Managing heat stress in transition cows and calves

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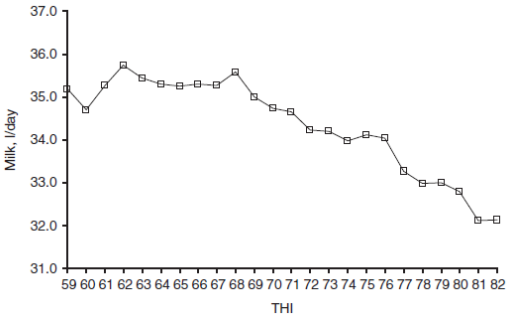
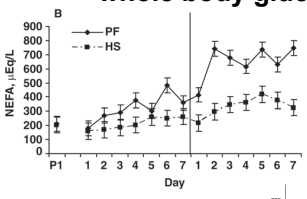
Heat stress reduces milk production

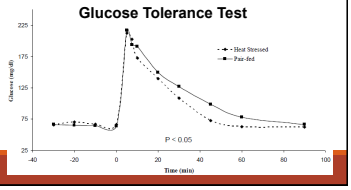


Review by Bernabucci et al., 2010

Heat-stressed lactating cows have blunted adipose tissue mobilization and increased whole body glucose utilization

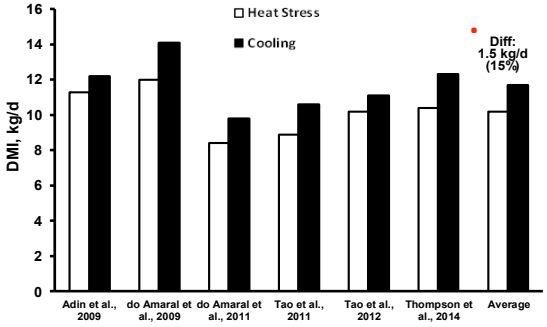


Glucose Tolerance Test

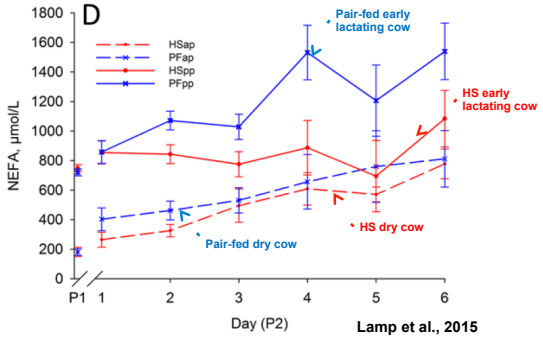


Wheelock et al., 2010

Cooling during the ENTIRE dry on DMI

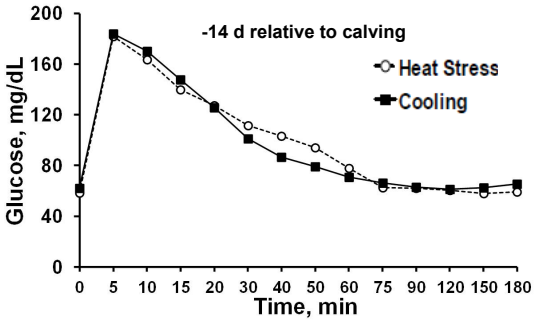


Heat stress doesn't affect fat mobilization of dry cows

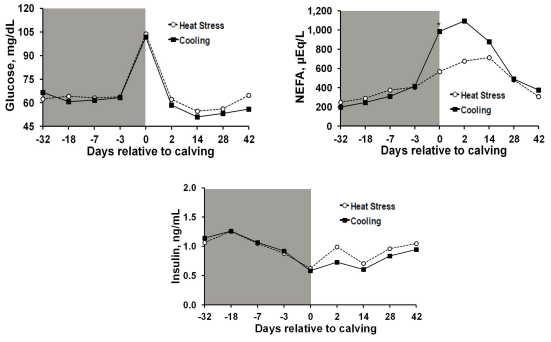


Lamp et al., 2015

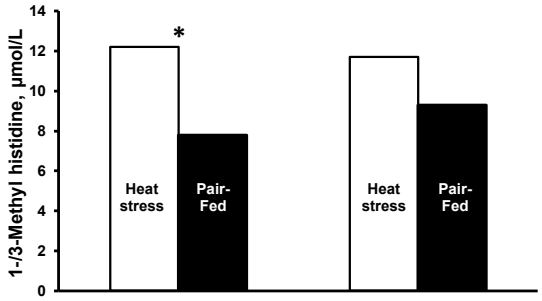
Heat stress doesn't affect glucose tolerance of dry cows



