

Subjective weather sensitivity and physiological stress responses after walking in nature in individuals with coronary artery disease

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Background

Physiological and psychological stress can influence the progression of coronary artery disease (CAD) (Gecaite J. et al., 2019). While natural environments are often associated with more effective stress recovery than urban settings (Olafsdottir G. et al., 2020), they are not universally restorative (Gatersleben B. et al., 2013). Little is known about their restorative potential for individuals who perceive themselves as weather-sensitive (WS).

Goal

To evaluate how subjective weather sensitivity influences physiological stress responses after walking in nature in individuals with CAD.

Materials and methods

Dataset

This randomized controlled trial was conducted at the Laboratory of Behavioral Medicine, Neuroscience Institute (NI), Lithuanian University of Health Sciences (LUHS), in Palanga, Lithuania.

A total of 71 individuals with CAD (83.1% men and 16.9% women; mean age 59 ± 7.5 years), who were attending a rehabilitation program at the Palanga Clinic of the LUHS NI, participated in this study (Martinaitiene D. et al, 2024).

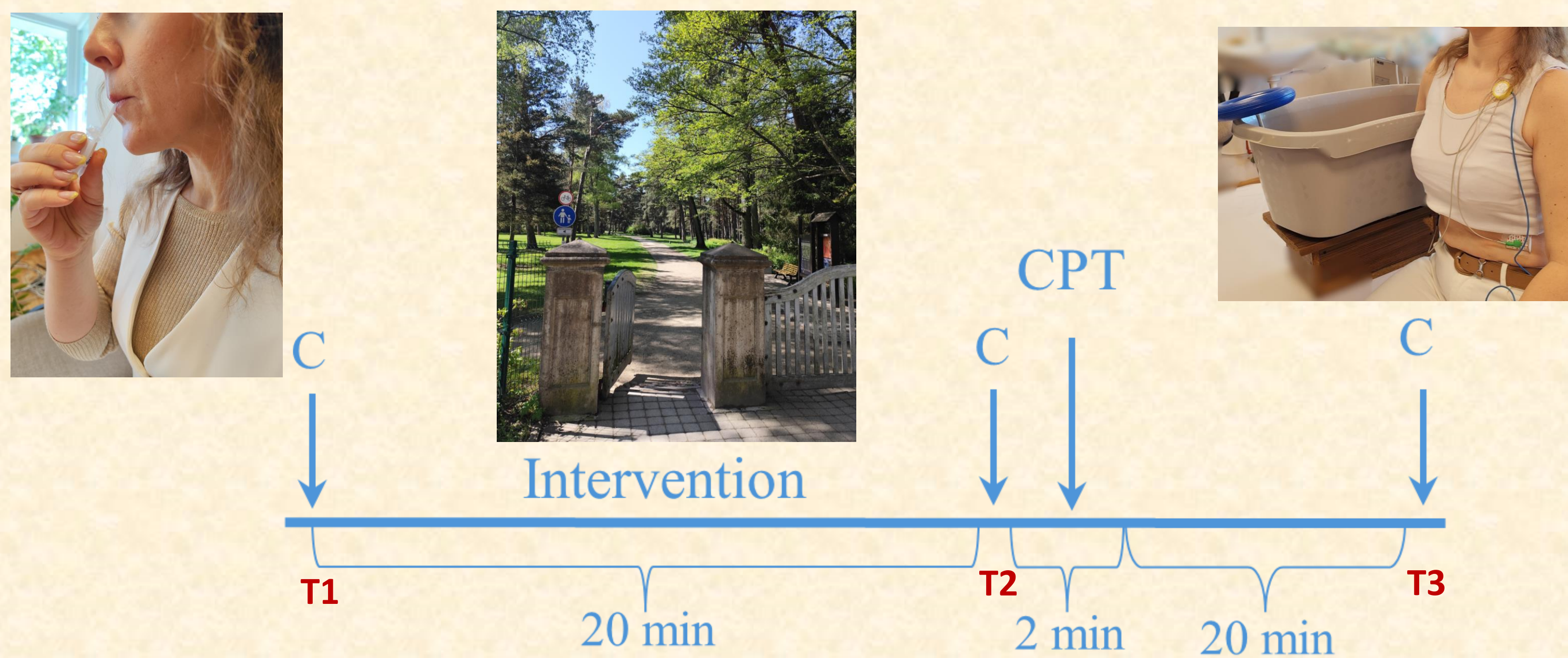
Measurements

- **Self-perceived weather sensitivity:** Assessed by asking participants, "Do you feel the weather changes?" Those who answered "YES" were classified as WS; all others were classified as non-WS.
- **Physiological stress (salivary cortisol):** Cortisol levels were measured from saliva samples collected at predefined time points (see Figure 1).
- **Cold Pressor Test (CPT):** To induce acute physiological stress, participants immersed their right hand in an ice-water bath (4 °C) up to just above the elbow for 2 minutes.

