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Effects of Climate changes on poultry production and its aadaptation and mitigation strategies

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Abstract

The global poultry is the fastest growing agricultural subsector in developing countries. Poultrysector isexpected to continue to grow as demand for meat and eggs is driven by grow ing populations, rising incomes and urbanisation. Poultry makes a substantial contribution contribution to food security and nutrition, providing energy, protein, and essential micronutri ents to humans, Climate change is emerging as a major challenge to poultry production worldwide, affecting bird health, productivity, and farm profitability. Rising temperatures, humidity fluctuations, and other climatic variations cause heat stress, leading to reduced feed intake, poor growth, lower egg production, impaired reproduction, and increased mortality in poultry. Climate change also indirectly affects poultry production by reducing the availability and quality of feed resources and increasing the prevalence of diseases. Heat stress compromise's immune function, making birds more susceptible to infections and reducing overall production efficiency. Various adaptation and mitigation strategies, including improved housing, proper nutrition, efficient water management, biosecurity measures, and the use of heat-tolerant breeds, can help reduce the adverse effects of climate change. Adopting sustainable and climate-resilient poultry farming practices is essential to ensure future food security and the continued growth of the poultry sector.

Key words: Climate change, poultry production, health, control measures

Introduction

By the year 2050, global demand for poultry meat and eggs is expected to increase nearly fourfold largely driven by population growth and improved socioeconomic conditions. Climate variation is a persistent change in the mean of climate parameters such as temperature, rainfall, humidity and soil moisture due to change in the composition of atmospheric gases. Climate variation is posing a threat to livestock production, especially the poultry enterprise. Climate variation in many parts of the world adversely affects socioeconomic sectors which include water resources, agriculture, forestry, fisheries and animal husbandry. It is a phenomenon that will continue to occur; mitigating its effects is the only way out. Poultry species—including chickens, ducks, turkeys, and ostriches—are characterized by higher feed

efficiency, rapid turnover, and lower production costs compared to other livestock species. Poultry farming empowered farmers and rural women to secure a means livelihood and provides protein requirement at low cost. Numerous human activities, including inadequate environmental sanitation, deforestation, bush burning, borehole drilling, fuel combustion, and cement production, are responsible for global climate change Alhassan *et al.* (2024). Poultry meat is cheapest among all meat from other species. Poultry provides high-quality animal protein in the form of meat and eggs which makes a substantial contribution to human. Adverse climate directly affects poultry production by reduced growth and egg production and increasing disease incidence and indirectly by altering nutritional quality of feeds and reducing water availability.

Direct effect on Poultry Production

Rising environmental temperatures or frequent variation of temperature are among the most critical climate-related stressors affecting poultry. Newly hatched chicks are very sensitive to changes in temperature and humidity. Proper temperature, humidity, and proper ventilation is very important for their optimum performance. Birds exposed to high ambient temperatures experience heat stress, which negatively influences their physiological function. eat stress disrupts the comfort of broilers and drastically reduces their performance (Liu *et al.,* 2020). Climate change mostly High temperature and high humidity directly affects the bids by altering their normal physiological function and indirectly by affecting the food production. High environmental heat causes reduce feed intake as a coping mechanism, leading to poor growth performance, reduced egg production, and compromised egg quality. Prolonged exposure to heat stress can also result in increased mortality, particularly in broilers and high-producing laying hens (Lara and Rostagno, 2013).

Effect on Behaviour and Physiology

Birds make many changes in their physiology to balance temperature with their surroundings when exposed to high ambient temperatures. They are likely to rest during periods of heat stress. Their wings usually move away from the body to balance their body temperature by reducing their body insulation. They frequently drink water to cool the body. They started panting with increasing ambient temperature to evaporate heat from their bodies. However, with shortness of breath, muscle activity increases, leading to more energy expenditure and intensifying heat stress.in extreme conditions death may happen. This is a destructive effect, especially in heavier birds. High ambient temperature alters the activity of the nervous system and endocrine system of poultry, thereby activating the hypothalamic-pituitary-adrenal (HPA) axis and increasing plasma corticosterone concentrations (Garriga *et al.,* 2006).

