



Does Type 2 Diabetes Impair Heat Loss as a Function of Heat Load?

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INTRODUCTION

Epidemiological data suggest that individuals with type 2 diabetes (T2D) are more likely to be hospitalized and/or die during extreme heat events compared to those without diabetes (1). In fact, a recent study showed that individuals with T2D have a reduced capacity to dissipate heat during exercise in a hot environment, thereby leading to greater whole-body heat storage (2). However, it remains unclear if diabetes-related impairments in heat dissipation only occur above a certain level of heat stress (defined by the environmental and metabolic heat loads) and whether the degree of impairment is augmented as the level of heat stress increases. Thus, the purpose of this study is to determine the extent to which T2D affects the body's ability to dissipate heat as a function of progressive elevations in metabolic heat production during exercise in the heat.

METHODS

Three adults with (60 ± 10 years) and three adults without (CON; 59 ± 8 years) T2D performed three 30-min bouts of exercise at increasing rates of heat production of 150 (EX1), 200 (EX2), and 250 (EX3) W/m^2 at $40^\circ C$ and 10% relative humidity. Each exercise bout was followed by 15-min of recovery (REC1, REC2, REC3). Whole-body heat loss (evaporative heat loss and dry heat exchange) was assessed using whole-body direct calorimetry while metabolic heat production was measured using indirect calorimetry. The change in body heat content was calculated as the temporal summation of the rate of metabolic heat production and the rate of total heat loss.

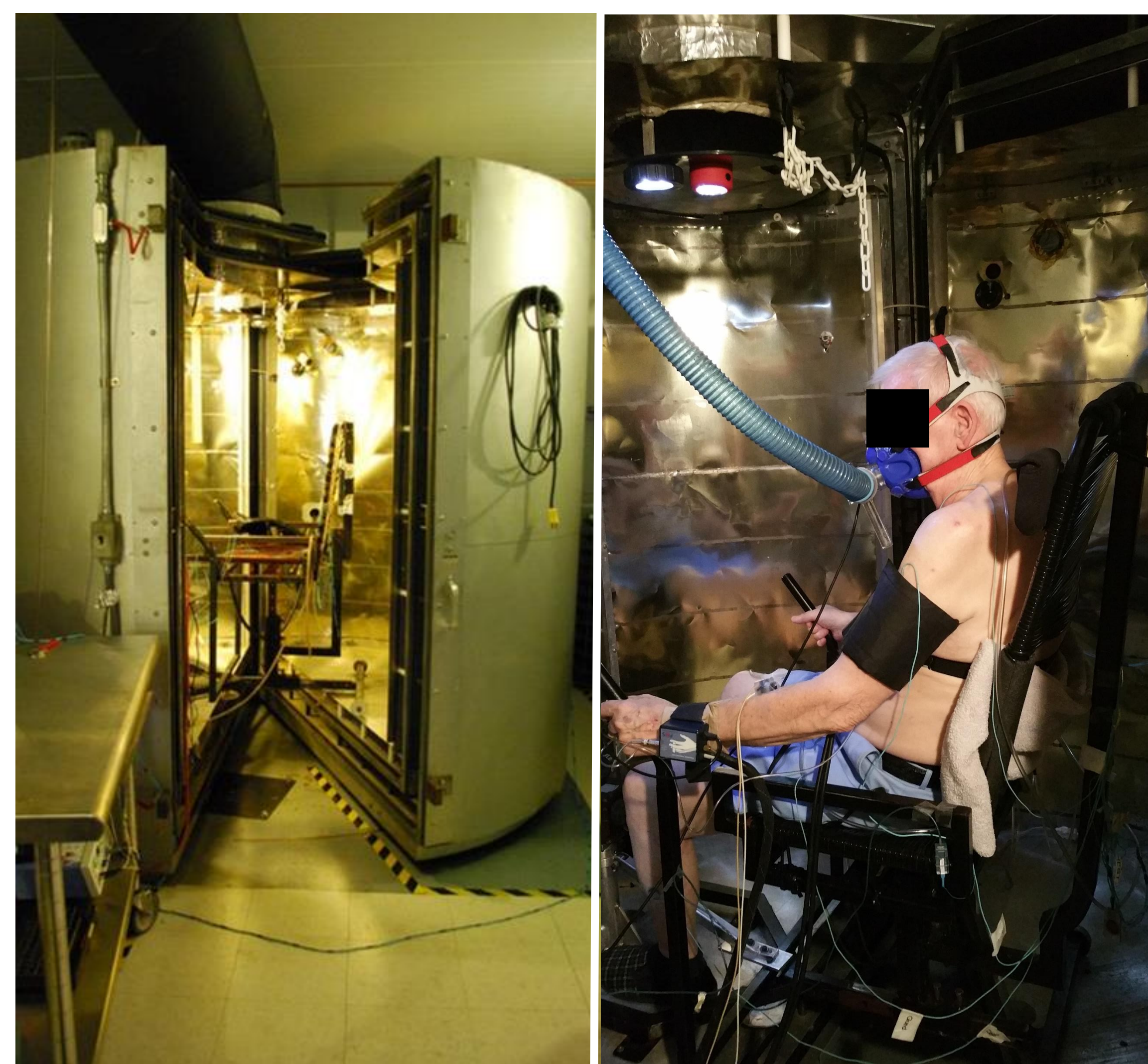


Fig 1. The Snellen whole-body human calorimeter.