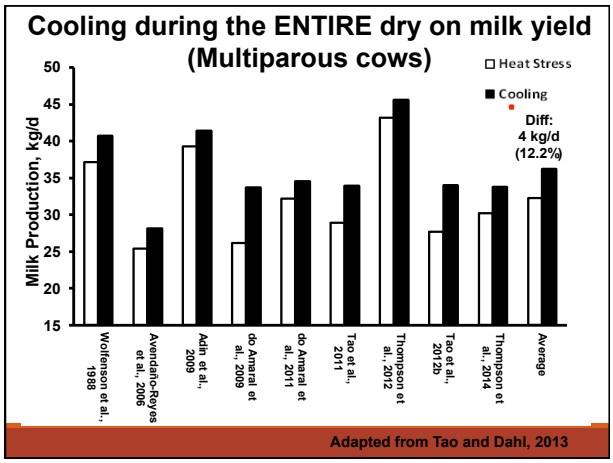
Heat stress doesn't affect blood metabolites and insulin of dry cows

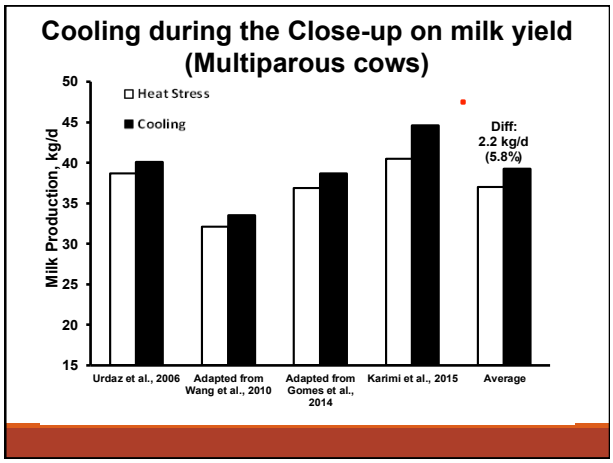


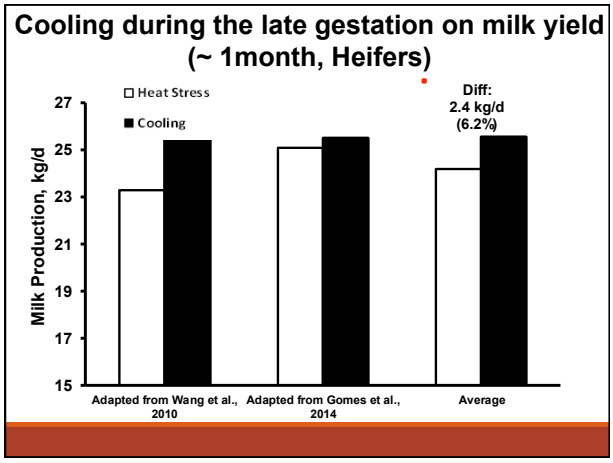
Heat stress increases protein mobilization of dry cows

