An HSUS Report: Welfare Issues with Transport of Day-Old Chicks

Abstract

In the United States, more than 9 billion chickens and 250 million turkeys are raised and slaughtered annually for food. Virtually all broiler chickens (those raised for meat) and turkeys come from strains produced by four and three primary breeding companies, respectively. Within several hours after hatching, the chicks are typically relocated from the hatchery or breeder farm to the commercial grow-out facility via ground and air transportation. Small hatcheries also send chicks to backyard "hobbyists" via U.S. Postal Service delivery. Unless carefully controlled and properly managed, transport—whether by truck or plane and regardless of scale, commercial or specialty—can subject newly hatched chicks to substandard environmental conditions that may be detrimental to their welfare and even result in death.

Introduction

Day-old chicks' "welfare and growth, development and performance may be markedly influenced by the first episode of transportation between hatchery and rearing site."[1] As such, optimizing conditions is vital to reducing mortality rates during and following transport.

Unlike adult birds and mammals, who are able to regulate body temperature metabolically, recently hatched chicks cannot fully self-regulate their body temperature. As a result, they are sensitive to heat stress and are especially prone to becoming chilled, thereby requiring an external heat source. Because of the special temperature requirements of chicks during the first week of life, affording them protection from environmental extremes of heat and cold during transport is both critically important and challenging.

Before hatching, chicks prepare themselves for their first few days of life by taking the yolk, a store of nutrients, into the abdominal cavity. The yolk "comprises approximately 20% of the BW [body weight] of chicks and provides immediate posthatch energy and protein for maintenance and growth."[2] However, commercial broiler chicks have been bred, in part, for unnaturally high metabolic rates,[*] so the yolk may be nutritionally insufficient for these purposes.[3,4] Absorption of the yolk should enable chicks to survive at least a short time without outside nutrients, but they are typically transported without food or water, which compounds the pressures on their bodies.[5]

In a review of the scientific literature to date, it is suggested that "to simultaneously optimize survival, productivity and welfare of the newly hatched chick in transit, an effective strategy would be to match the thermal characteristics of the micro-environment to the biological requirements of the birds."[6] However, this recommendation may be difficult to follow, given the range of weather conditions found throughout the United States, where extremes can range from below -17.8°C (0°F) to above 37.8°C (100°F). Temperature fluctuations of tens of degrees across geographical areas at the same time or at one place over just a few hours are also common.

[*] For more information see "An HSUS Report: Welfare Issues with Selective Breeding for Rapid Growth in Broiler Chickens and Turkeys" at www.hsus.org/farm/resources/research/practices/fast_growth_chickens_turkeys.html

Air transport contributes additional challenges that can adversely affect chick welfare before, during, and following flights. As extremely low temperatures and atmospheric pressures are found at the altitudes at which commercial planes fly, cargo holds should be pressurized, heated, and ventilated to provide appropriate environmental conditions for live animal transport.[7] Possibly due to the lack of environmental control during the holding stages preceding and following flights, these periods can be even more detrimental to the chicks' welfare than the flights themselves.[8]

Duration of Transport

Since chicks have a limited store of nutrients at hatching, the duration of transport has a significant impact on the animals' physiological condition. Shipments of newly hatched chicks may be comprised of both early- and late-hatching chicks, meaning the animals can vary in age by 21 to 36 hours.[9,10] As a result, early-hatching chicks may be deprived of food and water for a longer period of time before transport.[11]

Hongwei Xin, Professor of Agricultural and Biosystems Engineering at Iowa State University, and Steve Rieger, with Hy-Line International, report that the dead-on-arrival (DOA) mortality percentage of chicks transported by aircraft is proportional to travel time. For journeys approaching 72 hours, the mortality rate was more than 11%, while the seven-day mortality (including DOAs) for chicks was nearly 50%. This was with an average box temperature of 31-35^{o}C (88-95^{o}F) during ground transport and 26-34^{o}C (79-93^{o}F) during flight.[12]

