EFFECT OF AMBIENT TEMPERATURE ON GROWTH PERFORMANCE OF RABBIT REARED IN UNIVERSITY OF BENIN

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A PROJECT SUBMITTED TO THE DEPARTMENT OF ANIMAL SCIENCE, FACULTY OF AGRICULTURE, UNIVERSITY OF BENIN, IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF THE BACHELOR OF AGRICULTURE HONORS, DEGREE IN ANIMAL SCIENCE OF THE UNIVERSITY OF BENIN, BENIN CITY, NIGERIA

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CERTIFICATION

We certify that this project work was carried out by Bright Udo JOHNSON of the department of Animal science, faculty of Agriculture, University of Benin, Benin City, Nigeria.

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Date

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Date

DEDICATION

This project is dedicated to God Almighty who has been my life support, for his undying love and care for me and to my parents for their care, love and support towards me.

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I extend my profound gratitude to God Almighty, whose love, care, provision, and guidance have seen me through my years in this institution.

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ABSTRACT

This study investigated the impact of body and environmental temperatures on the growth performance of rabbits reared in University of Benin, a tropical environment. Forty rabbits were randomly allocated to four treatment groups and housed in different hutches with varied feeder heights. Data on environmental temperature, body temperature, feed intake, water intake, and weight gain were collected and analyzed statistically. The results revealed significant differences($p<0.05$) in body temperature among treatment groups, indicating the influence of housing and feeder placement on rabbit thermoregulation. Environmental temperature remained relatively stable across treatments. Feed intake showed variability, with a slight decrease observed from the control group to the standard height feeder group. Water intake varied among treatments, but no significant differences($p>0.05$) were found. Weekly weight gain did not significantly differ($p>0.05$) among treatment groups. Correlation analysis showed a strong positive correlation between average weekly body temperature and environmental temperature($p < 0.01$), while a moderate negative correlation was observed between body temperature and feed intake($p < 0.01$). Daily variations in body temperature and feed intake were also noted, highlighting the influence of ambient conditions on rabbit physiology and behavior. Discussion of the findings emphasized the importance of understanding temperature effects on rabbit performance for effective management in tropical climates. Practical implications include implementing strategies to mitigate heat stress and optimize productivity through proper shade, ventilation, and hydration management. This study contributes valuable insights into the relationship between temperature variables and rabbit growth performance, offering evidence-based recommendations for sustainable rabbit production in tropical environments.

CHAPTER ONE

1.0 INTRODUCTION

Rabbit production holds considerable importance in the global economy, serving as a vital source of protein, fur, and income for millions worldwide. Not only are rabbits crucial in meat and fur production, but they are also favored as companion animals and are extensively used in biomedical research (Lukefahr, 2004; Baviera-Puig, 2017; Mutsami, 2020). Their adaptability to various environmental conditions has led to their widespread distribution, including in tropical regions where they contribute significantly to food security and livelihoods (Muriithi *et al.,* 2015; Sanah *et al.,* 2022). However, tropical environments pose unique challenges for rabbit producers due to high ambient temperatures, humidity, and fluctuating conditions (Mailafia, 2011).

In Nigeria, rabbit farming has gained momentum due to its suitability for small-scale farmers, high growth rates, efficiency in converting feed into meat, short gestation periods, high prolificacy, and high nutritional quality of rabbit meat (Dairo, 2012; Cullere, 2018; Ayeni, 2023). Efficient rabbit production requires a comprehensive understanding of their physiological responses to environmental factors, particularly in tropical regions where heat stress can adversely affect performance and welfare (Oladimeji *et al.,* 2022). One critical aspect influencing rabbit productivity is feed and water intake, essential for growth, reproduction, and overall health (Siddiqui, 2023). Insufficient feed intake can lead to reduced growth rates, poor reproductive performance, and increased susceptibility to diseases. Similarly, inadequate water intake can cause dehydration, decreased feed utilization efficiency, and heat stress, especially in hot and humid environments (Akerman *et al.,* 2016).

