

# Effect of Eggshell Temperature and Oxygen Concentration on Survival Rate and Nutrient Utilization in Chicken Embryos

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**Environmental conditions such as temperature and O<sub>2</sub> concentration affect embryo development that may be associated with modifications in nutrient partitioning during incubation. Additionally, prenatal conditions can affect postnatal nutrient utilization.**

Using broiler chicken embryos, we studied the effects of eggshell temperature (EST; 37.8 or 38.9°C) and O<sub>2</sub> (17, 21 or 25%) applied from d 7 until 19 of incubation in a 2×3 factorial design. Effects of these factors on embryonic survival, development and nutrient utilization were assessed in the pre- and posthatch period. High EST reduced yolk free body (YFB) mass compared to normal EST (36.1 vs. 37.7 g), possibly through reduced incubation duration (479 vs. 487 h) and lower efficiency of protein utilization for growth (83.6 vs. 86.8%). Increasing O<sub>2</sub> increased YFB mass (from 35.7 to 38.3 g) at 12 h after emergence from the

eggshell, but differences were larger between the low and normal O<sub>2</sub> than between the normal and high O<sub>2</sub>. This might be due to the lower efficiency of nutrient utilization for growth at low O<sub>2</sub>. However, the effects of O<sub>2</sub> that were found at 12 h, were less pronounced at 48 h posthatch. When O<sub>2</sub> was shifted to 21% for all treatments at d 19 of incubation, embryos incubated at low O<sub>2</sub> utilized nutrients more efficiently than those incubated at normal or high O<sub>2</sub>. An additional negative effect on survival and chick development occurred when embryos were exposed to a combination of high EST and low O<sub>2</sub>.

Possible explanations include reduced nutrient availability for hatching, decreased body development to fulfill the energy-demanding hatching process and higher incidence of malpositions. In conclusion, EST and O<sub>2</sub> during incubation affect nutrient utilization for growth, which may explain differences in survival and development. Embryos raised under suboptimal

environmental conditions in the prenatal period may develop adaptive mechanisms that still continue in the posthatch period.

*Full text:*

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