Effects on Nutrition and Feed Resources

Climate change indirectly affects poultry production through its impact on feed resources. Altered climatic conditions influence the availability and quality of major feed ingredients. Heat stressed birds consume less feed to compensate the load of heat as a result they suffer from nutrient deficiency which causes poor performance. Heat stress also impairs digestive efficiency and nutrient utilization in birds, resulting in poor feed conversion and increased nutritional requirements for maintenance rather than production (Renaudeau et al., 2012**)**. These challenges increase production costs and threaten the economic sustainability of poultry farming, particularly for small-scale producers.

Effect on Reproduction and Egg Quality

Climate change has a significant impact on reproduction and egg quality in poultry, High temperature reduces reproductive efficiency by disrupting hormones like estrogen and progesterone causing decreases egg production, thin eggshells due to reduced calcium metabolism resulting increased shell breakage, irregular shell shapes., Hot and humid condition encourages growth of bacteria which increases risk of egg contamination. Poor fertility and hatchability, albumen becomes thinner, reduced nutritional value over time due to faster spoilage, Heat stress negatively affects calcium metabolism, resulting in thinner eggshells and poor internal egg quality. Fertility and hatchability also reduced greatly.

Immune Function and Disease Susceptibility

Heat stress due to cclimate change suppresses immune function by reducing activity of immune cells like lymphocytes and macrophages, increases stress hormones (cortisol), which weaken immunity. Lower feed intake leads to nutrient deficiencies (vitamins, minerals) which weakens immunity resulting higher disease risk. Disease outbreaks not only reduce productivity but also increase reliance on medications, raising concerns about antimicrobial resistance and food safety (Patz et al., 2005). Heat stress suppresses immune responses, making birds more susceptible to infectious diseases. Hot humid conditions favor the survival and spread of pathogens and vectors, increasing the incidence of diseases such as Coccidiosis.

Impact of Heat Stress on Production Performance

Several studies have shown that high temperatures can negatively affect the health, physiology, and efficiency of broilers (Hu et al., 2022; Sun et al., 2023), laying hens (Deng et al., 2012), ducks (Ma et al., 2014; Oluwagbenga et al., 2022), turkeys (Farghly et al., 2017), and Japanese quail (Qin et al., 2023). In addition, high ambient temperatures can lead to higher mortality rates and welfare issues, reduced feed intake and egg production in laying hens (Caffrey et al., 2017).

Adaptation and Mitigation Strategies

1. **Proper Housing Management:** By providing proper ventilation, use insulated roofing. Installing cooling systems, optimal stocking density to avoid overcrowding, reduces heat stress and improves bird comfort.
2. **Water Management:** Ensure continuous supply of cool, clean water, adding electrolytes and vitamins during heat stress, increase number of drinkers to prevent dehydration.
3. **Feeding Strategies:** Feed during cooler hours, provide high-quality, easily digestible feed with Vitamins (A, C, E), minerals (Ca, P) supplementation and addition of antioxidants to reduce stress effects which will maintains growth, egg production, and immunity.
4. **Breed Selection:** Use of heat-tolerant and disease-resistant breeds**, i**ndigenous/local breeds adapt better to harsh climates.
5. **Health and Disease Management:** Maintain strict biosecurity and health management measures.
6. **Seasonal Management:** Better management during summer and winter season.
7. **Waste Management:** Proper disposal and treatment of poultry litter and other farm wastes.
8. **Sustainable Farming Practices:** Integrating poultry with crop farming shows potential to improve soil health, increase yield and quality of produce, and enhance overall farm resiliency.

Conclusion

Climate change poses a serious threat to the poultry industry by affecting bird health, immunity, growth, reproduction, productivity, welfare, and economic viability. High temperature and high humidity directly affect the bids by altering their normal physiological function and indirectly by affecting the food production. Climate-induced changes in feed availability and quality further threaten the economic sustainability of poultry farming. The different adaptation and mitigation Strategies to be followed for sustainable poultry production under changing climatic conditions with integrated approaches involving improved management practices besides proper nutrition and health aspects.

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