APRI FACTS

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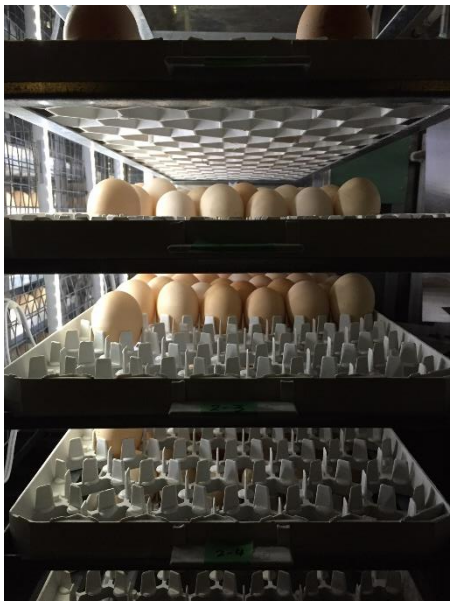
LIGHTING DURING INCUBATION – WHAT WE KNOW; WHAT WE DON'T KNOW

The transition towards limiting the use of antibiotics in the production of commercial broiler chickens has challenged the Canadian poultry industry to consider alternate approaches to managing bird health and disease. Ensuring that newly hatched chicks are of the highest quality is a large part of optimizing early growth performance. This good start in life is one of the keys to successfully growing birds in a "raised without antibiotics" production system, as historically, weak chicks would be given an antibiotic to help them get through the first few critical days of life. A focus on optimizing early health and performance has led researchers to investigate parameters in the incubation environment that encourage superior embryo development and chick quality.

Environmental conditions in which an egg is incubated influences the production performance later in the life cycle. Studies have shown that the chicken is sensitive to a range of wavelengths from infrared to ultra-violet; and various physiological functions of the bird are influenced differently depending on the wavelength of the light source. It is hypothesized that light received during incubation can potentially improve a chick's development and its ability to adapt more readily to the post-hatch environment.

Dr. Bruce Rathgeber and his team have been conducting research on the impact of light in the incubator on hatching performance and post-hatch growth performance for layers and broilers since 2015.



Much of the focus of the team's research has been directed towards measuring the impact of providing light to narrow the hatch window. This is important as chicks hatching too late will not be harvested, and chicks hatching too early may become dehydrated. The research team has identified some lighting parameters that influence the rate at which chicks hatch once the process begins such as the color of light and the length of exposure to light and dark. However, the results have been contradictory and inconsistent.

One parameter that has had repeatable results is body weight gain within the first 6 hours following placement of chicks in the production facility. Providing light during incubation for 12 h per day has been shown to improve body weight gain by as much as 22% and feed intake by 13% in the first 6 hours after placement, in the case of broiler chickens. And although this benefit disappears over time, when compared with other lighting treatments, optimizing the hatching environment has the potential to improve chick survivability and reduce the use of antibiotics.

A question arising from this finding is “What factor is controlling the higher feed intake under this lighting regime?” Is it controlled by the exploratory behavior, dehydration due to an early hatch, or the secretion of the hormones which are involved in the regulation of feed intake?

Melatonin, produced by the pineal gland, is one of the important hormones that prevent metabolic and physiological disorders in poultry. It regulates the brain's circadian rhythm or ‘biological clock’, acts on respiration, circulation, excretion, reproduction, and the immune system. Melatonin also helps regulate feed consumption, energy metabolism and body heat. It stimulates growth hormone secretion and, thus, affects growth performance (Calislar et. al. 2018).

During the growth of the chick embryo, the pineal gland forms on the 3rd day of incubation and the first sign of photoreceptor development in the broiler retina can be observed on the 8th day of incubation. Those cells and organs will be matured and functional by the last week of incubation. However, it is not clear at which stage of incubation, the embryo utilizes the day-night information to synchronize their biological clock. Determining the optimal day length is also important as continuous illumination during incubation has been found to negatively affect chick quality including navel closure condition, growth parameters and tibia and femur development.

Dr. Rathgeber and Ph.D. candidate, Xujie Li plan to measure embryo melatonin to identify the timing of circadian rhythm development in chicken embryos. Embryo temperature will also be measured as an indirect indicator to discover its correlation to the day-night pattern of melatonin production.

The integrative role of the circadian clock system will be thoroughly investigated to understand the underlying mechanism of how a lighting program in the incubator, the combination of daylength and wavelength, impacts growth and feed consumption in neonatal chicks.

Industry Impact:
The research will determine if providing light during incubation can be an alternate approach to reducing the use of antibiotics to stabilize the health of commercial birds. It may also reveal the optimum age to begin illumination for chicken embryos, thus affecting energy costs.

Reference
Çalışlar S, Yeter B, Şahin A 2018. Importance of Melatonin on Poultry. KSÜ Tar Doğa Derg 21(6) : 987-997, DOI:10.18016/ksutarimdoga.vi.433039