

# Gut Health from Hatchery



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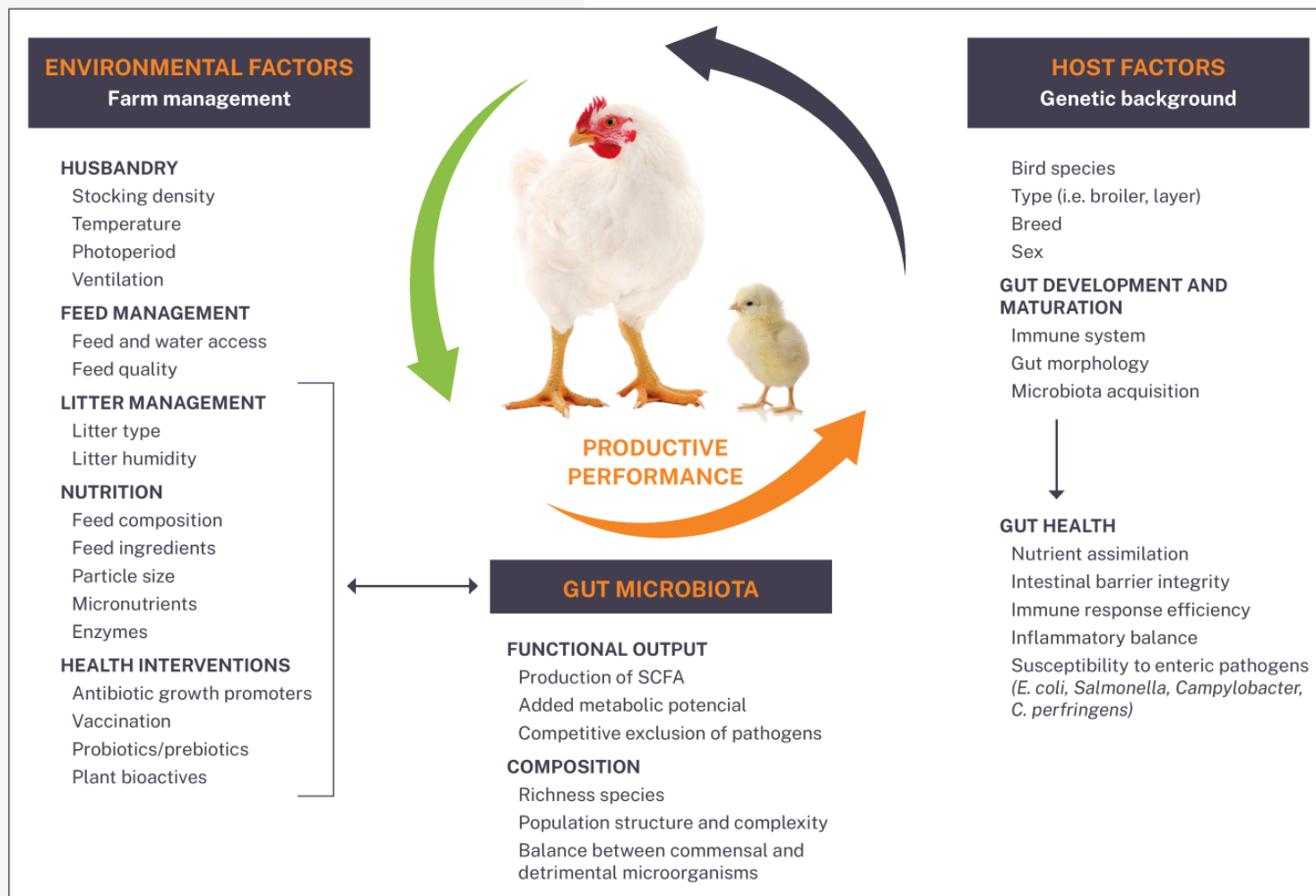


Gut health is receiving greater attention in antibiotic-free production systems. Hatcheries have gained more relevance due to their impact on several key factors in maintaining gut health.

**Poultry gut health depends on environmental and host factors.** Both influence the development, composition, and function of gut microbiota.



**Among the host (bird) factors, incubation plays an important role in hatchling gut development and maturation, the development of the immune system, and microbiota acquisition.**





Hatcheries are also involved in most vaccinations and, recently, in early feeding. **The development of the gastrointestinal tract starts very early**, with the formation of the endoderm in the primitive streak 16 hours after the egg is laid. The gizzard and guts are already visible at 6 days of incubation.