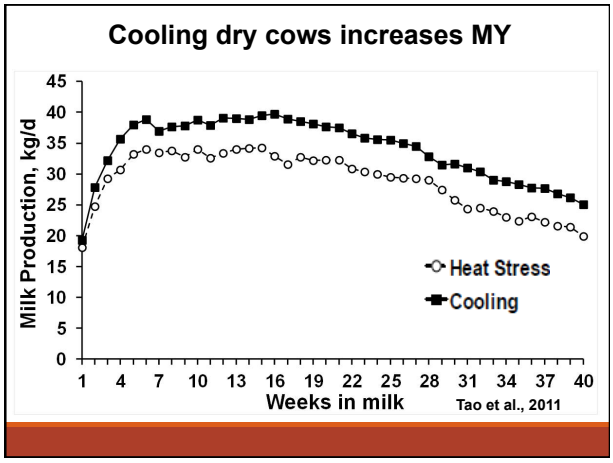


Adapted from Lamp et al., 2015

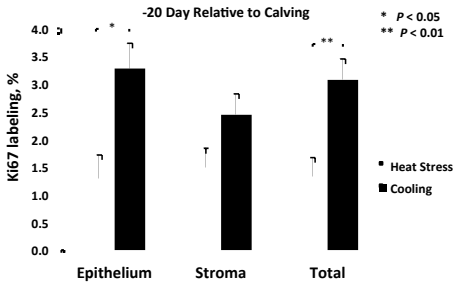

Cooling during the ENTIRE dry on milk yield
(Multiparous cows)
Heat Stress
Cooling
Diff:
4 kg/d
(12.2%)
Milk Production, kg/d
50
45
40
35
30
25
20
15
Wolfenson et al., 1988
Avendaño-Reyes et al., 2006
Adin et al., 2009
do Amaral et al., 2009
do Amaral et al., 2011
Tao et al., 2011
Thompson et al., 2012
Tao et al., 2012b
Thompson et al., 2014
Average
Adapted from Tao and Dahl, 2013


Cooling during the Close-up on milk yield
(Multiparous cows)
Heat Stress
Cooling
Diff:
2.2 kg/d
(5.8%)
Milk Production, kg/d
50
45
40
35
30
25
20
15
Urdaz et al., 2006
Adapted from Wang et al., 2010
Adapted from Gomes et al., 2014
Karimi et al., 2015
Average

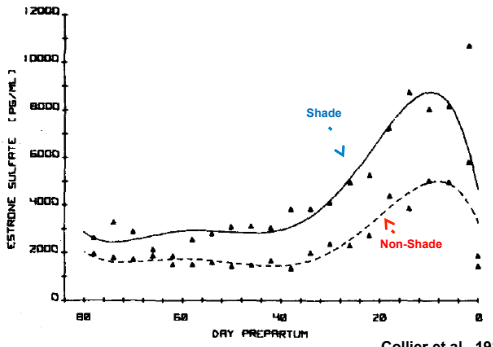

Cooling during the late gestation on milk yield
(~ 1month, Heifers)
Heat Stress
Cooling
Diff:
2.4 kg/d
(6.2%)
Milk Production, kg/d
27
25
23
21
19
17
15
Adapted from Wang et al., 2010
Adapted from Gomes et al., 2014
Average


Cooling dry cows increases MY
Milk Production, kg/d
45
40
35
30
25
20
15
10
5
0
1
4
7
10
13
16
19
22
25
28
31
34
37
40
Weeks in milk
Heat Stress
Cooling
Tao et al., 2011

