CLIMATE

Control temperature of young

Individual chicks may have different environmental temperature demands. The trick is to provide every chick with the right body temperature. By measuring individual chick temperatures, hatchery staff and broiler growers or layer producers are better able to provide the right environmental temperature for every flock at all times. This will reduce first week mortality and improve performance.

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Broilers kept at the right starting temperature show less mortality and better performance. *(Photo: World Poultry)*

When a chick hatches, it is still more or less cold-blooded and cannot regulate its body temperature properly. To maintain body temperature at the desired level, the young chick depends mainly on its environment. After hatching, the chick gradually transforms into a warm-blooded organism that can regulate its body temperature within certain limits by increasing or decreasing heat production or food intake. On average, this transition period lasts about 3-4 days and the duration depends mainly on the size of the chicken and the age of the breeder flock. Small chicks appear to have more problems controlling their temperature because of their relative large surface area compared to body mass. For chicks from a young breeder flock, (till 35 weeks) the transition to a fully developed heat regulating system lasts about 24 to 48 hours longer compared to chicks from an older flock. This process is not clearly understood, but we must realise that chickens from different sources may have different temperature requirements.

Body temperature of the young chick is the result of the balance between the amount of heat produced by the chick and the amount of heat lost to the environment. Although day-old chicks have very limited possibilities to regulate heat production, they are able to influence their heat loss. When body temperatures become too high, they will start gasping for air in order to cool down by the evaporation of water. At low body temperatures, chicks huddle against each other to minimise their total surface in order to prevent excessive heat loss. If body temperatures are outside their tolerance limits, day-old chicks will express their inconvenience by screaming and by moving around. In the field, it appears that chicks from young breeder flocks do not express their discomfort as clearly as chicks from older breeder flocks; something the farmer should be aware off.

Comfort zone

Two decades ago, Dr Kaltofen at the Centre for Applied Poultry Science "Het Spelderholt" in the Netherlands, investigated the effect of temperature and humidity on day old chicks. Based on the behaviour of the chicks in varying conditions, he defined a comfort zone, both for solitary chicks and for chicks placed with 50 in a box. At varying environmental conditions, the rectal temperature of the chicks was measured. Temperature ranged from 30˚C to 44˚C; relative humidity ranged from 20% to 90%. Measurements were performed in still air, however, and we have to be aware of the chilling effect of air velocity on body temperature, as the heat transfer will be much higher at higher air velocity.

Temperature

Individual, solitary chicks did not show any abnormal behaviour at environmental temperatures of 32 – 34˚C (*Table 1*). These chicks were able to maintain rectal temperatures at 39^{o}C. For comparison: a mature, non-brooding hen has a deep body temperature of 41˚C, a brooding hen approximately 39˚C.

Not all chickens responded identically at lower temperatures, as shown in *Figure 1*. In this experiment, day-old chicks were placed at 10˚C and 60% relative humidity. Only one (line g) out of 7 chicks was able to maintain rectal temperature above 35˚C. Apparently, the temperature control mechanism of the other chickens was not developed sufficiently at this time. Other chicks showed more difficulties maintaining body temperature (e-f) while most chicks (a-d) cooled

chicks to reduce mortality

Table 1. The influence of environmental temperature on behaviour and body temperature of day old chicks at constant relative humidity of 60% (after Kaltoven & Dijk, 1984)