**Gut bacteria with health impacts on birds and food safety implications can be obtained in hatcheries.** Hatcheries are also responsible for vaccine application to prevent critical diseases, including coccidiosis, vital to gut health.



# Learning Objectives


 This module seeks to explain the effects of incubation on gastrointestinal development and gut health. We will also review the impact of hatchery management practices on gut health.

 **Temperature and relative humidity are the most important factors that may affect embryo development and gut development.**

Bacteria and fungi are involved in several incubation factors. Egg disinfection may affect the normal microbiota or microorganisms that come naturally with the egg.

It is well known that **eggshell temperature, especially during the last incubation phase, affects broiler performance post-hatch.** There are effects on body weight and feed conversion.

When temperature profiles are suboptimal, feed conversion is negatively affected. The feed conversion ratio increases by two to three points, and body weight gain is reduced when incubation is suboptimal. This effect has been confirmed in several experiments.

 **There are relevant differences in the performance of broilers depending on the incubation system used.**

Broilers hatched from single-stage incubators have 20 grams more, 5 points less FCR, and 0.05% lower mortality at 62 days of age than broilers hatched from multi-stage machine. **Even changes in the management of hatchers can have an important effect on broiler live performance.**

The reason is that high temperatures, mainly in the hatcher, cause 5% smaller chicks, just two grams lower body weights, but cause a reduction in gizzard proventriculus and small intestine development. These tissues are less mature, and enzyme activity is reduced.

This effect can be observed in necropsies when gut development is observed. **At hatch, gut length, liver, and intestines are smaller when chicks endure a suboptimal incubation.** By seven days of age, all viscera are larger in proportion to body weight, but they are less efficient. The ceca gets larger since more undigested feed is observed.



We tested whether broilers can differ in feed energy utilization due to incubation profiles. We compared a standard incubation with eggshell at 38.1 °C (100 °F), with a profile that had low eggshell temperature (36.9 °C) the first three days and a elevated eggshell temperature (38.9 °C) the last three days of incubation.



We could **not detect significant differences in energy utilization or digestibility in the two experiments conducted.** Other researchers were also unable to detect this effect.



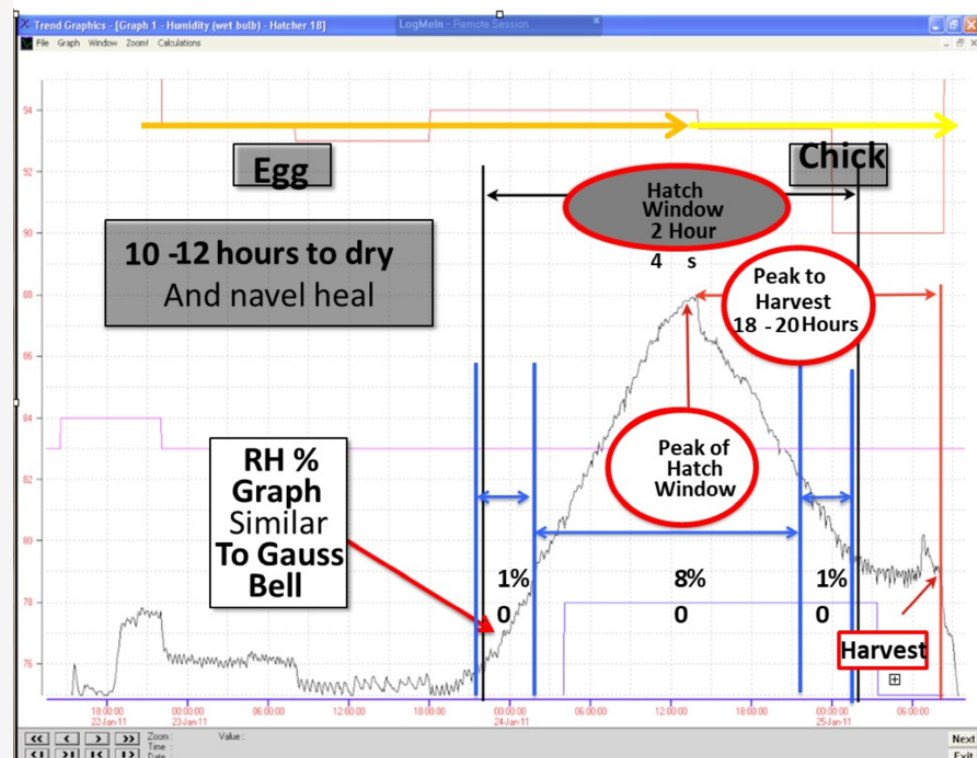
**However, it seems that variations in temperature during incubation may affect metabolic heat production, which is why they are less efficient.**

The adverse are not permanent in the intestine development and chickens compensate to obtain similar nutrients and energy from feed, but their metabolism changes and become less efficient.

