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MEASURES ADOPTED BY POULTRY FARMERS IN COMBATING HEAT STRESS IN KATSINA, NIGERIA

BY

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ABSTRACT

Heat stress poses significant challenges for poultry farmers, impacting bird welfare and productivity. This study aims to investigate the measures adopted by poultry farmers in combating heat stress and analyze the demographic characteristics of the participants in Katsina local government area of Katsina state, Nigeria. A total of 20 poultry farmers participated in the study, providing information through surveys on age, sex, marital status, type of production, number of birds, and system of production. Additionally, data on heat stress awareness, its effects on birds, measures taken, and their effectiveness were collected. The findings indicate a high level of awareness among poultry farmers regarding heat stress. Common measures adopted include increasing ventilation systems, increased water availability, giving electrolytes and vitamins, shaded areas, dietary adjustments, and management practices. The effectiveness of the measures varied, with a majority of farmers reporting them as partially effective. The study provides valuable insights into the measures adopted by poultry farmers, it recommends targeted education and awareness campaigns to further enhance knowledge and understanding of effective heat stress management practices and also adoption of advanced technologies, such as automated environmental monitoring systems and improved ventilation designs.

Keywords: Poultry, Heat Stress, Ventilation Systems, Electrolytes

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INTRODUCTION

With an increasing global population and mounting concerns about nutritional deficiencies, ensuring a sustainable and adequate food supply is essential. As dietary patterns transition and nutritional requirements become more complex, it is crucial to explore sustainable protein production options that can contribute to food security and human well-being. Poultry, particularly chickens, have emerged as a critical source of animal protein worldwide. The world's population is projected to exceed 9 billion by 2050, accompanied by an increased demand for food, particularly protein-rich sources (FAO, 2017). Meeting these demands poses significant challenges, given limited resources and concerns about environmental sustainability. Furthermore, malnutrition, including protein deficiency, continues to be a persistent issue in many regions, adversely affecting health and overall development (Popkin et al., 2012). Thus, adopting efficient and sustainable protein production systems becomes paramount.

Poultry production offers a viable solution to address these challenges and fulfill the nutritional requirements of a growing population. Poultry, such as chicken, presents several advantages which includes high-quality protein. Poultry meat and eggs are excellent sources of high-quality protein, containing all essential amino acids necessary for human health and growth. Poultry production is also accessible and affordable; their products are relatively affordable compared to other animal protein sources, making them accessible to a wide range of consumers, including low-income populations. Poultry production systems have a relatively small ecological footprint compared to other livestock species. Chickens are efficient converters of feed into high-quality protein, requiring less land, water, and resources compared to larger animals (Abbas et al., 2021). Thus poultry production is efficiency and environmental friendly.

Heat stress is a significant challenge faced by livestock and poultry worldwide, as rising temperatures and extreme weather events become increasingly common due to climate change. Heat stress negatively affects animal health, welfare, productivity, and overall profitability of livestock operations. Heat stress disrupts the thermoregulatory mechanisms of animals, leading to various physiological effects, including an increase in body temperature, which impairs metabolic processes and compromises overall animal health (Faisal and Riaz, 2019). It adversely affects feed intake, leading to reduced nutrient absorption and lower feed conversion efficiency. Heat stress impacts reproductive performance, resulting in reduced fertility, poor conception rates, and decreased milk production in dairy animals. Animals exposed to heat stress may display changes in behavior, such as reduced activity levels, seeking shade, or increased water intake. Severe heat stress can even lead to heatstroke and increased mortality rates.

Heat stress is a significant concern in poultry farming, particularly in regions with high temperatures such as Katsina, Nigeria. Katsina located in Katsina state northern Nigeria, experiences high temperatures and a dry climate, posing a considerable challenge for poultry farmers in the region. Geographically, Katsina State lies within the Sudano-Sahelian ecological zone, characterized by a semi-arid climate with two distinct seasons: a dry season and a rainy season. The dry season usually lasts from October to May, while the rainy season is relatively short, occurring between June and September. The state experiences high temperatures, with average annual temperatures ranging from 27 to 30 degrees Celsius.

The thermoneutral zone is the temperature range within which poultry can maintain normal physiological functions without expending extra energy to regulate their body temperature (Lara and Rostagno, 2013). However, when temperatures rise above this range, poultry experience increased heat load and may struggle to dissipate excess heat, leading to reduced performance and health complications. To address the negative consequences of heat stress, both nutritional and environmental interventions have been explored. Despite the recognized importance of these measures, there is still a need to understand their adoption and effectiveness among poultry farmers in Katsina, Nigeria. This study aims to fill this knowledge gap by conducting a survey on the measures adopted by poultry farmers in combating heat stress and evaluating their outcomes.

