



Technical Information

**The decisive difference
in chick length**

cm

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Hatching chicks is running a marathon, followed by a sprint

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In practice, achieving a good chick quality at hatch is important as the incubation process of broilers includes at the moment 33% of the bird's lifespan and the production cycle still reduces over the years. Chicks with a good growth and feed conversion, good health and a low mortality are preferred in the field. The question is what the chick requires both prenatal and postnatal to meet these goals.

Starting with the egg, the yolk and albumen contain the nutrients for energy and development of the embryo. An egg contains 50% water and 50% solid matter, which are mainly lipids and proteins and only a small amount of carbohydrates (<1%). The nutrient use of the embryo during the early stages of development is mainly glucose and protein. During the latter half of development, which represent the major growth period, energy metabolism of the embryo is dominated by the utilization of yolk lipids. Embryos can be compared in this period with athletes running a marathon, as they both use mainly lipids to obtain energy. At the end of the incubation process when the embryo starts to emerge from the eggshell, a lot of energy is required in a short period and carbohydrates are important again. Oxygen is limited during this hatching process and that is the reason why carbohydrates are used, as they can provide energy without the presence of oxygen. During the hatching process, embryos can be compared with athletes running a sprint.

Development of a hatchling is related with its livability and subsequent performance. Development can be influenced during incubation by temperature, gas level, relative humidity, but also storage period and age of the breeder flock. If development and nutrient supplies are not optimised, this has negative consequences. In the worst case, the embryo is not able to hatch and dies during incubation. If the chick hatches and development or nutrient supplies are not sufficient, the chick is weak and not able to survive the period between hatch and access to food. Late mortality which varies between 3-8% and

second grade chicks which exceeds 2% might be related to sub-optimal nutrition transition and storage.

Suboptimal incubation conditions negatively influences performance in later life, in terms of a lower slaughter weight, a lower breast meat yield and a higher feed conversion ratio. Until now, it is less clear what is happening with the nutrient flow from the egg to the embryo during incubation. How is running the marathon or performing a sprint of the embryo influenced by different incubation conditions? We are trying to answer this question in a PhD project.

In the first experiment, we evaluated the effect of temperature and oxygen on survival rate, development, metabolism and energy content of hatchlings. We found that both temperature and oxygen concentration influence development of the birds and the utilization and storage of nutrients in the bird, but in a different way.

High eggshell temperature compared to normal eggshell temperature had a negative effect on embryo development and impaired growth of the cardiovascular system, expressed by a lower heart and lung weight. Energy content of the birds was reduced in the high eggshell temperature treatment, but also the efficiency of nutrient transfer from the egg to the embryo was decreased. High compared to optimal eggshell temperature seemed to destroy the normal flow of nutrients from egg to embryo and impaired development.

This is in contrast with oxygen concentration. A lower oxygen level reduces development as well, but this is relative and organ weights are not decreased. Energy contents are lower in chicks incubated in a lower oxygen concentration, but the efficiency in energy transfer from egg to embryo is in general not reduced. Oxygen concentration determines growth rate of the embryo and only changes the ratio of nutrients going from the egg to the embryo.

At the moment, we are preparing a trial about the effect of eggshell temperature on subsequent performance and health status of broilers during their life span. This experiment will be done at the PennState university in Pennsylvania during the spring of 2009.

We understand more and more what is happening inside the egg with the nutrient flow from the egg to embryo and how different incubation conditions can influence these processes. Transferring this knowledge into practical incubation will lead to better results, both in hatchability as in subsequent performance of the birds.

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