Moisture during brooding

By Ron Meijerhof

It is often believed that relative humidity during brooding needs to be high, to create a good starting condition for the birds. Although most people will set their target for relative humidity during the first days on a level of approximately 40%, it is often stated that the optimal levels are much higher, 70% or even 80% relative humidity.

The rationality of this advice for such high relative humidity levels is not always clear, but some people argue that it needs to be that high as the chicks are experiencing that high level in the hatcher, and they need to continue with this level to prevent dehydration.

Indeed the relative humidity during hatching is high, even up to 80%. However, the reason for this level is that we prefer to keep the hatchers as much as possible closed during the hatching process, to keep the carbon dioxide levels in the machine high and to avoid cold spots created by taking in relatively cold air. As a result of this limited ventilation, relative humidity goes up as each hatching chick will release 3 gram of water during the process of drying up after emerging from the egg shell. In this respect the relative humidity is the result of what we are doing, more than being essential for the process. This is shown with some new systems that allow the chicks to hatch in the broiler house. Due to the big volume in the house the relative humidity in this system will remain very low, but the broilers are hatching and growing well anyway.

It seems logical that a higher relative humidity will prevent moisture loss of the chicks, and therefore will prevent dehydration. But as a chicken can't sweat, all its moisture loss will be through breathing. And as long as its body temperature is on level, it will breath through its nostrils and moisture loss will be limited to 1-2 g per 24 hours. However, if the body temperature of the bird is increased, it has to evaporate moisture for cooling purposes. This panting will result in an increased moisture loss, as this is the way for a bird to control its body temperature in case of overheating. This makes it clear that dehydration is actually not so much a result of relative humidity but of temperature control, as temperature control is the way to avoid panting.

The temperature that a body (chicken, dog, human) feels is not only influenced by the direct temperature itself, but also by other factors as air velocity and relative humidity. Also feather coverage etc plays a role. This so called effective temperature is the real temperature that an animal feels, and in that way more important than the actual temperature measured with a thermometer. This is easy to understand if we look at air velocity. A high air velocity makes a high temperature feel comfortable for us, while without that high air velocity we would feel overheated. Also relative humidity has a big effect. If its warm and humid, we feel much more uncomfortable than when its warm and dry. This is not so much because the humid air can take up less heat from our body (actually it's the other way around, humid air has a slightly higher heat content than dry air) but the high humidity prevents us from sweating, and therefore blocks our most effective way to loose heat. That means at a higher relative humidity, we should have a lower actual air temperature to experience the same effective temperature. We tend to put this knowledge on chickens as well, so a higher relative humidity results in a higher effective temperature. That is true, but not at the same level as in humans, as birds do not sweat.

But the knowledge of the influence on relative humidity on humans have lead to a tendency to increase the relative humidity in a broiler house during the period that the birds need the most heat, the brooding period, even up to a level of 70-80%.

Not even is there no scientific data available that suggest that these conditions are in favor for the bird and result in a better growth or a better start, this advice is not on all points very logical, and in some points create even a potential risk, especially when outside temperatures are low.

If we want to have 75% relative humidity with an air temperature of 35oC, this results in approx. 27 g of water in each m^3 of air. First of all, this condition of 27 g of water per m^3 hardly exists in nature. Even in tropical countries this combination is very rare. It will be 35^oC, and it can be 75% humidity, but seldom at the same moment. This means that if these advices are correct, our birds would have a preference for a condition that hardly exists in their natural habitat. This by itself does already indicate that perhaps the positive effect of this conditions might be limited, as there will not have been a lot of "natural selection" in favor of this condition.

But if we calculate what these conditions mean for our house environment, it is getting more questionable. If we assume that the outside conditions are 20 ^oC. and 50% humidity, the air holds 7 grams of moisture per m^3. If we want to increase the temperature and humidity to a level of 35oC and 75% relative humidity (27 g water/ m^3 air) we need to add 20 grams of water to every m^3 of air in the house. A typical house for 40.000 birds will have a surface area of 2000 m^2 surface and an average height of approx 3 meter, which gives a volume of 6000 m^3. We therefore need to add 6000 x 0,02 is 120 liter of water, to get to the desired level. If we start to ventilate our day old chicks, we have to add extra water, as every m^3 of air that we bring in will need an additional 20 g of water to get to the desired level. But evaporating so much water will drop the temperature. Without going into the details of the calculation, a temperature drop of 3-4 degrees can be expected from evaporating these amounts of water. To compensate for this temperature drop, we have to put the heaters on. As the burning of gas produces carbon dioxide and we don't want to have that at a level above 2500 ppm, we need to ventilate more. With more ventilation, we need to bring in more water to get to the climate requirements of 35^oC and 75%. And as a result, temperature drops and more heating is needed….

Another problem of the high level of humidity during brooding is the risk of condensation. The dew point of 35^oC and 75% humidity is 30 ^oC. This means that if the floor of the house is not above 30 ^oC, it will condensate and moisture will be formed under the litter, which increases the risk of molds etc. A climate of 35^oC and 40% RH has a dew point of 19 ^oC, so condensation will not likely occur.

In other words, it is not really possible to increase the relative humidity during brooding to these high levels, unless the outside conditions are already in favor of it. If the incoming air already holds a high amount of water, the relative humidity in the house will be high. But if that is not the case, artificially increasing the relative humidity to the desired levels probably creates more problems than it solves.