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Poultry Health Management Practices and Their Effect on Production and Reproduction

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Abstract
This Poultry health management practices are crucial for the industry's success in terms of both productivity and reproduction. Boosting poultry farming's productivity, illness resistance, and reproductive success via sound health management practices. Heat stress is a major environmental factor that hurts poultry productivity across the globe. This article examines the effects of heat stress on the productivity, fertility, and development of chickens, as well as how these effects may be mitigated by genetic manipulation. High ambient temperatures have devastating economic consequences for the chicken business because they reduce growth rate, body weight, egg output, egg weight, egg quality, meat quality, sperm quality, fertility, and hatchability. The poultry's performance characteristics are negatively impacted by the high ambient temperature. Therefore, birds bred for performance are more likely to perish from heat stress. The heat stress that birds experience during travel results in lower meat quality, higher mortality, and welfare concerns. To select poultry birds with increased thermo-tolerance and disease resistance, molecular markers are now being investigated to identify the prospective candidate genes connected to production, reproduction, and growth features.

Keywords: Temperature, Production and Reproduction, egg, exposures, heat stress

Introduction

A considerable portion of high-quality protein is produced by the chicken sector. Domesticated birds farmed for meat, eggs, or both are referred to as poultry. Although chickens are the most popular form of poultry, other birds are also grown for food, including turkeys, ducks, and geese. Values in Nutrition Chicken and turkey meat, among others, are great examples of high-quality protein found in poultry. It's a complete source of protein, meaning it has everything your body needs to build new cells and repair old ones. Poultry meat, especially lean cuts, is a good source of protein since it is low in fat (1). Cost-effectiveness and easiness of access Chicken and other poultry items may be found at a broad range of prices, making them accessible to a wide demographic. Chicken may be farmed in a wide range of sizes, from domestic to industrial, guaranteeing a constant supply of chicken products. Feed Conversion Efficiency is well-known that poultry, particularly chickens, make excellent use of their feed. They have a higher efficiency for turning feed into meat than most cattle. Due to the low resource consumption per unit of meat produced, chicken farming is a viable, sustainable protein production alternative (2). The kitchen may be versatile with poultry items. Various culinary alternatives are available because of how chicken and turkey may be cooked. In addition, eggs, another crucial product of the poultry sector, are very adaptable and employed in various cuisines. Economic Relevance numerous nations' economies heavily depend on the chicken sector. It contributes to the whole agricultural industry, helps farmers' lives, and offers job possibilities. The export of chicken products helps the sector make money as well (3).

Indeed, two of the century's most important concerns are ensuring the long-term viability of agriculture and supplying the world's food needs. It does predict that by 2040, there will be close to ten billion people on the earth who need to be fed due to population growth. Rise in Food Demand There will be more need for food as the population rises. To do this, sustainable agricultural methods must be used to produce enough food to satisfy the dietary demands of a bigger global population. To maximize resource use entails raising agricultural yields, enhancing livestock output, and developing novel approaches (4). Agriculture faces danger from climate change. Agricultural production is affected by factors such as changing precipitation patterns, extreme weather, the effect on natural resources, and increasing temperatures. For agriculture to be sustainable in the long run, climate change adaptation and damage mitigation are essential. Impact on the Environment Deforestation, water pollution, greenhouse gas emissions, and soil deterioration are just a few of the negative environmental effects of agriculture. Through strategies like organic farming, agroforestry, and precision agriculture, among others, sustainable agricultural practices seek to reduce these effects (5). Intensive farming methods often result in biodiversity loss, including habitat damage and a decline in the genetic variety of crops and animals. This problem may be solved by promoting agroecological methods that preserve biodiversity and support sustainable agricultural practices. In many areas, water shortage is a major problem. Since agriculture consumes a significant amount of water, effective water management strategies are necessary to maintain sustainable irrigation techniques, reduce water loss, and give agricultural priority when using water in water-stressed regions. Innovation and technical improvement must be welcomed if agriculture is to be sustainable. To optimize resource usage, decrease waste, and increase production, this comprises genetic engineering, biotechnology, remote sensing, and data analytics (6).

Long-term sustainability in agriculture depends on ensuring equal access to resources, fostering rural development, and tackling concerns of poverty and food security. Developing rural communities and assisting small-scale farmers may help promote sustainable agricultural practices. It takes a multifaceted strategy to address these issues, engaging consumers, farmers, scientists, and other stakeholders. It entails promoting sustainable agricultural methods, making research and development investments, encouraging global partnerships, and developing laws that reward sustainable agriculture. By emphasizing agriculture's long-term viability (7). In emerging nations, especially those with tropical climates, poultry production has risen quickly. Environmental changes, however, have a considerable impact on the viability of animal production systems in these areas, including poultry. Thermoregulation and Heat Stress Heat stress, in particular, makes poultry very sensitive to temperature changes. In tropical settings, high ambient temperatures may cause animals to consume less feed, develop slower, lay fewer eggs, and even die. For sustaining chicken health and production, it is essential to minimize heat stress via appropriate ventilation, shade, cooling devices, and breed selection (8). High humidity levels are a common feature of tropical regions, which facilitates the spread of diseases. Growing bacteria, fungi, and parasites in chicken houses may increase the risk of illnesses such as coccidiosis, bacterial infections, and respiratory conditions. Reduced disease risks may be achieved by using effective insecurity controls, good waste management practices, and suitable housing designs. The availability of feed for chickens may be impacted by the separate wet and dry seasons that are frequent in tropical climates. Forage and pasture availability during the dry season may decrease, impacting the quality and availability of feed supplies for chickens. To meet these issues, techniques for feed storage, supplementing, and alternate feed sources should be developed (9).