# Hatching window

The hatching window affects the time it takes to access feed and water, which is critical for gut development.

The machine's graphs of relative humidity provide a good idea of the hatch window. **The wider the hatch window, the greater the number of chickens that may have delayed access to feed and water.** Feed and water stimulate the use of residual yolk.

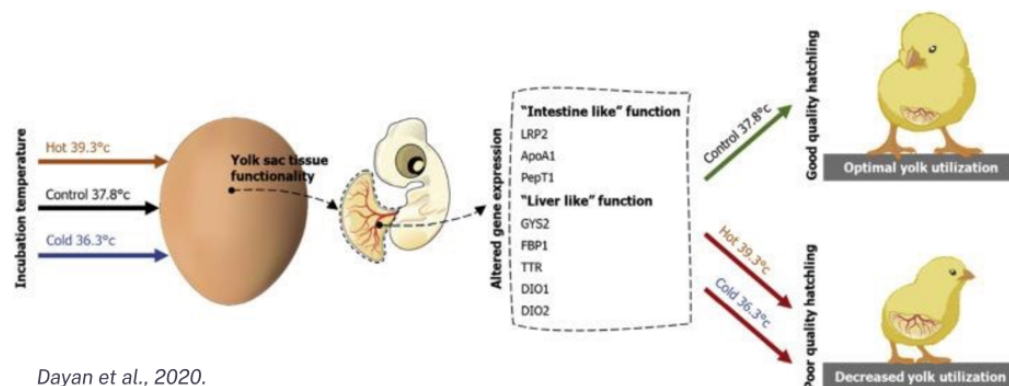


# Incubation conditions affect gastrointestinal immunity

The yolk tissue has essential functions that replace the intestine and liver, but when the incubation is suboptimal, the function is altered, and the yolk utilization decreases.

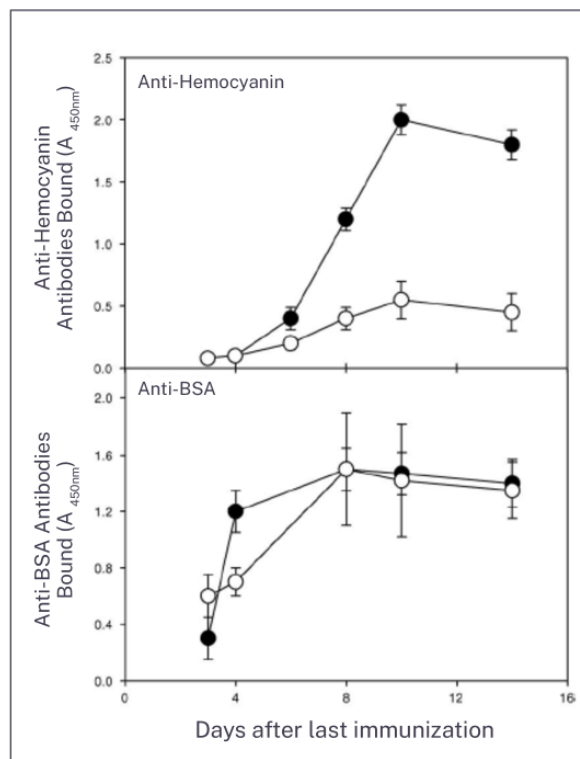
The delay in accessing feed and water affects gut mucosa development and microvilli. It also affects immune development.

