

The thermoneutral zone indicates the range in which the animal feels itself comfortable (see figure 1). The thermoneutral zone is bounded by a lowest and upper critical temperature.

Heat stress occurs when the ambient temperature rises above the upper critical temperature point at which the animal produces more heat and/or where the animal ‘captures’ more heat from its environment than it can give off to the environment. For sows is this around 22°C, for finishers around 25°C and for piglets depending on age around 30 to 32°C.

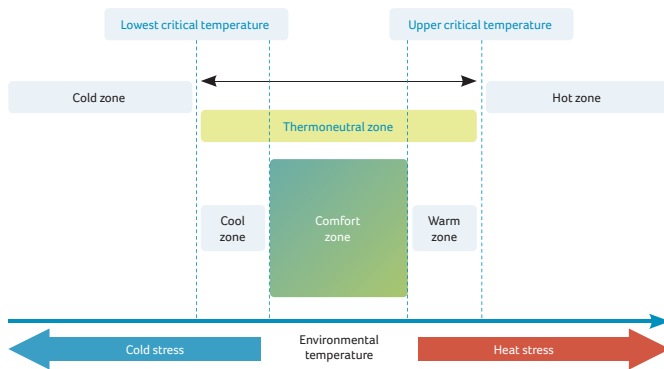


Figure 1: Thermoregulation



Why are pigs so sensitive to heat stress?

Compared to other species of farm animals, pigs are more sensitive to high environmental temperatures, because they cannot sweat and not pant so well due to their relatively small lungs. They can have a lot of subcutaneous fat that keeps the heat inside the pig.

When pigs are exposed to heat stress, the most obvious symptoms are an increased respiration rate (panting), a loss

of appetite and scattered lying behaviour. When the exposure to heat stress is very long, pigs will also start to drink excessive amounts of water (increasing loss of electrolytes) and they will accumulate acids produced within the body (causing a loss of acid/base balance). This may eventually result in diarrhoea or death in severe cases.

What does current research say about heat stress?

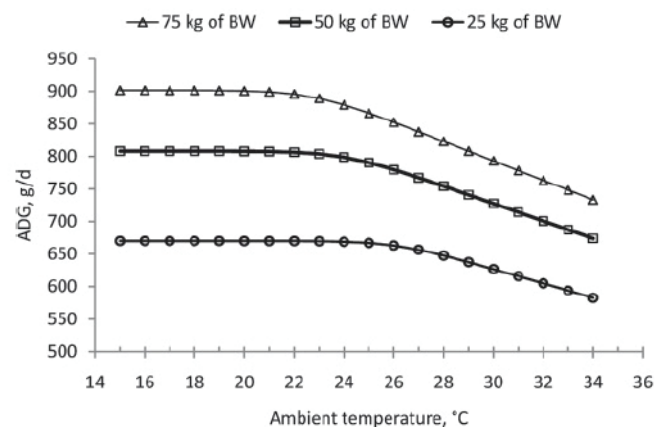
Exposure up to 35 °C for 24 hours results in significant damage to the intestinal defence function and in an increased plasma endotoxin level. That is why heat stress can cause secondary infections when the sanitary conditions are poor.

What are the consequences of heat stress on the performance of pigs? Finishers

Heat stress can cause decreased growth performance, more sensitivity for diseases due to a decreased immunity and oxidative stress. Occasionally, there are also more abnormal behaviours symptoms as tail biting, ear biting.

Larger pigs are more sensitive to heat stress and the reduction of growth performance is bigger compared to smaller pigs. The reason is that larger pigs grow faster and produce a lot of internal heat.

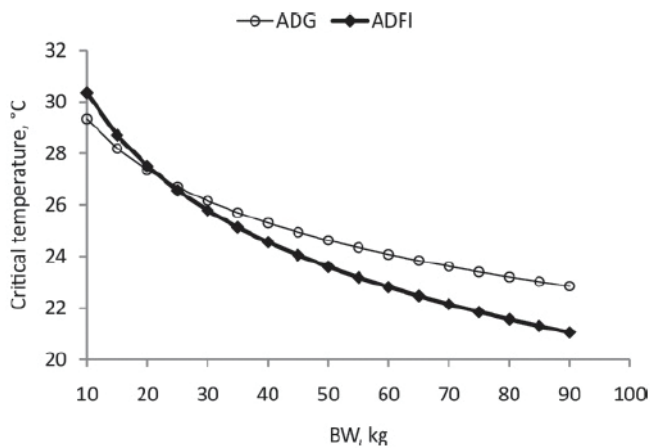
Figure 2 shows the scope of performance loss in 25 kg, 50 kg, and 75 kg pigs when the ambient temperature increases from 14 °C to 35 °C. The average daily gain (ADG) starts decreasing when 75 kg pigs are exposed to temperatures above 23 °C, while for 25 kg pigs, the ADG starts to decrease when they are exposed to temperatures above 27 °C.