Water is necessary for poultry production, and in hot regions, its accessibility and quality may be compromised. The hydration and health of chickens may be impacted by drought and water constraints. Additionally, microorganisms in water sources may impact avian health and raise the risk of sickness. For sustainable poultry production, it's crucial to have access to clean enough water, apply water management strategies, and regularly check the quality of the water. Tropical regions can support various parasites that may harm poultry, including worms, ticks, mites, and flies (10). The health, productivity, and mortality of chickens may all be negatively impacted by these parasites. The sustainability of chicken production depends on using efficient parasite control strategies, such as routine deworming, pest management, and good sanitation. Improvements in management techniques, infrastructure, and technological advancements must be made together to address the sustainability issues in chicken production in tropical regions. This entails implementing climate-smart chicken housing, enhancing ventilation and cooling systems, choosing hardy and heat-tolerant poultry breeds, encouraging excellent insecurity practices, and educating and training farmers on best practices. Developing robust and sustainable poultry production systems in tropical climates requires cooperation between researchers, decision-makers, and farmers (11).

Heat stress may harm the productivity of chicken farms, resulting in lower output and higher mortality. Chickens' appetites may be suppressed by high temperatures, which lead to a reduction in feed consumption. This decrease in feed intake results in a reduced nutritional intake, which impacts the birds' general growth and development. Reduced feed intake also causes laying chickens to produce fewer eggs and grow less weight. The growth rates of hens may be slowed down by heat stress. Birds' metabolism speeds up to disperse heat and maintain body temperature when subjected to prolonged high temperatures. Slower growth rates result from this higher energy expenditure on thermoregulation, which diverts resources from development activities (12). The ability of hens to reproduce under heat stress might suffer. High temperatures in roosters may lower sperm production and quality, which lowers fertility rates. Heat stress in laying chickens may alter the regular laying cycle and lower egg output. Furthermore, elevated incubation temperatures might have a detrimental effect on chick quality and hatchability rates. Chicken mortality rates may be greatly increased by heat stress. Long-term exposure to extreme heat may cause organ failure, heat stroke, or exhaustion. Broilers, intended for fast development, have greater mortality rates than other chicken breeds because they are more sensitive to heat stress (13). To maintain the ideal temperature and air circulation, suitable ventilation, and cooling systems must be installed in chicken housing. Access to cold, clean drinking water is made available to ensure hydration. Regulating the lighting schedule to prevent heat exhaustion during the sunniest hours. Using chicken breeds or strains better suited to high-temperature conditions that are heat-tolerant. Adjusting feeding procedures, such as feeding during cooler hours of the day or utilizing feed compositions resistant to heat. To lessen the heat load in outdoor production systems, use shade structures or sprinkler systems (14).

The use of antibiotics may be reduced by implementing stringent insecurity controls, good hygiene practices, and successful disease prevention initiatives. Keeping clean and well-ventilated chicken housing, routine cleaning, efficient waste disposal, and appropriate flock management practices are all part of this. Vaccination campaigns Infectious illness prevention and management in poultry heavily rely on vaccination. Poultry farmers may lower the risk of disease outbreaks, enhance flock health, and lessen the need for antibiotics by adopting well-designed vaccination programs. Common chicken illnesses, including coccidiosis, infectious bronchitis, and Newcastle disease, may all be prevented with vaccinations (15). The study (16) evaluates the livestock industry, including the poultry sector, as a vital component. Heat stress (HS) causes it to suffer significant losses. Applying productive techniques on farms is as crucial. Researchers have proposed a number of tactics. The fundamental necessity for all kinds of livestock raised for animal protein is the provision of a suitable environment with selected raising methods coupled with sufficient ventilation and cleanliness. The addition of a suitable feed additive might be helpful for enhancing intestinal absorption and reducing the harmful effects of HS. The main concerns about chicken health and advises the actions to be taken in response to the rise in ambient temperature. The study (17) examines one of the main environmental stressors in the chicken business; heat stress causes important financial loss. Numerous physiological changes brought on by heat stress include oxidative damage, acid-base imbalance, and reduced immunocompetence. In recent years, there has been a lot of interest in the usage of the bare neck (Na) and frizzle (F) genes in certain breed lines. Only a handful of these tactics have, however, seen widespread use in the chicken business. Consequently, breeding heat-tolerant breeds and practicing good management are essential. the available scientific data on how heat stress affects broiler chickens and laying hens' health and performance, as well as any viable preventative measures.

