Sokoto Journal of Geographical Studies (SJGS)

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Prof. I. M. Dankani

Editor-in-Chief

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IMPACT OF HEAT STRESS AND EXTREME TEMPERATURE ON LIVESTOCK PRODUCTION IN YOBE STATE

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Abstract *https://doi.org/10.65760/sjgs.v3.i1.8*

The study aimed to identify impact of heat stress and extreme temperature on livestock production in Yobe state. Purposive sampling technique was used to select study villages across Yobe state. Thereby sampling 180 respondents for structured interviews. A guideline for temperature requirement for livestock production in the drylands was compared with actual monthly temperature recorded in the determination of monthly temporal condition and status of livestock in the area. A checklist was used to guide the Focus Group Discussion. FGDs were conducted in each of the six (6) study villages, where some experienced agropastoralists were selected based on their long years of experienced and was analyzed using thematic analysis in the area of study. The finding reveals that livestock experience heat stress during April, May, and June due to temperatures exceeding 40°C, impact their productivity and health. The animals also face cold stress in January, February, and December, except for beef cows that experience normal cold ((36°C -39°C based on the requirement). conditions. The months of March and October have required normal temperature of 21°C - 39°C, while July and November temperature was a bit colder (25°C - 36°C and 19°C - 36°C respectively) for dairy cows, sheep, and goats with exception of beef cow that experienced normal temperature based on its requirement. The finding based on the FGD reveals that heat stress reduces feed intake, milk yield, body weight, and reproductive performance, and increases disease occurrence. It was concluded that, climate variability (extreme temperature) had significantly affected livestock production in Yobe State, Nigeria, with heat stress being a major obstacle to animal growth and development. It was also recommended that there is need for the pastoralists to seriously, implement heat stress mitigation strategies such as by providing shade, using cooling systems, and adopt early morning grazing to reduce heat stress as well as preventive veterinary in the area.

Keywords: *Climate Smart, Livestock Production, Climate Variability, Agropastoralists.*

Introduction

Livestock also serves important cultural functions, particularly for important traditional (dowry) or religious events and ceremonies and a source of prestige for chiefs and merchants. Livestock helps to reduce the workload on humans (draught power), to control weeds (particularly in tree plantations), to valorize marginal lands and protected forest and to turn crop residues and other waste products into valuable food (Momale (2014). According to Tao, Orellana, Weng and Marins (2018), defined heat stress as an environmental setting that disrupts the balance between the heat accumulation and the ability for an animal to dissipate heat.

Heat stress is a significant challenge affecting livestock production globally, with far-reaching consequences for food security and the livelihoods of farmers (Adekoya *et al.*, 2023). The impact of heat stress on livestock is a pressing concern, particularly in Africa, where rising temperatures and changing climate patterns threaten the very foundation of livestock farming. In Africa, heat

stress has been linked to significant economic losses, with estimates suggesting that the continent loses up to 10% of its livestock population annually due to heat-related illnesses (Sejian *et al*., 2018, Lara & Rostagno, 2013).

In Nigeria, specifically Yobe State, the impact of heat stress on livestock production is a critical issue. The region's semi-arid climate makes it vulnerable to extreme temperatures, which can lead to reduced feed intake, weight loss, and decreased milk production in livestock (Cartwright *et al*., 2023; Aliyu & Barau, 2023). In other words, Heat stress poses significant challenges to agricultural production and livelihoods in Nigeria's semi-arid regions, particularly among agropastoralists (Adebayo & Adeyemi, 2017). Cartwright *et al*., (2023) reported that heat stress can have devastating effects on livestock production, including reduced growth rates, impaired reproductive performance, and increased mortality rates.

In Yobe State, the situation is particularly dire, with many farmers relying on livestock production as a primary source of income. The state's semi-arid climate, combined with inadequate infrastructure and limited access to resources, makes it challenging for pastoralists to mitigate the effects of heat stress on their livestock.

