Thermoregulatory responses of chicks (Gallus domesticus) to low ambient temperatures at an early age

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The potential to induce improved thermotolerance in broiler chickens is of great importance. Thermal conditioning is one of the management tools used to improve thermotolerance, enabling broilers to cope with extreme environmental conditions. This study investigated the effects of exposing chicks to low ambient temperature (Ta) on-chick body (Tb), surface (Ts) temperatures and total sensible heat loss (SHL) by convection and radiation from the body and from 2 main radiative organs, the face and the legs. At 3, 4, or at both 3 and 4 d of age, chicks were exposed to 5øC for 1.5 h a day (to avoid mortality) or to 10 or 15øC for 3 h a day. In general, in all treatments, the results during exposure to cold differed significantly from the control. A second cold exposure (on d 4 after a first exposure on d 3) clearly enhanced the chicks' ability to maintain on-chick body surface temperatures during exposure to 15øC and to recover much faster from cold exposure. A dramatic decline in average surface temperature was observed during the first 15 min of chicks' exposure to the various low ambient temperatures in all ages, reaching the lowest values in the 5øC treated chicks. The face responded immediately to cold exposure by significantly increasing its SHL to a level that then remained relatively steady (15øC) or declined moderately with time (10 and 5øC). In the legs, however, a significant and continuous decline in SHL was exhibited in all ages. The dynamics of SHL from the legs differed from that from the face, suggesting that the legs are a major organ for vasomotor responses, whereas the face is a more conservative vasoregulatory organ. It is concluded that repetitive exposure to cold may enhance thermotolerance, and that this is partially related to the vasomotor responses. This is the first report quantifying the differentiation between the legs as a responsive vasomotor organ and the face as a conservative vasomotor one.