PRELIMINARY RESULTS

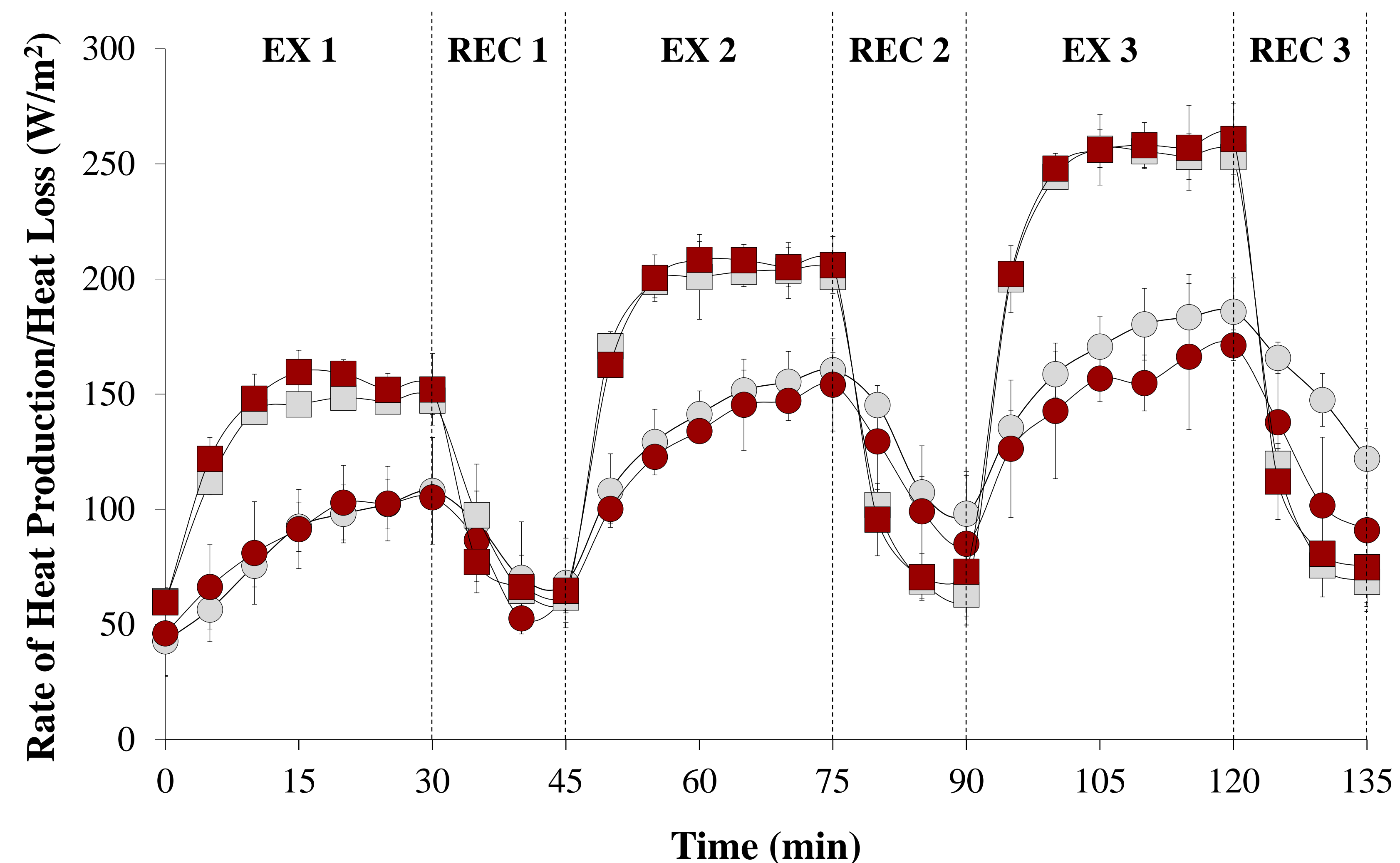


Fig 2. Mean (\pm SD) rate of metabolic heat production (squares) and whole-body heat loss (circles) for individuals with type 2 diabetes (red) and their control counterparts (grey) over a 135-min intermittent exercise protocol.