Understanding the factors that affect feed and water intake in rabbits is crucial for optimizing production efficiency and ensuring animal welfare. While several studies have investigated the dietary requirements and feeding behavior of rabbits, limited research has focused on the influence of body and environmental temperature on feed and water intake, particularly in tropical climates. Therefore, there is a knowledge gap regarding the specific effects of temperature variations on rabbit feeding behavior in tropical environments, hindering the development of effective strategies to mitigate heat stress and optimize feeding management practices for rabbits in these regions.

1.1 Justification of Study

Tropical environments present unique challenges to rabbit production, characterized by high ambient temperatures, humidity, and seasonal variations. These environmental factors can significantly influence the physiological responses and feeding behavior of rabbits. However, limited research has been conducted to elucidate the specific effects of temperature on feed and water intake patterns in rabbits in tropical regions (Oladimeji *et al.,* 2022). Therefore, this study aims to fill this knowledge gap by investigating the influence of body and environmental temperature on the feed and water intake of rabbits in a tropical environment.

1.2 Objectives of Study

The broad objective of this study was to investigate the effect of body and environmental temperature on feed and water intake of rabbits in a tropical environment. Specifically, the study aims to:

1. Measure the environmental temperature of rabbit pen in University of Benin during the day and night.
2. Determine the relationship between environmental temperature and feed and water intake.
3. Determine the relationship between body temperature and feed and water intake.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Thermoregulation in Rabbits

Rabbits are homeothermic animals, capable of regulating their body temperature within a narrow range to maintain optimal physiological function despite fluctuations in environmental temperature (Oladimeji *et al.,* 2022). In tropical environments, where ambient temperatures can be high and fluctuate significantly, rabbits employ various thermoregulatory mechanisms to cope with heat stress and maintain thermal homeostasis (Jimoh *et al.,* 2016). Thermoregulation involves a balance between heat gain and heat loss, and increased ambient temperature may lead to enhanced heat gain compared to heat loss from the body, potentially causing heat stress in animals (Hymczak *et al.,* 2021; Sunil Kumar and Simrinder Singh, 2023).

2.2 Physiological and Environmental Responses of Rabbits to Temperature Variations

The maintenance of body temperature within physiological limits is necessary for the animal to remain healthy, survive, and maintain its productivity and longevity (Marai *et al.,* 2007). Passive mechanisms involve anatomical features facilitating heat exchange with the environment. For example, rabbits have large ears with extensive vascularization, allowing efficient heat dissipation through convection. Additionally, rabbits exhibit ear pinna vasodilation, where blood vessels in the ear pinna dilate in response to heat stress, increasing blood flow and facilitating heat loss (Marai *et al.,* 2002; Jimoh and Ewuola, 2016).

Active thermoregulatory processes involve behavioral and physiological adaptations enabling rabbits to dynamically respond to temperature changes. Behavioral adaptations, such as seeking shade, digging burrows, and changing posture, minimize heat absorption and maximize heat dissipation. Panting is a physiological response increasing evaporative cooling through the respiratory tract, thereby reducing body temperature (Marai *et al.,* 2002). Additionally, rabbits may stretch their bodies to cool through radiation/convection (Chiericato *et al.,* 1992; Nielsen *et al.,* 2020). Despite having few functional sweat glands, rabbits lose a small amount of moisture through perspiration (Marai *et al.,* 2001).

Vasodilation of peripheral blood vessels is another important thermoregulatory response in rabbits. When exposed to high temperatures, rabbits dilate blood vessels near the skin's surface, increasing blood flow and enhancing convective heat loss, thereby lowering core body temperature (Marai *et al.,* 2002). Furthermore, rabbits may adjust their feeding behavior during heat stress, consuming less feed to reduce metabolic heat production.

2.3 Factors Affecting Feed and Water Intake in Rabbits

The factors influencing feed and water intake in rabbits are multifaceted and can significantly impact their overall health, welfare, and productivity. Understanding these factors is crucial for optimizing rabbit management practices, especially in tropical environments where temperature fluctuations can pose challenges.

