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Review article

Common Causes of Early Death in Chicks

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Abstract

Chicks are susceptible in the days after hatching, as their digestive systems and immunity are underdeveloped and their ability to regulate their body temperature is inadequate. Failure to meet their needs during this period and adverse environmental conditions can easily cause them to get sick and die. Mortality in chicks is commonly highest in the first seven days. Mortality in the first week, up to 1%, can be considered normal. The causes of deaths exceeding this rate should be investigated and necessary precautions should be taken. Although it is not possible to completely prevent early chick deaths, the number of deaths can be reduced with precautions that can be taken when the causes of death are determined. This is very important in terms of animal health and business profit. Although there are numerous reasons for early chick deaths, the most common causes are genetics, nutrition, diseases and management. Genetic disorders can cause chicks to die while incubating or after hatching. Even if chicks obtained from genetically good flocks are used in production, it will not be possible to achieve the expected productivity if there are problems with care, feeding and management. Good flock management is essential to keep the animals healthy and alive. To reduce early chick deaths, paying attention to the care and nutrition of the parents, storing eggs in suitable environments, purchasing chicks from reliable suppliers if purchased from outside, performing incubation practices per the procedure, taking the necessary precautions against diseases, using healthy and balanced rations and managing the flock well are among the precautions that can be taken.

Keywords: Chick, Early Death, Diseases, Wrong Breeding Practices, Precautions to be Taken.

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INTRODUCTION

It is necessary to start production with good quality and healthy chicks, to obtain the optimum yield expected from chickens. Otherwise, even if they are fed with the best feed and managed in the best way, the desired yield level will not be achieved. Therefore, starting production with quality and healthy chicks is the most important criterion in breeding.

Chicks are very sensitive and weak in the first few weeks after hatching. It has been reported that the mortality rate in the first week can be an indicator of the performance of the flock during the rearing period (Yassin et al., 2009) and that the first 7 days will determine the health and performance until slaughter (Türkoğlu and Sarıca, 2009). Mortality rate in broilers means loss of income for breeders and hatcheries (Yassin et al., 2009). Therefore, it is necessary to pay special attention to their care and nutrition during this period. In cases where the rate of early chick death exceeds 5% in rearing, the underlying causes should be investigated. It is not possible to completely prevent early chick mortality, even if the genetics are sound and all kinds of measures are taken regarding management (Naser, 2018; Anonymous, 2024a). However, it is possible to reduce mortality rates by investigating the causes of chick mortality and taking precautions. At the same time, it is possible to increase efficiency and thus the farmers' profit by protecting animal health.

The causes of early chick deaths can be divided into two periods: pre-hatch and post-hatch. Pre-hatch causes can be listed as genetics, management of parent stock, egg storage and incubation. Post-hatch causes can be classified as chick development, chick gender, season, transportation, hunger and thirst, nutrition, diseases, flock management, and the experience and education level of managers. After determining the causes, measures can be taken to reduce chick deaths and enable more economical production.

PRE-HATCH CAUSES

Genetics

Chick losses in the first 3 days are closely linked to chick quality. There are approximately 21 lethal gene mutations in birds. Most of these lethal genes cause embryo death during the incubation period. In addition, congenital tremors and congenital loco are effective in the occurrence of deaths in chicks within a week after hatching (Anonymous, 2024a). The breeds of animals used in production also affect chick deaths (Yassin et al., 2009; Appiah, 2019; Yerpes et al., 2021). Moreover, chicken astrovirus found in parents is a viral disease that causes deaths during hatching and after hatching (Mcllwaine et al., 2021).

Management of Parent Stock

Increasing flock age negatively affects early embryo mortality and first-week mortality (Yassin et al., 2009; Okur and Türkoğlu, 2016; Yerpes et al., 2021). Similarly, inadequate or incorrect parental nutrition leads to the formation of malformed chicks. On the other side, chicks hatched from eggs obtained from diseased parent stock have difficulty breathing and this may cause death (Muhammed et al., 2009; Anonymous, 2024b).

Egg Handling

Egg collection, cooling, uneven temperature, and rough handling are effective in hatching chick mortality (Kolariczyk, 2022). Obtaining quality and uniform chicks depends on the frequency of egg collection, the number and hygiene of the nests, the fumigation process applied to the eggs after collection, as well as the transportation conditions and transportation distance of the eggs (Gönenç, 2017).

Egg storage

Incorrect storage of eggs results in the hatching of chicks with deformities such as crossed beaks, missing eyes, crooked necks, crooked toes, and wide legs. Eggs stored for too long result in panting chick with a high rate of early death. Dirty eggs can cause navel infections, leading to chick deaths (Yassin et al., 2009; Okur and Türkoğlu, 2016; Anonymous, 2024b; Yerpes et al., 2020).