The objective of the survey is to identify measures adopted by poultry farmers in combating heat stress in selected poultry farms in Katsina, Nigeria. Katsina is located in northern Nigeria, experiences high temperatures and a dry climate, thus posing a considerable challenge for poultry farmers in the region. To overcome these challenges, it is believed that poultry farmers in Katsina have implemented several measures to mitigate the adverse effects of heat stress.

METHODOLOGY

STUDY AREA

Katsina State, located in northern Nigeria, is known for its agricultural activities, including poultry production. The region's geographical location and climate play a significant role in determining the type and scale of poultry farming practiced.

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Study Design

A quantitative research design was employed to gather data on the measures adopted by poultry farmers to combat heat stress. A survey research method was specifically utilized to collect information from a representative sample of poultry farmers.

Sampling

The target population consisted of poultry farmers in the study area (Katsina LG). Stratified random sampling was employed to ensure representation of different farm sizes and production systems. A random selection process was used to determine the desired number of respondents based on sample size calculations to achieve a representative sample of 20 respondents.

Questionnaire Development

A structured questionnaire was developed to focus on the measures implemented by poultry farmers to combat heat stress. The questionnaire included closed-ended and open-ended questions to capture quantitative data on specific practices and gather qualitative insights.

Question formulation prioritized clarity, relevance, and logical flow to ensure participant understanding and accurate responses.

Data Collection

Twenty (20) questionnaires were administered to the representative sample of poultry farmers in the study area. Face-to-face interviews to fill the questionnaires were conducted. Clear explanations were provided during the interviews to ensure accuracy of responses which were recorded.

Data Analysis

The collected data was coded and entered into a statistical analysis software package (MS Excel). Appropriate statistical techniques, including descriptive statistics and frequency analysis were employed to analyze the quantitative data.

RESULTS AND DISCUSSION

Demographic Characteristics of Participants

A total of 20 poultry farmers participated in the survey. The demographic characteristics of the participants are presented in Table 1.

Table 1: Demographic Characteristics of Respondents

Characteristics	Frequency	Percentage (%)
Sex		
Male	14	70
Female	6	30
	20	
Marital Status		
Single	4	20
Married	16	80
	20	
Age		
20 – 30	3	15
30 – 40	8	40
40 – 50	9	45
	20	
Educational Status		
Primary Education	4	20
Secondary Education	9	45
Tertiary Education	7	35
	20	
Class of birds managed		
Layers	13	65
Broilers	7	35
Both	0	0
	20	
Flock size		
001 – 400	3	15
401 -800	6	30

Above 800	11	55
	20	
Type of housing system		
Deep litter	12	60
Battery cage	5	25
Both	3	15
	20	

Source: Field survey, 2023

The demographic characteristics of the respondents in the study area show the highest age group to be 40 – 50 years making 45% of the respondents. Age can reflect the experience, knowledge, and expertise of poultry farmers. The gender distribution among respondents is categorized as male or female. Males covered 70% of the respondents while 30% are female. The marital status of the respondents is reported as 80% married and single are 20%. The flock size of farms in the area had most (55%) of the respondents with more than 800 birds with most (65%) of them having laying birds. Most (60%) of the birds in the study area were managed under the deep litter system of production.

Table 2: Response to heat stress related questions

Characteristics	Frequency	Percentage
Are you aware of heat stress?		
Yes	20	100
No	0	0
	20	
Has heat stress affected your production?		
Yes	20	100
No	0	0
	20	
If yes above, How?		
Reduced feed intake	14	70
Decreased egg production	13	100
Reduced growth (weight)	13	65
Poor egg quality	10	50
Increased mortality	5	25
Heat-induced production diseases	4	20
Behavioral changes	3	15
Respiratory distress:	2	10
Measures taken to tackle heat stress		
Adequate ventilation systems	20	100
Increasing access to cool water	16	80
Offering shaded areas	4	20
Adjusting bird diet	2	10
Giving electrolytes and vitamins	15	75
Increasing floor space	3	15
Use of foggers	1	05
Are the measures taken effective?		

Yes	6	30
No	0	00
Partially	14	70
	20	

Source: Field survey, 2023

The survey results indicate that all the participants (100%) reported being aware of heat stress and its potential impact on their birds. This finding reflects a positive level of knowledge and understanding among poultry farmers regarding the potential risks associated with heat stress. Additionally, a notable percentage of the participants (70%) reported adverse effects of heat stress on their birds led to decreased feed intake, To keep its internal temperature from rising above its external temperature, a bird experiencing heat stress will lower its food intake (Gaughan et al., 2015, Pawar et al,. 2016). Heat stress in the chickens leads to a decrease in their feed intake due to the birds being outside their comfort zone as the birds tend to adjust to the changes in the environment (Osti et al., 2017). All the respondents (100%) in layer production indicated reduced egg production due to heat stress. Reduced growth (weight), Poor egg quality, Increased mortality, Heat-induced production diseases and Respiratory distress were all indicated to be as a result of heat stress by the respondents. These findings highlight the real-world implications of heat stress on poultry farming operations.