There are several studies from different scholars and perspective on the subject matter. For instance, according to (FAO, 2009) on its study carried out using survey techniques, reveals that Livestock products are an important food source globally, as they provide 17% of the calories consumed and 33% of the global protein consumption. Reports have shown that our population is continually growing indicating a need to increase production of livestock products. It is estimated that by 2050 our livestock production will need to increase by 70% to meet the demands globally. According to Henry *et. al*. (2018), Rojas (2017) and Thornton (2009), reported that the environmental issues associated with climate change pose a threat to the livestock industry globally. Increased levels of carbon dioxide in combination with increased ambient temperatures has led to reduced forage quality. This is because these factors change the composition of the plants making them less digestible for livestock. This poses an issue for livestock as they may not be able to receive the nutrients, they require to sustain the mechanisms involved in production, reproduction, and overall health. Bett (2017) also reveals that indirect effect of global warming on the well-being of livestock species is the increased survival and distribution of vector borne pathogens. Increases in ambient temperatures has allowed vector-borne pathogens to survive much longer than they typically would. It has also allowed them to migrate and survive in other geographical locations that they typically would not have survived in the past. This results in increased rates of disease spread and transmission in livestock as well as the emergence of new diseases (Rojas, 2017 and Bett, 2017). Global warming also impacts production, reproduction and health, of livestock species, directly as a result of heat stress.

Key *et. al*. (2014) also emphasizes that Heat stress is a welfare and economic issue in the livestock industry, that will continue to be a problem in the future as greenhouse gasses in the atmosphere continue to increase. However, of all the livestock species heat stress seems to have a large impact on dairy cattle. Heat stress results in economic loss, with the greatest loss seen in the dairy industry, where about 63% of total economic losses in the United States, due to heat stress, is observed in dairy cattle versus other livestock species. Key *et. al.* (2014) also reported that, heat stress that has led to economic losses for dairy producers globally. Previous estimates in the United States have reported losses of approximately $1.5 billion per year in lactating cow due to heat stress. To understand why such losses, occur the physiological response. Kadzere, Murphy, Silanikove and Maltz (2022) on their study also reveals that dairy cattle have been identified as one of the livestock species thar are susceptible to elevated temperatures and humidity beyond thermoneutral zones (20). Therefore, when assessing heat stress in dairy cattle, temperature humidity indexes (THI) are typically used. Because dairy cattle are so susceptible to

heat stress several productive, reproductive and health related issues occur as a result of to heat stress must first be understood. Physiological response to heat stress

Polsky and von-Keyserling (2017) and Collier *et. al*. (2019) in their research reported that response to heat stress in cattle can be seen through several physiological signs or symptoms as a means of trying to maintain internal homeostasis. When the atmospheric temperature exceeds the normal core body temperature, cattle must expend heat to maintain normal core temperatures. Therefore, initially, an increase in heart rate is observed which causes enhanced blood flow to the body surface. Sammad *et. al*. (2020) and Wheelock (2010) reveal that glucose tends to be the favored energy source and that glycolysis is increased in dairy cattle that are suffering from heat stress. This suggests that dairy cattle will typically use glycolysis to supply the energy required for heat dissipation and cellular protection. Additionally, it has also been suggested that the immune system is stimulated during heat stress and cells of the immune system will increase their consumption of glucose when stimulated Abdelnour (2019). This increase in glucose consumption likely occurs in order to perform glycolysis, which is required to supply enough energy for the various physiological changes and effector functions associated with a response to heat stress. Conflicting evidence, in dairy cattle, exists regarding the involvement of other metabolites and metabolic pathways during heat stress. On the same vein, Mylostyvyi (2021) reported that, it is possible that lactating cattle may suppress fatty acid oxidation to reduce metabolic heat load. Whereas other studies in lactating dairy cattle have shown increased concentrations of circulating fatty acids and increased fatty acid oxidation during heat stress and it has been suggested that these metabolites and pathways may be needed to provide the extra energy required to meet the bodies demands during heat stress.