Solitude			*Group*		
T air (C)	*T rectal (C)*	*Chick behaviour*	*T air (C)*	*T rectal (C)*	*Chick behaviour*
44	44.0 - 44.0	Heavy panting, moments of panic, lying down, sudden movements, some chicks die	44.0 - 44.5	44.5 - 45.5	Equal to solitude; many chicks become unconscious and die
42	43.5	Heavy panting, sudden movements, dropped wings, high chirps, alternate standing/sitting	42.0 - 43.0	44.5 - 45.0	Heavy panting, high chirps, high distress, many chicks become unconscious, some die
40	41.0 - 43.0	Strong panting, lying with legs stretched, some distress, high chirps, dropped wings	40.5 - 41.0	44.5 - 45.0	Heavy panting, strong chirps, moments of panic, sudden movements, many chicks become unconscious
38	40.5 - 41.0	Fast and irregular panting, dropped wings	39.5 - 40.5	43.5 - 44.5	Distress, strong panting, beaks open, chicks walking, some become unconscious
36	39.5 - 40.0	Some chicks have dropped wings	37.9 - 39.5	42.5 - 43.5	Distress, fast panting, beaks open
34	39.0 - 39.8	No remarks	37.0 - 39.0	41.5 - 42.0	Distress, some birds with open beak, fast breathing
32	38.5 - 39.0	No remarks	34.5 - 37.5	40.0 - 40.5	Chicks are spread out in the boxes, are distressed
30	37.5 - 38.0	Quiet, some chicks look droopy, some chirping	33.0 - 36.0	40.0	No remarks
28	37.0 - 38.5	Droopy, blinking eyes, shaking of heads	30.5 - 35.0	39.5	No remarks
24	36.8 - 38.0	Droopy, some chirping, chicks sit in hunched-up position	28.5 - 34.0	39.0 - 39.5	Incidental huddling
20	36.0 - 37.5	Chicks sit hunched-up, chirping	24.5 - 33.0	38.5 - 39.0	Most chicks huddling
15	32.0 - 35.0	Chilled, hunched-up appearance	18.0 - 35.0	37.0 - 38.0	Huddling, all chicks close together
10	30.5 - 34.0	Chilled, hunched-up appearance	15.0 - 35.0	36.5 - 37.5	Huddling, all chicks at one side of box

Figure 1. Rectal temperatures of seven chicks placed in solitary with an environmental temperature of 10˚C. (after Kalthoven en Dijk, 1984)

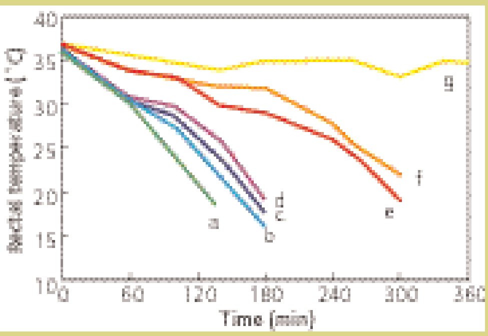
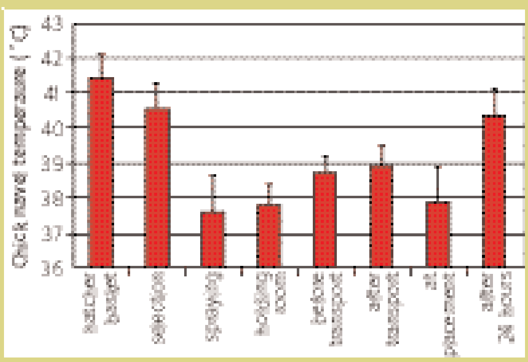


Figure 2. Average navel temperature of chicks at different moments after hatch



are too low, when air velocity is too high or when moisturisers are pointed directly towards the chickens. In temperature controlled trucks, cooling capacity and ventilation rate are set for the number of chicks loaded. Chickens in a half-loaded truck can easily become too cold if cooling capacity or ventilation rate is set for a fully loaded truck.

Brooding temperature

When receiving day-old chicks, the temperature at bird or floor level must be correct. At that time, body temperature is the most critical factor for bird performance. Until the correct body temperature is reached, the young birds do not eat or grow satisfactorily, and are more susceptible to disease. Brooding temperatures for chicks from a young breeder flock should be set higher and maintained for a longer period. This allows all birds to develop their temperature regulatory function, as this is a function of time and not uniform for all birds. At placement some birds will be more developed than other birds due to natural variation, incubation conditions, hatchery processing or transport conditions. Body temperature variation of chicks at placement is a good parameter for proper chick management, including the process of incubation. Body temperature can be easily measured with an infrared ear thermometer at the navel (blow away the down) of young chicks. Ideally, all birds should have body