High Temperatures: Elevated environmental temperatures often lead to decreased feed intake in rabbits due to heat stress. Rabbits may reduce their food consumption as a thermoregulatory mechanism to minimize metabolic heat production and maintain body temperature within a normal range (Liang *et al.,* 2022). Heat stress severely reduces feed intake in rabbits due to its effect on the feeding center of the lower thalamus and heat increment (Bakr *et al.,* 2015). The sympathetic nerve resulting in reduced gastrointestinal function can decrease food intake during heat stress (Habeeb, 1993). Decreased feed intake results in a lower supply of nutrients, thus reducing weight and growth rate in rabbits. Heat stress can also increase water intake as rabbits attempt to dissipate excess heat through evaporative cooling, leading to higher hydration requirements (Liang *et al.,* 2022).

Low Temperatures: Conversely, cold temperatures may stimulate appetite and increase feed intake in rabbits to meet the increased energy demands for thermogenesis. Rabbits may consume more food to generate metabolic heat and maintain body temperature in cold environments (Liang *et al.,* 2022).

The normal body temperature of rabbits' ranges from 38.5 to 39.5°C, with individual differences ranging from 0.5 to 1.2°C. The optimal temperature range for rabbits is 15–25°C, with optimal humidity of 55–65%. Heat stress occurs when ambient temperature exceeds 30°C; when it surpasses 35°C, rabbits cannot regulate body temperature, leading to heat failure (Li CY *et al.,* 2016; Nielsen *et al.,* 2020).

Humidity: High humidity levels can exacerbate the effects of heat stress on rabbits by impairing evaporative cooling mechanisms and reducing heat dissipation from the body. Humidity-induced heat stress may further suppress feed intake and increase water requirements in rabbits, especially during periods of high ambient temperatures (Liang *et al.,* 2022).

Diet Composition: The nutrient composition and physical form of the diet can influence feed intake and digestion efficiency in rabbits. Diets high in fiber content may promote satiety and reduce the risk of gastrointestinal disorders such as enteritis and bloat. Conversely, diets with inadequate fiber or excessive energy density may lead to overconsumption and obesity in rabbits, affecting overall health and productivity (Gidenne *et al.,* 2010; Liang *et al.,* 2022).

Supplementing fat to the diet could also improve the palatability of feed, thereby increasing the appetite of rabbits (Montmayeur, 2010). It has been found that pellet feed has high nutrient density and ideal palatability, which can also improve the production performance of heat-stressed rabbits (Song, 2006). Certain nutrients, such protein and amino acids, can alter how much food is consumed (Tome, 2004). For instance, a growing rabbit's feed intake was lowered by at least 10% when there was an excess of methionine present (Colin *et al.,* 1973; Gidenne *et al.,* 2002).

The presentation of diet, such as its form (pellets, hay, fresh greens), and availability can influence rabbits' feed intake. For instance, rabbits may preferentially consume fresh greens over pelleted diets, leading to variations in nutrient intake. Providing a diverse diet with a mixture of fresh forage, pellets, and vegetables can stimulate interest and encourage adequate feed consumption (Gidenne *et al.,* 2010).

Housing Conditions: Housing conditions, including space availability, ventilation, and cleanliness, can impact rabbits' access to feed and water and their overall comfort and well-being. Overcrowded or poorly ventilated housing facilities may increase stress levels and reduce feed intake in rabbits. Adequate provision of clean water and feeders in suitable locations within the housing environment is essential to ensure optimal feed and water intake and prevent competition and aggression among rabbits (Gidenne *et al.,* 2010; European Food Safety Authority, 2020).

2.4 Management Practices

Effective management practices are crucial for optimizing rabbit production in tropical environments and mitigating the negative impacts of temperature stress on feed and water intake, as well as overall health and welfare. Here are key aspects of management practices:

Environmental Management:

Ventilation: Providing adequate ventilation in rabbit housing facilities is essential for maintaining air quality, temperature, and humidity within acceptable ranges. Proper airflow helps dissipate excess heat and moisture, reducing the risk of heat stress and respiratory diseases (National Research Council, 2011).