Network (2021). Also explained that, in lactating dairy cattle have shown an increase in circulation of ketone bodies during heat stress, which may be a result of reduced availability of carbohydrates for energy due to reduced feed consumption, whereas other studies in lactating dairy cattle have shown no effect of heat stress on the concentration of circulating ketone bodies. Aliyu and Muhammed, (2021); Carabaño *et. al*. (2017); Berman (2005) and Aliyu & Barau, (2023) further indicated that heat stress can lead to extreme losses in milk yield, which greatly effects economics for dairy producers. Similarly, it has been shown selection for increased milk production increases dairy cattle's susceptibility to heat stress, which is likely a result of the metabolic heat load of milk production. This is especially a problem in the Holstein breed, where selection in the Canadian dairy industry has put a large focus on production traits for a number of years. It has been reported that for each 10kg/day increase in milk yield the heat stress threshold will decrease by 5°C. According to Das (2016) is of the opinion that Several studies have indicated cattle have increased disease occurrence during times of heat stress. Thus, heat stress can alter the rumen function and in combination with reduced feed consumption increases cattle's risk for metabolic disorders.

It was also noted that, none of the aforementioned research was conducted in the study area in this context. Hence this research intends to fill this spatial and contextual gaps. Thus, understanding the impact of heat stress on livestock production in Yobe State is crucial for developing effective strategies to improve livestock resilience and productivity. Therefore, this study aims to investigate the effects of heat stress on livestock production in Yobe State, with a focus on identifying potential mitigation strategies and improving the livelihoods of pastoralists in the study area.

Study Area

Yobe State in North-East Nigeria is among the six states bordering the Niger Republic. Yobe State is located between latitude 10°30'N to 13°25'N and longitudes 9°35′E and 12°30′E. Yobe State shares borders with Borno State to the east for about 421 km, Gombe State to the south for 140 km (in the vicinity of Gongola River), Bauchi State for 188 km and Jigawa State for 193 km

to the west and the Republic of Niger to the North for about 352 km. (It borders to the North the Diffa and Zinder Regions of Niger) (Environmental and Social Impact Assessment (ESIA, 2024). The northern part of the state is characterized by desert, active sand dunes and difficult terrain, while the southern part is mountainous and undulating hills. The region is aptly described as the major wetland in the semi-arid Sahel corridor, supporting some 11 million people **(**Abubakar & Gashua, 2024) (figure 1).

