The importance of temperature control in optimising chick health

Chicken embryos and newborn chicks are extremely sensitive creatures, especially in regard to environmental temperatures. Low temperatures, including those resulting from spray vaccination, may have a dramatic effect on the birds' feed intake and stimulation of the immune system.

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Chickens are homeothermic, which means that, within limits, they can regulate their own body temperature, much as mammals do. However, they are not born that way. During the embryonic phase, chickens are poikilothermic, which means that their body temperature follows that of their environment, as in reptiles. The difference with reptiles is that they can function properly at a wide range of body temperatures: they simply adjust their metabolism accordingly. Chickens achieve ideal development at optimum body temperature, but in the poikilothermic stage they cannot maintain that temperature themselves. This phenomenon is well known in incubation. In the incubator we set the temperature very precisely to bring the embryos exactly to optimum temperature. In an ideal situation, heat production by the embryo, heat loss from the egg and the environmental conditions are so well balanced, that the temperature of the embryo stays exactly at its optimum.

Optimum embryonic temperature is acknowledged to be 100.0 - 100.5˚F, measured as egg shell temperature, as this accurately reflects the temperature of the embryo. The incubation process is controlled by checking the temperature of the shell with an infra-red ear thermometer and adjusting incubator conditions to achieve the optimum heat balance.

In chickens this issue is much less critical. If temperature is not exactly in balance with the heat production of the bird, the bird will not immediately reflect that in its body temperature. However, it will pay a price for keeping its body temperature constant, either by having to use more feed for heat production or by limiting its feed intake to reduce heat production. In any case, the direct effect is not as dramatic as in embryos.

The critical transition time

For the embryo, the process of changing from poikilothermic to homeothermic takes five or six days – starting at day 19 of incubation and completing when the chick is four to five days old. In chicks from young breeder flocks, this process can take 24 to 48 hours longer. This actually means that a day-old chick's ability to regulate or maintain its temperature is as immature as an embryo's, and if conditions are not optimal, its body temperature can drop dramatically. Within two hours following placement, a day-old chick's body temperature can drop more than 5˚C, from the optimal level of 40˚C to 35˚C or lower. Body temperatures as low as 33˚C have been found, without the bird actually dying - at least not immediately (*see Figures 1 and 2*).

We control the body temperature of a day-old chick mainly by controlling heat loss through the floor. If the house is on temperature but the floor is too cold (below 29 - 30˚C), the birds lose too much heat through their feet, lie down and become even colder because now a larger body area is touching the floor, and their body temperature will drop very quickly. It is clear, therefore, that maintaining the correct air temperature is not enough to prevent this heat loss: it's exactly the same principle as when humans walk barefoot over a cold floor.

Consequences of low temperature

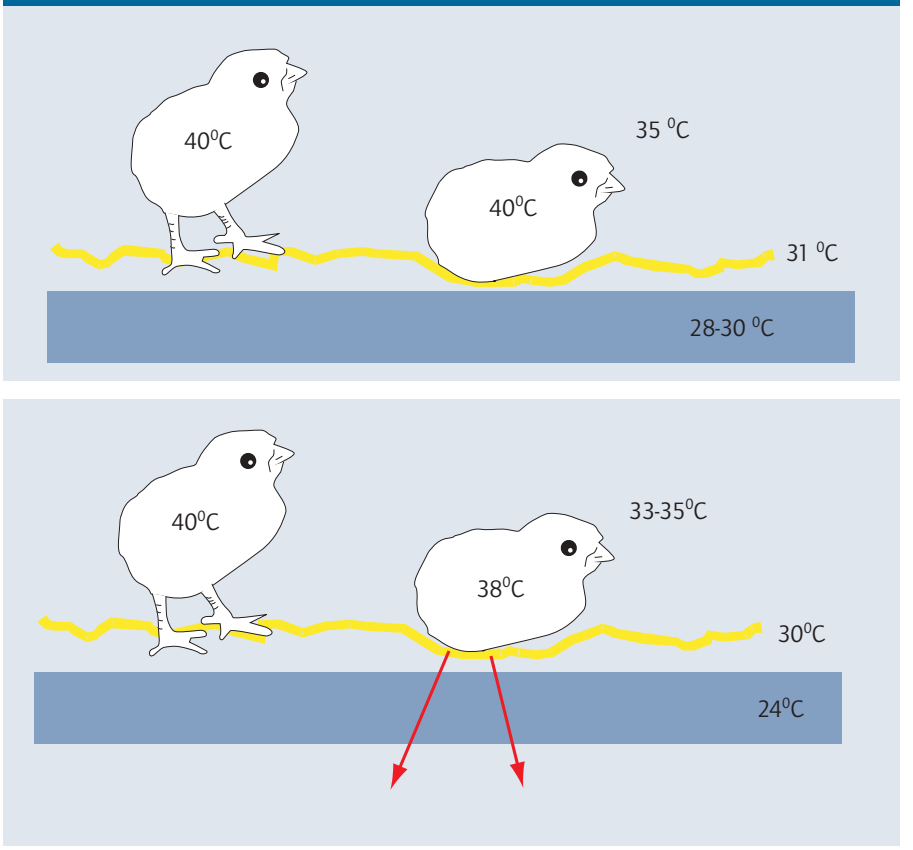
The consequences of this drop in body temperature are quite dramatic. Although day-old chicks are able to deal with a relatively large range of body temperatures, as are all newborn animals, they will – if the correct body temperature is not restored quickly – experience difficulties.