The European Food Safety Authority's Scientific Panel on Animal Health and Welfare cautions that under some conditions "the food reserves of domestic fowl chicks are used up by 48h. When temperatures are high, they are used up much earlier."[13] Newer breeds of commercial birds have a much higher metabolism than older breeds, so the chicks are less equipped to "withstand long periods of inanition than chicks of 20 years ago."[14] One study concludes that delaying feeding of fast-growing broiler chicks by 48 hours can inhibit development, "which may not be offset by regular diet and hatchery practices."[15] Researchers in Denmark investigating the effects of post-hatch delayed feeding on broiler chicks' growth and immune function found that "food deprivation for 48h may be unfavourable to the growth, viability, and the immune performance"[16] and concluded that "[f]orty-eight hours without food is therefore not recommended."[17] Another study indicated that "the maximum fasting period, which had no significant negative effect on final weight, was 24h after the chicks were removed from the hatchers."[18] Providing access to nutrients during transport may mitigate effects of delayed feeding.[19]

Temperature

The effects of the environment on the health and growth of day-old chicks have been studied extensively, with research progressing from looking only at temperature effects to including details such as relative humidity and ventilation. Typically during transport, commercial containers or boxes are stacked one on top of another in tiers, with several boxes per tier and 80 to 100 chicks per box.[20] Measured temperatures inside the containers placed in the center of the stack, both vertically and horizontally, can be 8-14^{o}C (14-25^{o}F) warmer than the ambient temperature, while the temperature of the boxes placed on the outer perimeter of the stack are likely closer to the ambient temperature.[21]

A comfortable, or thermoneutral, temperature for day-old chicks is approximately 31^{o}C (88^{o}F).[22] Thermoneutral temperatures are often given as a range, defined by minimal metabolic rates or minimal expended energy to create or dissipate heat.[23,24] Based on differing measurements of thermoregulatory efforts, scientists vary in their proposed thermoneutral temperature ranges for day-old chicks, spanning from ranges as narrow as 30-32^{o}C (86-90^{o}F)[25] or 32-35^{o}C (90-95^{o}F)[26] to more encompassing ranges, such as 31-37^{o}C (88-99^{o}F).[27] Outside of these limits, an animal must adjust his or her behavior to thermoregulate. When investigating the effects of extreme temperature ranges on chicks, it was found that the upper critical temperature for day-old chicks is approximately 36-37^{o}C (97-99^{o}F)[28] and the lower critical temperature approximately 30^{o}C (86^{o}F).[29]

Examples in the scientific literature demonstrate that extreme temperatures may quickly become lethal for chicks. Though much better equipped to thermoregulate than a day-old chick, a seven-day-old chick may stop breathing in less than three hours at an ambient temperature of 10°C (50°F), though the heart may continue to beat.[30] A poultry breeding representative has noted that at freezing temperatures (0°C or 32°F), chicks cannot survive for more than 15-20 minutes.[31] Measurements taken during air transport studies of chicks recorded box temperatures exceeding 37°C (99°F) for up to several hours.[32] If held at slightly higher temperatures, for example, at 40°C (104°F), the chicks' water stores may be exhausted in 8-10 hours.[33]

Xin studied the effects of cycling temperatures over 50 hours on the body weight and mortality of chicks in commercial containers where half of the chicks had access to nutrients and water. Over the duration of the experiment, there was no significant decrease in mortality between the two groups—those afforded access to nutrients and those deprived. However, the research did not continue to monitor for mortality after the 50-hour experiment, when further effects of temperature stress and nutrient deprivation may have become apparent. The chicks who were given access to in-transit feed maintained their body weight better than those without access to nutrients, and Xin concluded that increased metabolic heat production due to a supply of nutrients "will greatly enhance the chicks [sic] ability to cope with cold stress."[34] Other research has shown that food and water deprivation for 48 hours increased mortality rates for birds under conditions of heat stress.[35] More work is needed in this area, but the availability of food and water during transport seems to improve the welfare of the birds transported over long periods of time and at extreme temperatures.