down below 20˚C within 3 hours. To maintain body temperature between 39 and 39.5˚C, environmental temperature should be kept between 30.5 and 36˚C for solitary chicks, and between 28 and 30˚C for chicks in boxes. When temperature inside the box decreased, chicks huddled together. Doing so, they reduced their total surface area and minimised heat loss. Apparently groups of chicks can deal with a larger environmental temperature range than individual chicks. *Table 1* shows that at body temperature below 39˚C, chicks respond by huddling together.

Humidity

At high temperatures, chicks increase their heat loss through panting, as panting evaporates water and that process consumes energy that cools down the chick. Humidity, however, hardly influenced the behaviour of day old chicks. High relative humidity decreased the effectiveness of panting. At relative humidity higher than 85% the temperature comfort zone decreased by 1˚C. At relative humidity lower than 40% the temperature comfort zone increased by 1˚C. At relative humidity below 40%, typical draught reactions occurred: swallowing, eye blinking, closed eyes, drowsy attitude. At high relative humidity no typical "wet" reactions occurred. High humidity helps to evenly distribute the heat through the chicken house and diminishes hot and cold spots.

Hatchery and transportation

In the hatchery and during transportation, cold stress must be avoided. Cold stress can be induced when hatches are pulled too early, when processing room temperatures

Figure 3. Concrete floor temperature and chick naval temperatures at Kuijpers Kip, The Netherlands

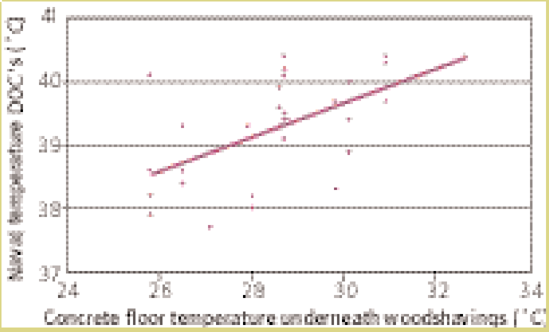


Figure 4. Naval temperatures of chicks from a young (35 weeks) and an old (55 weeks) flock at placement and after 5 hours and 24 hours