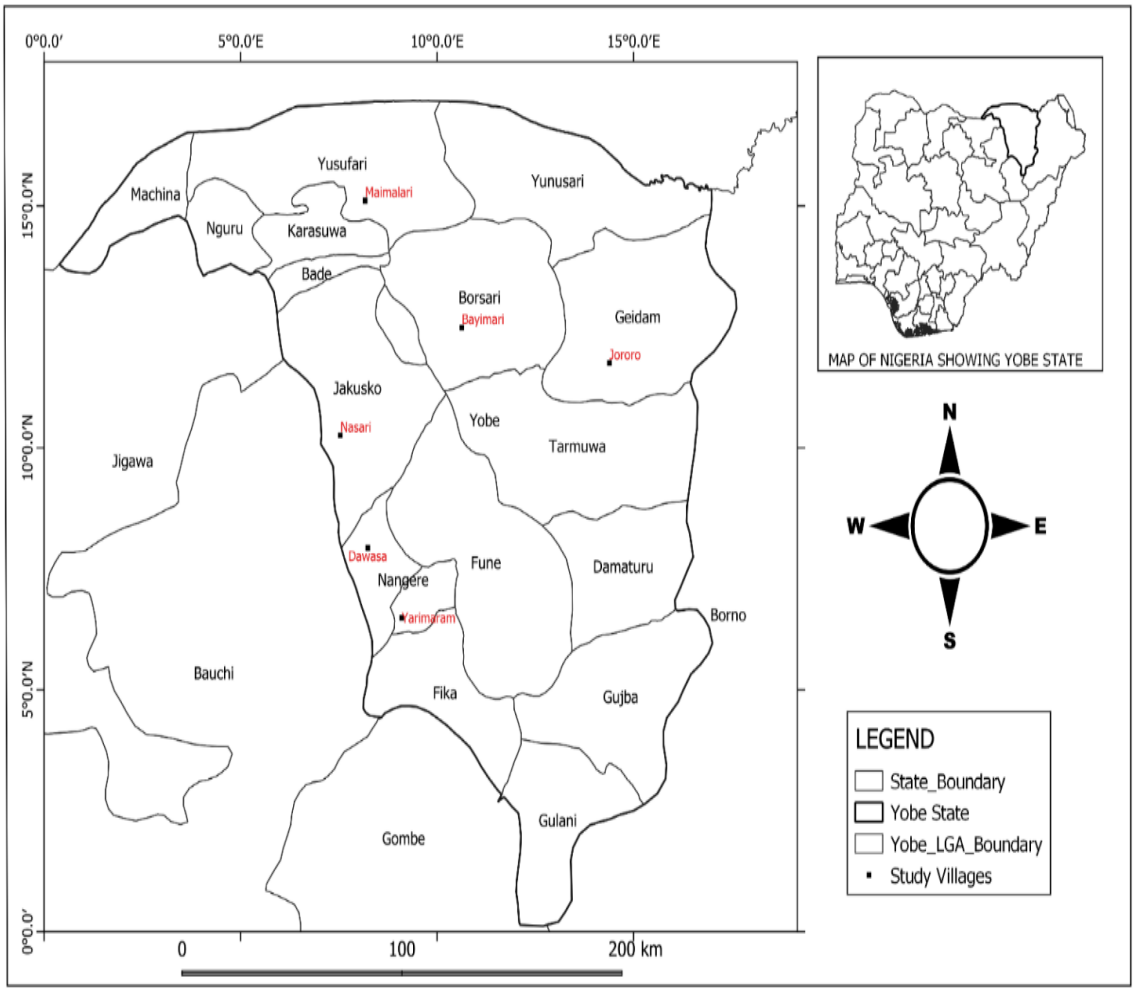

Figure 1: Study Area

Temperature of the area indicates an index of sensible heat from the atmosphere; it also indicates the relative degree of molecular activity of a substance. Temperature characteristics of the project State is therefore typical of a tropical area which is high and relatively stable throughout the year with an indication of seasonal fluctuations (Yobe Sapz report, 2024). The temperature is usually high during the dry season and low during the wet season. The mean maximum temperature of the area ranges from 30.7^0 C during the wet season to as high as 40.07^0 C in the dry season period. The three hottest months in Yobe State are March, April, and May. In any of these months, a single temperature event could be as high as 46.1 ^{0}C; this will bring about extreme heat. December and February is the period of harmattan which is characterized by cold, dry, dusty and wind (Usman, 2020).

UKaid, (2018) reported that, about 80 percent of the population are engaged in primary production agriculture. According to Food and agricultural organization and international crops research institute for the semi-Arid Tropics (FAO and ICRISAT, 2019), about 60 percent of

households are engaged in livestock production. According to NAERLS (2020) Yobe State had 1,081, 204 cattle population in 2020. According to Yobe state Agricultural policy drafting committee (YAPDC 2023) the livestock population as at 2023 in the State stands at: Cattle - 2.4 million, Sheep - 2.01Million, Goat - 2.78Million, Poultry - 2.28Million, Horse - 57,000, Camel - 830,0 and Donkey - 57,000. Cattle, goat, sheep and poultry are some of the different types of livestock kept by households in Yobe State. Thus, according to YAPDC (2023) The species of livestock for production in the State include the following: Cattle (Bokoloji, Red Bororo, White Fulani for beef, hide and dairy), Sheep (Yan Kasa, Balami, Uda, Sudan for skin and mutton) and Goat (Red Sokoto, Sahel for skin and Chevon).

Research Methodology

Sources of Data Collection

The study adopted a mix method approach involving both quantitative (structured interview and temperature) and qualitative (FGD) research strategies, to capture the views, experiences and adaptive responses of the participants in line with (Creswell, 2008). This approach allows for the triangulation of data and enabled a holistic understanding of phenomena in the study area. The quantitative data included questionnaire in the identification of climate smart practices to adopt to extreme temperature and climatic data (specifically actual monthly temperature recorded) was used to compare with a guideline for temperature requirement for individual livestock in the dryland (developed by Sejian *et al.*, 2021) so as determine monthly temporal condition and status of livestock in the area. A checklist was used to guide the Focus Group Discussion. While the qualitative adopted was the Focus Group Discussion. FGDs were conducted in each of the six (6) study villages, where some experienced agropastoralists were selected based on their long years of experienced and was analyzed using thematic analysis in the area of study. The rationale behind the selection of Yobe state was due to the fact that is a state with highest livestock production in Nigeria.