The research (18) determined the experiment was to create Poultry Litter Biochar (PLB) from fresh PL in order to evaluate the significant characteristics of both PL and PLB and to track the impact on plant development. It evaluated the alteration in soil characteristics after the application of PL and PLB. After the initial crop was harvested, the same plant was cultivated again to evaluate prospective and lasting effects. After the first crop was harvested, post-

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harvest soil analysis was also done. For both the first and second crops, a substantial increase in plant growth and biomass production was seen, and it was greater in the PLB-treated soil than the PL-treated soil. A potential organic fertilizer with a higher nutritional concentration than fresh PL is PLB. The experiment (19) described the poultry business as becoming more important to the agriculture and ancillary industries as a whole. In the tropics especially, heat stress was discovered to have a deleterious effect on poultry output. Heat stress may have a negative effect on poultry productivity, but there are ways to mitigate its effects. Strategy types include genetic, managerial, and dietary approaches. Heat stress may have a detrimental influence on poultry productivity; these methods may help mitigate its consequences. Shelters are designed properly; shade is provided, sprinklers are used, and cooling devices, fans, and ventilation systems are included as part of the management techniques. The use of modern biotechnological methods has the potential to aid in the identification of appropriate genetic markers in poultry, which might lead to the development of new, more thermo-tolerant strains through the implementation of a marker-assisted selective breeding program. The genetic, physiological, and nutritional characteristics of Africa's native chickens have received little attention during the last decade. It is well-documented that these hens have significant cultural, social, and economic value for the underprivileged people of Africa. The group has started a conservation initiative for native birds. In addition, four indigenous South African chicken varieties are being safeguarded by the Agricultural Research Council. The goal of this analysis is to help readers learn more about the background, benefits, and strategies for preserving native chicken breeds in Africa. Several researches on the nutritional needs of local hens have shown conflicting and unsatisfactory findings (20). Consequently, it is crucial to implement a thorough and individualized health management strategy in conjunction with poultry health specialists to maximize production and reproductive results.

Chickens' Reaction to Extreme Heat

Heat stress is dangerous for chickens, particularly in the hottest weather. Birds experience heat stress when their internal temperature increases over the safe limit, which causes a cascade of adverse effects on their physiological and metabolic systems. Signs of discomfort that hens may show include panting, open-mouthed breathing, and spreading their wings away from their bodies. Poultry producers may use a variety of management techniques to lessen the impact of high temperatures on their flocks. Maintaining a pleasant temperature and air flow in chicken housing is essential. Providing hens with places to get out of the sun's rays, such as coops or shelters. Providing clean drinking water and keeping tabs on it regularly. Changing feeding times to the morning or evening might increase feed consumption. Using water-based cooling methods, such as sprinklers or misters, and making cool areas more accessible. Keeping an eye out for symptoms of heat stress in birds by their behavior, health, and production metrics. Farmers may reduce the harmful effects of high temperatures on hens, improve their welfare, and ensure peak performance by adopting these practices.

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Laying of Eggs

The fundamental goal of the poultry business, in terms of egg production specifically, is to maximize egg quality. Poultry's productivity, particularly the quality and number of eggs laid, may be negatively impacted by heat stress. Chickens consume less when they're stressed out by heat. Chickens have a decreased nutritional intake because they feed less when exposed to hot temperatures. Reduced egg production is a direct result of reduced feed intake. When exposed to high temperatures, chickens speed up their breathing, a behavior known as panting. Chickens' ability to pant aids in heat dissipation and temperature control. But if you don't drink enough water, your increased panting can cause you to lose even more moisture via your breath, which may lead to dehydration. Chickens' protein metabolism may be thrown off by heat stress. Albumin and globulin levels in the plasma may drop as a consequence. Egg formation is only one of several bodily processes that need these proteins. A drop in plasma protein levels may hinder the laying of healthy eggs. Laying chickens have less calcium available due to heat stress. Eggshells need calcium to be strong and thick. Hence a lack of calcium may make shells fragile. Egg quality, especially shell quality and strength, might suffer from a lack of calcium due to heat stress. Egg production may drop in heat-stressed hens due to a number of factors. These include lower feed intake, dehydration, altered protein metabolism, and less available calcium. The quantity of eggs laid by laying hens may decrease, and the average egg weight and size may shift. Poultry's egg production and quality may take a serious hit at temperatures as high as 36 degrees Celsius. Having Fewer Eggs to Lay In laying chickens, heat stress may cause egg output to drop. Chickens' reproductive hormones and processes are disrupted by high temperatures, leading to fewer eggs being deposited.