Cooling improves mammary growth in the late dry period

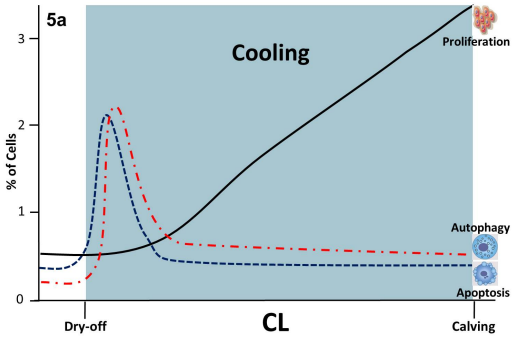


Heat stress decreases estrone sulfate

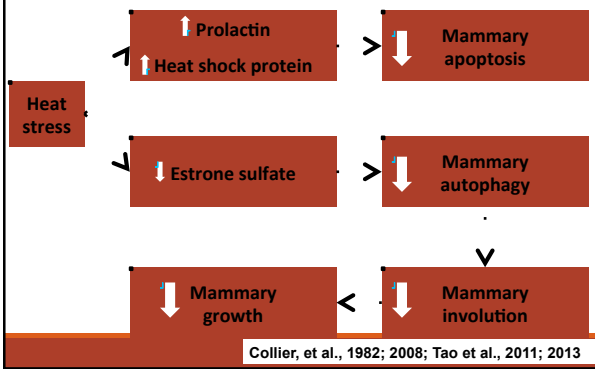


Collier et al., 1982

Mammary Gland Development During the Dry Period

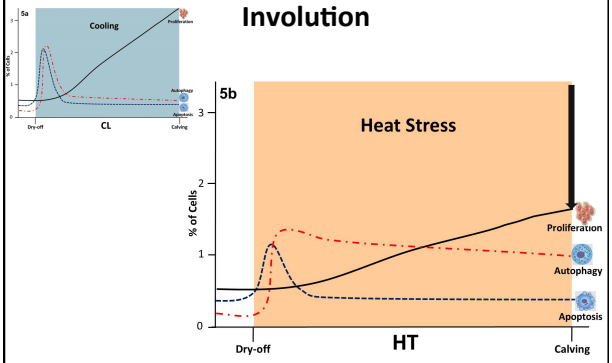


Heat Stress May Alter Mammary Involution in Early Dry Period

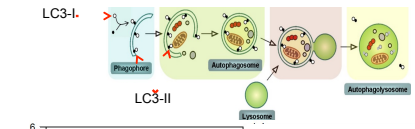


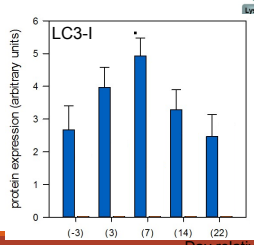
Collier, et al., 1982; 2008; Tao et al., 2011; 2013

Hypothesis: Heat Stress Impairs Mammary Involution



Heat stress blunts mammary autophagy during the early dry period

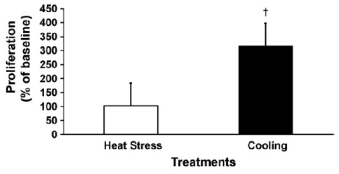


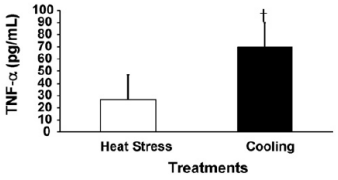


Cooling
Heat Stress

Wohlgemuth et al., 2015

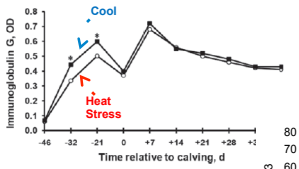
Heat stress impairs lymphocyte proliferation



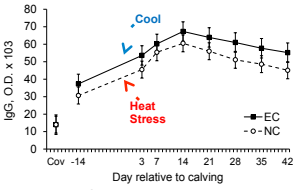


do Amaral et al., 2011

Heat stress impairs IgG responses against ovalbumin challenge

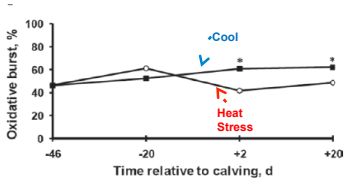


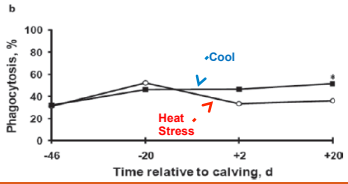
do Amaral et al., 2011



Gomes et al., 2014

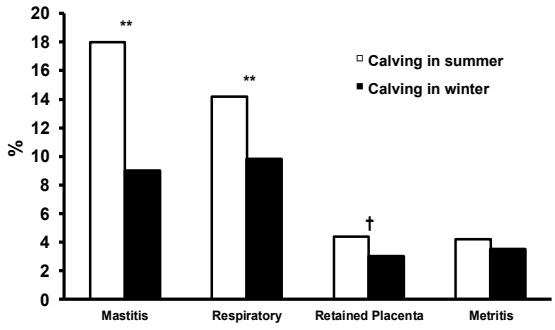
Heat stress impairs neutrophil function





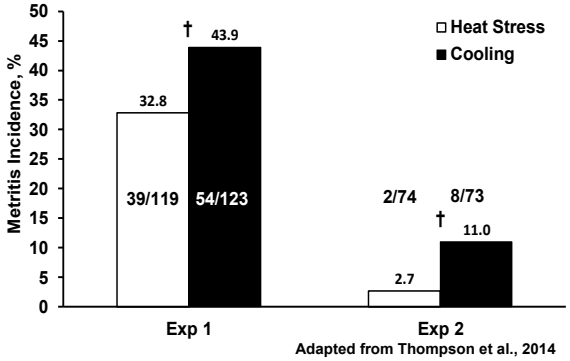
do Amaral et al., 2011

Calving season on cow health (up to 60 DIM)