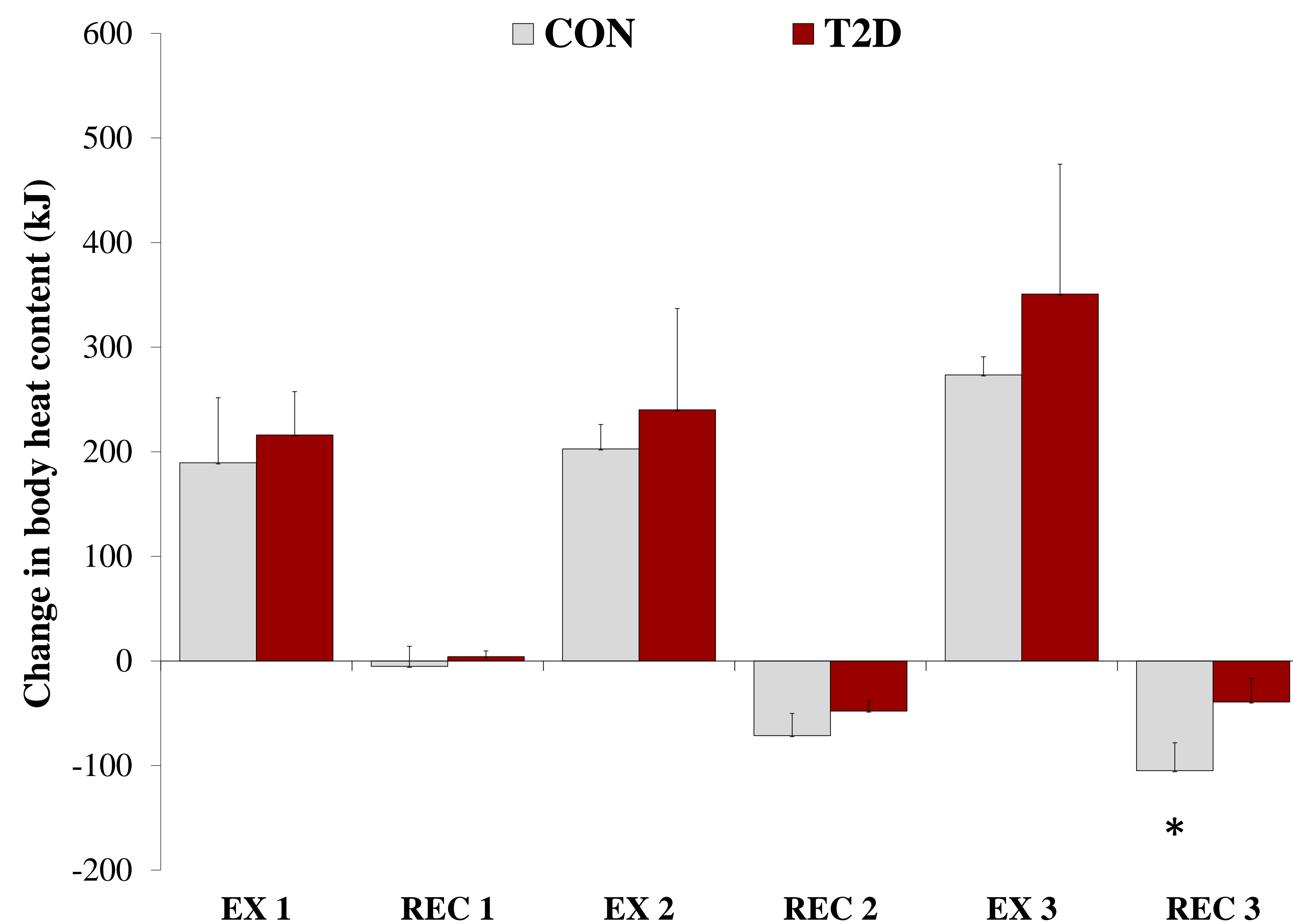


Fig 3. Mean (\pm SD) change in body heat content during each exercise/recovery cycle. * Significantly different then CON, $p \leq 0.05$

	Age (yrs)	Height (cm)	Weight (kg)	BF (%)	BSA (m^2)	VO ₂ _{max} ($mL \cdot min^{-1} \cdot kg^{-1}$)
T2D	60 ± 10	1.77 ± 0.09	95.3 ± 14.0	31.9 ± 2.6	2.13 ± 0.20	25.4 ± 1.5
CON	59 ± 8	1.76 ± 0.09	87.1 ± 4.8	24.9 ± 0.1	2.04 ± 0.04	34.2 ± 3.3

Table 1. Mean (\pm SD) physical characteristics of the participants.