Incubation

Temperature

Incubation temperature is the most important external parameter determining embryonic development and growth. High embryo mortality in the early and late stages is due to high incubation temperature. Similarly, chicks hatching very early with bloody navels are also due to high incubation temperature (Preez, 2007; Fayaz, 2014; Anonymous, 2024b). Every 0.5°C decrease in incubation temperature increases the incubation period by 4 hours. If the temperature exceeds 39°C during the development period after the 16th day, the incubation period rises again. It is difficult to standardize the time when chicks are removed from the incubator. If chicks are removed early, they will be classified as second-class because they do not dry completely. If they remain in incubators for a long time, the risk of dehydration and death in the first week will increase (Anonymous, 2024c).

Humidity

Insufficient humidity causes the embryo to stick to the shell and die, and also causes the chicks to be small and malformed, leading to death. Excessive humidity can cause chicks with rude or unhealed navel and sticky chicks to hatch, leading to death (Anonymous, 2024b).

Ventilation

Inadequate ventilation leads to the formation of dead embryos and hatching of sticky chicks contaminated with egg contents. On the other hand, it leads to the formation of large, soft-bodied chicks, and the existence of hatched but dead chicks (Anonymous, 2024b).

Turning

Inadequate turning of eggs may cause the embryo to stick to the shell, causing many embryo deaths in the early stages (Elibol, 2003; Okur and Türkoğlu, 2016; Oliveira et al., 2020; Anonymous, 2024b).

Hygiene

The most likely cause of abnormalities, weak chicks and omphalitis in chicks is sick breeder flocks or inadequate hygiene and sanitation in hatchery operations (Muhammed et al., 2009).

CAUSES OF EARLY DEATH IN CHICKS

Chick Development

Digestive System

Since the embryo uses the egg yolk as a source of energy and albumin as a source of protein during the incubation period, the digestive system is not developed in the chicks after hatching (Vieira and Moran, 1999). Towards the last stage of incubation, the unused egg yolk is withdrawn into the abdominal cavity to be used to meet metabolic needs until the chick starts eating. The use of the egg yolk also encourages the development of the small intestine (Noy and Sklan, 1999). The chicks need to have access to food and water as soon as possible (within 48 hours) because the yolk sac can meet the chicks' nutritional needs for several days. Since the embryo is fed with lipid-based nutrients found in the egg yolk, it needs to be fed with the help of the digestive system after hatching, and it will need a certain amount of time to adapt to solid foods that are carbohydrate- and protein-based. Therefore, the first week is an important time as morphological and physiological changes occur in the digestive organs of the chicks, especially in the intestine. Broiler chicks need to start consuming feed within the first 24 hours for their subsequent good performance (Maiorka et al., 2004; Uni and Ferket, 2004; Saki, 2005).

In the last few days of incubation, nutrients such as carbohydrates, amino acids, proteins, minerals, and vitamins are given to the amniotic fluid of the embryo using the *in-ovo* method, and the embryo starts to consume feed while it is incubating. With this application, the weight of the yolk sac taken into the abdominal cavity is increased, post-hatching mortality is reduced, enzyme activities (sucrase-isomaltase and amino-peptidase) are increased, and post-hatching feed consumption is stimulated by increasing appetite (Uni and Ferket, 2004). With the use of the in ovo feeding method, feed consumption is encouraged in chicks within the first 24 hours after hatching, and the development

rate of the digestive system is increased by giving feeds containing appropriate nutrient composition. In this way, the completion of the digestive system development is delayed to an earlier age, allowing them to benefit better from feeds. Thus, their immune systems are strengthened, their resistance to diseases increases, and chick mortality rates decrease. The performance of the animals improves, resulting in more economical production (Çelik and Açıkgöz, 2006).

Immunity

The intestinal flora of newly hatched chicks has not yet developed, so immunity from the mother through egg yolk supports them in coping with the stress they face (Van der Eijk et al., 2020). While starting feed consumption after 24 hours does not negatively affect immune system development in chicks, starting it after 48 hours prevents immune system development (Juul-Madsen et al., 2004). Researchers are trying to strengthen the immune system against intestinal antigens, accelerate intestinal development, increase muscle development and breast meat yield with in ovo feeding (Uni and Ferket, 2004).

Body Temperature

Chicks are very sensitive, especially in the first 15 days. During this period, their ability to regulate their body temperature is quite inadequate and can easily cause them to get sick and die (Anonymous, 2024c).