Source: <https://www.thepigsite.com>

Figure 2: Effect of ambient temperature on the average daily gain of grower-finisher pigs.

Figure 3 shows critical temperatures at various body weights.



Source: <https://www.thepigsite.com>

Figure 3: Pig body weight has a significant effect on the critical temperature for average daily feed intake (ADFI) and average daily gain (ADG).

Sows

Heat stress can cause reproductive performance: Longer weaning to oestrus intervals, decreased pregnancy rate and farrowing rate, failure to maintain pregnancy and a lower conception rate. In farrowing sows, the feed intake will be decreased, and a poor colostrum-milk production will influence the growth and performance of the piglets. The body condition of the sow will decrease during the lactation, which will influence the reproduction results in the next litter(s). The “second litter syndrome” in primipare sows manifests more in the summer period due to the negative energy balance in these sows.

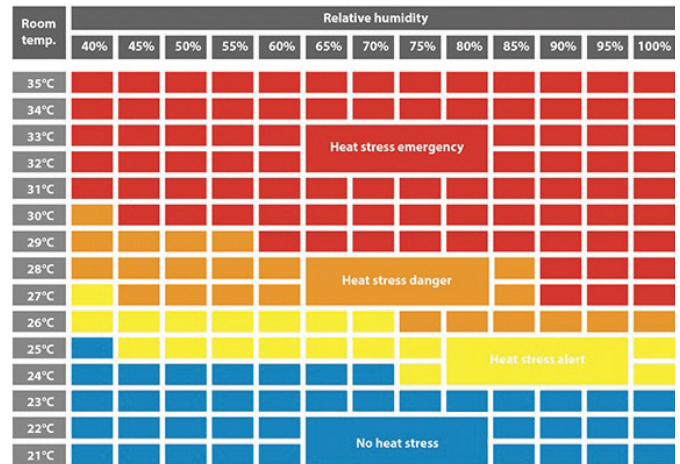
At what temperature and humidity do pigs become heat stressed?

Ambient temperature, as well as humidity, are 2 factors that contribute to heat stress.

Pigs generally develop heat stress at lower temperatures when the humidity is high.

The heat index stress chart developed by Iowa State University shows that an average humidity of 30% and a temperature of above 28 °C significantly affects the intestinal health and performance of grower-finisher pigs (Figure 4).

Heat Stress index for grow-finish swine



Source: Iowa State University, taken from the Pig Site

Figure 4: heat stress index chart of grower-finisher pigs

What are the recommended management tools to reduce heat stress?

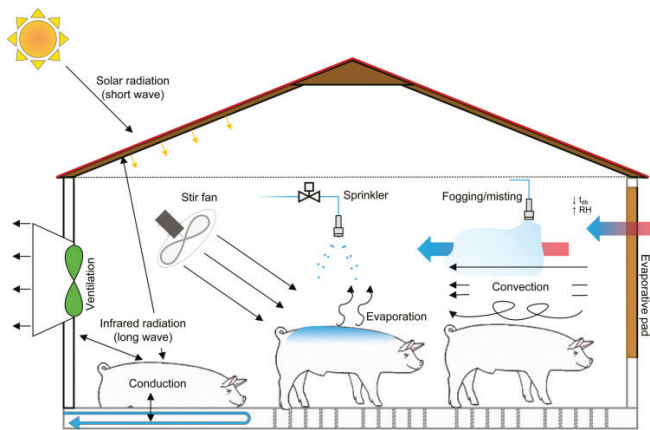
1. Ventilation

- ✓ Increase the ventilation and the airflow.
 - Make sure that there is sufficient ventilation capacity.
 - Clean and control the functionality of the air inlets, fans, and ducts regularly
 - Prune any plants that pose a problem for proper ventilation.
 - Use auxiliary fans for additional air exhausting and circulation.

