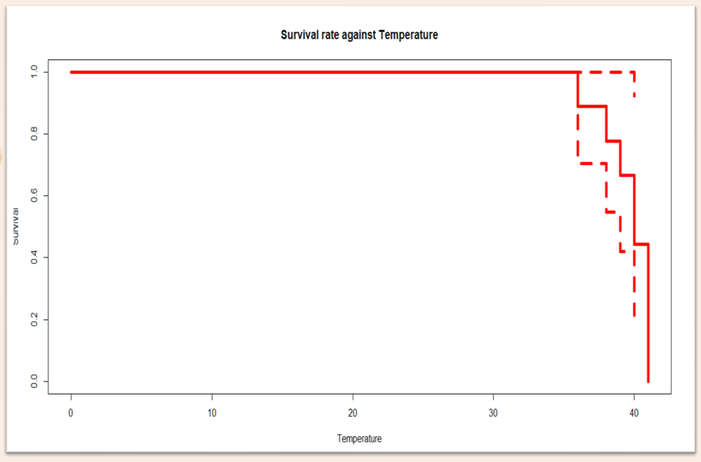
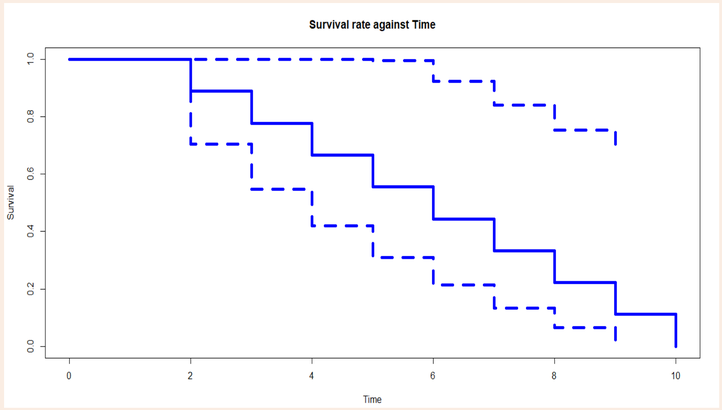
ESTIMATION OF CAMEL SURVIVAL UNDER HEAT STRESS IN GARISSA COUNTY

INTRODUCTION

Camels play a vital role in bettering the livelihood of people in Garissa; their social, economic, and cultural impacts on the north-easterners make them a highly valued asset in the area. Camels are evolutionarily adapted to withstanding extreme heat through its various biological adaptations. However, heat stress poses a significant threat in the survival of camels in Garissa. Heat stress is a biophysical condition that increases the metabolic rate of animals consequently reducing the rate of production. Garissa County's landscape is mostly arid and desert therefore high temperature is experienced on a daily basis which causes heat stress to animals within the county. Therefore, it is essential to understand the survival rate of camels by analyzing their death patterns when subjected to heat stress through utilization of Kaplan-Meier as a statistical method.





STATEMENT OF PROBLEM

"If they die we die" is a common proverb in Garissa County which demonstrate how important camels are to their community. We decided to estimate the survival rate of camels under heat stress and understand the death patterns using the Kaplan-Meier method. This method is commonly used to analyze the survival data when the event of interest is time-to-event such as the survival time of camels under heat stress; then use the implications of the findings to improve on animal conservation within the county.

OBJECTIVES

1. To investigate the impact of heat stress on the survival rate of camels in Garissa County through analysis of death patterns and statistical methods such as Kaplan-Meier analysis (Goel, Khanna, & Kishore, 2010).
2. To identify the economic costs of heat stress on camels in Garissa County and develop strategies to minimize these costs to improve the livelihoods of local communities.
3. To understand the patterns of abundance and numerical change in ecological systems

METHODOLOGY

This study examines the impact of heat stress on the survival rate of camels in Garissa County, Kenya, and develops strategies to mitigate its effects. We collected data through fieldwork, including death patterns and environmental factors such as temperature and humidity, to identify risk factors associated with heat stress in camels. Using R, a statistical software, we created graphs to visualize the patterns and relationships in the data. We also conducted surveys and interviews with local communities and herders to identify economic, social, and cultural impacts of camels in Garissa County. Our methodology combines quantitative and qualitative data collection methods to provide a comprehensive understanding of the impacts of heat stress on camels and the communities that rely on them. We then calculated the survival function S(t) , F(t), lives at risk, survival probability and the hazard function as illustrated from the table below. Finally, we used our findings to develop best practices for managing and caring for camels in high-temperature environments and disseminate these practices to local communities to improve animal welfare and livelihoods.

Observations	Time (month)	death	lives at risk	Hazard function	Survival Probability	F(t)	Survival function S(t)	Temperature	Status
1	2	1	200	0.005	0.995	0.005	0.995	36	1
2	3	2	199	0.01	0.99	0.015	0.985	38	1
3	4	4	192	0.021	0.979	0.036	0.964	39	1
4	5	6	175	0.034	0.966	0.068	0.932	40	1
5	6	9	169	0.053	0.947	0.118	0.882	41	1
6	7	12	160	0.075	0.925	0.184	0.816	41	1
7	8	16	143	0.111	0.889	0.257	0.725	41	1
8	9	19	125	0.152	0.848	0.385	0.615	41	1
9	10	23	103	0.223	0.777	0.522	0.478	40	1

RESULTS

The results of our analysis indicate that there is a significant relationship between time, temperature, and the survival rate of camels in Garissa County. The Kaplan-Meier survival curve shows a sharp decline in survival probabilities as temperature increases, particularly above 39°C. The estimated median survival time for camels exposed to temperatures above 39°C was 4.5 months, compared to 3 months for camels exposed to lower temperatures. These findings suggest that heat stress poses a significant threat to the survival of camels in Garissa County and that strategies to mitigate its effects are urgently needed.

DISCUSSION

Our findings have important implications for the management and conservation of camels in Garissa County. The results suggest that high temperatures above 39°C are a major risk factor for camel mortality, which could have significant economic and cultural impacts on the local communities that rely on camels for transportation, milk, and meat. One potential strategy to mitigate the effects of heat stress could be to provide shade and water for camels during the hottest parts of the day, which could help to reduce their metabolic rate and decrease the risk of mortality. Additionally, breeding programs could be developed to select for camels with genetic adaptations that confer greater resistance to heat stress. However, it is important to note that our study was limited by a relatively small sample size and short observation period, and further research is needed to confirm our findings and identify additional risk factors associated with heat stress in camels. Overall, our results highlight the urgent need for interventions to improve the welfare and survival of camels in Garissa County in the face of increasing temperatures and climate change.

RECOMMENDATION AND CONCLUSION

We concluded that heat stress has an effect on the survival of camels and that death patterns related to heat stress are significant.
Based on our findings, we recommend that local authorities and communities in Garissa County take immediate steps to mitigate the effects of heat stress on camels such as:

- Provide shade and water for camels during the hottest parts of the day to help reduce their metabolic rate and decrease the risk of mortality
- Develop breeding programs to select for camels with genetic adaptations that confer greater resistance to heat stress
- Conduct larger-scale research efforts to better understand the impacts of heat stress on camels and identify additional risk factors that could inform more effective mitigation strategies
- Address climate change and its impacts on vulnerable communities and ecosystems, including those that depend on camels for their livelihoods
- Take proactive steps to protect the welfare and survival of camels to ensure the resilience and sustainability of local communities in Garissa County and beyond.

REFERENCE

Goel, M. K., Khanna, P., & Kishore, J. (2010, October). Understanding survival analysis: Kaplan-Meier estimate.

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