HatchTech
INCUBATION TECHNOLOGY

Technical Information

Cold brooding conditions result in decreased development

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Brooding temperatures

Suboptimal brooding conditions in chickens are known to impair growth performance and welfare. An important condition in early life that is known to influence later performance is the environmental temperature. At hatch, the thermoregulation of a chicken is not fully developed yet. Therefore, hatchlings are not able to regulate their own body temperature very well and they are largely dependent on the environmental temperature.

When brooding temperatures are too low, rectal temperatures will fall below the optimal average of 40.6°C and chickens will decrease their feed and water intake. Their health, growth, and development will be negatively affected. Chickens gradually become more capable to regulate their own body temperature within a few days after hatch, but in those first days brooding temperature is critical.

At an optimal brooding temperature, the rectal temperature of the chickens is around 40.6°C. However, this is not the only sign that brooding temperatures are optimal. The behaviour and vocalisation of the chickens also indicate a correct brooding temperature. Rectal temperatures are around the optimal 40.6°C when chickens are quiet, not panting, and when they are evenly spread in the broiler house or brooding unit. When chickens are huddled together, it is a sign that brooding temperatures are too low. By huddling together, chickens increase their body temperature by using each other's heat production. When chickens are panting, it is a sign that brooding temperatures are too high. The chickens' rectal temperatures probably lie above 41.0°C.

Experiment: Cold brooding and development

It is well established that body weight decreases as a result of cold brooding temperatures, but less is known about the development of the chicken under these suboptimal conditions. HatchTech's Research team conducted an experiment to study the effect of a cold brooding temperature during 4 days post-hatch on development. Chickens from a 47 week old parent stock were housed in a HatchBrood unit that was either set to an optimal temperature profile, which leads to rectal temperatures around 40.6°C, or to a cold temperature profile that was on average 5.5°C colder than the optimal profile.

To prevent an effect of huddling, chickens were housed with only 5 per cradle. However, it appeared this did not work as hoped. The rectal temperature of the chickens housed at the cold brooding temperature did not differ from the rectal temperature of chickens housed at an optimal brooding temperature, and was around 40.6°C. It can be speculated that even with only 5 chickens present optimal body temperatures could be maintained through huddling.

To see how the cold brooding temperature affected the chickens, chick length and body weight were measured. Chick length was used as a measure of frame development. It is also a more reliable indicator of early life growth than body weight, because it is not influenced by residual yolk weight or crop fills. Chick length is measured by stretching a chicken along a ruler and measuring the length from the tip of the beak to the end of the middle toe, excluding the nail (Figure 1).

Figure 1. *Measuring chick length*

Body weight and feed conversion
Although the chickens' rectal temperatures remained at optimal levels in the cold brooding temperature, the development of the chickens was clearly negatively affected. After 4 days, chickens brooded at a cold temperature weighed 5.5 grams less than chickens brooded at an optimal temperature (Figure 2). Feed intake, too, was reduced: 12.8 grams/chicken per day for the cold brooding temperature compared to 14.1 grams/chicken per day for the optimal brooding temperature. However, feed conversion (g feed/g growth) was the same between brooding temperatures. This indicates that the reduction in body weight gain could be attributed to the reduced feed intake, and not to reduced efficiency to convert feed into body weight.

Chick length
Cold brooding temperature had a large negative effect on chick length. Chickens brooded at a cold temperature were 0.9 cm shorter at day 4 than chickens brooded at the optimal temperature (Figure 3). To evaluate the efficiency with which chickens converted feed into body length, their feed to length conversion (g feed / cm growth) was calculated (Table 1). This ratio is comparable to the used feed conversion ratio, except that the conversion in terms of length, is calculated. Cold brooding chickens had a feed to length conversion of 19.5 g/cm, while optimal brooding chickens had a lower feed to length conversion of 15.8 g/cm. In other words, chickens brooded at a cold temperature were less efficient in converting feed to frame development. Possibly, the way in which the frame of cold brooding chickens develops is different. A well-developed frame in early life is essential for optimal growth and health during the grow out period.