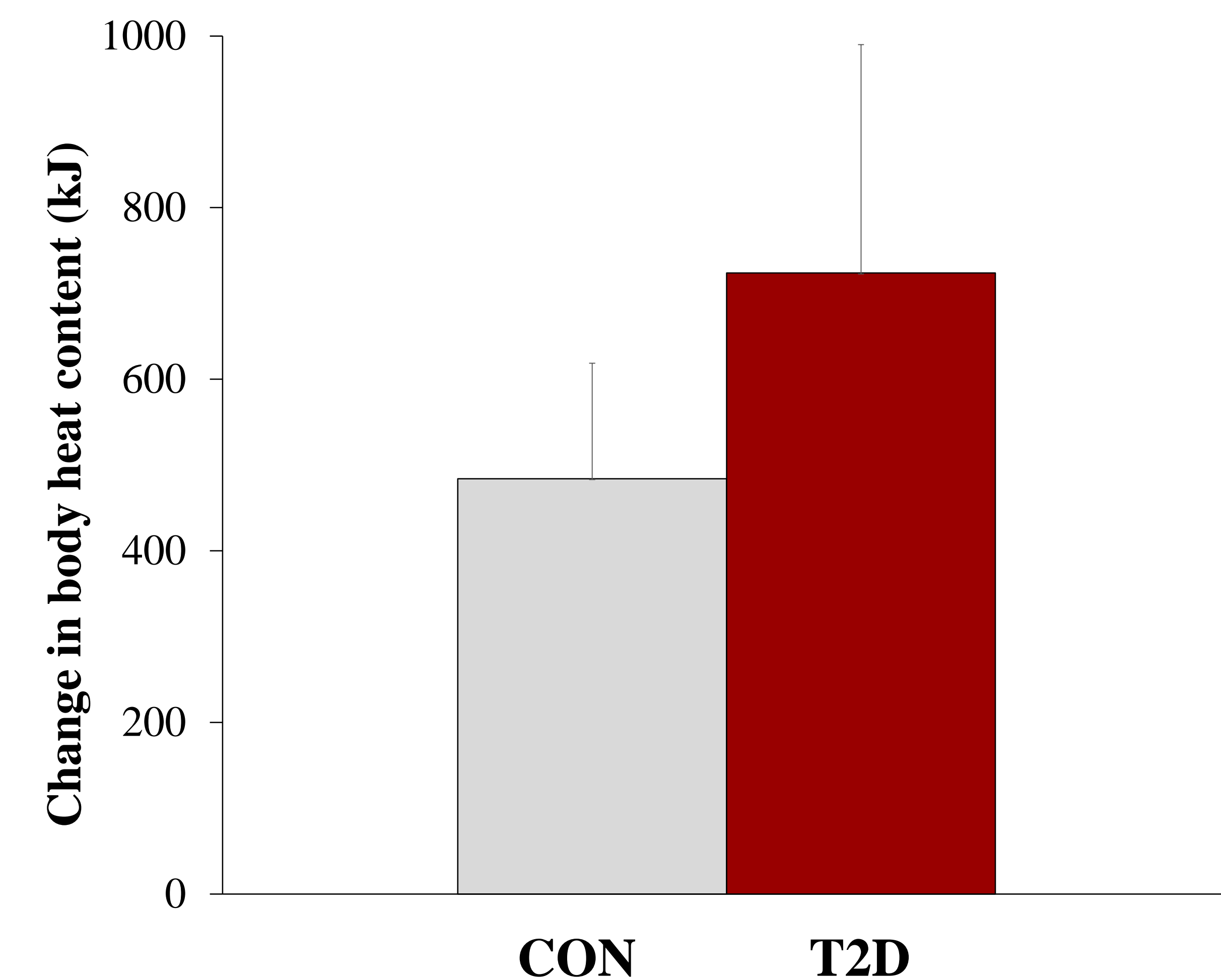


Fig. 4. Mean (\pm SD) cumulative change in body heat content for the incremental intermittent exercise protocol.

CONCLUSION

The preliminary results show no significant differences in whole-body heat loss between individuals with T2D and their matched counterparts at the end of each exercise bout. Moreover, no differences in heat loss were measured at the end of each recovery period, however the individuals with T2D lost less heat in the third recovery period relative to CON. Despite a lack of statistical significance at this time, the cumulative amount of heat stored over the three exercise/recovery cycles was ~ 1.5 -fold greater in individuals with T2D compared to CON. To determine if T2D does impair heat loss as a function of heat load, the objective of this study is to obtain 15 pairs of individuals with and without T2D.

REFERENCES

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- Kenny, G.P., et al. *Med Sci Sports Exerc*, 2013.

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