Technical Information

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PROVIDING SUPERIOR CHICK QUALITY

Gildetrom 25 | P.O. Box 256 | NL-3900 AG Veenendaal | The Netherlands | T +31 (0)318 512511 | F +31 (0)318 517487 | info@hatchtech.nl | www.hatchtech.nl

HATCHTECHNOLOGY INCUBATION CONCEPTS
HATCHTRAVELLER CHICK TRANSPORT
HATCHBROOD BROODING CONTROL

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

Roos Molenaar*, Ron Meijerhof†, Ilona van den Anker‡, Marcel Heetkamp‡, Joost van den Borne§, Bas Kemp‡, and Henry van den Brand‡

*HatchTech Incubation Technology B.V., P.O. Box 256, 3900 AG Veenendaal, the Netherlands; †Poultry Performance Plus, Kleine Enkweg 1, 7383 DB Voorst, the Netherlands; ‡Adaptation Physiology Group, Wageningen University, P.O. Box 338, 6700 AH Wageningen, the Netherlands; §Animal Nutrition Group, Wageningen University, P.O. Box 338, 6700 AH Wageningen, the Netherlands.

Abstract

Environmental conditions such as temperature and O_2 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_2 (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_2 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_2 than between the normal and high O_2. This might be due to the lower efficiency of nutrient utilization for growth at low O_2. However, the effects of O_2 that were found at 12 h, were less pronounced at 48 h posthatch. When O_2 was shifted to 21% for all treatments at d 19 of incubation, embryos incubated at low O_2 utilized nutrients more efficiently than those incubated at normal or high O_2. An additional negative effect on survival and chick development occurred when embryos were exposed to a combination of high EST and low O_2.

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_2 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.

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Corresponding author: rmolenaar@hatchtech.nl