It is good practice to occasionally (e.g. twice a year) monitor the distribution of vaccine within a box, using the blue dye used commonly to evaluate efficiency in the administration of Marek's disease vaccine. (Photo Intervet)

The chick's first reaction will be to start making noise, to attract the attention of mother hen and to tell her that it needs support. If, in our chicken houses, mother hen doesn't respond and the temperature drops further, the bird will become under-cooled and start to lie down, which further accelerates the process of becoming under-cooled. An under-cooled bird will experience stress, which prevents its immune-system from functioning properly, leaving it more susceptible to *E. coli* or any other type of bacterial infection. In these circumstances, first week mortality will inevitably be increased.

By lying down, the chick is also prevented from finding feed and water – which it normally finds when moving around. Because these 'non-starters' will not digest any feed in the first hours/days, they will also not obtain any heat from the digestion process. By not eating, neither the digestive tract nor the immune system is stimulated. And because they have not taken up the carbohydrates they need to absorb the yolk residue, the residual yolk will remain longer in the body cavity, not only increasing the risk of navel-yolk sac mortality, but also reducing the chick's access to the benefits of the

Figure 1 and 2 - Day-old chicks try to restore body themperature by lying down, but that prevents them from eating and drinking, which results in dehydration and insufficient energy intake



maternal antibodies that are also stored in the yolk.

Last but not least, the consequences for the performance of the flock are significant. The problem is not so much increased mortality in the first week, which although regrettable, is a relatively inexpensive mortality. It is the birds that were under-cooled but didn't die that cause greater concern. These birds will not start for a couple of days, and remain at hatch weight when the rest of the flock has reached body weights of 120 - 150 g. Not only will this variance reduce the flock's average bodyweight and FCR at seven days of age, but it will also undermine uniformity, both at seven days and at the end. This uniformity shows as uniformity of bodyweight, but can also be expressed as uniformity of immune competency.

Temperature fluctuation at vaccination

Chick sensitivity to temperature fluctuations may significantly influence the effectiveness of day old spray vaccination, performed either in the hatchery or after arrival in the house. Using an excessive volume of water for vaccine preparation and improper size of droplets are the most common reasons for post vaccination reactions and problems, even if the correct type and strength of vaccine was used.

The evaporative effect when a vaccine solution is sprayed can have an undesirable chilling effect, especially when chick holding environments are not organised properly. Draughts and improperly managed environmental temperatures can exacerbate the discomfort of vaccinated chicks: they are chilled as easily as we are, if we don't dry our bodies after taking a shower!

In fact it is surprising how remarkable the economic impact of thermal discomfort at an early age can be, when we chill chicks not fully able to maintain their body temperature. In these flocks, mortality usually starts at three-five days of age, and sneezing and rales can occur as early as 48 hours after improper vaccination, causing a high condemnation rate.

Thermal stress at an early age and immunosupression as a consequence of stress can also lead to acute or chronic septicaemia (bacteria present in the bloodstream) or even viral infections of the respiratory system.

Inappropriate spray particle size is less likely to be the only reason for post-vaccination reactions and problems than it is commonly believed to be. In most cases, the actual reason is a combination of size and uneven distribution of droplets combined with environmental factors, which lead to the chilling effect in vaccinated chicks.

Shower chill

Most well-maintained spraying equipment can generate a droplet size of 100 to 150 microns, which is well tolerated by the respiratory system of day-old chicks. But no machine in the world performs consistently without regular maintenance and checks, so it really is worth conducting an annual check up of spraying equipment – including how it generates droplet size, its cleanness and distribution of droplets. There are special protocols that can help when checking equipment, to maintain correct performance and avoid undesirable post-vaccination effects.

On average, the volume of water used to dissolve and administer the vaccine by spray method is 200 - 250 ml per 1000 chicks, if vaccinated with a knap-sack sprayer.

When using a spray cabinet, usually 70-80 ml of water is used per 1000 chicks, although this can vary depending on the type of spray cabinet. Water temperature should range between 15 and 20°C. Properly vaccinated chicks should look evenly damp in the box immediately after spraying, but they should never look totally wet, or dripping with applied vaccine.

If vaccination occurs on farm, chicks should be left in the boxes in a draughtless place for an additional 15-20 min, to allow them to dry properly. If vaccination is performed in the hatchery, chicks stay in boxes for at least 15-20 min before they can be shipped safely. Temperature in the storage room should be not less then 24°C, and as before – the room should be draught-free.

Checking spay cabinets

It is also good practice to occasionally (e.g. twice a year) monitor the distribution of vaccine within a box. The blue dye commonly used to evaluate Marek's disease vaccination is a very practical tool for evaluating the efficiency of spray vaccination, as it makes it easy to see the percentage of chicks not vaccinated per box, as well as giving an excellent visual guide as to how wet the chicks are.

It is worth re-emphasising that the introduction of spray vaccination for day-old chicks more than 30 years ago was, without a doubt, a milestone in preventing respiratory diseases like Infectious Bronchitis, Newcastle Disease or TRT/SHS syndrome. If done properly, this method stimulates good, early, localised protection of the mucosa, which is the gateway of choice for respiratory viruses.

And last but not least – the chick's respiratory system is the system most exposed to infections in conditions of intensive poultry production, due to its specific anatomy.

It is almost impossible to overestimate the advantages of early age vaccination, and nothing except neglecting the proper management of environmental conditions and the chick's physiology can undermine its positive effects. ■