Assessing the Relationship between Agricultural Tasks and Cardiovascular Load Among Crop Workers

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PURPOSE

This study aims to assess the relationships between agricultural tasks, cardiovascular load, and environmental temperature among crop workers in Colorado.

INTRODUCTION

- Agricultural work involves physically demanding tasks in changing temperatures.
- These conditions can lead to heat stress, fatigue, and health risks.
- Cardiovascular load measures the strain on the heart from physical activity.
- This analysis examines how specific tasks affect cardiovascular load in hot work environments.

Weeding

Harvesting Spinach

METHODS

In the summer of 2023, crop workers (n=34) from six farms in Colorado wore the Zephyr Bio-Harness to monitor and record their heart rate while performing different agricultural tasks. The research team monitored the environmental temperature estimating Wet Bulb Globe Temperature(WBGT) as a measure of the heat stress, during their shifts.

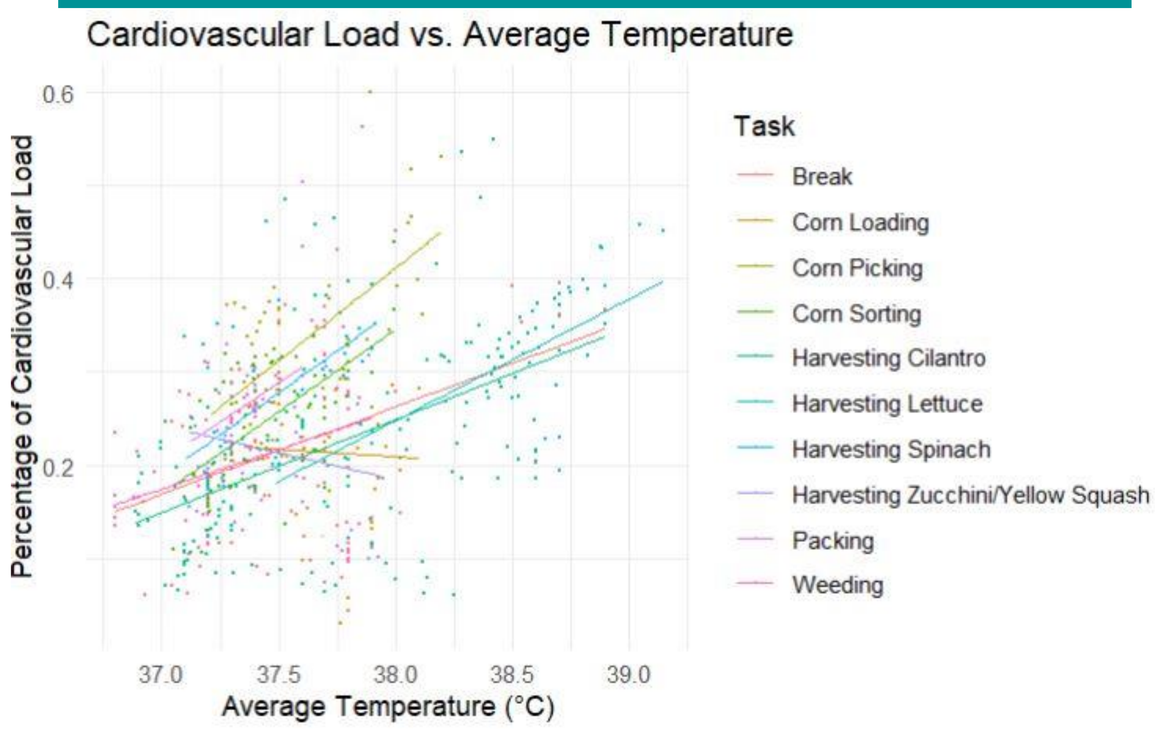
Cardiovascular Load Formula:

100%*((Working Heart Rate – Resting Heart Rate) /

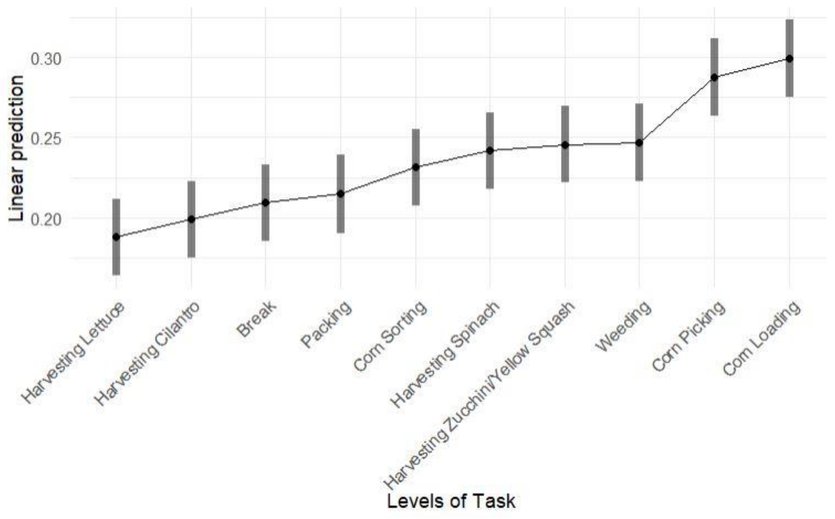
((1/3 * (220 – Age))+Resting Heart Rate))

I calculated the average core temperature at 15-minute intervals for each task and applied a linear regression model to analyze and compare the results.

RESULTS



Task	Emmeans	Lower CI	Upper CI
Harvesting Lettuce	0.19	0.16	0.21
Harvesting Cilantro	0.20	0.18	0.22
Break	0.21	0.19	0.23
Packing	0.22	0.19	0.24
Corn Sorting	0.23	0.21	0.26
Harvesting Spinach	0.24	0.22	0.27
Harvesting Zucchini/Yellow Squash	0.25	0.22	0.27
Weeding	0.25	0.22	0.27
Corn Picking	0.29	0.26	0.31
Corn Loading	0.30	0.28	0.32



CONCLUSION

- Among the agricultural tasks, corn loading has the highest estimated marginal mean (0.30), while harvesting lettuce has the lowest (0.19).
- Cardiovascular load varied by task:
  - Higher: corn loading, corn picking
  - Lower: harvesting cilantro, harvesting lettuce
- The model adjusts for environmental temperature, so these differences persist after controlling for temperature.
- As temperatures rise, identifying high cardiovascular load tasks can help farm owners and workers adjust for safety.
- More research is needed to understand task-specific strain and find effective mitigation strategies.

REFERENCES

1. TSI. “QuestTemp°32-34-36 Area Heat Stress Monitors.” https://tsi.com/products/heat-stress-monitors/questemp%C2%BA-32-34-36-area-heat-stress-monitors/#resources. Accessed 4 Feb. 2025.
2. Zephyr. “Zephyr BioHarness 3 Log Data Descriptions.” https://www.zephyranywhere.com/media/download/bioharness-log-data-descriptions-07-apr-2016.pdf. Accessed 4 Feb. 2025.