The study also revealed that poultry farmers employed various measures to address heat stress on their farms. The most commonly reported measures included providing adequate ventilation systems (100%), as reported by Attia *et al.* (2016) high air speed is necessary to relieve the birds during heat stress. Abbas (2021) also reported increasing ventilation is helpful to expel hot air from poultry pens. Increasing access to water (80%) was found to be a measure taken by almost all the respondents, this is in line with Holik (2010) and Abbas (2017) that reported providing adlib clean and cool water cools down the body temperature of birds. It has been reported that during heat stress (30°C - 35°C), birds tend to eat less and drink more during hot weather to reduce their body temperature (Saeed et al, 2019).

Supplementation of electrolytes is a common practice in the study area, 75% responded to give vitamins and electrolytes in combating heat stress. Electrolyte supplementation has been promising to achieve acid-base balance in birds reared in hot summer (Abbas et al., 2021; Leeson and Summer, 2001). Supplementation of vitamins in the feed and/or via drinking water can be helpful to maintain the body temperature of heat stressed birds (Attia et al. 2009, 2011, 2016; Khattak et al., 2012). Role of ascorbic acid and vitamin E is well documented in this regard. Ascorbic acid (Vitamin C) primarily synthesized by kidneys (Leeson and Summer, 2001) and helps to alleviate oxidative stress in cells and decrease cortisol level and enhances proliferation of B and T cells in birds during heat stress (Attia et al., 2009).

Most (15%) of the respondents increased floor space to combat heat stress, as reported by Donald and William (2002), high stocking rate during hot season can result in improper ventilation. Metabolic heat produced by birds and decreased loss of heat due to improper ventilation during heat stress may raise the temperature of the poultry house. Therefore floor space should be adjusted keeping in view intensity of heat stress conditions.

Two respondents making 10% of the sample population adjust the diets of the birds during heat stress conditions. The low number can be attributed to the lack of option on feed manipulation to the farmers. However, Starving or fasting birds during hot hours also help to keep calm the birds (Saeed et al., 2019). Feed withdrawal two hours before hot hours can

increase resistance against heat stress, enhances survival, and reduce heat production and mortality in birds (Yalcin et. al., 2003).

CONCLUSION

The study aimed to investigate the measures adopted by poultry farmers to combat heat stress and the demographic characteristics of the participants. Findings indicated a high level of awareness among participants regarding heat stress, with a significant proportion reporting being affected by the condition. Common measures adopted by the farmers included ventilation systems, increasing water availability, providing shaded areas, adjusting bird diets, and implementing management practices. Overall, the farmers reported these measures as partially effective in combating heat stress, although some variability in effectiveness was observed.

RECOMMENDATIONS

Based on the results of this study, the following recommendations can be made:

1. Education and Awareness: Building on the existing high level of heat stress awareness among farmers, there is a need for targeted education and awareness campaigns to further enhance knowledge and understanding of effective heat stress management practices.

2. Technology Adoption: Encouraging the adoption of advanced technologies, such as automated environmental monitoring systems and improved ventilation designs, can enhance the effectiveness and efficiency of heat stress management.

3. Research and Development: Continued research efforts are needed to explore innovative strategies and technologies for heat stress management.

REFERENCES

Abbas, G., Arshad M., Tanveer, A. J., Jabbar M. A., Arshad1, A., AL-Taey D. K. A., Mahmood, A., Khan, M. A., Konca, Y., Sultan, R. A., Qureshi, R. A. M., Iqbal, A., Amad, F., Ashraf, M., Mahmood, R. & Abbas H. (2021). Combating Heat Stress in Laying Hens A Review. Pakistan Journal of Science, 73(4), 634-655

Abbas, G., Mahmood, S. ul Haq A. & Nawaz H. (2017). Effect of dietary inclusion of sodium bicarbonate on blood profile of caged layers during summer. *Pak. J. Agri. Sci., Vol.* 54(2): 443-450.

Abreu, V.M., Nääs, I.A., & Caldara, F.R. (2019). Shade structures mitigate the negative effects of high ambient temperatures on broiler welfare and performance. Poultry Science, 98(8), 3843-3853.

Abudullahi, U., Lawal, J. R., & Abubakar, A. (2019). Heat Stress in Poultry: Understanding the Challenges and Management Strategies. Nigerian Veterinary Journal, 40(3), 189-199.

