

Effects of Temperature and CO₂ during the last 4 days of Incubation on Chick Quality

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The goal of a hatchery is a high hatchability and a good chick quality, resulting in a good performance in later life. To optimize embryo development during incubation and thereby chick quality, incubation conditions need to be controlled and adapted to the requirements of the embryo.

Temperature has been shown to be of major importance for optimal embryo development and growth (French, 1994). A constant eggshell temperature (EST) of 37.8°C until day 18 of incubation has been shown to be the optimal temperature to gain the lowest embryo mortality, highest hatchability and optimal embryo development, expressed in a longer chick length, and higher yolk free body mass (YFBM) at day of hatch (Lourens et al., 2005).

However, little is known about the effect of applying different eggshell temperatures, simultaneously with different CO₂-levels from day 18 till 21 of incubation on embryo

physiology, development, and chick quality. Therefore, it can be speculated that when eggshell temperatures lower or higher than 37.8°C in combination with different CO₂-levels are applied during the last 4 days of incubation, an effect can be found on embryo physiology, development, and subsequent chick quality.

The experiment was designed as a 3x2 experimental design with 3 EST (36.7, 37.8 or 38.9°C) and 2 CO₂-levels (2,000ppm or 10,000ppm) from day 18 till 21 of incubation. A total of 600 first grade hatching eggs (62-65 grams; Ross 308 prime flock), were used. Until day 18, eggs were incubated at an

eggshell temperature of 37.8°C in a HT-combi incubator with the capacity of 4,800 eggs (HatchTech BV, Veenendaal, the Netherlands). From day 18 until day 21 of incubation, three EST and 2 CO₂-levels were applied.

At internal pipping (IP), hatch, and 12 hours after hatch, different chick quality parameters were measured; chick weight, yolk weight, YFBM, and chick length. Chickens were not provided with food or water and had continuous light.

Results showed an interaction between EST and CO₂ for chick weight ($P < 0.0001$). At an EST of 37.8°C, chick weight (= +0.84gr), yolk weight (= +0.68gr), YFBM (= +0.15gr), and chick length (= +0.27cm) were higher at a CO₂-level of 10,000ppm compared to a CO₂-level of 2,000ppm. However, at an EST of 36.7 or 38.9°C, chick weight (= -0.22gr), yolk weight (= -0.08gr), YFBM (= -0.14gr), and chick length (= -0.22cm) were lower at a CO₂-level of 10,000ppm compared to a CO₂-

level of 2,000ppm. Furthermore, embryos incubated at an EST of 36.7°C compared to 37.8 and 38.9°C had a higher chick weight (45.62gr, versus 45.57 and 45.39gr), lower yolk weight (6.64gr, versus 6.81 and 6.82gr), higher YFBM (38.97gr, versus 38.75 and 38.57gr), and longer chick length (19.63cm, versus 19.60 and 19.58gr).

The higher chick quality gained by the reduced EST of 36.7°C may be related to the extended incubation time of 6 hours, which provided the embryo the possibility to convert more yolk nutrients into body mass. This is in agreement with lower yolk weight at low EST of 36.7°C compared to normal (37.8°C) and high EST (38.9°C). In conclusion, a low EST of 36.7°C compared to normal EST (37.8°C) and high EST (38.9°C) improves chick quality. Furthermore, the effect of CO₂-level on chick quality is dependent on the EST. The reason for this is unclear, but might be related to the differences in physiological characteristics which are currently under investigation.

References

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