Structured Interview

Structured interview was administered to livestock producers, to capture data on identification of local practices and strategies used to adopt extreme temperatures (climate uncertainties) among the study population. The interview was conducted with the help of trained assistants. Purposive sampling technique was also used to select study villages across Yobe state, which includes Jororo (Geidam), Bayimari (Borsari/Dapch), Maimalari (Yusufari), Nasari (Jakusko), Dawasa (Nangere) and Yerimaram (Potiskum) for details study as they have diversity of livestock production practices and strategies. This selection also is in line with livestock mapping of Yobe State Agriculture Policy Drafting Committee (2023). A total of 180 respondents for structured interview. The data collected from structured interview was coded and analyze using statistical package for social sciences (SPSS version 20) and MS excel software, was also subjected to percentage, frequency and charts.

Focus Group Discussion

A checklist was used to guide the Focus Group Discussion. An FGDs were conducted in each of the six (6) study villages, where some experienced agropastoralists were selected based on their long years of experienced and was analyzed using thematic analysis in the area of study. One FGD was conducted in each of the study village, and the FGD has composition of 8-10 individuals agropastoralists with long years of experience of more than 20 years (45- 55 years of age) depending on availability of the participants (Table 1).

Table 1: Distribution of Focus Group Discussions

S/N	Name of the Study Villages	Number of Discussants
1	Jororo (Geidam)	8
2	Borsari (Bayimari)	10
3	Maimalari (Yusufari)	9
4	Nasari (Jakusko)	10
5	Dawasa (Nangere)	9
6	Yerimaram (Potiskum)	8
	Total	**45**

Source: Field Work (2025)

Climatic Data:

A guideline for temperature requirement for livestock production in the drylands developed by Sejian *et al*. (2021) was compared with actual monthly temperature recorded in the determination of monthly temporal condition and status of livestock in the area.

Temperature Requirement for Livestock Production

In tropical and subtropical countries an animal may often be under heat or cold stress. When the environmental temperature exceeds the upper or lower critical level (18^0 to 24°C, depending on the species) there is usually a drop in production or a reduced rate of gain. Furthermore, when the temperature falls outside the comfort zone, other climatic factors assume greater significance. Humidity becomes increasingly important as do solar radiation and wind velocity. Dairy Cattle show a reduced feed-intake under heat stress resulting in lowered milk production and reduced growth. Reproduction is also adversely affected (Table 2).

The body temperature of most domestic animals is considerably higher than the environmental temperature to which they are exposed most of the time. They maintain their body temperatures by balancing internal heat production and heat loss to the environment. Varying temperature also results in changed behavior. Most animals reduce their level of activity in a hot environment and, for example, pigs lie clustered in a heap at low temperatures, while they lie spread out with extended limbs at high temperatures.

Table 2: Temperature Requirement for Livestock Production

Animals	Temperature °C	
	Average	Range
Dairy Cow	38.6	38.0 - 39.3
Beef Cow	38.3	36.7 - 39.1
Pig	39.2	38.7- 39.8
Sheep	39.1	38.3 - 39.9
Goat		38.7 - 40.7
Horse	37.9	37.2- 38.2
Chicken	41.7	40.6 - 43.0

Source: Sejian *et al*. (2021b)

Notes on the Status and Condition of Livestock:

Normal temp. = (Dairy Cow =38.0 - 39.3°C), (Beef cow 36.7-39.1°C, Sheep 38.3-39.9°C and Goat 38.7-40.7°C) **Hotter events = (**40°C for all livestock except goat**)**

Colder event = (less than 36°C-35°C) **Very colder** = (Less than 34°C for all animals)

Results and Discussions

Status and Condition of Livestock in The Extreme Temperature Events

Based on Table 3, monthly temperature and climatic for requirement for livestock production in the study area, it can be deduced that all the animals under study (Dairy cow, Beef cow, Sheep and Goat) are under heat stress in the month of April, May and June in the study villages of Yobe state, this due to the fact that the temperature recorded is higher than the temperature required (the temperature for the three months is above 40°C) (Table 3). The findings also reveal that, all the animals under study experienced very colder weather (as they observed as low as 31°Cin the area) in the month of January, February, and December (which is contrary to their temperature requirement) with exception of beef cow that experience normal coldly situation. Thus, the implication of this is that, the animal may be under threat, this is the rationale behind the reason why some livestock make frequent use of cowpea related feed as it helps animal to generate heat (Body temperature).

