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Heat load affects measures of aversion in dairy cows

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AVERSION RACE: GENERAL OVERVIEW

PURPOSE: evaluate the emotional valence (**+** vs. **–**) animals associate with a stimulus

PRINCIPLE: animals will show **willingness** to approach **rewarding** (**+**) stimuli and **reluctance** to approach **aversive** (**–**) stimuli

METHOD: animals are tested individually and repeatedly in a narrow raceway in a between-subjects design

Measures:

1. **TRANSIT TIME** (TT)**:** amount of time it takes animals to complete the race
2. **HANDLING PRESSURE** (HP)**:** effort from a handler to encourage animals to move forward

Examples of handling pressure:
- pressure applied, scored on a standardized ordinal scale
- amount of time spent actively pushing animals
- number of times animals were prodded

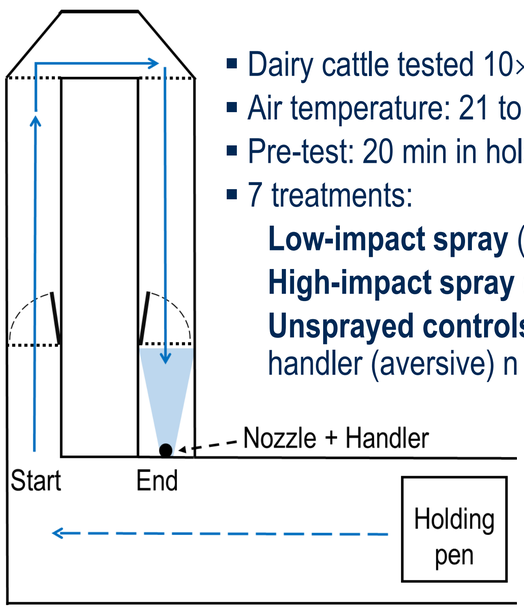
Example treatments	Emotional valence	Predicted response
Shouting person	☹ – aversive	↑ TRANSIT TIME, HANDLING PRESSURE
Control: silent, still person	😐 neutral	
Person offering feed	☺ + rewarding	

Do previous studies support these predictions?

Treatment (vs. control)	Using **transit time** alone	Using **both TT & HP**
☹ – aversive	✓ Dairy cattle[1] ✓ Sheep[2] ✓ Red deer[3] × Red deer[4] ✓ Laboratory rats[5, 6] ? Laying hens[7]	✓ Dairy cattle[8, 9, 10] × Dairy cattle[11] ✓ Sheep[12, 13]
☺ + rewarding	–	✓ Dairy cattle[10] ✓ Sheep[14]

HOW DOES HEAT LOAD AFFECT COWS' WILLINGNESS TO APPROACH SPRAY?

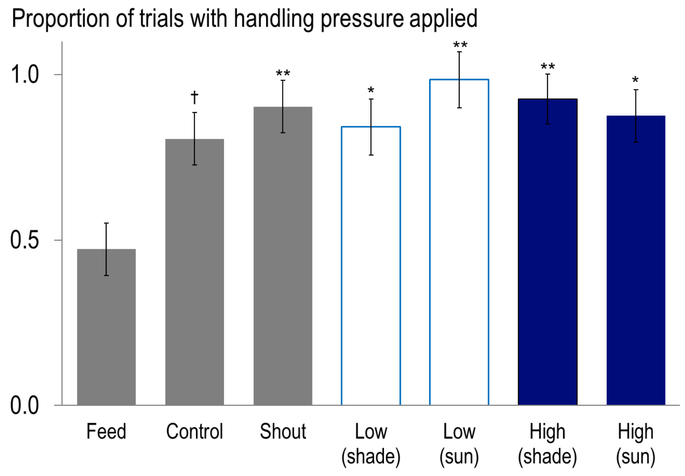
All analyses: MIXED (SAS 9.4) using trials 2-10 (non-naïve to treatments)



A handler moved behind the cow as she traveled through the shaded race. At the end, another handler administered treatments for 1 min.

- Dairy cattle tested 10× each
- Air temperature: 21 to 44°C
- Pre-test: 20 min in holding pen, with shade or without
- 7 treatments:
  - **Low-impact spray** (1.1 kPa): n = 7 + 7
  - **High-impact spray** (8.9 kPa): n = 9 + 8
  - **Unsprayed controls**: feed (rewarding) n = 8, shouting handler (aversive) n = 8, neither (neutral) n = 8

1 **HANDLING PRESSURE confirmed feed was rewarding: handlers applied pressure half as often when feed was offered** (binary measure: applied or not; overall $P = 0.001$). Pairwise differences between the feed treatment vs. others: $^{**}P < 0.01$; $^{*}P < 0.05$; $^{\dagger}P < 0.07$. There were no other treatment differences ($P \geq 0.725$). Based on this, the feed treatment was excluded from analyses ❷❹❺



2 **Handling pressure did not change with heat load** ($P \geq 0.129$)

3 **TRANSIT TIME did not reflect differences in reward or aversion** (overall $P = 0.424$)

Instead, TRANSIT TIME reflected heat load:

4
- **In warmer weather, transit time increased overall** (by 13 s per 10°C increase in air temperature; $P = 0.043$)
- **As respiration rate ⇧, unsprayed cows moved more slowly** (by 7 s per 10 breaths/min increase; $P = 0.017$), **but sprinklers mitigated this response** ($P \geq 0.283$)

5 **Average speed to approach non-feed treatments was 0.1 m/s compared to 0.5 to 0.7 m/s in other studies[9, 11]**
To our knowledge, ours is the 1st study conducted in warm weather

6 **Cows may have walked more slowly to avoid heat gain, as body temperature ⇧ with physical activity[15, 16]**

STRENGTHS

+ Advantage over preference tests: allows inference of emotional valence (**+** vs. **–**) animals associate with a stimulus

+ Few technical requirements (raceway, stopwatch)

+ Has been used successfully in many species (cattle, sheep, deer, rats, and limited evidence in poultry)

WEAKNESSES

– Not validated to measure sustained emotional states

– Requires large sample size for between-subjects design

– Cattle become lethargic in warmer weather, and transit time reflects this rather than aversion

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