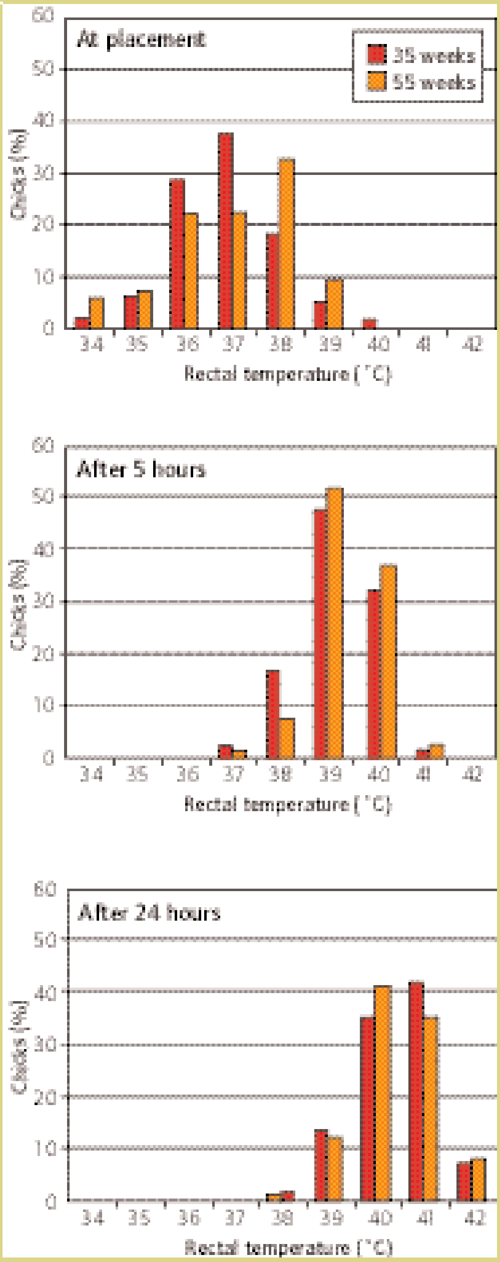


Table 2. Percentage chicks with naval temperatures below 39°C at placement, after five hours and after twenty-four hours for chicks from a young flock (30 weeks) and an old flock (55 weeks)

Breeder age	*At placement*	*After 5 hours*	*After 24 hours*
Young (30 weeks)	92.9	19.2	1.5
Old (55 weeks)	90.8	9.1	2.0

temperatures between 39.5 and 40.5°C, regardless of housing system, breeder age, transportation conditions, time, etc.

Measurements

When visiting a hatchery we measured chick temperatures at different moments between hatch pull and 24 hours after placement at the broiler farm as well as naval temperatures of 15 chicks at different moments. The results are in *Figure 2*.

We were unaware of the consequences of fluctuating chick temperatures in such a short period of time. It is known that the first day after hatch is a very critical time and any deviation from optimum may lead to increased first week mortality or have detrimental effects on chick performance. The environmental conditions at some stages between hatch and set-up were too far from optimum to maintain the desired naval temperature. Measuring chick naval temperatures is easy to do and provides the hatchery staff powerful information on how to give their chicks the best possible start.

Also at the broiler farm temperature measurements can provide useful information about the floor temperature distribution across the house and the effects on chick naval temperature. At a commercial farm (Kuijpers Kip, The Netherlands) also the temperature variation at the concrete floor underneath the wood shavings was measured and related to chick naval temperature three hours after chick delivery (*Figure 3*). When naval temperature was below 39°C chicks were too cold so floor temperature should be higher than 28°C to provide most chicks the right temperature. By knowing the temperature distribution of the floor and the different temperature requirements of chicks from different breeder flocks Kuijpers Kip is now able to provide all different batches of chicks the right temperature and decreased first week mortality by half.

Broiler breeder age

The age of the breeder flock also appears to have influence on the ability of the day old broilers to cope with fluctuating environmental temperatures. When we received chicks for a broiler trial that came from different flocks of different ages we noticed that the chicks showed cold stressed behaviour and some chicks more than others. Temperature measurements revealed the following:

Eight thousand chicks were transported from a commercial hatchery in a temperature-controlled truck for less than two hours to the Research Institute for Animal Husbandry "Het Spelderholt" in the Netherlands. The transport conditions inside the truck however were accidentally set for a fully loaded truck with 60,000 chicks so air temperature was too low to maintain body temperature at the desired level. Body temperatures of 400 broilers originating from a young (30 weeks) and an old (55 weeks) breeder flock were measured at placement, five hours and twenty-four hours after placement. At placement, the house was fully warmed, including the concrete floor and the litter.

Results of the chick temperature measurements are in *Figure 4*. The percentage of birds with naval temperature below 39°C is in *Table 2* for both ages. A large number of birds were cold stressed at placement, and chicks from the young breeder flock needed more time to raise temperature above 39°C. First week mortality for chicks from the young breeder flock averaged 3.2%, for chicks from the old breeder flock 1.0%. The cause of mortality was diagnosed mainly as yolk sac infections by E. coli. As the mortality will be the result of the presence of E.coli and the health status and resistance, low body temperatures at placement will not help the birds.

Bottom line

Chicks from different backgrounds have different temperature requirements. It can be very helpful to measure chick temperatures and to adjust environmental temperatures to provide all chicks the right naval temperature of between 39.0 and 40.5°C. Not only for the first day, it also works when birds grow older. This will minimise the risk of wrong starting temperatures in the first week. This tool can help the broiler or pullet farmer as well as the poultry integrator to optimise their technical and financial results. ☐

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