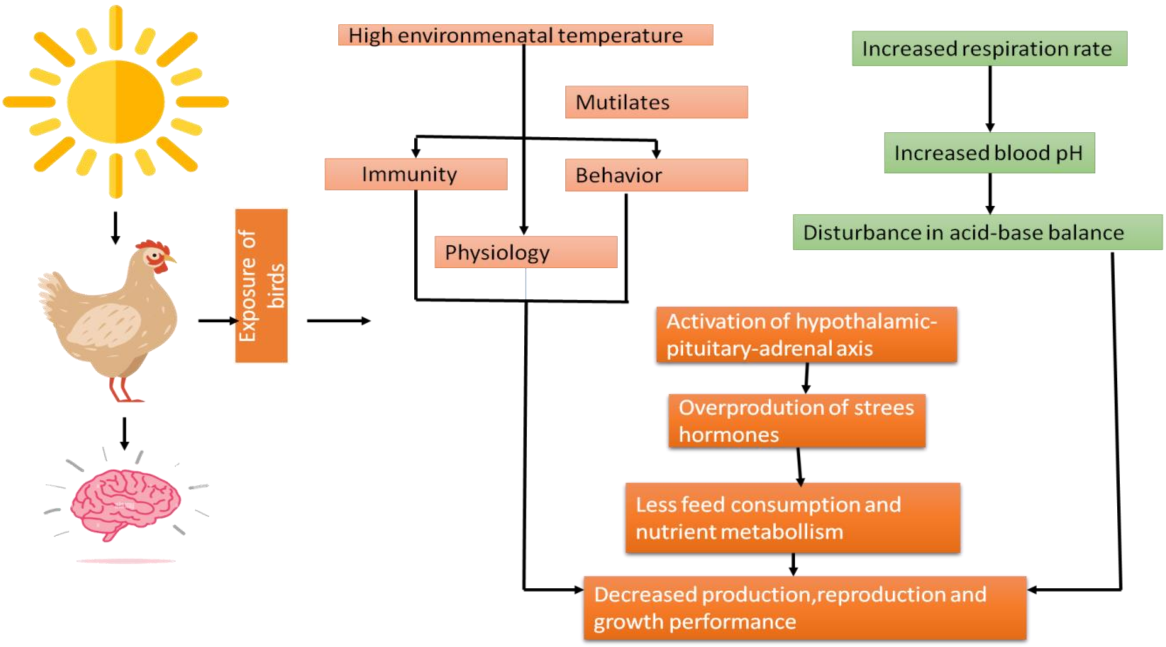

Figure (1): Flow diagram showing poultry's heat stress reactions

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Depending on the length and severity of the heat stress, the drop in egg production may be mild, moderate, or severe. Poultry egg production, quality, and the proportion of marketable eggs all dropped when ambient temperatures were raised from 21 to 36 degrees Celsius. Researchers looking at how airspeed, in addition to high temperature, affects the productive ability of Japanese quail discovered that raising the Temperature Humidity Index (THI) from 26 to 30 causes a 25% drop in egg production. In addition, the quantity of calcium needed by the uterus for making eggshells is reduced owing to panting, as hydrogen carbonate and carbon dioxide levels in the blood are lowered, and respiratory alkalosis is elevated.

Table (1): Numerical outcomes of treatment temperature

Treatment temperature (C)	Daily Feed intake and decrease in egg production (%)	
	Egg production (%)	**Daily feed intake (%)**
30	7.13	14.64
33	25.16	17.27
36	29.9	31.47
39	34.26	32.7

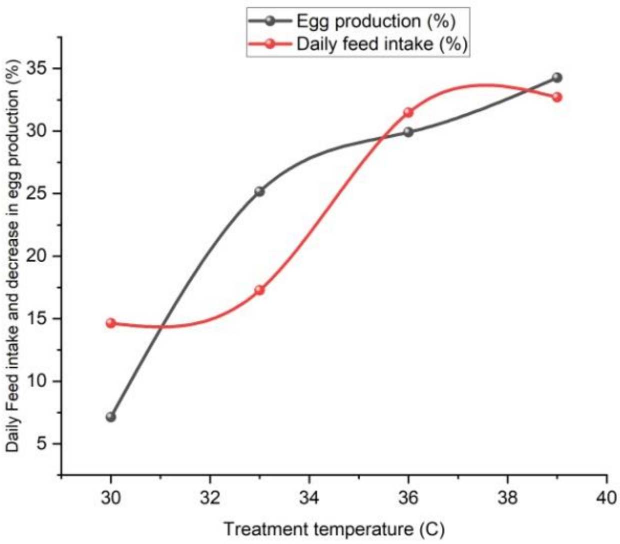

Figure (2): Percent reduction in chicken egg making and daily feed consumption against treatment temperature

This results in the generation of fractured eggs due to the weakness of the eggshell. In poultry, this causes an adverse impact on metabolism and feed intake, leading to lower overall performance as depicted in (Figure 1). Specifically, it increases the production of the glucocorticoids, stress hormones cortical, corticosterone, catecholamine, and the hormones in the hypothalamus, pituitary, and glands of the adrenals.

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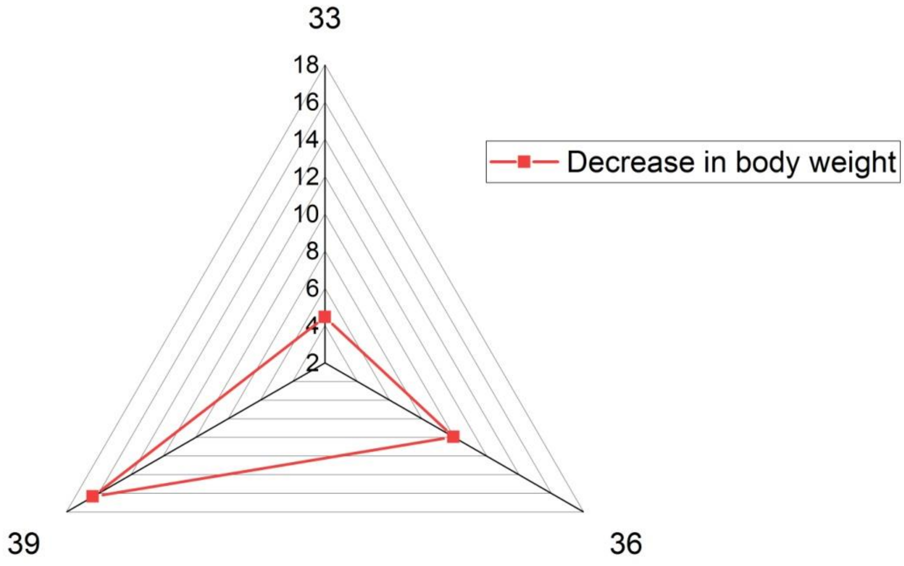

Figure (3): Prevention temp versus weight loss

Researchers from a variety of fields have researched the belongings of heat stress on chickens, along with their findings are summarized in (Table 2).