Chick Gender

Gender is reported to be significantly associated with chick mortality in the first week. Mortality rates are higher in male or mixed flocks than in female flocks (Yerpes et al., 2021).

Season

In terms of chick mortality, mortality is higher in autumn and winter seasons compared to spring and summer (Yerpes et al., 2021).

Transportation

The relationship between chick transportation and chick mortality in the first week of life was investigated and was found to be related to the percentage of daily chicks loaded per trip and chick gender (Chou et al., 2004; Yerpes et al., 2021).

Hunger and Thirst

In commercial broiler chicken production, it can take up to 48-72 hours for chicks to access feed and water in the field (Açıkgöz and Kırkpınar, 2017). During this period, being hungry and thirsty is

another important source of stress, negatively affecting the chicks. For many chicks, this process is very challenging and ends in death.

Nutrition

Water

Water is a must for chicks to be healthy and maintain their performance. In addition to transporting nutrients and metabolic end products, it plays a role in meeting some of the minerals such as Na, Ca, and K. On the other hand, it helps balance the body temperature of animals in hot weather. Using unhygienic water can cause high mortality (Anonymous, 2024a).

Feed Quality

Improving biosecurity measures for feed storage on the farm will reduce the risk of death in chicks by reducing pathogen proliferation in animal feed (Swelum et al., 2021). In case of insufficient protein, which is necessary for the development of muscles and organs and the healthy functioning of metabolism, growth retardation and death may occur (Anonymous, 2024d).

Stale and Spoiled Feed

Stale and spoiled feed given to chicks can be the cause of chick deaths. Toxins, especially in moldy feeds, can cause liver and kidney damage and lead to death in animals (Anonymous, 2024d).

Toxic Substances in Feeds

The most emphasized toxic substances are heavy metals, mycotoxins and pesticides for poultry (Kim, 2023). Feed-related toxicosis in animals usually develops due to an infectious agent, autointoxication, drugs used for therapeutic purposes, chemicals, mycotoxins, phytotoxins and biogenic amines (Kutlu, 2023). This may result in death in sensitive chicks.

Vitamin and Mineral Content

Significant deficiency of fat-soluble vitamins A, D, E and K and calcium, which are necessary for normal growth and development of chicks, can weaken the immune system and cause death. Water-soluble vitamins C and B-Complex are necessary for the metabolism, growth and development of chicks. A significant deficiency of these vitamins, as in fat-soluble vitamins, can cause death (Anonymous, 2024a; Anonymous, 2024d).

Diseases

Chickens are very susceptible to infections and diseases because their immunity is not fully developed in the first six weeks. If biosecurity measures are not taken, the probability of catching epidemic diseases such as Pullorum, Chicken Anaemia Virus Infection, Salmonellosis increases and deaths occur (Anonymous, 2024a; Appiah, 2019).

Vaccination

It is important to follow up on vaccinations. It reduces the risk of animals contracting endemic disease outbreaks such as Colibacillosis, Newcastle Diseases (ND), Fowl Typhoid, Chicken Anaemia Virus Infection, Gumboro Disease, Fowl Pox, etc. Incorrectly implemented vaccination programs may pose a risk for animals (Anonymous, 2024a).

Hygiene

Good quality chicks are a prerequisite for achieving the expected performance in industrial poultry farming. The most common problem in poor-quality chicks is bacterial infections, which are rarely observed in the first week in the henhouse. The source of infections is usually the farm or the hatchery. If vertical contamination is not present, the eggshell becomes contaminated with bacteria after laying. Processes such as egg collection, transportation, transfer to the hatcher, *in-ovo* injection application, transportation of chicks and elements such as nest litter, storage on the farm, hatchery conditions, chick boxes, and chick holding room can be the source of contamination (Anonymous, 2024c).

Herd Management

Insufficient or High Temperature

Chicks feel cold when the temperature of the henhouse is low. Prolonged exposure to cold causes the chicks' immune system to be affected and they become vulnerable to diseases. On the other hand, chicks instinctively try to huddle together to keep themselves warm. When chicks pile up on top of each other during gathering, suffocation and death occur (Anonymous, 2024a). If the temperature of the environment where the chicks are kept is too high, it causes the chicks to become dehydrated, encouraging them to consume more water instead of eating feed. Decreased feed consumption significantly affects the growth of the chicks and leads to death (Anonymous, 2024a).

Ventilation

The air requirement in the chick pens should be calculated as 85 m^3/hour for 1000 chicks. Inadequate ventilation causes ammonia gas accumulation in the house and when it exceeds 25 ppm, chicks die (Heier et al., 2002; Anonymous, 2024a; Anonymous, 2024c).