Cortisol changes within groups were analyzed using the Wilcoxon Signed Ranks Test.

Eksperimental procedure

On the day of the experiment, participants engaged in a 20-minute walk in a park environment, with all sessions conducted at the same time of day and supervised by researchers to ensure consistency and participant safety. Immediately afterwards, they underwent the Cold Pressor Test (CPT) to induce acute physiological stress. Salivary cortisol concentrations were collected at three time points to assess physiological stress responses: before the walk (T1), immediately after the walk (T2), and 20 minutes after the CPT (T3).



Note. C – saliva collection for cortisol analysis; Intervention – walking outdoor, CPT - cold pressor test

The study was conducted in Palanga, a coastal city in northwestern Lithuania (55°58' N, 21°03' E) in the country's coastal climate zone, part of the Baltic coastal region. The area has milder winters, cooler summers, high humidity, frequent westerly winds, and strong maritime influence. The study was conducted over one year under varying weather conditions (see table).

Table. The descriptive characteristics of the weather parameters in study place during 2023-06 - 2024-06 stratified by seasons (mean (SD))

Season	Temperature °C	Relative humidity, %	Atmospheric pressure, hPa	Wind speed, m/s	Solar Radiation, W/m ²
Winter	1.36(4.71)	89.88(6.27)	1008.94(13.60)	2.84(1.58)	18.06(43.37)
Spring	9.98(7.05)	78.59(15.38)	1014.80(8.57)	2.27(1.26)	161.71(230.70)
Summer	18.43(3.47)	78.26(12.77)	1013.25(6.78)	1.75(0.99)	232.78(277.23)
Autumn	10.81(7.19)	84.06(9.13)	1010.25(10.44)	2.54(1.71)	71.07(136.51)

Results

No statistically significant differences between the WS and non-WS groups were observed at any of the measurement points — neither before the walk, nor after the walk, nor following the stress test (Figure 2). However, although the differences were not statistically significant, a trend was observed: WS individuals tended to have higher cortisol levels before the walk.

Figure 1. Overall salivary cortisol levels by weather sensitivity across measurement time points.

