An early start

Years of experience have taught hatchery managers, day-old-chick transporters, and poultry farmers which climate conditions their newly hatched chicks prefer. However, the world of incubation is changing, and the requirements of the day-old-chick may be changing along with it. One important change is the development of systems in which chicks receive water and feed immediately post hatch.

In a traditional hatchery, newly hatched chicks do not receive water and feed until they arrive at the farm. The full onset of their growth and development is delayed in this period without feed and water. New systems in which chicks are provided with water and feed immediately after hatching are becoming the new standard. For example, HatchCare is HatchTech’s hatcher with light, water, and feed. Providing nutrition immediately post hatch means that a chick can continue developing. However, this impacts the chick’s physiology. Digestion of feed increases the metabolic rate as some of the energy in feed is converted to heat when nutrients are digested and metabolized. This results in increased heat production.

An increase in heat production may have consequences for the ideal environment of the chick, and thereby the required cooling capacity for the chicks’ hatching, storage, and transport systems. HatchTech’s research team performed an experiment to quantify the difference in heat production between chicks that had received water and feed immediately post hatch and traditional chicks.

Experiment: heat production

120 Ross 308 eggs that had been incubated for 18.5 days were placed in 4 climate respiration chambers at Wageningen University & Research. Climate respiration chambers are facilities in which the energy metabolism of live animals can be measured through their respiration. All eggs were incubated at an eggshell temperature of 37.8°C and were exposed to continuous light. Half of the hatched chicks received water and a pelleted feed immediately after hatch, and the other half did not receive water and feed. The experiment was ended on day 22 after the start of incubation, when all chicks had hatched.

O₂ intake and CO₂ output per climate respiration chamber were measured continuously and used to calculate heat production (mW/chick; Gerrits and Labussière, 2015). Moment of hatching was recorded for each egg through video observations. At pull time, individual body weights were measured per climate respiration chamber (for chicks with access to water and feed).
Higher heat production

Heat production increased for all embryos and chicks as the hatching process progressed until embryonic day (E)20:06h (Figure 1). By then, about 90% of all chicks had hatched. The chicks that had access to water and feed continued increasing heat production while the withheld chicks plateaued at about 340 mW/chick average. Often, chicks with access to water and feed will be pulled from the incubator between E21:06 and E21:12. Heat production by then may already be 1.3 to 1.5 times higher than for withheld chicks, as it was found to be 390 mW/chick at E21:00 and 521 mW/chick at E21:12.

These results show that the amount of heat produced in a batch of chickens that had had access to water and feed is much higher than in a batch of traditional chicks. This has consequences for the required cooling capacity of the hatching system, chick storage rooms, and transport. If a machine is already performing close to its maximum capacity when filled with withheld chicks, it will not be able to meet the environmental requirements of chicks with water and feed in the hatcher and they run a risk of overheating. Another aspect to keep in mind is that chicks that received water and feed in the hatcher may require a lower broiler house temperature than withheld chicks. Their metabolism is upregulated, resulting in a higher body temperature if the environmental temperature is not adjusted accordingly.

If chicks are pulled later than E21:12, or if they receive feed and water in storage and/or during transportation, their heat production will increase even more. In this experiment, heat production of chicks with access to water and feed was found to be 634 mW/chick at E22:00, which was almost 2 times as high as the values found for the withheld chicks.

As expected, the fed chicks differed from the withheld chicks not only in heat production, but also in body weight. By pull time at E22:00, body weight of the chicks with access to water and feed averaged 57.0 g while it averaged 42.7 g for the withheld chicks. It is known that chicks start to ingest small amount of feed in the first 12 hours post hatch, but they increase their feed intake with time post hatch. This corresponds with the increase in heat production that can be seen from E20:06 onward. Once withheld chicks start feed intake in the broiler house, their heat production will likely increase similarly to a fed chick, but with a delay of about 1 day.
Ventilation is crucial
Along with the increase in heat production, an increase in O₂ consumption and CO₂ production could be observed for the chicks with access to water and feed compared to the withheld chicks. By the time at which chicks are normally pulled from their incubator, at E21:12, CO₂ production was 2 times higher for chicks with access to water and feed (at 1.42 ml/min) than for withheld chicks (at 0.71 ml/min). By E22:00, O₂ consumption was 1.80 ml/min per chick for chicks with access to water and feed compared to 1.00 ml/min per chick for withheld chicks. CO₂ production was 1.74 ml/min per chick for chicks with access to water and feed compared to 0.73 ml/min per chick for withheld chicks. These results emphasize the importance of adequate ventilation for chicks with access to water and feed during hatching, storage, and transportation, as they will likely increase CO₂ levels more than traditional chicks.

Conclusions
Providing water and feed immediately post hatch creates a more developed, robust day-old-chick than when chicks hatch in a traditional system. However, the advantages of providing water and feed in the hatcher may be diminished if post hatch conditions are sub optimal. Extra care should therefore be taken to ensure that the environmental needs of chicks that received water and feed in the hatcher are met in all stages post hatch.

It was found that providing water and feed in the hatcher clearly increased the metabolic rate compared to withheld chicks, increasing overall heat production, O₂ consumption, and CO₂ production. While chicks that had received water and feed are in their hatching system, storage, or transport, they run a higher risk for overheating and the CO₂ levels may increase above the desired level more easily than traditionally. This shows that cooling and ventilation are even more crucial for chicks with access to water and feed than for traditional chicks. It may furthermore be wise to lower broiler house temperature at arrival for chicks that had had access to water and feed in the hatcher compared to traditional chicks to compensate for the higher body heat production. By ensuring that all chicks with access to water and feed are kept at a comfortable temperature that suits their changing needs, optimal chick quality is guaranteed and health and performance are maximized.

Reference