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Analysis of key factors involved in developmental arrest in windowed eggs for genome editing and transgenesis studies

Poultry production traits such as disease resistance, growth rate muscle yield can be improved through traditional artificial selection and new technologies such as genome editing and transgenesis. These new technologies are expected to speed up genetic improvement, and to provide new ways to analyze gene effect. To create trans-generation changes using these new technologies in birds, it is necessary to access early embryos by windowing through the eggshell. However, windowing on eggshell before incubation has proven to severely impact the viability of embryo, cause developmental arrest and death. The goal of this study is to develop windowing and incubation methods in order to increase embryonic viability, hence to increase the success rate of genome editing and transgenesis studies. We hypothesize that windowing and resealing of the eggshell reduces the oxygen permeability of the shell causing early embryo death. In this presentation, we report the study of oxygen level changes during early chicken embryo development, and the effect of elevated oxygen supplies during the rapid development stage on windowed embryos. Preliminary results show that embryo viability at 10 and 12 days has been increased when incubated under elevated oxygen level. This method can improve the successful rate of transgenesis and genome editing in poultry.