Table 3: Status and Condition of Livestock in the Extreme Temperature Events

Months of the Year	The Temp Recorded Min – Max	Temperature Required by Livestock			
		Dairy Cow(°C) 38.0 - 39.3	Beef Cow (°C) 36.7 - 39.1	Sheep (°C) 38.3 - 39.9	Goat (°C) 38.7 - 40.7
January	14°C - 31°C	Very cold	Very cold	Very cold	Very cold
February	17°C - 34°C	Very cold	Colder	Very cold	Very cold
March	21°C - 39°C	Normal	Normal	Normal	Normal
April	24°C - 42°C	Hotter	Hotter	Hotter	Hotter
May	26°C - 43°C	Hotter	Hotter	Hotter	Hotter
June	27°C - 40°C	Hotter	Hotter	Hotter	Hotter
July	25°C - 36°C	Colder	Normal	Colder	Colder
August	23°C - 33°C	Very cold	Colder	Very cold	Very cold
September	24° - 36°C	Colder	Normal	Colder	Colder
October	22°C - 39°C	Normal	Normal	Normal	Normal
November	19°C - 36°C	Colder	Normal	Colder	Colder
December	15°C - 31°C	Very Cold	Very Cold	Very Cold	Very Cold

Source: Sejian et al. (2021), Meteoblue (retrieved on 22/04/2025, www.weather&climate.com)

The findings also reveal that, in all the livestock under study, the temperature used to be normal without any harm, in the months of March and October (as the observed temperature value is almost same with required one) in the study area. The result further shows that, temperature tend to be colder in the month of July and November, for dairy cow, sheep and goat, while tend to be normal in the beef cow in the same month in the study area (Table 3).

Hence this is in line with research of Misrah and Singh (2019) whom explained that, rise in surface temperature will hasten livestock vulnerability to heat stress, disease occurrence and availability of feed and fodder resources which reduce milk production of dairy animal by 10-20% depending on the breed and production level.

Impact and Consequences of Heat and Cold Stress on Livestock Production

Based on the findings of this research, the respondents lamented in the FGD that, heat stress was regarded as one of the important obstacles that hinder animals' growth and development. Hence, Climatic factors, such as high temperature, high relative humidity (RH) and high solar radiation, can induce a heat stress response in heat-susceptible animals. High temperature that subsequently leads to heat stress in the area had been altering the rate of animal productivity. Furthermore, the respondents lamented that, heat stress lowers feed intake (Heat stress suppresses the appetite) of animal which in turn reduces their productivity in terms of milk yield, body weight and reproductive performance. According some of the respondents in Maimalari (Yusufari) explained that:

> "In our area heat stress lowers feed intake as it suppresses the appetite of animal which in turn reduces their productivity in terms of milk yield".

High ambient temperature can adversely affect the structure and physiology of cells causing impaired transcription, translation, oxidative metabolism, membrane structure and function. (Muluneh, 2014).

Furthermore, the aforementioned problems of climate variability on livestock production, is in line with the work of Pankaj *et.al* (2013), that, emphasized that, animal production is affected by climate variability in four ways, a). through changes in livestock feed-grain availability and price; b). impacts word livestock pastures and forage crop production and quality; c). changes in the distribution of livestock diseases and pests; and the direct effects of weather on animal health, growth and reproduction.

The respondents also indicated that heat stress in the area had resulted in the increase in the rate of animal evaporation, that may subsequently resulted in the animals high water intake so as to supplement the water loses. The respondents also explained that another negative consequences of high temperature is that whenever there is extreme temperature rate, the intensity of the heat may stop the animals from forage browsing, hence this may lead to malnutrition. In other word the respondents explained that the heat may, induce physiological and behavioral changes that contribute to a decrease in production and reproduction, and could impair immune function.

