RECREATIONALLY ACTIVE ADULTS EXHIBIT OVERTRAINING FOLLOWING AN INTENSIVE 3-WEEK LAB-CONTROLLED TRAINING PROTOCOL



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difference

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INTRODUCTION

Optimal sports performance requires a careful balance between training and recovery. When training is persistently met with inadequate recovery, athletes may become overtrained (OT). There is an absence of sensitive diagnostic criteria to detect OT and most previous research has focused on elite male athletes.

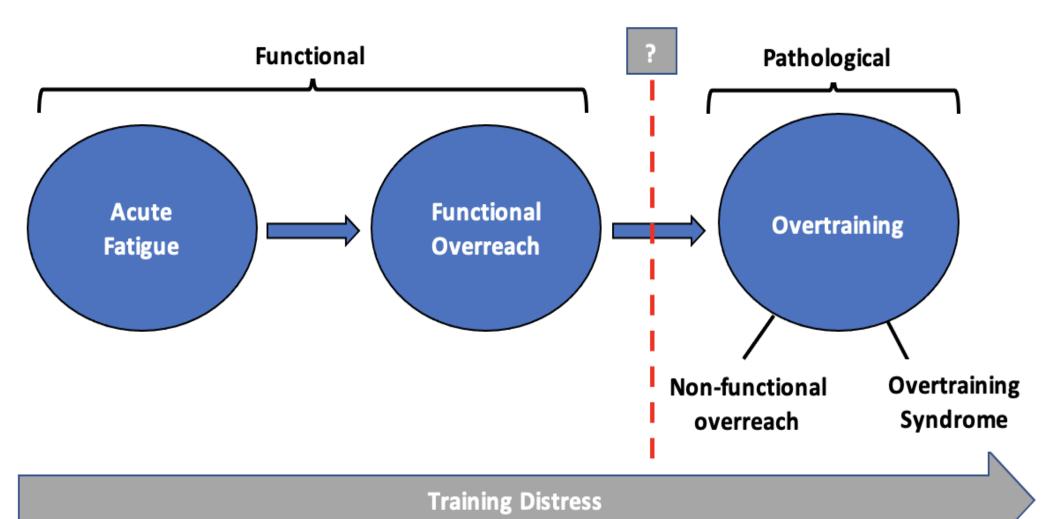
The current definition of overtraining is, "a decrease in performance capacity with or without physiological/psychological symptoms of maladaptation which may last weeks to months." 1

Purpose: To determine if an intense, three-week lab-controlled training protocol can induce symptoms of OT in recreationally active adults.

Central Hypothesis: Overtraining is not exclusive to high-level athletes and can occur in recreationally active males and females.

Training Continuum:

The boundary between functional and nonfunctional overreach is unknown. Symptoms between these training states are identical, distinguished only by the recovery timeline.



OVERTRAINING AT A GLANCE:

- Diagnosis of exclusion
- No single sensitive diagnostic criteria for Overtraining
- Overwhelmingly focused on elite-level male athletes
- Absence of recreationally active populations in OT research
- We <u>DO NOT KNOW</u> if overreaching/overtraining can occur in non-elite active populations

METHODS

- Healthy adults (TR)(n=11, 10f) underwent an intense cycling protocol exercising six days a week for three weeks including a mix of long-duration, interval, and sprint-like sessions. Subjects were monitored for three weeks of recovery (REC) and compared to healthy controls (CON) (n=10, 6f) who maintained a consistent lifestyle for six weeks.
- Both groups completed weekly maximal incremental exercise, which included exhaled gas analysis, lactate measures, and heart rate monitoring.
- Time comparisons were baseline (BL), MID (48 hours post-training for TR group; week four for CON), and **END** (after REC for TR; week six for CON).