Table (2): Poultry productivity, reproduction, and development under heat stress

Breed	N	Exposure Temperature		Egg prod (%)	Egg wt (%)	Daily feed intake (%)	Body wt(%)	Body wt gain (%)	FCR (%)
		Control (C)	Treatment (c)						
W-36 parent-line (2 wk after HS)	408	24	36	-7.30	-	-47.33	-4.9	-	+99.52
W-36 parent-line (4 wk after HS	408	24	36	-5.99	-	-39.78	-5.5	-	+72.35
Hy-Line brown commercial laying strain	857	27	34	-7.12	-11.05	-13.64	-	-	-
Hy-Line commercial laying strain	201	20-27	23-37	-	-4.25	-	-	-	-
Isa Brown layer	41	23	31.16-34.12	-26	-3.78	17.27	4.74	-	+9.88
White Leghorn	451	20-23	30=34	-	-3.25	-	-	-51.0	_
Ross-708 strain (21 days)	451	23	35±2	-	-	-16.09	-16.43	-	+0.68
Ross-708 strain (42 days)	60241	23	35±2	-	-	-	-33.6	-	+26.6
Rhode Island Red Japanese quails	241	22	38	-37.4	-3.42	16.5	-	-	-
Japanese quails	181	24.9	35	-	-	-31.7	-11	-15.5	-
Commercial laying strain 1	241	24	36	-	-	-	-9.2	-12	-
Single-comb White Leghorn (Expose to heat stress -8–14 days)	81	11-24	35	-29.8	-	-	-	-	-
Single-comb White Leghorn (Expose to heat stress 30–42	81	11-24	38	-26.4	14.3	-	-	-	-

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days)									
Single-comb White Leghorn (Expose to heat stress 43–56 days)	81	11-24	38	-58.0	-	-	-	-	-

It was found that egg weight, body weight, body weight increase, daily feed consumption, and egg production all decreased by between 4.99 and 57 percent, 2.78 to 14.3 percent, 3.74 to 32 percent, 11 to 50 percent, and 16.09 to 46 percent, respectively. However, FCR increased from 0.67 to 99.51 %. (Table 1 and Figures 2 and 3) indicate the average decrease in daily feed consumption, egg production, and body weight of chicken as reported by various studies in response to an increase in ambient temperature.

Controlled temperatures exposures

The performance of poultry, including parent lines and commercial laying strains, in terms of production, reproduction, and growth may be significantly influenced by heat stress shown in Figure 4. Reduced fecundity Laying hens' egg production might drop if they're subjected to extreme heat. When temperatures are too high, birds may delay or even stop laying eggs altogether. Having subpar eggs Cracked or deformed eggs, as well as thinner shells and worse albumen quality, are all possible outcomes of hens experiencing heat stress. Adapted intake during times of extreme heat, birds may reduce their meal intake, thus diminishing productivity. Lower birthrate Reduced fertility and hatching success in nesting birds have been linked to heat stress.

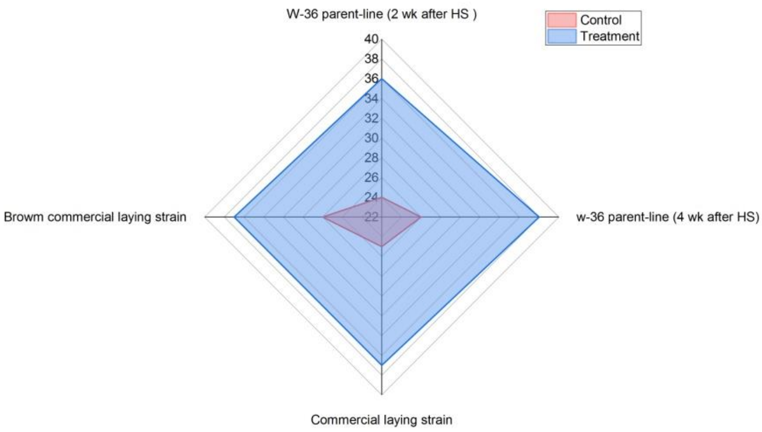

Figure 4: Experiments with Temperature Control

The reproductive systems of both sexes may be negatively impacted by high temperatures. Male sperm production, quality, and motility, as well as female fertility, can all be negatively impacted by heat. Reduced likelihood of hatching Embryos that die during incubation due to high temperatures has a reduced chance of hatching. Obesity suppression Poultry can't grow and develop normally when subjected to high temperatures, which might reduce their weight increase and total growth performance. The death rate has gone up. Younger birds, which are more sensitive to temperature changes, are more likely to perish in the event of extreme heat stress. Depending on factors, including the genetic makeup and level of adaptation of certain chicken strains, the particular consequences of heat stress might range from mild to severe. It is possible to reduce the detrimental effects of heat stress on chicken production, reproduction and growth performance by the use of proper management practices.

Production of Meat

Broilers that are exposed to high temperatures exhibit a decline in appetite, feed efficiency, plasma protein and calcium concentration, weight increase, and body condition score. Heat stress causes chickens to drink more water than normal, produce higher levels of the stress hormone triiodothyronine (T3), and ultimately die. When broilers are exposed to high temperatures throughout their development, the quality of their meat, muscle development, fat metabolism, and chemical profile all suffer. Carcass appearance, flavor, and consumer acceptance are all impacted by changes in chicken quality parameters like pallor, color, oxidation stability, tenderness, softness, and water-holding capacity. Changes in carcass traits, such as increased fat content in the belly or decreased quality of the breast or thigh meat, are also detected. In the summer, chickens have roughly 120 g less carcass weight and a 12.2 and 1.3% drop in leg and breast production, respectively. These anti-social effects in grill birds are caused by faster anaerobic glycolysis, which in turn leads to an improved intensity of hasty oxygen variety and injury to the "Ca^{2+}-ATPase" of the sarcoendoplasmic reticulum. This, in turn, leads to an increased amount of corticosterone hormone and a decrease in growth.