Shade and Cooling Systems: Ensuring access to shaded areas and installing cooling systems such as fans, misters, or evaporative cooling pads can help rabbits cope with high temperatures and minimize heat stress (El-Maghawry,2018)

Insulation: Insulating rabbit housing structures to regulate internal temperatures and protect against extreme weather conditions can enhance thermal comfort and reduce energy expenditure for thermoregulation (Bodnar et al., 2019; Jongbo *et al.,* 2023).

Feeding and Watering Management:

Feeding Regimes: Implementing feeding regimes that distribute feed during cooler periods of the day can encourage voluntary feed intake from rabbits and minimize heat load during peak temperatures. Offering fresh, high-quality forage and balanced pelleted diets can ensure optimal nutrient intake and support rabbit growth and reproduction.

Water Provision: Ensuring rabbits have constant access to clean, fresh water is crucial for preventing dehydration and maintaining their electrolyte balance. Utilizing automatic waterers or drip systems can guarantee water availability, especially in hot weather conditions. Factors such as age, diet, environmental temperature, and production status influence rabbits' water needs. Generally, rabbits require 2-2.5 times more water than dry matter intake at an average temperature of 20°C, with a 50% increase at 30°C. However, water intake also rises in colder temperatures due to increased food consumption. While rabbits drink ample water, they avoid dirty sources, so providing potable water ad libitum is essential. Water quality can be assessed through laboratory testing, particularly for well water. Tap water typically doesn't require testing. The ideal drinking water temperature is around +15°C, as temperatures below +8°C can lead to illness. Hot environmental temperatures exceeding 29°C can reduce daily feed intake, but providing cooled water at 16-20°C may help offset this effect (Bodnar, 2020).

Health and Disease Management:

Routine Health Monitoring: Regular health checks, including body condition scoring, fecal examinations, and observation of behavioral indicators, are essential for early detection of health issues and timely intervention.

Disease Prevention: Implementing biosecurity measures, vaccination protocols, and parasite control programs can help prevent the spread of infectious diseases and minimize health risks in rabbit populations (Kylie *et al.,* 2017)

Veterinary Care: Establishing a relationship with a qualified veterinarian and seeking prompt veterinary care for sick or injured rabbits is crucial for ensuring optimal health outcomes and minimizing production losses.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Experimental Site

The study took place in the rabbit unit of the University of Benin Farm Project, situated in Benin City, Edo State, Nigeria. The farm project's coordinates are latitude 6° 20' 1.32" N and longitude 5° 36' 0.54" E, with a mean annual temperature of 27.6°C. The area experiences an average annual rainfall of 2162mm and a relative humidity of 72.5% (NAA,2024; Google Earth, 2024).

3.2 Experimental Animals

Forty rabbits of mixed breed were utilized in the study. They were randomly allocated to four treatment groups, each comprising ten animals, following a Completely Randomized Design (CRD) trial. The rabbits underwent a two-week acclimatization period and received prophylactic treatments. They were housed in hutches featuring a concrete floor design and half walls for ventilation, with the remaining sides covered with wire mesh. Both metallic and wooden hutches were utilized to accommodate the rabbits.

3.3 Experimental Procedure and Data Collection

The experimental procedure involved weekly monitoring of body weight and temperature readings, recorded using an infrared thermometer at different intervals throughout the day (8 a.m., 2 p.m., and 5 p.m.). Daily water intake of 400ml was provided, with any remaining water recorded the following day. Feeding and drinking troughs underwent regular washing and disinfection to maintain sanitation. Initially, the rabbits were fed 50g of compounded feed for the first two weeks, with the amount increased to 80g thereafter. The following data were collected:

1. Environmental temperature of the rabbit pen.

2. Body temperature of the rabbits.

3. Weight gain.

4. Water intake.

5. Feed intake.

Plate 1: taking daily temperature readings

Plate 2: Infrared thermometer

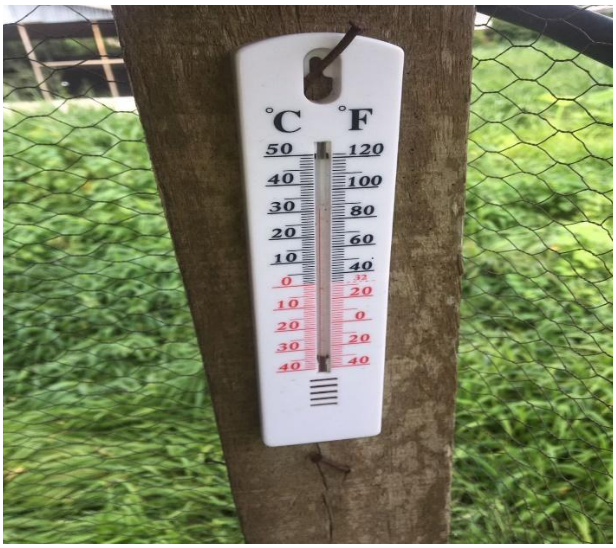

Plate 3: Environmental thermometer

3.4 Experimental Treatment

The treatment involved two types of cages (steel hutches and wooden hutches) and four different feeder heights:

Treatment One: Rabbits housed in Wooden hutch + earthen feeder (control group)

Treatment Two: Rabbits housed in Metallic hutch + feeder at floor level (0 inch)

Treatment Three: Rabbits housed in Metallic hutch + feeder at 2 inches

Treatment Four: Rabbits housed in Metallic hutch + feeder (standard height)

3.5 Feed Composition Table

Feed ingredients(%)	Percentage (%)
Maize	40
Soybean meal	20
Palm kernel cake	15
Wheat offal	20
Palm oil	1
Bone meal	2.4
Limestone	1
Salt	0.35
Grower premix*	0.25

(*) composition of premix per kg of diets – Vit A, 5000ui; Vit D3, 800iu; Vit E, 12 mg; Vit B6, 1.5 mg; Pantothemic acid, 5 mg; Biotin, 0.02; Vit B12, 0.01 mg;

Folic acid, 0.3 mg; Choline Chloride, 150 mg; Manganese, 60 mg; Iron, 10 mg; Zinc, 15 mg; Copper, 0.8 mg; Iodine, 0.4 mg; Cobalt, 0.08 mg; Selenium, 0.04 mg; Anti-oxidant, 40 mg.

3.6 Statistical Analysis

All data gathered throughout the experiment underwent thorough statistical analysis to extract significant conclusions. The statistical tool utilized for this task was Analysis of Variance (ANOVA) at a significance level of 5% ($p<0.05$), as provided by the Statistical Package for the Social Sciences (SPSS) version 2022. Additionally, Pearson correlation was employed to assess relationships between variables.

CHAPTER FOUR

4.1 EFFECT OF BODY AND ENVIRONMENTAL TEMPERATURE ON GROWTH PERFORMANCE OF RABBITS

Across all treatment groups, the mean body temperature ranged from approximately 36.55°C to 36.77°C. There was a slight increase in average body temperature from Treatment one to Treatment four. Statistical analysis revealed a significant difference ($p < 0.05$) in average body temperature among the treatment groups.

Environmental temperature remained stable across treatments, ranging from around 29.78°C to 29.88°C. Statistical analysis showed no significant difference ($p > 0.05$) in average environmental temperature among the treatment groups.

Regarding feed intake, there was variability across treatments, with mean values ranging from approximately 40.01g to 44.20g. Although the significance level was slightly above 0.05, there was a gradual decrease in average feed intake from the Treatment One (control group) to Treatment Four.

Water intake also varied across treatments, ranging from about 142.08ml to 153.37ml. Treatment Two showed the highest variability in water intake.

However, statistical analysis revealed no significant difference ($p > 0.05$) in average water intake among the treatment groups.