Furthermore, the findings of this research shows that heat stress may cause the problem of liver-fluck disease that usually hinder the growth and development of animals in the area. Hence this is in line with research of Misrah and Singh (2019) whom explained that, rise in surface temperature will hasten livestock vulnerability to heat stress, disease occurrence and availability of feed and fodder resources which reduce milk production of dairy animal by 10-20% depending on the breed and production level. In addition, the finding of this research on the effects of climate variability on livestock production goes in line with view of McCarthy, Canziani *et al.* (2001), whom stated that Climate variability can affect livestock both directly and indirectly. Direct effects from air temperature, humidity, wind speed and other climate factors, influence animal performance such as growth, milk production, wool production and reproduction.

Resilience Strategies of Heat Stress and Extreme Temperature

The result shows that 20 % of the respondents use to provide shade, 10 % are using cooling system and 23.3 % use to keep the animal under tree shadow in Jororo village as a measures to reduce extreme heat. The result also shows that 10 % of the respondents use to provide shade, 6.6 % are using cooling system and 30 % use to keep the animal under tree shadow Bayimari village as a measures to reduce extreme heat. The result also shows that 13.3 % of the respondents use to provide shade, and 16.6 % use to keep the animal under tree shadow Maiamalari village as a

measures to reduce extreme heat. The finding also shows that 3.3 % of the respondents use to provide shade, and 16.6 % use to keep the animal under tree shadow Nasari village as a measures to reduce extreme heat. The result also shows that 6.6 % of the respondents use to provide shade, 0.0 % are using cooling system and 20 % use to keep the animal under tree shadow in Dawasa village as a measures to reduce extreme heat. On the other hand, the result also shows that 6.6 % of the respondents use to provide shade, 0.0 % are using cooling system and 16.6 % use to keep the animal under tree shadow Yerimaram village as a measures to reduce extreme heat in the study area.

Based on this finding it can be deduced that majority of the respondents did not adopt any measures to reduce extreme heat in all the six study villages (46.6 % in Jororo, 63.3 % in Bayimari, 70 % in Maimalari, 80 % in Nasari, 73.3 % in Dawasa, and also 76.6 % in Yerimaram) (Figure 2).

The findings of this research goes in line with work of Pankaj (2013), who described the use of shades as an effective method in helping to cool animals. Shades can cut the radiant heat load from the sun by as much as 40%. Shades with straw roofs are best because they have a high insulation value and a reflective surface.

Based on the FGD conducted with respondents elaborated that whenever there is high temperature they use to move their animals from grazing ground to the tree shadow (especially the weak ones) in Jororo village. It was also noted, some respondents (especially those with small number of livestock) make frequent use of cowpea related feed (cowpea and its byproducts) during extreme cold season so as to help animals generate heat (increase body temperature) which will subsequently lead to frequent consumption of water by the animals. On the other hand, this practice may be hazardous and disastrous during hot season (as it may even lead to their death), because it will be difficult for them to do respiration.