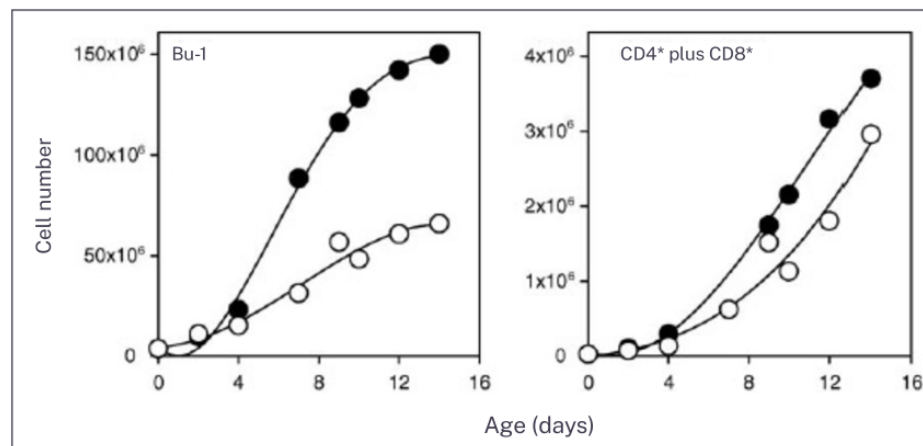
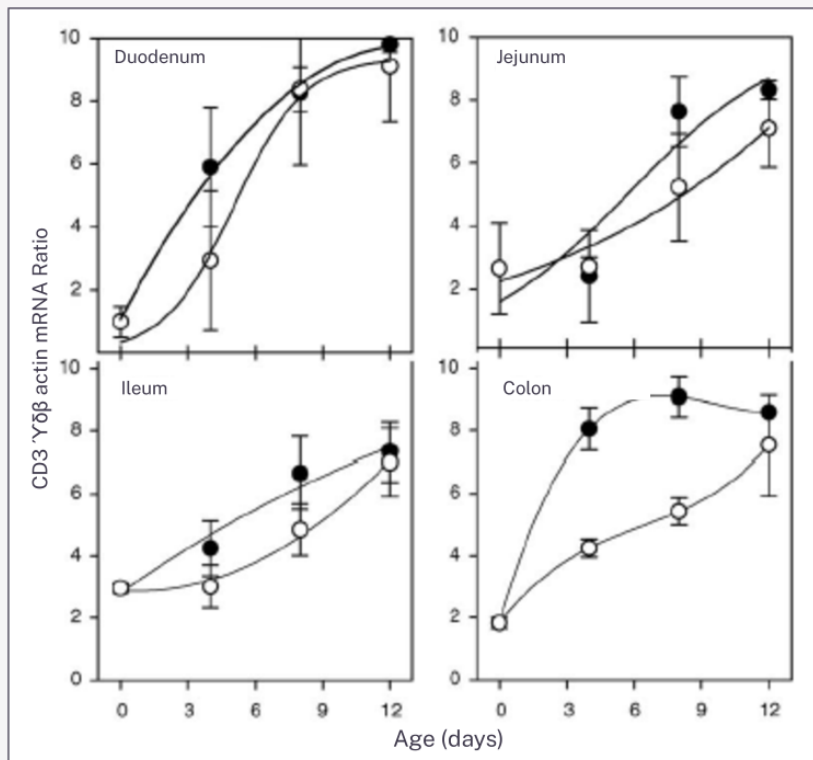
**The maturation of the whole immune system occurs near to hatching.**



**This fasting has negative effects on the immune response**, which can be reduced for up to two weeks after hatch.

The heat stress of chicks during the last phase of incubation can be observed in the lower number of lymphocytes and higher heterophil/lymphocyte ratio, which is another marker of stress and reduced immune development.





Antibody response against non-specific antigens in colon and ceca is delayed several days. Shira et al., 2005.

# Sources of gut microflora

The first contacts that hatchlings may have with microorganisms are the air and surfaces of the hatchery, together with the hen, farm, and egg transportation environment.




**The hatchery environment should be kept clean to avoid the development of pathogenic bacteria and fungi. Good biosecurity can prevent pathogenic microorganisms.**

However, egg disinfection should also be considered.

- ▶ Egg disinfection reduces the microbial load but also changes the diversity of microorganisms. Some disinfections can modify the composition of the microorganisms in the egg and make it very different from visible clean eggs before disinfection.
- ▶ Disinfection could be important for visibly dirty eggs, but excessive use of disinfectant products or other sanitation methods can affect microflora, which may impact chickens later.

**Changes in eggshell microflora can occur during all manipulations of egg setting, selection, and transport.** Therefore, the surfaces and equipment used must be cleaned and disinfected more frequently.

 **The main cause of egg contamination and the proliferation of pathogens is using eggs with eggshell microfractures.** These can be detected with ovoscopy and should be avoided.

These eggs have lower hatchability due to moisture loss and changes in albumen and yolk properties. If their embryos hatch, the quality of chicks will most likely be reduced.

Finally, it is important to remind everyone once again of the importance of all vaccinations in the hatchery. They are part of the biosecurity against pathogens that may affect gut health.



## Conclusions



Egg management, incubation practices, and conditions affect gastrointestinal tract and immunity development. **Temperature control could be the most important factor.** Microorganism control during incubation may impact hatchling microbial populations and gut health.





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# Thank you!

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