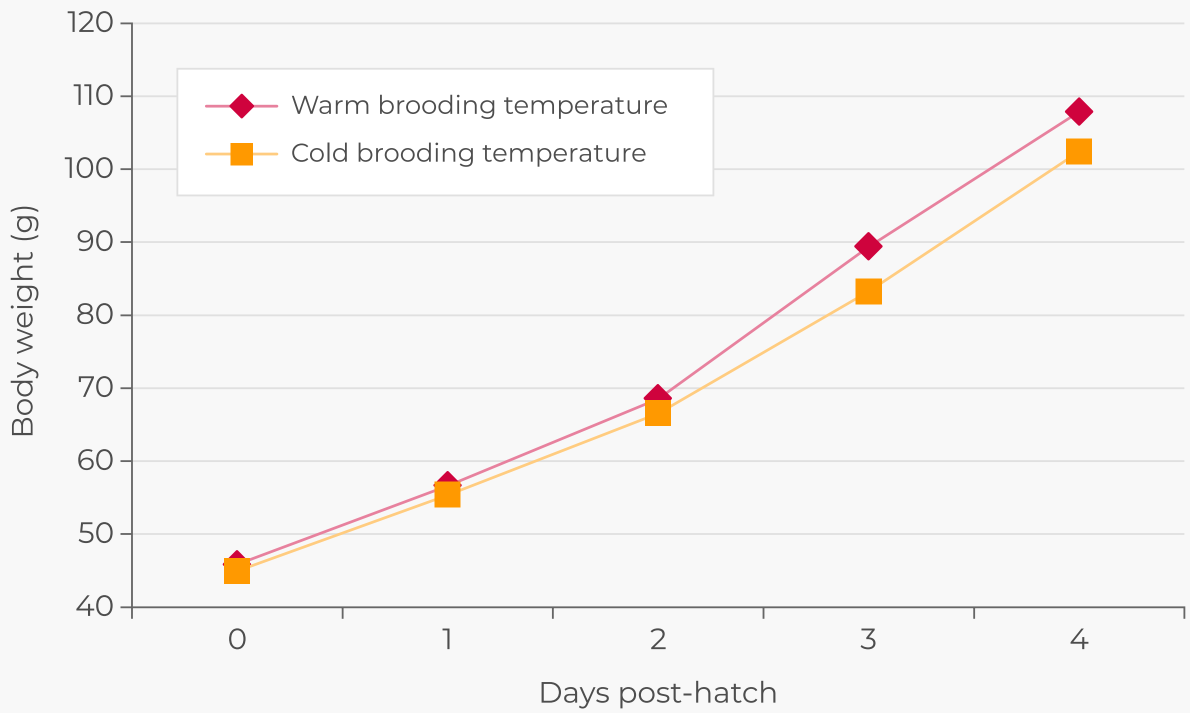

Figure 2: *Body weight (g) of chickens housed at an optimal or cold brooding temperature for 4 days post-hatch.*

Brooding temperature	Feed intake (g / chicken per day)	Feed conversion (g feed / g growth)	Feed to length conversion (g feed / cm growth)
Cold	12.8[b]	0.89	19.5[a]
Optimal	14.1[a]	0.91	15.8[b]
SEM	0.24	0.009	0.25
P-value	< 0.001	0.11	< 0.001

[a,b] *LSMeans followed by different superscript within a column are significant different (P<0.05).*

Table 1: *Feed intake, feed conversion, and feed to length conversion of chickens housed at a cold or optimal brooding temperature for 4 days post-hatch*

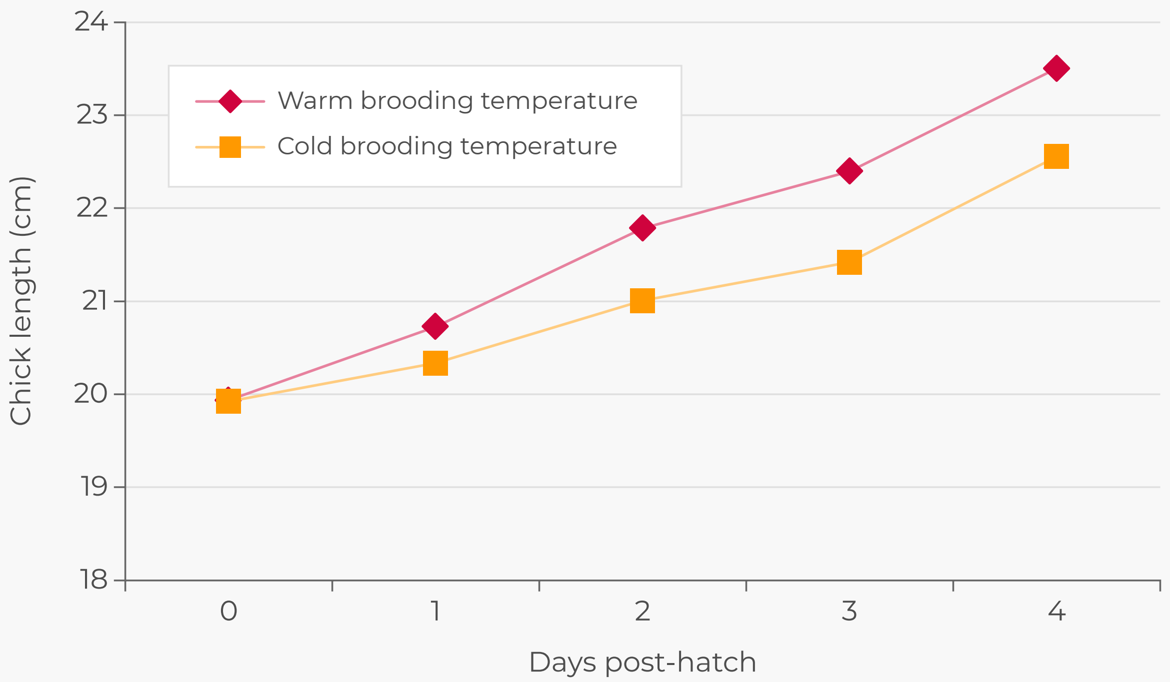

Figure 3: *Chick length (cm) of chickens housed at an optimal or cold brooding temperature for 4 days post-hatch.*

Conclusion

It can be concluded from this experiment that cold brooding temperatures not only lead to reduced body weights as a result of reduced feed intake, but also to reduced frame development and efficiency to convert feed into frame. This means that a chicken brooded at a cold temperature not only shows lower growth in the brooding period, but also that it may not be able to compensate by increasing its growth rate in later life because its development was suboptimal during the brooding period.

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