SUBJECT DEMOGRAPHICS						
Subjects	Age (years)	Height (cm)	Weight (kg)	VO _{2Peak} (L/min)	% Normative VO _{2Peak} (ml/kg/min)	
CON 10 (6f)	28.6 ±8.3	168.2 ±11.0	69.9 ±12.6	2.67 ±0.58	96.3 ±22.0%	
TR 11 (10f)	30.6 ±8.5	170.6 ±8.5	76.7 ±16.2	2.60 ±0.62	105.8 ±29.6%	
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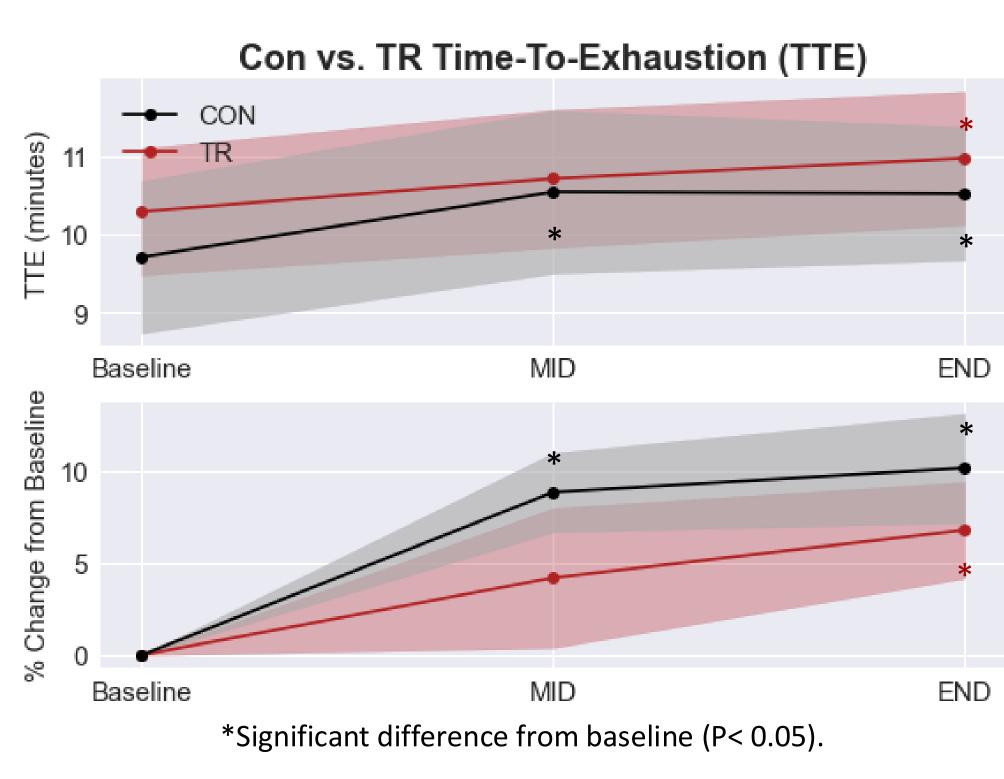
All values are reported from the baseline visit. Values are presented as mean \pm SD.

EXERCISE TRAINING PROTOCOL

WEEK 1	WEEK 2	WEEK 3	
Performance Testing	Performance Testing	Performance Testing	
50-min ride @ 60% PWL	50-min ride @65% PWL	50-min ride @ 70% PWL	
5x5min @75% PWL	5x5:15min @75% PWL	5x5:31min @75% PWL	
3-min active recovery	3-min active recovery	3-min active recovery	
2x20min @65% PWL	2x25min @65% PWL	2x30min @65% PWL	
5-min active recovery	5-min active recovery	5-min active recovery	
12x45s @130% PWL	12x50s @130% PWL	12x55s @130% PWL	
2-min active recovery	2-min active recovery	2-min active recovery	
50-min Lactate Ride	55-min Lactate Ride	60-min Lactate Ride	
~3mmol*L ⁻¹	~3mmol*L ⁻¹	~3mmol*L ⁻¹	
Rest day	Rest day	Rest day	

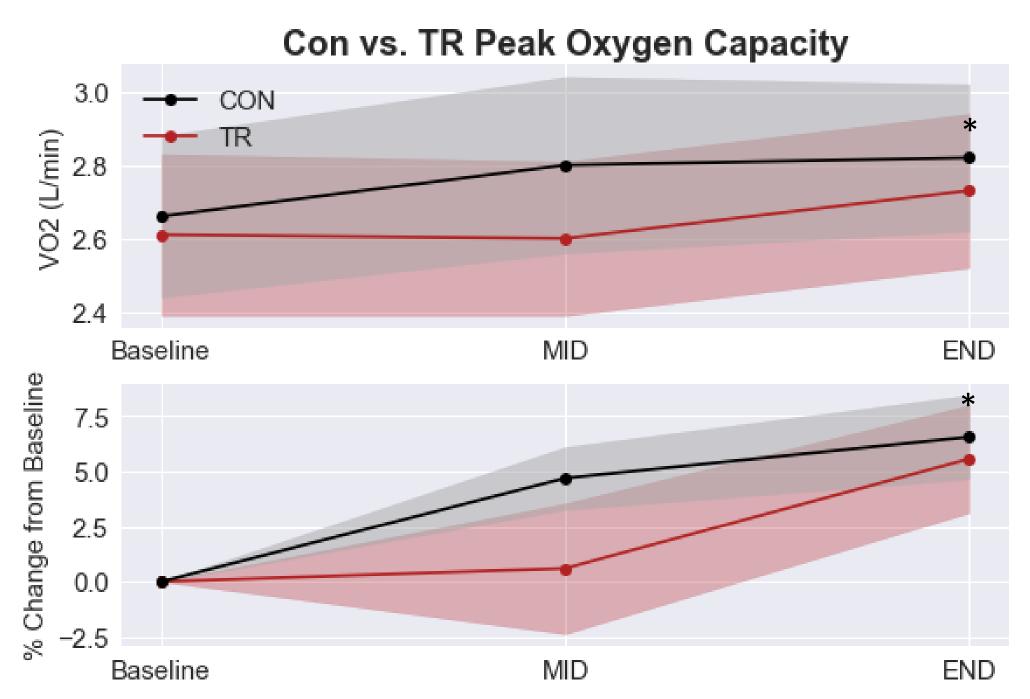
Performance testing included maximal graded exercise testing (GXT), via cycle ergometer, to exhaustion. Training intensities were based on the highest peak workload (PWL) achieved during GXT on any performance testing day. Training sessions during weeks two and three increased in either intensity or duration from the previous week's session.