Transporting meat without compromising quality

Several stresses may be put on poultry during the way from the farm to the processing plant, but the temperature over the thermoneutral zone is the most critical. It causes unsafe conditions, excessive mortality, and low-quality meat. When transported under conditions of high heat stress, heavier chickens do worse than their lighter counterparts in terms of survival. The efficacy of the bird's behavioral and physiological thermoregulatory processes is reduced during transport in the summer months (June to August). Furthermore, distance and season have a greater impact on chicken quality attributes (shear force, pH, lightness, and cooking losses) than crate location in the truck.

Reproductive effectiveness

The disadvantageous effects of heat load on ovulation rate in laying and breeding hens lead to lower reproductive efficiency, decreased fertility, and decreased hatchability. It also slows down the development of follicles, oocytes, and yolks, which causes difficulties with infertility in poultry. Possible causes include altered levels of Heat Shock Proteins (HSPs), fatty acid content, and antioxidants, as well as decreased GnRH, LH, and FSH hormone release. Additionally, exposure to sensitive heat load modifies the hypothalamic control of laying hen reproductive function and lowers circulating luteinizing hormone levels. It's because the hypothalamus isn't working as well. Breeder chickens sexed in the morning as

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opposed to the afternoon seem to have higher fertility and hatchability. Heat stress in laying quails, hens, and ducks causes oxidative damage to the small ovaries, oviducts, and yellow follicles. This makes the ovaries, oviducts, and amount of big follicles much lighter than they would be otherwise. So, it leads to less egg production, and in the worst cases, it can lead to impotence. Male breeders are more likely to become infertile because of heat stress than female breeders. Temperatures above the thermoneutral zone caused an increase in lipid peroxidation, which damaged the testis and, in the end, had bad effects on the male Japanese quail and grill chicken's sperm parameters. Several things, such as temperature, pH, and ion concentration, can affect seminal characteristics like sperm production, metabolism, quality, and movement. This can lead to poverty and the construction of low-quality spermatozoa. In the early stages, a rise in temperature makes the testicles grow, and the amount and quantity of sperm increase. However, a further rise in temperature makes it harder for birds to reproduce. When the temperature was above the comfort zone, both the quality and amount of sperm were lower. Also, when roosters were stressed out by the heat, their sperm didn't get as far into the eggs, so the number of fertilized eggs was lower. In-vivo sperm-egg entry in grill males was 48% lower at 27 °C than at 21 °C.

Economic Development

Poultry that has been selectively bred for faster development and higher feed conversion efficiency is more likely to suffer from heat stress for a variety of reasons. High environmental temperatures slow development because animals are less motivated to eat. Overproduction of stress hormones causes poor growth presentation in broilers subjected to heat load. The ability of birds to endure greater ambient temperatures decreases as their development rate increases because of the increased generation of metabolic heat. Overproduction of stress hormones causes poor growth performance in broilers subjected to heat load. Investigated the effect of heat stress on the expression of amino acid- and fatty acid-binding protein transporters in the chickens' jejunum and found that the bird's ability to absorb nutrients was diminished. Impaired embryonic growth, slowed post-hatch development, and birth abnormalities are all facilitated by chronic heat stress. Observed that the body weight of both male and female quails decreased significantly at higher temperatures (34±2 C) compared to lower temperatures (22±2 C) over the course of six weeks. Due to increased heat output, the impact of heat load was more definite in fast-growing broilers than in slow-growing ones. Compared to rapid growers, slow-growing grill lines exhibited lower rates of mortality and average body temperature. Internal organs were also affected by heat stress, as seen by the reduced weight of the liver, spleen, and thymus in laying hens subjected to a prolonged heat load.

The Impact of Heredity on Heat Stress

The most pressing issue right now is the selective breeding of heat-resistant avian species in tropical and subtropical locations. The foundation of this method is the isolation and selective breeding of heat- and disease-resistant genes. Their inability to adapt to high temperatures meant that they never reached their full genetic potential for rapid development. Heat

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exposure causes mitochondrial dysfunction and oxidative stress, both of which have been made worse by the selective breeding of birds for production qualities. Epigallocatechin-3-gallate (EGCG) was shown to suppress nuclear factor kappa B (NF-B) production in quail hepatic cells by 42% when supplemented under heat stress. There is also evidence that high-production birds are more vulnerable to heat stress. For this reason, Desi or backyard chickens are better equipped to handle high temperatures than commercial chickens or recently developed varieties. Because of human intervention, bird populations have become overcrowded, putting more birds at risk from heat stress. Breed improvement programs have increased growth, egg and meat output, and feed efficiency, but they have also reduced heat tolerance.

