Efficacy and Reliability of Portable Infrared Sauna Use as a Dehydration Intervention Modality

Modesto A. Lebron, David H. Fukuda, Kworweinski Lafontant, Jack T. Cregan, Julia M. Shell, Jeffrey R. Stout

School of Kinesiology and Rehabilitation Science, University of Central Florida, Orlando, FL

Background

Dehydration, or hypohydration, is typically considered a body water loss of ≥2% of an individual's total body mass (BM) (Cheuvront & Kenefick, 2011). Dehydration in a research setting can be elicited in various ways, including both active and passive modalities, which may alter physiological responses depending on which modality is chosen. While environmental chambers are traditionally used for studying dehydration, portable infrared saunas offer a more accessible and cost-effective alternative. Although portable infrared saunas have been used in previous investigations (Mollica et al., 2019), no research exists examining the efficacy and repeatability of using a portable infrared sauna as an intervention modality to achieve predetermined body mass losses (BML).

Purpose

To assess efficacy and the test-retest reliability of sweat rates, sauna temperatures, estimated core body temperatures, and BML using a portable infrared sauna.

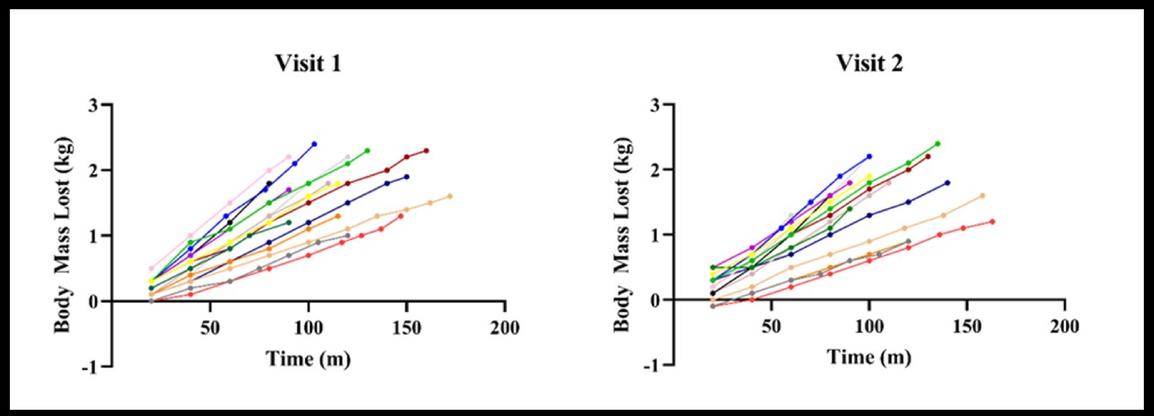
Methods

- Fifteen healthy participants completed two identical dehydration trials at least 72 hours apart.
- 11 males: 22.46±2.70 years, 175.48±6.54 cm, 76.35±9.78 kg; 4 females: 21.00±2.58 years, 163.10±2.79 cm, 54.78±4.25 kg
- The intervention involved a 15-minute walking treadmill warm-up and alternating exposures of 20 minutes in the sauna set at the maximum temperature of ~66°C and 5 minutes of passive rest in a thermoneutral environment (~23°C).
- Participants were weighed during each 5-minute rest period until they achieved a BML of 2.8±0.3% for males or 2.4±0.3% for females.
- Dependent variables include total sauna time (TT), maximum core temperature (MCT), absolute BML (ABM_{DIFF}), relative BML ($\%BM_{DIFF}$), absolute BML per 60 minutes (ABM_{SLOPE}), relative BML per 60 minutes ($\%BM_{SLOPE}$), and average sauna temperature when entering (ST_{IN}) and exiting (ST_{OUT}) during each interval.

Institute of Exercise Physiology and Rehabilitation Science

Variables	Trial Desciptives		Intertrial CV%	SEM	MDC_{95}	* ICC (2,1), ** ICC (2,k)		
	1	2				Point Estimate	Lower 95% CI	Upper 95% CI
TT (min)*	119.5±27.7	119.4±26.0	4.86±4.19	4.41	12.22	0.821	0.590	0.928
MCT (°C)*	37.6±0.5	37.5±0.4	0.36±0.24	0.09	0.24	0.758	0.425	0.905
ST_{IN} (°C)**	54.6±2.7	55.3±2.4	1.34±1.10	0.81	2.23	0.710	0.251	0.890
ST_{OUT} (°C)**	50.2±1.8	50.4±2.1	1.01±0.74	0.46	1.27	0.781	0.427	0.918
ABM_{DIFF} (kg)*	1.9±0.4	1.9±0.4	2.34±2.59	0.01	0.04	0.969	0.922	0.988
$\%BM_{DIFF}$ (%)*	2.6±0.2	2.6±0.2	2.33±2.32	0.00	0.00	0.729	0.417	0.888
ABM_{SLOPE} (kg·60 minutes^{-1})*	0.97±0.31	0.95±0.31	5.03±4.40	0.02	0.06	0.918	0.800	0.968
$\%BM_{SLOPE}$ (%BM·60 minutes^{-1})*	1.36±0.31	1.33±0.29	4.91±4.28	0.04	0.11	0.833	0.614	0.933

Time to achieve targeted dehydration of 2-3% of body mass using portable infrared saunas is reliable in healthy young adults.



Results

- Moderate reliability (ICC = 0.50 – 0.75) was observed for ST_{IN} and $\%BM_{DIFF}$.
- Good reliability (ICC = 0.75 – 0.90) was observed for TT, MCT, ST_{OUT} and $\%BM_{SLOPE}$.
- Excellent reliability (ICC > 0.90) was observed for ABM_{DIFF} and ABM_{SLOPE}.
- All variables demonstrated acceptable absolute reliability (CV < 5%)
- Significant differences were only observed for MCT (Trial 1 > Trial 2, t = 2.157, p = 0.049, d = 0.557).

Conclusion

Using a portable infrared sauna as a dehydration intervention modality provides reliable outcomes related to time, temperature, sweat rate, and BM loss. Additionally, participants consistently achieved their intended dehydration levels.

Practical Application

Portable infrared saunas provide individuals with an inexpensive and accessible modality for those who intend to conduct research involving passive dehydration via heat exposure as an intervention. Individuals interested in assessing the influence of dehydration on performance or the impact of nutritional agents on recovery can use the proposed protocol to decrease body mass by 2 – 3% in approximately 120 minutes of sauna exposure.

References

Cheuvront, S. N., & Kenefick, R. W. (2011). Dehydration: Physiology, assessment, and performance effects. Comprehensive Physiology, 4(1), 257–285.

Mollica, J. A., Desbrow, B., & Irwin, C. G. (2019). No Impact of Heat Stress and Dehydration on Short Duration Simulated Motor-Racing Performance. International Journal of Exercise Science, 12(6), 960.

Acknowledgement

This data was collected as part of a larger project funded by Abbott Nutrition.