Overdensity

It has been reported that crowding in the first week in houses can increase the survival rate of chicks. The reason why mortality rates in houses are high in flocks with low density is that chicks lose less heat in flocks with high density and it is easier for untrained chicks to reach food and water sources in dense flocks (Heier et al., 2002; Chou et al., 2004; Yassin et al., 2009).

Dirty Henhouse - Litter - Contact with Feces

Another reason for chick deaths is a dirty coop, contaminated litter material and chicks coming into contact with feces. When the litter material is dirty and wet, ammonia accumulation occurs in the compartment, which is harmful to the chicks. When ammonia gas exceeds 25 ppm, stress, inadequate feed intake, irritation of the eye and nasal membrane, slow growth, and respiratory diseases such as coryza and bronchitis can cause serious problems and lead to death (Anonymous, 2024a). They mostly use sawdust as bedding material in the henhouses. However, since the chicks are inexperienced, they can mix sawdust with feed and consume too much sawdust as feed. Eating sawdust can cause gastrointestinal obstruction and lead to death (Anonymous, 2024a).

Poisoning

Mycotoxicosis is an important cause of intoxication in poultry. Mortality due to poisoning in chicks is proportionally high. Poisoning can be caused by many factors, such as botulism, herbal poisoning, excessive doses of drugs, excessive salt intake from feed, herbicides, insecticides, disinfectants, heavy metal poisoning, ambient ammonia and carbon monoxide levels. The type, dose and duration of the substance causing the poisoning are important here. Algae formed in pool water or tank water can also cause poisoning from time to time (Naser, 2018; Anonymous, 2024a; Anonymous, 2024d).

Injuries

Injuries can occur in hatched chicks during vaccination, sex determination, beak cutting, and transportation from the hatchery to the rearing houses and can result in death (Anonymous, 2024a).

Inadequate Feeders and Waterers

Inadequate feeders and waterers affect the performance of chicks by preventing them from accessing food and water and lead to deaths from starvation and thirst in later stages. Transporting chicks and subsequently not being able to access water leads to dehydration, and water losses of over 10% result in deaths (Naser, 2018). On the other hand, it can cause chick death by causing a stampede for accessing food and water (Anonymous, 2024a).

High Relative Humidity

High relative humidity in the henhouse causes the bedding material to become wet and creates suitable conditions for epidemic diseases by preparing the ground for the proliferation of microorganisms. It can result in the death of chicks (Anonymous, 2024a).

Excessive light

Excessive light and brightness inside the henhouse cause the blood vessels to be attracted by other young chicks, which leads to feather pecking and cannibalism (Appleby, 2004). Cannibalism is an important welfare problem because it causes increased feed consumption and death in animals (Rodenburg et al., 2010).

Stress

Stress can reduce immunity in animals, leading to bacterial growth, infection and death of chicks (Anonymous, 2024d; Onbaşılar, 2005).

Predators

Poor construction of henhouses can cause predators such as rats, dogs, cats, etc. to enter the henhouse, attack the chicks and cause chick deaths (Anonymous, 2024a).

Experience and Education Level of Managers

The lack of education and experience of managers increases the chick mortality rate (Apiah, 2019).

PRECAUTIONS

- Purchasing eggs and chicks from reputable and reliable suppliers
- Paying attention to the care and nutrition of the parents
- Storing eggs in appropriate storage conditions
- Properly collecting and transporting eggs
- Carrying out incubation practices following the procedure
- Completing the processes in the hatchery as soon as possible and shipping the chicks
- Transporting the chicks at low temperatures of the day
- Ensuring that the chicks have access to water and feed as soon as possible
- Managing the flock well
- Taking the necessary precautions against diseases
- Using healthy (not moldy, spoiled or stale) and balanced rations
- Having a sufficient number of waterers and feeders
- Keeping the waterers and feeders clean

- Checking the health status of the animals
- Protecting the chicks from cold weather
- Cleaning the henhouses regularly
- Ventilating the henhouses sufficiently
- Lighting the henhouses sufficiently
- Complying with vaccination programs
- Complying with hygiene rules in the henhouse
- Using clean and suitable litter
- Adjusting the chick density in the henhouse
- Protecting chicks from poisoning and injuries
- Keeping chicks as stress-free as possible
- Protecting the henhouse from predators
- Regularly having animals checked by a veterinarian

Additional Declaration

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Responsible Artificial Intelligence Statement

No artificial intelligence support was received in any part of this study.

Conflicts of Interest

The author declares that there are no conflicts of interest related to the publication of this study.

Ethics Approval

In all processes of this study, the principles of Pen Academic Publishing Research Ethics Policy were followed.

This study does not require ethics committee approval as it does not involve any direct application on human or animal subjects.

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