Genetic techniques for reducing heat stress

Multiple approaches, including environmental, dietary, genetic, and housing changes, are necessary in chickens to lessen the impact of high ambient temperatures. One of the first steps is to find birds that can withstand high temperatures due to their genetic makeup. Improving birds' ability to withstand high temperatures may need selection in a hot climate. It has a number of drawbacks, however, including limited heritability in certain species (like fast-growing broiler chickens), stunted development at typical temperature changes based on genetics and growth potential, and functional intermission of some genes, which makes birds susceptible to a variety of illnesses. A heritable marker is a specific DNA progression on a certain chromosome that is associated with a characteristic. Poultry breeders are interested in single nucleotide polymorphisms (SNPs) that affect the animals' ability to withstand high temperatures. The genetic expression of most proteins is suppressed in chicken subjected to high ambient high temperature, with the exception of heat shock proteins. Their job is to interact with heat-sensitive proteins in heat-shocked cells and stop the precipitation of those proteins. Genotypes may react differently to high temperature and thermoneutral conditions. Different organs in chicken have been shown to react differently in terms of gene expression and transcriptomic in response to exposure to high ambient temperatures; Thermal treatment during embryogenesis enhances thermotolerance in colored broiler chickens, as shown by an analysis of the effect of embryonic heat stress on protein expression and heat shock protein genes in both embryos and chronically heat challenged 42-day-old chicks. The expression of heat shock protein 70 (HSP70) and heat shock protein 90 (HSP90) genes was found to be considerably higher in the Dandarawi line than in the Leghorn line under heat stress conditions. The functional allele fitness of HSP70 and HSP90 in the Dandarawi chicken line, which was selected at high ambient temperature for 4 generations, was higher than that of the Leghorn chicken line. The bare neck gene did more than just lessen the amount of feathers an animal had it also increased the expression of the HSP70 gene, which helped the animal gain mass and endure heat. The Dandarawi breed was found to have higher expression of the HSP70 and CPT-1 genes than the Fayoumi and Sinai breeds, according to their findings. As a result, the Dandarawi breed proved to be more resistant to the heat than others. Feather loss of 20% in the Na/na genotype and 40% in the Na/Na genotype was seen in birds exposed to elevated ambient high temperature for an extended period of time shown in (Figure 5).

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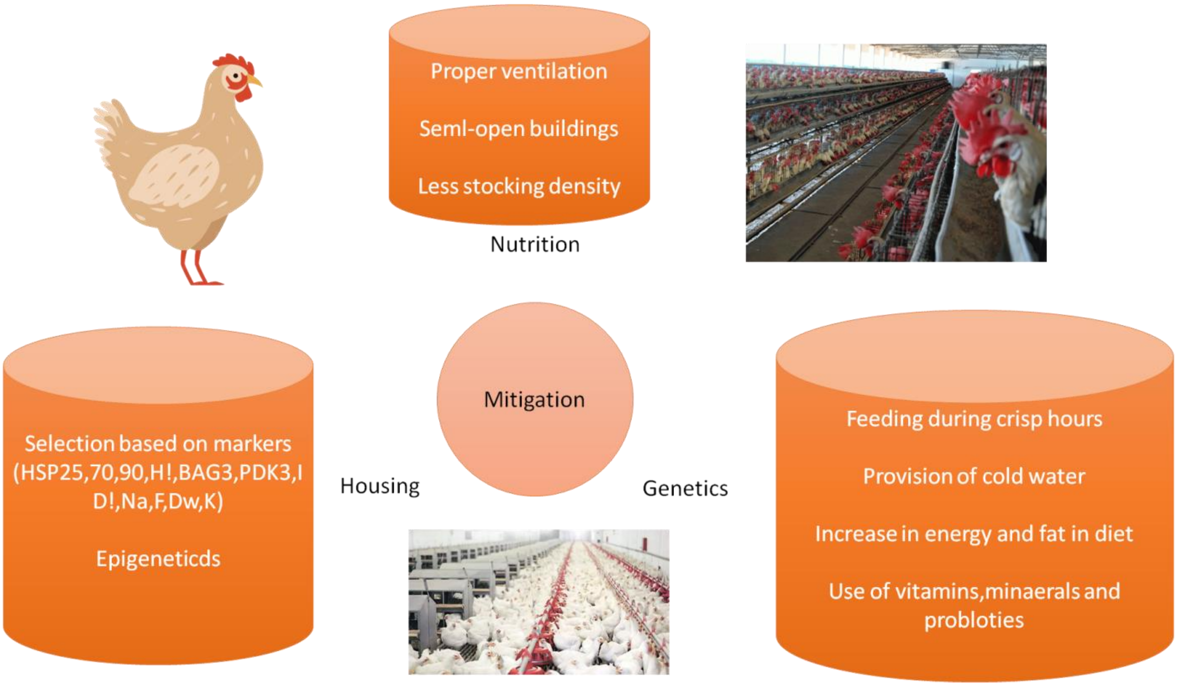

Figure (5): Heat stress mitigating techniques. Selection based on molecular signatures may mitigate climate change and heat stress

In addition to lowering metabolic heat output by 30–40% in grill breeders, the sex-related recessive dwarfism (dw) gene causes a decrease in adult body size. But, the new gene was shown to have no effect on grill hens' thermo-tolerance even when subjected to protracted heat stress. As a result of rising demand, there is a pressing need to rethink the selection procedures used in future breed development efforts in tropical and subtropical climates. Finally, a comprehensive study of heritable differences in poultry birds.