Afsana, K., Ahaduzzaman, M., Rahman, M.M., Khair, M.A., & Khan, M.R. (2015). Effects of heat stress on productive and reproductive performance of Black Australorp hens. International Journal of Livestock Research, 5(12), 61-70.

Attia, Y. A., E. H. Aelh, A. A. Abedalla, M. A. Berika, M. A.Alharthi, O. Kucuk, K.Sahin & B. M. Aboushehema (2016). Laying performance, digestibility and plasma hormones

in laying hens exposed to chronic heat stress as affected by betaine, vitamin C, and/or vitamin E supplementation, Springerplus, 5, 1619.

Attia, Y. A., R. A. Hassan & E. M. Qota (2009). Recovery from adverse effects of heat stress on slow-growing chicks in the tropics 1: Effect of ascorbic acid and different levels of betaine. Tropical Animal Health and Production, 41, 807–818.

Attia, Y. A., R. A Hassan, A. E. Tag El-Din & B. M. Abou-Shehema (2011). Effect of ascorbic acid or increasing metabolizable energy level with or without supplementation of some essential amino acids on productive and physiological traits of slow-growing chicks exposed to chronic heat stress. J. Anim. Physiol. Anim. Nutr., 95:744–755.

Donald D. B., & D. W. William (2002). Commercial Chicken Meat and Egg Production, 6th Edition, Online ISBN 978-1-4615-0811-3, Kluwer Academic Publishers.

Faisal, N. & M. Riaz (2019). Climate change in Pakistan, climate, population, and vulnerability in pakistan exploring evidence of linkages for adaptation chapter 1, pp 27

Food and Agriculture Organization (FAO) (2017). The future of food and agriculture: Trends and challenges. www.fao.org/faostat/en/ Rome: FAO

Gaughan J, & Cawdell-Smith AJ. (2015). Impact of climate change on livestock production and reproduction. In Climate change Impact on livestock: Adaptation and mitigation. Springer, New Delhi. 2015;51-60.

Gaughan, J. B., Mader, T. L., Holt, S. M., Sullivan, M. L., & Hahn, G. L. (2020). Heat stress in livestock production: Mitigation strategies for sustainable thermoregulation and productivity. Animals, 10(12), 2366.

Holik, V. (2010). Managing heat stress - Part 1 - Layers respond to hot climatic conditions Poultry world, https://www.poultryworld.net/Breeders/General/2010/3/Managing-heat-stress---Part-1---Layers-respond-to-hot-climatic-conditions-WP007271W/.

Khattak, F. M., T. Acamovic, N. Sparks, T. N. Pasha, M. H. Hussain, M. Joiya & Z. Ali (2012). Comparative efficacy of different supplements used to reduce heat stress in broilers. Pak. J. Zool. 44: 31.

Lara, L.J., & Rostagno, M.H. (2013). Impact of heat stress on poultry production. Animals, 3(2), 356-369.

Leeson, S., & J. D. Summers (2001). Scott's nutrition of the chicken. 4th Ed. University Books; Guelph, Ontario, Canada

Osti R, Bhattarai D, & Zhou D. (2017). Climatic variation: Effects on stress levels, feed intake, and bodyweight of broilers. Brazilian Journal of Poultry Science. 2017; 19(3):489-496

Pawar SS, Sajjanar B, Lonkar VD, Kurade NP, Kadam AS, Nirmal AV, & Bal SK. (2016). Assessing and mitigating the impact of heat stress in poultry. Adv. Anim. Vet. Sci. 2016;4(6):332-341.

Popkin, B. M., Adair, L. S., & Ng, S. W. (2012). Global nutrition transition and the pandemic of obesity in developing countries. Nutrition Reviews, 70(1), 3-21.

Saeed, M., G Abbas**,** M. Alagawanyd, A. A. Kamboh, M E. Abd El-Hack, A. F. Khafaga, & S. Chao (2019). Heat Stress Management in Poultry Farms: A comprehensive overview. Journal of Thermal Biology, 84: 414-425.

Tao, S., Monteiro, A. P. A., Thompson, I. M., Hayen, M. J., Dahl, G. E., & Tao, S. (2020). Impact of heat stress on livestock reproductive performance: Insights into the cellular and molecular responses of gametes and embryos. International Journal of Molecular Sciences, 21(10), 3667.

Wheelock, J. B., Rhoads, R. P., VanBaale, M. J., Sanders, S. R., Baumgard, L. H., & Collier, R. J. (2010). Effects of heat stress on energetic metabolism in lactating Holstein cows. Journal of Dairy Science, 93(2), 644-655.

Yalcin, S., Ozkan, S., Cabuk, M. & P.B. Siegel (2003).Criteria for evaluating husbandry practices to alleviate heat stress in broilers. Journal of Applied Poultry Research 12: 382-388.