa R, Hasen G, Regea G, Tadesse G. Review on blackleg in cattle. J Dairy Vet Sci. 2019;9.
32. Falquet L, Calderon-Copete SP, Frey J. Draft genome sequence of the virulent Clostridium chauvoei reference strain JF4335. Genome Announc. 2013;1(4).
33. Snider TA, Stern AW. Pathology in practice. Myocarditis and epicarditis. J Anim Vet Med Assoc. 2011;238:1119–21.
34. Van Vleet JF, Valentine BA. Blackleg. In: Maxie MG, editor. Jubb, Kennedy, and Palmer's Pathology of Domestic Animals. Vol. 1. Philadelphia: WB Saunders Co; 2007. p. 261-4.
35. Frey J, Falquet L. Patho-genetics of Clostridium chauvoei. Res Microbiol. 2015;166(4):384-92.
36. Radostits OM, Clive CG, Kenneth WH, Cliff PD. Veterinary Medicine: A textbook of the disease of Cattle, Sheep, Goats, Pigs, and Horses. 10th ed. London: Saunders, Elsevier; 2007. p. 828-30.
37. Disasa DD, Balcha MT, Negewo SM, Mamo ME, W/Sanbat TB, Disasa WK. Review on the blackleg disease in domestic animal. GSJ. 2020;8(8):1133-48.
38. Groseth PK, Ersdal C, Bjelland AM, Stokstad M. Large outbreak of blackleg in housed cattle. Vet Rec-Engl Ed. 2011;169(13):339.