RESULTS

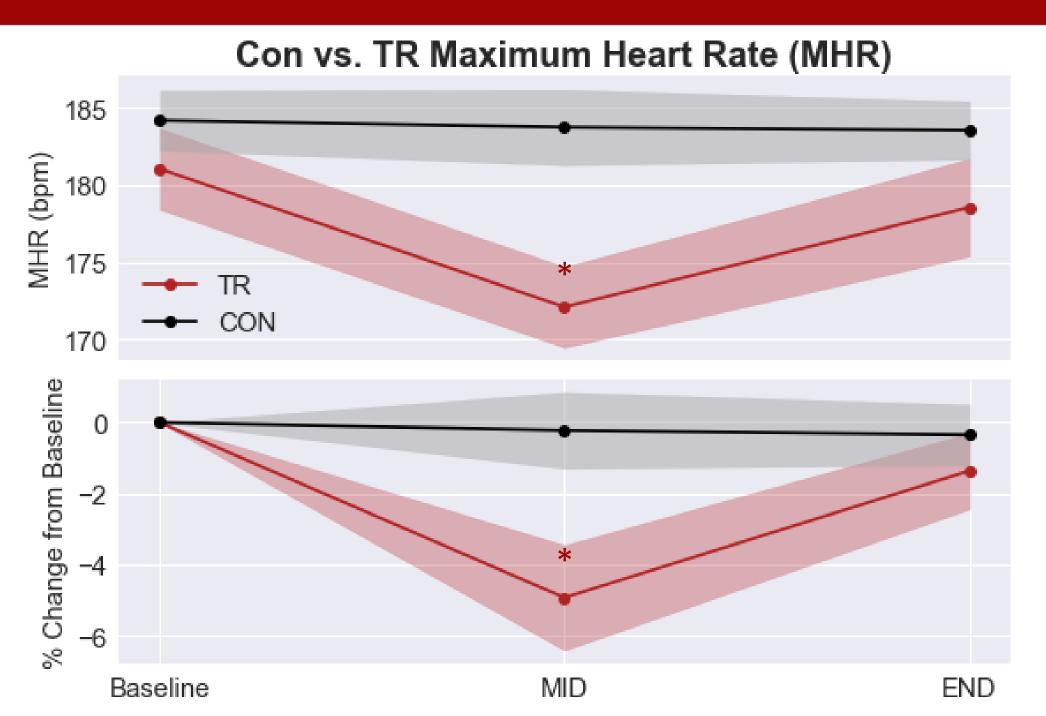


CON time-to-exhaustion (TTE) improved 8.1 ±7.0% from BL to MID (9.8 ±2.9 to 10.6 ±3.1min, *P*=0.019) and 9.74 ±9.02% from BL at END (10.6±2.6min, *P*=0.002). From BL, the TR group showed no significant changes in TTE at MID (10.2 ±2.8 to 10.7 ±3.1min from BL to MID, *P*=0.181), but improved 6.93 ±2.88% from BL at END (10.9 ±3.0min, P=0.027).

