Testing Passive Cooling Methods To Reduce Heat Without Electricity

Hypothesis & Purpose

Purpose:

- Which household-material design keeps an enclosed space the coolest over time without electricity?

Hypothesis:

- If four boxes (cardboard, foil, Styrofoam, paper towels) are tested under the same conditions, then the box with wet paper towels will stay the coolest due to evaporative cooling.

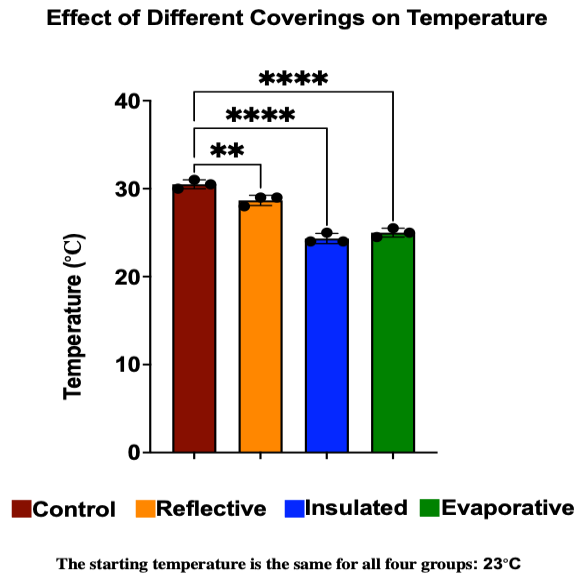
Data & Results

Avg. Temperatures (°C):

- Insulated: 24.3
- Evaporative: 25
- Reflective: 28.7
- Control: 30.5

ANOVA results (vs control):

- Reflective: $p \approx 0.01478$
- Insulated: $p \approx 0.00017$
- Evaporative: $p \approx 0.00018$



Methodology

Materials:

- 4–5 identical cardboard boxes (7.5 in. × 12.2 in. × 3.8 in.)
- Aluminum foil, Styrofoam, paper towels, thermometer
- Oven set to 37℃/98.6℉ and a 5-minute timer

Procedures:

1. Prepare four box types (control, reflective, insulated, evaporative) with thermometers (start at 23 °C).
2. Evaporative box: wet paper towels re-wetted as needed during trials
3. Place boxes in the oven set to 37 °C/98.6 °F, turn it on, start a 5-minute timer, and record temperatures
4. Repeat all conditions for 3 trials

Conclusion & Improvements

Conclusion:

- Contrary to the hypothesis, the insulated box stayed coolest (24.3°C), likely because insulation reduced heat transfer through conduction while the oven's limited airflow reduced evaporation.
- Low-cost materials can effectively reduce heat without electricity.

Improvements:

- Test outdoors and run more trials for longer data collection.
- Explore hybrid cooling methods for future designs.