Three decades ago, the believed optimal temperature range for transporting chicks was 16-20°C (63-67°F).[36] The International Air Transportation Association's (IATA's) acceptable ambient temperature range (effective October 1, 2006) for shipping day-old chicks is 14-23°C (57-73°F).[37] This range is below other recommendations. Several scientific studies, a breeder company, and the European Food Safety Authority's Scientific Panel on Animal Health and Welfare currently recommend a temperature range for chick transport of 24-26°C (75-79°F).[38,39,40,41] In a review of the recent literature, the ideal temperature and relative humidity (RH) range was determined to be 24.5-25.0°C (76-77°F) and 63-70% RH for transported chicks held at typical stocking densities. This recommendation is based on several physiological indicators of chick comfort, including minimal change in body temperature, hydration state, and electrolyte balance,[42 43] and takes into account the heat generated inside the transport container by the chicks themselves. At these temperatures the microenvironment within the transport crate will be closer to the chick's thermoneutral temperature.[44]

Arguably, high temperature is the most severe stressor that chicks face during transport. At high temperatures and high humidity, the ability to regulate body temperature through water evaporation by panting becomes difficult. It is in this situation that appropriate ventilation is important, "but its achievement is often difficult because of the construction of the crates and their proximity to one another."[45]

Ventilation

As noted, when traveling at higher temperatures, it is critical to keep chicks well-ventilated to allow for more effective thermoregulation. With restricted ventilation (as in an aircraft), when temperatures around the transport container are at or above 34°C (93°F), the temperature inside the crate increases quickly to exceed 40°C (104°F). At this elevated temperature, the chicks begin panting, which increases the relative humidity inside the container and reduces the amount of heat loss by evaporation—effects that can increase body temperatures up to 43-44°C (109-111°F) within 40-50 minutes, which may induce coma and death in chicks.[46]

Midwest Plan Service, a university-based publishing cooperative that distributes agricultural information, recommends a minimum ventilation rate of 0.019 L/s/chick (liters per second per chick) in cold weather.[47] However, to obtain this minimum air flow, the vertical distance (VD) between containers should be about 8 cm (3.15 in),[48] which is much greater than the IATA's recommended distance of 1 cm (0.4 in).[49] Ventilation rates around take-off and landing are significantly lower than during flight and pose a greater risk of rapidly increasing temperatures.[50] The problem is exacerbated in an aircraft due to the tight packing, restricted free volume around the transport containers, and the possibility of nearby mechanical equipment producing heat.[51]

Oxygen shortages from a lack of ventilation in holding areas and cargo compartments of aircraft have been reported in chicks. Higher flow of air through the stacks of transport containers are recommended to alleviate this problem.[52] Research on heat tolerance and transport of day-old chicks has shown that two-compartment boxes with "about 20 chickens each and vertical spacing all around each stack will give the lowest weight loss and mortality."[53]

Conclusion

When transporting day-old chicks, extreme temperature ranges may be detrimental to animal welfare, and, at excessively high and low temperatures, chicks may die in less than one hour. Reduced ventilation may also adversely affect chicks. While good ventilation can help prevent high temperatures, it is not clear that current stacking configurations and spacing are adequate to promote proper ventilation.

According to the research available to date, optimal conditions for day-old chick transport are: a temperature range of 24-25°C (75-77°F), relative humidity of approximately 65%, space allowance of 21-25 cm^2 (3.3-3.9 in^2) per chick, and travel time from hatching no longer than 48 hours,[54,55,56] with some scientists advising even shorter travel times of 12 hours.[57] The temperature within the transport container should remain as close as possible to 31°C (88°F), though this may be difficult to ensure. Temperatures within densely packed commercial containers may vary by several degrees if poor ventilation exists. The transport boxes placed on the outer perimeter of a stack typically measure at different temperatures than those found towards the center of a stack, both vertically and horizontally.

Current container densities should be reviewed to improve ventilation through the transport crates in confined spaces. New research may also further clarify the importance of food and water access in reducing stress and mortality of chicks on long journeys or at extreme temperatures. Unless such work demonstrates that these resources are unnecessary, chicks should be transported with nutrient supplies to promote well-being.

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