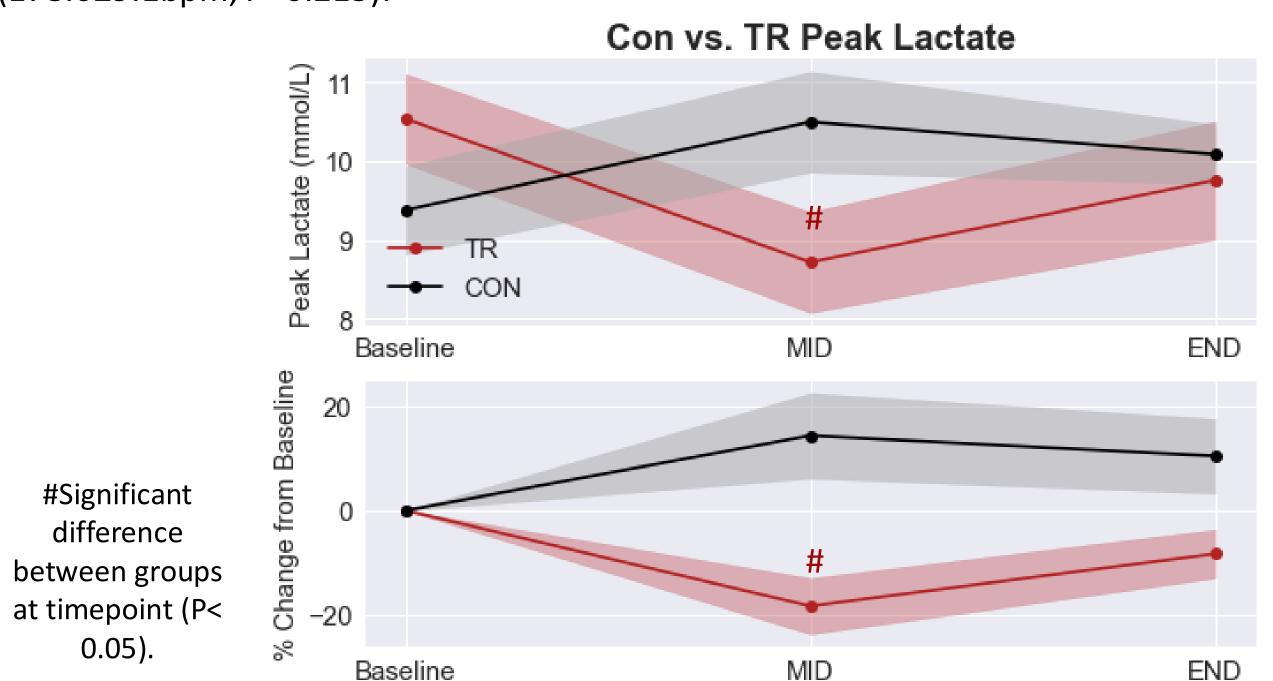
CON peak oxygen consumption (VO_{2peak} L/min) showed no change from BL to MID (2.67 ±0.58 to 2.79 ±0.65 L/min, *P>0.05)* but significantly increased 6.4 ±5.5% from BL to END (2.82 ±0.53 L/min, *P*=0.014). The TR group showed no changes in VO_{2peak} at any timepoint (BL= 2.60 ± 0.62 , MID= 2.59 ±0.56, END=2.71 ±.57 L/min, *P*>0.05).



RESULTS



In CON, Maximum heart rate (MHR) did not change during the six weeks (BL= 184.7 ±6.8, MID=182.7 ±8.4, END=183.6 ±7.5bpm, P>0.05). In TR, MHR decreased 4.5 ±4.6% at MID (180.2 \pm 8.1 to 172.1 \pm 11.2bpm from BL to MID, P=0.002) and returned to near BL levels at END (178.0±9.1bpm, *P*=0.215).



Peak Lactate (LA_p) did not change during the six weeks in either the CON (BL=9.72 ±1.99, MID= 10.4 ±1.86, END=10.27 ±1.24 mmol*L⁻¹, P>0.05) or in TR group (BL= 10.2 ±1.49, MID= 8.65 ± 2.85 , END= 9.53 ± 2.51 mmol*L⁻¹, P > 0.05). At the MID timepoint, there was a significant difference in LA_P between groups (CON= 10.4 ± 1.86 ; TR= $8.65 \pm 2.85 \text{ mmol*}L^{-1}$, P=0.015).

CONCLUSIONS

An aggressive, three-week training protocol led to minor improvements in performance and aerobic capacity after three weeks of recovery in recreationally active adults. These changes were not different than those found in the control group. The training protocol resulted in only a modest increase in aerobic capacity, a significant decrease in MHR, and a strong trend of decreased peak lactate. These findings provide evidence that the heavy training load induced training maladaptation. These findings suggest that non-elite athletes can develop OT, potentially providing a new model to study the physiological antecedents to training maladaptation.

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