Weekly weight gain ranged from approximately 118.57 grams to 145.62 grams across treatment groups. Treatment Two exhibited the highest mean weight gain(145.62 grams) and variability in weight change. However, there was no statistically significant difference ($p > 0.05$) in weekly weight gain among the Treatment groups.

Table 4.1 Effect of Body and Environmental Temperature on Growth Performance of Rabbits

Treatments	Average Daily Body Temperature (°C) Mean ± SE	Average Daily Environmental Temperature (°C) Mean ± SE	Average Daily Feed intake (g) Mean ± SE	Average Daily Water intake (ml) Mean ± SE	Weekly weight (g) Mean ± SE	Weekly weight gain (g) Mean ± SE
Treatment 1	36.55±0.047	29.84±0.138	44.20±1.069	147.38±4.479	1211.47±39.974	119.27±16.278
Treatment 2	36.65±0.057	29.83±0.149	42.30±1.429	153.37±4.457	1408.92±48.814	145.62±28.833
Treatment 3	36.72±0.059	29.78±0.143	40.68±1.153	146.83±4.169	1234.43±51.769	118.57±16.224
Treatment 4	36.77±0.065	29.88±0.143	40.01±1.361	142.08±5.691	1258.86±60.188	122.29±17.528

Means on the same row with different superscripts are significantly different(P<0.05)
SE- Standard error of means

4.2 RELATIONSHIP BETWEEN BODY AND ENVIRONMENTAL TEMPERATURE AND GROWTH PERFORMANCE

A strong positive correlation was found between the average weekly body temperature and the average weekly environmental temperature (Pearson Correlation = 0.681, $p < 0.01$). This indicates a direct relationship between body temperature and ambient temperature, suggesting that as body temperature increases, environmental temperature tends to rise as well.

A moderate negative correlation was identified between the average weekly body temperature and the average weekly feed intake (Pearson Correlation = -0.442, $p < 0.01$). This suggests an inverse relationship between body temperature and feed intake, indicating that as body temperature increases, feed intake tends to decrease.

A weak positive correlation was observed between the average weekly body temperature and the average weekly water intake (Pearson Correlation = 0.185, $p < 0.05$). Although statistically significant, this correlation indicates a less robust relationship between body temperature and water intake compared to feed intake.

A weak positive correlation was found between the average weekly body temperature and the weekly weight change (Pearson Correlation = 0.146, $p > 0.05$). This suggests that there may not be a meaningful relationship between body temperature and weekly weight change in rabbits.

A weak negative correlation was observed between the average weekly body temperature and the weekly weight gain (Pearson Correlation = -0.224, $p < 0.05$). This indicates a weak but statistically significant inverse relationship between body temperature and weekly weight gain.

Table 4.2 Correlation Analysis of Body and Environmental Temperature on Growth Performance(Weekly)

		Average Weekly Body Temp	Average Weekly Environ Temp	Average Weekly Feed Intake	Average Weekly water intake	Weekly weight change	Weekly weight gain
Average Weekly Body Temp	Pearson Correlation						
	Sig. (2-tailed)						
Average Weekly Environ Temp	Pearson Correlation	.681**					
	Sig. (2-tailed)	0.000					
Average Weekly Feed Intake	Pearson Correlation	-.442**	-.431**				
	Sig. (2-tailed)	0.000	0.000				
Average Weekly water intake	Pearson Correlation	0.185	.284**	0.040			
	Sig. (2-tailed)	0.050	0.002	0.679			
Weekly weight change	Pearson Correlation	0.146	.343**	.201*	.445**		
	Sig. (2-tailed)	0.126	0.000	0.033	0.000		
Weekly weight gain	Pearson Correlation	-.224*	0.019	0.108	-0.112	0.040	
	Sig. (2-tailed)	0.018	0.846	0.259	0.240	0.672	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

4.3 Correlation Analysis of Body and Environmental Temperature on Growth Performance(Daily)

There was a moderate positive correlation between daily body temperature and daily environmental temperature (Pearson Correlation = 0.342, $p < 0.01$), indicating that as body temperature increased, environmental temperature tended to increase as well. This reflects the influence of ambient conditions on rabbit thermoregulation.