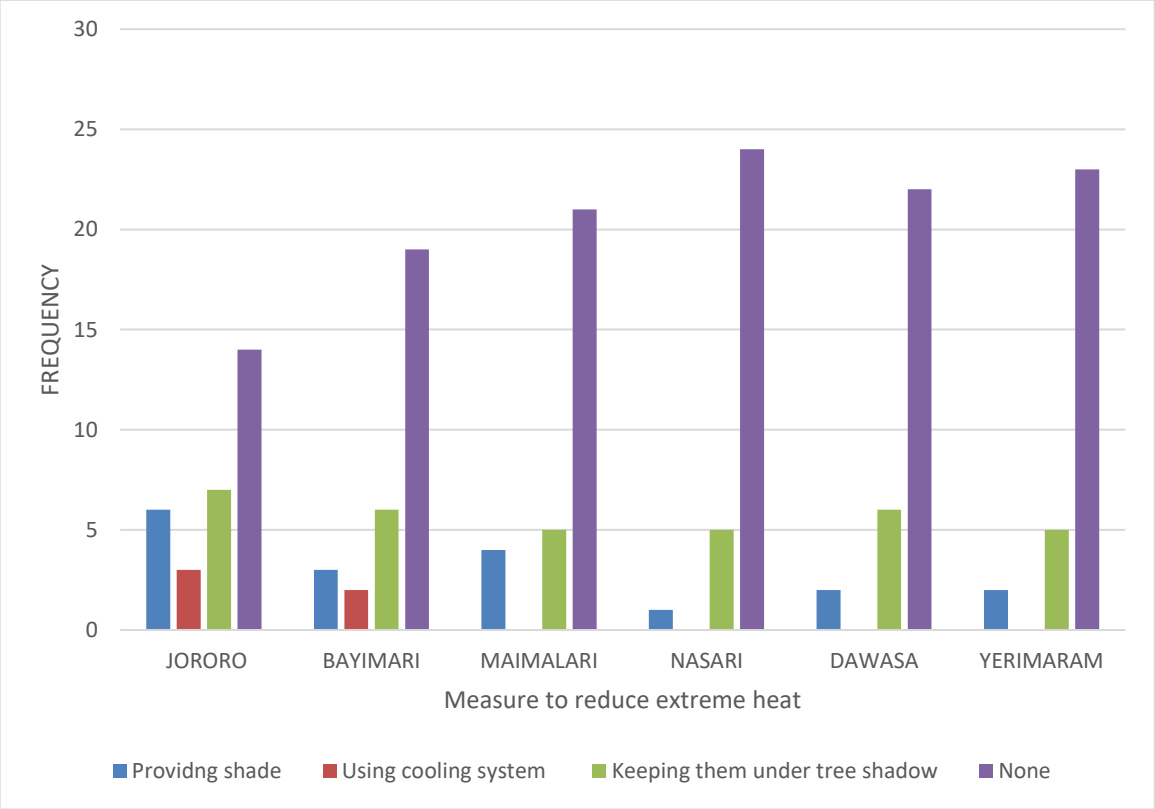

Figure 2: Measures to Reduce Heat Stress and Extreme Temperatures in Livestock

Furthermore, the respondents lamented that, heat stress lowers feed intake (Heat stress suppresses the appetite) of animal which in turn reduces their productivity in terms of milk yield, body weight and reproductive performance. Hence, according to Muluneh, (2014), high ambient temperature can adversely affect the structure and physiology of cells causing impaired transcription, translation, oxidative metabolism, membrane structure and function. The respondents based on FGD conducted also indicated that heat stress in the area had resulted in the increase in the rate of animal evaporation, that may subsequently have resulted in the animals' high water intake so as to supplement the water loses. The respondents also explained that another negative consequences of high temperature is that whenever there is extreme temperature rate, the intensity of the heat may stop the animals from forage browsing, hence this may lead to malnutrition. In other word the respondents explained that the heat may, induce physiological and behavioral changes that contribute to a decrease in production and reproduction, and could impair immune function. Furthermore, the findings of this research based on the FGD shows that heat stress may cause the problem of liver-fluck disease that usually hinder the growth and development of animals in the area.

The findings of this research based on FGD also shows that in responding to the problem of heat stress in the area, some of the pastoralists adopted early morning grazing, keeping animals under the tree Shadow, preserving water to cope with high evaporation. The agropastoralists of the study area reveals that they use to walk out early in the morning with their animals for grazing to avoid the effects of sunlight. They also added that whenever there is high temperature they use to move their animals from grazing ground to the tree shadow (especially the weak ones). Moreover, the respondents added that they use to preserved water for the animals so as to cope with high evaporation. Moreover, the findings go in-line with report of FAO (2010) report that basically, there are three resilient scenarios that may lead to a better way of coping with the negative consequences of climate variability and associated drivers of disease, pest dynamics and the overall health status of animals as: Preventive veterinary husbandry, Adjustment of animal husbandry and social resilience.

Conclusion and Recommendations

It was concluded that, climate variability (extreme temperature) had significantly affects livestock production in Yobe State, Nigeria, with heat stress being a major obstacle to animal growth and development. The lack of adoption of heat stress mitigation measures exacerbates the issue. It was also recommended that there is need for the pastoralists to seriously, implement heat stress mitigation strategies such as by Providing shade, use cooling systems, and adopt early morning grazing to reduce heat stress. There is also need to enhance veterinary services, through preventive veterinary husbandry and adjust animal husbandry practices to cope with climate variability.

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