

## CFD modelling of the thermal environment in a negative pressure tunnel ventilated broiler barn during the first week of life

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### Abstract

As they are normally located in regions with warm weather and small temperature differences, Brazilian broiler producers usually opt for installations without thermal insulation of the sides of houses so that hybrid negative pressure tunnel ventilation can be used. However, chicks should be protected from cold stress during the early stages of life, especially in the winter. The question of whether the lack of side insulation compromises thermal comfort and adequate air speeds in the brooding area remains unanswered. It is known that, depending on their intensity and duration, poor thermal environments in early life may cause irreversible damage to broiler performance. The objective of this research was to use Computational Fluid Dynamics (CFD) to evaluate the air velocity and temperature profiles in the brooding area of a broiler barn during the chicks' first week of life. The non-insulated barn had sides made up of double layers of polyethylene curtains, and was equipped with a negative pressure tunnel ventilation system. The full-scale CFD model was validated using air velocity data collected in a real barn. The computer model showed no statistical difference compared to real conditions in terms of air velocity. The results indicated a need to increase the distance between the double side curtains and roof-ceiling in order to increase insulation capacity. Alternatively, decreasing the floor area allocated to the birds and keeping them away from areas of relatively high wind speeds can be a solution, creating an environment which provides chicks with adequate comfort and welfare.

**Keywords:** Animal welfare, model validation, non-insulated installation, cold stress.

### Introduction

Housing conditions and stocking densities have a direct influence on animal welfare (Baêta & Souza, 2010). Brazil lies in a predominantly warm climate region with a relatively small temperature range. The Brazilian broiler chicken industry is ranked as the third largest producer in the world, and the biggest exporter. Typical Brazilian broiler barns have little or no insulation on the sides, which are usually made of polyethylene