Adapted from Thompson and Dahl., 2012

Prepartum cooling increases metritis

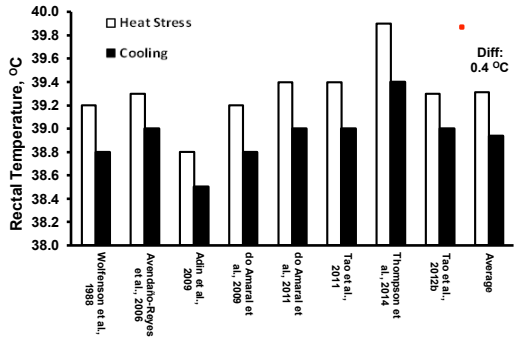


Adapted from Thompson et al., 2014

Prepartum cooling is the key

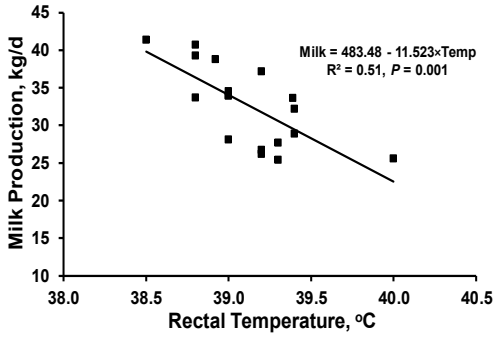
- Most effective approach
- Slight reduction in body temperature can have strong impact on subsequent lactation

Prepartum cooling slightly reduces cow body temperature



Adapted from Tao and Dahl, 2013

Reduction in body temperature when dry improves subsequent milk yield



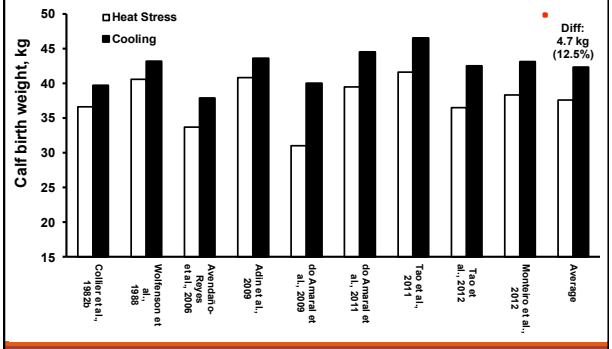
Tao and Dahl, 2013

Summary – Heat stress during the dry period on cow

- Impairs mammary growth during the dry period
- Decreases milk production in the next lactation
- Alters metabolic responses during transition
- Compromises immune function during transition
- Cooling dry cow is the key