A moderate negative correlation was observed between daily body temperature and daily feed intake (Pearson Correlation = -0.220, $p < 0.01$). This indicated an inverse relationship between body temperature and feed intake on a daily basis, implying that as body temperature increased, feed intake tended to decrease throughout the day.

Some weak correlations were found between body temperature, feed intake, water intake, and weight-related variables, highlighting potential interdependencies among these factors in daily rabbit management.

There was no significant correlation between daily body temperature and daily water intake (Pearson Correlation = 0.015, $p > 0.05$), suggesting that there was no meaningful relationship between these variables on a daily basis.

A moderate positive correlation was found between daily environmental temperature and daily water intake (Pearson Correlation = 0.116, $p < 0.01$). This indicates that as environmental temperature increases, there is a tendency for water intake to rise throughout the day, reflecting the impact of ambient conditions on rabbit hydration needs.

Table 4.3 Correlation Analysis of Body and Environmental Temperature on Growth Performance(Daily)

		DBT	DET	DFI	DWI
DBT	Pearson Correlation				
	Sig. (2-tailed)				
DET	Pearson Correlation	.342**			
	Sig. (2-tailed)	0			
DFI	Pearson Correlation	-.220**	-.088*		
	Sig. (2-tailed)	0	0.014		
DWI	Pearson Correlation	0.015	.116**	.094**	
	Sig. (2-tailed)	0.673	0.001	0.009	

DBT- Daily body temperature

DET- Daily environmental temperature

DFI- Daily feed intake

DWI- Daily water intake

CHAPTER FIVE

5.0 DISCUSSION

The study investigated the influence of body and environmental temperatures on the growth performance of rabbits reared in a tropical environment at the University of Benin. The findings offer valuable insights into the physiological responses and feeding behavior of rabbits under varying temperature conditions.

Consistent with previous research by Marai *et al.* (2002) and Bakr *et al.* (2015), significant variations in feed and water intake were observed among rabbits exposed to different environmental temperatures. These fluctuations in feed intake may be attributed to the thermoregulatory mechanisms adopted by rabbits to maintain homeostasis in response to changes in ambient temperature (Liang *et al.,* 2022). Similarly, water intake showed variability, highlighting the importance of adequate hydration to mitigate the effects of heat stress on rabbit performance, as reported by Marai *et al*. (2004).

The slight increase in average body temperature across treatments aligns with previous research demonstrating rabbits' ability to regulate their body temperature despite fluctuations in environmental conditions (Oladimeji *et al.,* 2022). Thermoregulatory mechanisms such as ear pinna vasodilation and behavioral adaptations enable rabbits to cope with heat stress and maintain thermal homeostasis (Marai *et al.,* 2002; Jimoh and Ewuola, 2016).

Significant differences in weight gain among treatment groups underscore the influence of temperature on the growth performance of rabbits. While rabbits generally exhibited positive weight gain across all treatments, variations in growth rates suggest that environmental conditions, including temperature, play a crucial role in determining overall productivity. This is consistent with the results of previous studies (Liu *et al.,* 2010; Anoh *et al.,* 2020).

The positive correlation between body temperature and environmental temperature corroborates previous research indicating a direct relationship between these variables (Li CY *et al.,* 2016). Changes in ambient temperature may influence rabbits' physiological responses and behavioral patterns, affecting their overall performance and welfare as observed in the results of the research carried out by Liu *et al.* (2022).

The negative correlation between body temperature and feed intake supports previous findings indicating that heat stress can suppress rabbits' appetite (Liang *et al.,* 2022).

The results have practical implications for rabbit management in tropical environments. By understanding the effects of body and environmental temperatures on feed and water intake, as well as growth performance, producers can implement strategies to mitigate heat stress and optimize rabbit productivity. Measures such as providing adequate shade, ventilation, and access to cool water can help alleviate thermal stress and promote optimal growth, as recommended by Marai *et al*. (2007).