2. Cooling

- ✓ Check on a regular time if the cooling system is still working properly (for example spray cooling).
- ✓ Different cooling systems are available and are based on the principles of conduction, evaporation, or convection (see fig. 5).
 - Place sprinklers on the roof or in front of the air inlet. Be aware that the humidity will not increase too fast.
 - Spray the (concrete) floor inside and the paving around the pig stables with cold water.
 - Switch off the piglet heating lamps during the day or use them the first 12 hours after the birth.
 - Spray the pigs with water (briefly).
 - Open the doors early in the morning, so the wind can blow through the stable.
 - Let cold water flow through the underfloor heating in the farrowing house but discontinue the flow of cold water 12 hours before farrowing.

- Use evaporative cooling pads
- Provide plenty of organic shade outside the stable.
- Paint the windows and the roof with white chalk.



Source: <https://www.researchgate.net>

3. Stock density

- ✓ Reduce stocking density if possible.
- ✓ In the late gestation period, it is recommended to leave a space between 2 heavily pregnant sows so that their body heat not pass on through the back. If there is enough space in the farrowing house, put the sows already here on time.

4. Activity

- ✓ When a pig is more active, the body temperature will get higher. Therefore, limit the activity as much as possible.
- ✓ Do not upset the pigs or move them unnecessarily, keep it silent in the stables.
- ✓ Postpone actions such as vaccinations or perform them early in the morning.
- ✓ Move pregnant sows to the farrowing pen early in the morning.
- ✓ Make sure the pigs stand up while during feeding and drinking.
- ✓ Watch out for urinary tract infections. Pigs urinate less often when it is hot, or they don't drink enough. The colour of the urine can become darker and more concentrated.

5. Water

- ✓ Every pig must have the possibility to drink as much as necessary. Therefore, make sure that the drinking water system is functioning properly. In the table below are some indicators which can help to optimize the drinking water system.

	Weight in kg	Recommended height of drinking nipples	Angle of drinking nipple	Optimal water flow	Daily water intake
Piglet	>5 kg	15 cm	15° - 45°	>0.4 - 0.6 L/min	0.7 L
Weaned piglet	>10 kg	20-25 cm		>0.5 - 1.0 L/min	1.0 L
Fattening pig	>20 kg	35-40 cm		>0.8 - 1 L/min	2.0 - 3.0 L
Fattening pig	>50 kg	50-60 cm		>0.8 - 1 L/min	4.0 - 8.0 L
Fattening pig	>100 kg	70 cm		>0.8 - 1 L/min	8.0 - 10.0 L
Lactating sow		90 cm		>2.0 - 2.7 L/min	15 + 1,5 L per piglet
Boar		90 cm		>0.8 - 1 L/min	10.0 - 15 L

- ✓ Make sure that there are enough drinkers (see table 1) so that every pig can drink enough water.

System	Minimum requirement (grower/finisher pigs)
Nipple/bite drinker (restrict fed)	1 per 10 pigs
Nipple/bite drinker (ad lib fed)	1 per 15 pigs
Bowl (restrict fed)	1 per 20 pigs
Bowl (ad lib fed)	1 per 30 pigs
Trough space (>35 kg)	30 cm/25 pigs

Source: Defra Code of Recommendations for the Welfare of Livestock: Pigs; Genesis QA

- ✓ Clean the drinkers thoroughly.
- ✓ Check the quality and quantity of the drinking water regularly.
- ✓ If necessary, add electrolytes and extra vitamins E and C to the drinking water (keep in mind that vitamin C only lasts for 6 hours in a water solution).
- ✓ Keep the temperature of the drinking water as low as possible (around 10 °C is ideal).

6. Feed

- ✓ Avoid feeding between 10.00am-4.00pm (the hottest period of the day).
- ✓ Divide the total daily feed intake in 3 turns instead of 2.
- ✓ In hot temperatures, hygiene is crucial, especially when using liquid feed. Therefore, remove old feed and clean the feeder every time before filling them with new feed. Mycotoxins and other bacteria will grow very fast.
- ✓ Adapt the feed formulation and implement it already before the warm period starts. Create a special heat stress feed.
 - Increase the dietary energy density.
 - Minimize the excess non-essential amino acids and fibre (minimizing intestinal fermentation and therefore heat production).
 - Increase the availability of antioxidants through the diet such as vitamin E and betaine.

Conclusion

Heat stress in pigs can have a great influence on the productivity and profitability of a pig farm.

By applying various management tools and tips on ventilation, cooling, water, feed, activity, etc. heat stress can be tackled properly.

If you want additional information about this topic, don't hesitate to contact us by e-mail info@kela.health or our technical service & product team.

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