Conclusion

Poultry all over the globe is negatively impacted by heat stress, a significant environmental element within the circumstance of climate transformation and global warming. The physiological, behavioral, and immunological reactions triggered by exposure to it have a severe negative contact on the production, growth performance, and reproduction of birds. The chicken sector suffers severe economic losses as a result. Heat stress negatively affects both egg production and quality in layers and feed intake, water consumption, weight growth, dressing percentage, and feed conversion ratio in broilers. Repercussions on reproduction and growth in breeder females and males of chicken are also recorded. There has been a decrease in heat tolerance as a result of breed development programs. Furthermore, many genetic markers are investigated to find possible candidates for selecting birds with resistance to heat and illness. Breeding programs for heat-resistant chickens using marker-assisted selection are thus necessary. The selection methods used in breed development initiatives in tropical and subtropical regions need to be reexamined immediately.

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References

[1] Goel, A. (2021). Heat stress management in poultry. Journal of Animal Physiology and Animal Nutrition, 105(6), 1136-1145.
[2] Sikder, S., & Joardar, J. C. (2019). Biochar production from poultry litter as management approach and effects on plant growth. International Journal of Recycling of Organic Waste in Agriculture, 8, 47-58.
[3] Wasti, S., Sah, N., & Mishra, B. (2020). Impact of heat stress on poultry health and performances, and potential mitigation strategies. Animals, 10(8), 1266.
[4] Ranjan, A., Sinha, R., Devi, I., Rahim, A., & Tiwari, S. (2019). Effect of heat stress on poultry production and their managemental approaches. International Journal of Current Microbiology and Applied Sciences, 8(02), 1548-1555.
[5] Kuralkar, P., & Kuralkar, S. V. (2021). Role of herbal products in animal production–An updated review. Journal of Ethnopharmacology, 278, 114246.
[6] Saeed, M., Abbas, G., Alagawany, M., Kamboh, A. A., Abd El-Hack, M. E., Khafaga, A. F., & Chao, S. (2019). Heat stress management in poultry farms: A comprehensive overview. Journal of thermal biology, 84, 414-425.
[7] Swaggerty, C. L., Callaway, T. R., Kogut, M. H., Piva, A., & Grilli, E. (2019). Modulation of the immune response to improve health and reduce foodborne pathogens in poultry. Microorganisms, 7(3), 65.
[8] Abdelnour, S. A., Abd El-Hack, M. E., Alagawany, M., Farag, M. R., & Elnesr, S. S. (2019). Beneficial impacts of bee pollen in animal production, reproduction and health. Journal of animal physiology and animal nutrition, 103(2), 477-484.
[9] Vandana, G. D., Sejian, V., Lees, A. M., Pragna, P., Silpa, M. V., & Maloney, S. K. (2021). Heat stress and poultry production: impact and amelioration. International Journal of Biometeorology, 65, 163-179.
[10] Ali, A., Ponnampalam, E. N., Pushpakumara, G., Cottrell, J. J., Suleria, H. A., & Dunshea, F. R. (2021). Cinnamon: A natural feed additive for poultry health and production—A review. Animals, 11(7), 2026.
[11] Rayne, N., & Aula, L. (2020). Livestock manure and the impacts on soil health: A review. Soil Systems, 4(4), 64.
[12] Hafez, H. M., & Attia, Y. A. (2020). Challenges to the poultry industry: current perspectives and strategic future after the COVID-19 outbreak. Frontiers in veterinary science, 7, 516.
[13] Nabi, F., Arain, M. A., Hassan, F., Umar, M., Rajput, N., Alagawany, M., ... & Liu, J. (2020). Nutraceutical role of selenium nanoparticles in poultry nutrition: a review. World's Poultry Science Journal, 76(3), 459-471.
[14] Singer, R. S., Porter, L. J., Thomson, D. U., Gage, M., Beaudoin, A., & Wishnie, J. K. (2019). Raising animals without antibiotics: US producer and veterinarian experiences and opinions. Frontiers in veterinary science, 6, 452.
[15] Abd El-Hack, M. E., El-Saadony, M. T., Shafi, M. E., Qattan, S. Y., Batiha, G. E., Khafaga, A. F., ... & Alagawany, M. (2020). Probiotics in poultry feed: A comprehensive review. Journal of animal physiology and animal nutrition, 104(6), 1835-1850.
[16] Dróżdż, D., Wystalska, K., Malińska, K., Grosser, A., Grobelak, A., & Kacprzak, M. (2020). Management of poultry manure in Poland–Current state and future perspectives. Journal of Environmental Management, 264, 110327.

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Article Received: 18 April 2023; Revised: 26 May 2023; Accepted: 19 June 2023

[17] Gholami-Ahangaran, M., Ahmadi-Dastgerdi, A., Azizi, S., Basiratpour, A., Zokaei, M., & Derakhshan, M. (2022). Thymol and carvacrol supplementation in poultry health and performance. Veterinary Medicine and Science, 8(1), 267-288.

[18] Modak, M., Chowdhury, E. H., Rahman, M. S., & Sattar, M. N. (2019). Waste management practices and profitability analysis of poultry farming in Mymensingh district: A socioeconomic study: Poultry waste management, its impacts & BCA. Journal of the Bangladesh Agricultural University, 17(1), 50-57.

[19] Sharma, N., Hunt, P. W., Hine, B. C., & Ruhnke, I. (2019). The impacts of Ascaridia galli on performance, health, and immune responses of laying hens: new insights into an old problem. Poultry Science, 98(12), 6517-6526.

[20] Solaiman, Z. M., Shafi, M. I., Beaumont, E., & Anawar, H. M. (2020). Poultry litter biochar increases mycorrhizal colonization, soil fertility, and cucumber yield in a fertigation system on sandy soil. Agriculture, 10(10), 480.