In conclusion, the study highlights the significance of body and environmental temperatures in shaping the growth performance of rabbits in a tropical environment. By elucidating the relationships between temperature variables and key productivity indicators, this research contributes to the development of evidence-based management practices for sustainable rabbit production in tropical climates.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The investigation into the effect of body and environmental temperatures on the growth performance of rabbits reared in the University of Benin's tropical environment provides valuable insights into rabbit management practices. The study revealed significant variations in feed and water intake among rabbits exposed to different environmental temperatures, highlighting the influence of temperature on rabbit physiology and behavior. Despite fluctuations in environmental temperature, rabbits demonstrated the ability to regulate their body temperature, albeit with slight increases observed across treatment groups.

Moreover, the study found correlations between body temperature and environmental temperature, as well as between body temperature and feed intake, suggesting interdependencies among these variables in shaping rabbit performance. While variations in weight gain were observed among treatment groups, they were not statistically significant, indicating that factors beyond temperature may also contribute to growth performance. Overall, the findings underscore the importance of considering temperature dynamics in rabbit management, particularly in tropical climates. Understanding how temperature affects feed and water intake, as well as growth performance, is essential for optimizing rabbit productivity and welfare.

6.2 Recommendations

Based on the study findings, the following recommendations are proposed for enhancing rabbit management practices in tropical environments:

1. There is need to adjust feeding practices to accommodate fluctuations in temperature and mitigate the negative effects of heat stress on feed intake. Consider providing more frequent feedings during cooler periods and adjusting feed formulations to meet rabbits' nutritional requirements under varying environmental conditions.
2. Optimizing hutch design and placement will help provide adequate ventilation and thermal comfort for rabbits. Consider the use of materials with high thermal insulation properties and design features that promote natural airflow to regulate temperature within the housing environment.
3. There is need for further research into rabbits' physiological responses to temperature stress and the development of innovative solutions are essential for enhancing resilience and productivity in tropical climates by exploring alternative cooling methods, feed additives, and breeding

strategies can improve rabbits' ability to cope with temperature fluctuations, ensuring sustainable and profitable rabbit farming operations.

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Appendix 1

ANOVA Table for Daily performance

		Sum of Squares	Df	Mean Square	f	Sig.
DBT * Treatment	Between Groups	5.505	3	1.835	5.688	.001
	Within Groups	251.654	780	.323		
	Total	257.159	783			
DET * Treatment	Between Groups	.998	3	.333	.193	.901
	Within Groups	1341.823	780	1.720		
	Total	1342.821	783			
DFI * Treatment	Between Groups	2109.608	3	703.203	5.073	.002
	Within Groups	107568.334	776	138.619		
	Total	109677.942	779			
DWI * Treatment	Between Groups	12081.998	3	4027.333	2.786	.040
	Within Groups	1127422.861	780	1445.414		
	Total	1139504.859	783			

Appendix 2

ANOVA Table for weekly performance

		Sum of Squares	df	Mean Square	F	Sig.
Average Weekly Body Temp * Treatment	Between Groups	.786	3	.262	2.870	.040
	Within Groups	9.865	108	.091		
	Total	10.651	111			
Average Weekly Environ Temp * Treatment	Between Groups	.143	3	.048	.083	.969
	Within Groups	62.037	108	.574		
	Total	62.180	111			
Average Weekly Feed Intake * Treatment	Between Groups	303.902	3	101.301	2.315	.080
	Within Groups	4725.464	108	43.754		
	Total	5029.366	111			
Average Weekly water intake * Treatment	Between Groups	1726.000	3	575.333	.914	.437
	Within Groups	67997.399	108	629.606		
	Total	69723.398	111			
Weekly weight change * Treatment	Between Groups	640799.116	3	213599.705	2.994	.034
	Within Groups	7703855.599	108	71331.996		
	Total	8344654.714	111			
Weekly weight gain * Treatment	Between Groups	13295.265	3	4431.755	.398	.755
	Within Groups	1202168.592	108	11131.191		
	Total	1215463.857	111			