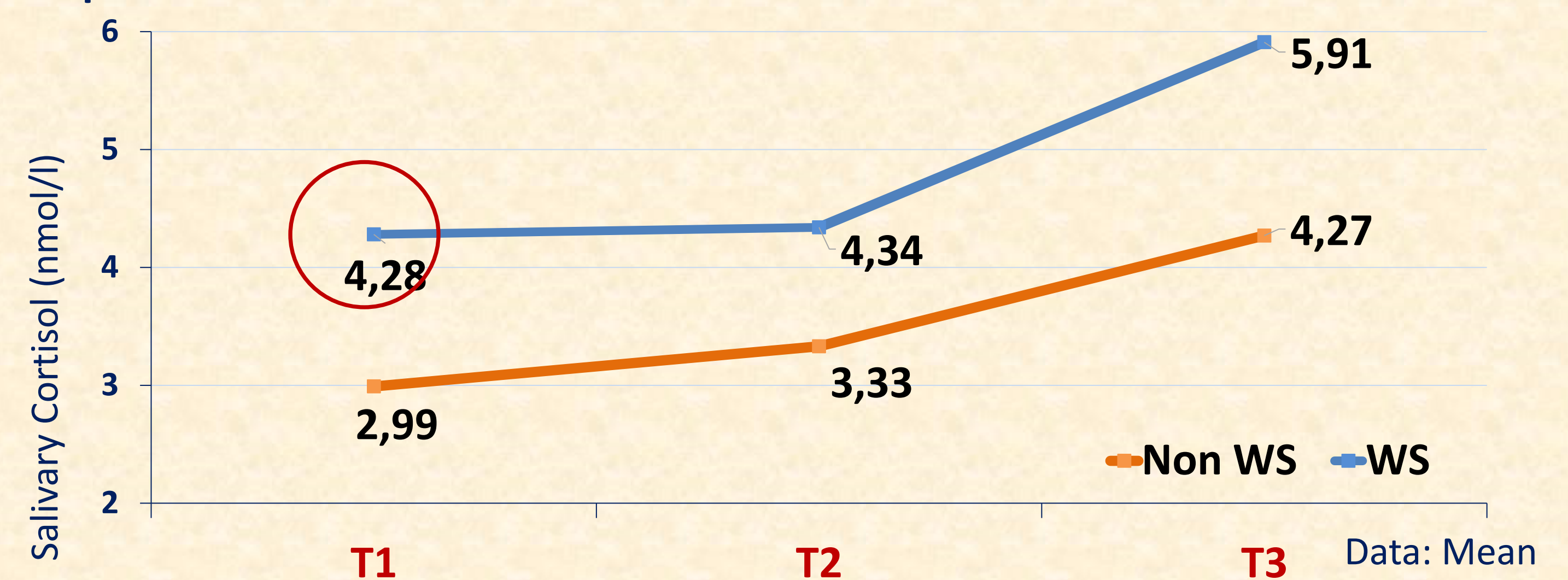
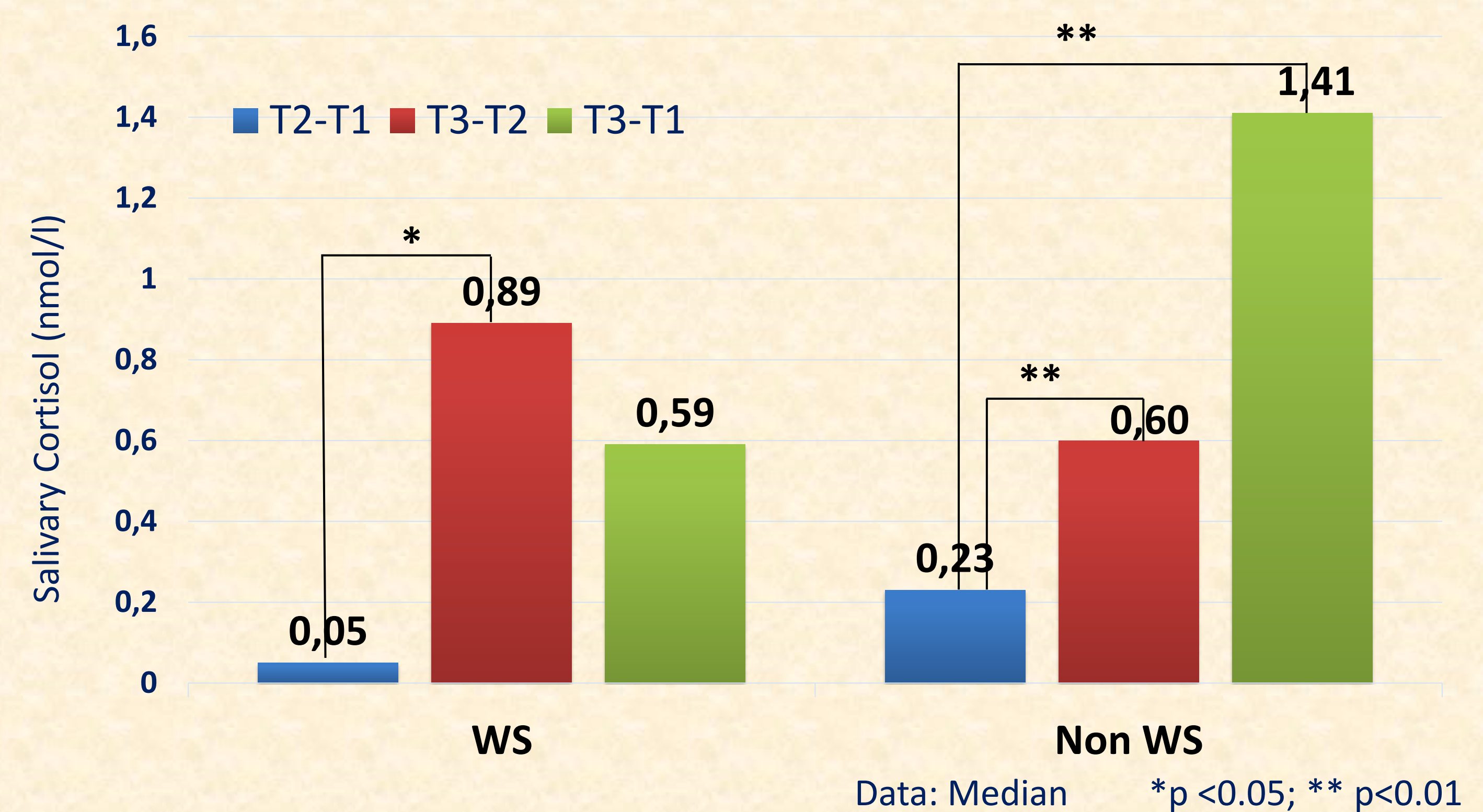


Figure 2. Within-group changes in salivary cortisol across measurement time points.



- Both WS and non-WS participants showed no significant change at T2 (immediately after the walk in the park).
- However, both groups showed a significant cortisol increase at T3 (in response to CPT), with a more pronounced change (higher absolute Z-value) in the non-WS.
- For WS participants, the increase from T1 to T3, and from T2 to T3 correspondingly, were both statistically significant (Z=2.18, p=0.029, median=0.59 and Z=2.55, p=0.011, median=0.87, respectively).
- Among non-WS participants, the increase from T1 to T3 was more pronounced (Z=3.05, p=0.002, median=1.41) and the rise from T2 to T3 remained significant (Z=3.10, p=0.002, median=0.60).

Conclusion

These results suggest that both subjective weather sensitivity and environmental context may influence physiological responses to stress in individuals with CAD.

Disclosure

Authors have no conflicts of interest to disclose

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