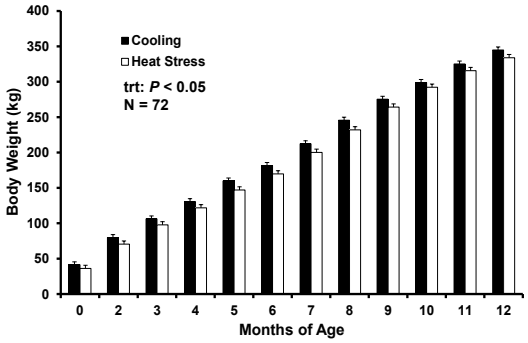
Maternal heat stress on calf

Late gestation heat stress decreases birth weight



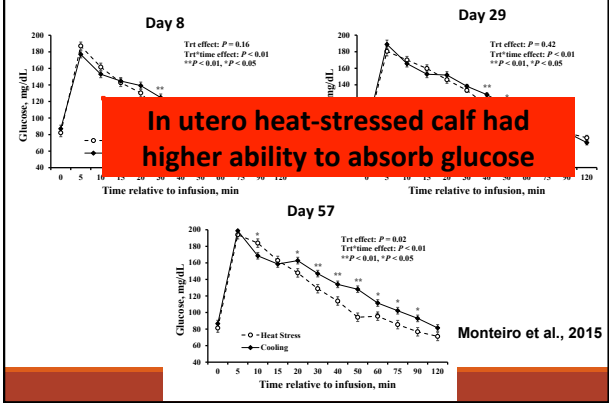
Adapted from Tao and Dahl, 2013

Late gestation heat stress affects calf body weight



Monteiro et al., 2013

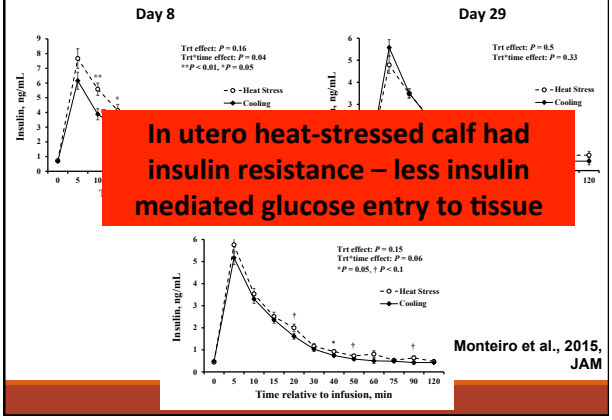
Glucose clearance to glucose infusion



In utero heat-stressed calf had higher ability to absorb glucose

Monteiro et al., 2015

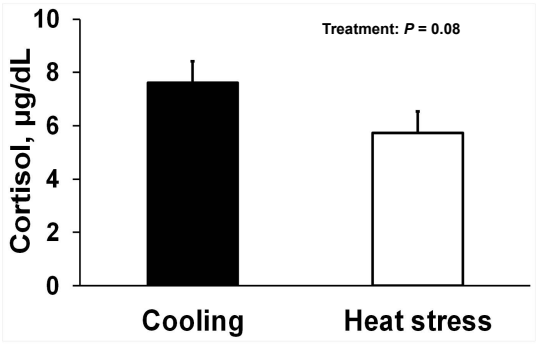
Insulin clearance to insulin infusion



In utero heat-stressed calf had insulin resistance – less insulin mediated glucose entry to tissue

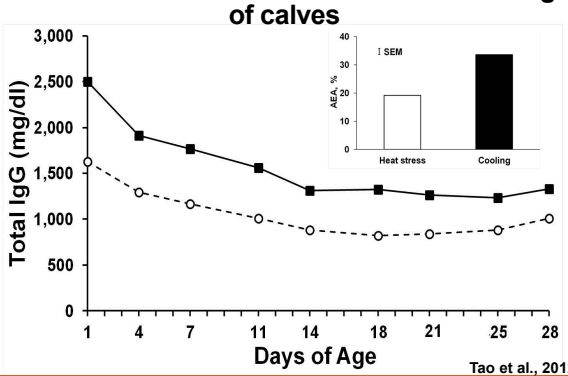
Monteiro et al., 2015, JAM

Cortisol at Calving



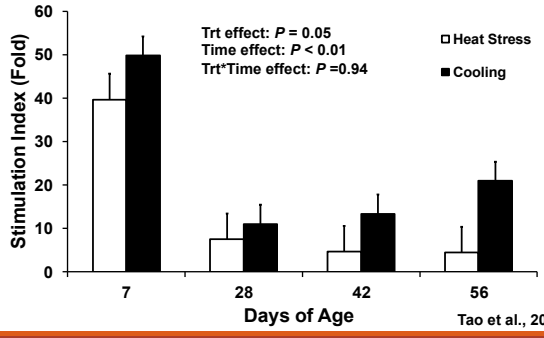
Tao et al., 2012

Maternal heat stress decreases serum total IgG of calves



Tao et al., 2012

Maternal heat stress affects lymphocyte function of calves



Tao et al., 2012

Summary – Heat stress during the dry period on calf

- Impairs fetal growth and lowers birth weight
- Compromises immune function before weaning
- Decreases milk production in the first lactation