# Heat stress ranges

Many of the references cite Marai 2001 as the source of their THI formula. Here’s the text for that.

Using the modified formula:

THI = db8C ^ [(0.31 ^ 0.31 RH) (db8C ^ 14.4)]

where db8C dry bulb temperature in Celsius and RH = relative humidity percentage/ 100..

Cattle- THI values – from https://www.heatstress.info/heatstressinfo/TemperatureHumidityIndexCattle/tabid/1232/Default.aspx

No stress <= 72

Mild stress 73 – 78

Moderate stress 79 – 89

Severe stress > 90

* From Brown-Brandl, T. M. (2018) for beef cattle in US

THI=0.8tdb+RH(tdb−14.4)+46.4

Normal, THI < 74; alert, 74 < THI < 79; danger, 79 < THI < 84; and emergency, THI > 84.

* From Lallo et al
* normal ≤ 74; moderate 75–78; severe 79–83; very severe (emergency) ≥ 84.

Broilers – from Purswell, J. L., Dozier, W. A. I., Olanrewaju, H. A., Davis, J. D., and Xin, H. (2012).

THI greater than 20.8C, broilers show reduced performance

Non-sweating animals (poultry and pigs)

﻿The corresponding values for non-sweating animals such as poultry and pigs are as follows: normal < 27.8, moderate 27.8–28.8, severe 28.9–29.9 and very severe (emergency) ≥ 30.0 (Marai et al. 2001).

# Sheep

﻿The values obtained indicate the following: <22.2 = absence of heat stress; 22.2 to <23.3 = moderate heat stress: 23.3 to <25.6 = severe heat stress and 25.6 and more = extreme severe heat stress (Marai et al., 2001).

Goats

From Battini 2016, THI was calculated following the equation described by Marai et al. (2001) in order to take into account the effect of the interaction between temperature and relative humidity. … THI ranges: cold (THI<50; 6 sessions), neutral (50<THI<65; 4 sessions) and hot (THI>65; 8 sessions). Two sessions performed during the last two time bands in spring had high THI (>65) and were therefore allocated to the hot season (Table 3).

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| animal | No stress | Moderate | Severe | Extreme | THI formula source | Stress cutoffs source |
| cattle | ≤ 74 | 75–78 | 79–83 | ≥ 84 |  | Hahn, et al, 2009 |
| sheep | <22.2 | 22.2 to <23.3 | 23.3 to <25.6 | ≥ 25.6 |  |  |
| yak | 52 | 55 | 59 | 62 | ﻿Krishnan et al. 2009a | Estimated from Fig 1 in Krishnan et al., 2018 |
| Goats, dairy | < 70 | 70-79 | 80-89 | 89 | El-Tarabany, M. S., et al (2017). doi:10.1007/s00484-016-1191-2.  Based on ruminant | El-Tarabany, M. S., et al (2017). doi:10.1007/s00484-016-1191-2. |
| pig | < 27.8 | 27.8–28.8 | 28.9–29.9 | ≥ 30.0 | ﻿Zumbach et al. (2008) | ﻿Marai et al. 2001 |
| chicken | < 27.8 | 27.8–28.8 | 28.9–29.9 | ≥ 30.0 |  | ﻿Marai et al. 2001 |
| Swine | 0 | 27.8–28.8 | 28.9–29.9 | ≥ 30.0 |  |  |
| broilers | < 27.8 | 27.8–28.8 | 28.9–29.9 | ≥ 30.0 | ﻿Tao and  Xin (2003) for broilers, with wet bulb correction |  |
| layers | < 27.8 | 27.8–28.8 | 28.9–29.9 | ≥ 30.0 | ﻿Zulovich and DeShazer (1990) for layers with wet bulb correction |  |