Effects Of Mental Fatigue On Maximal Exercise Test Performance In Physically Active And Sedentary Adults

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ABSTRACT

PURPOSE: This study examined the effects of mental fatigue on maximal treadmill walking exercise performance. **METHODS:** 50 young male (*n* = 25) and female (*n* = 25) adults were recruited to perform a maximal treadmill walking exercise test to volitional exhaustion on two occasions. Prior to the exercise test, participants performed a cognitive task in a randomized, counterbalanced manner for 30 minutes, with the incongruent Stroop task in the mental fatigue condition, and leisure magazine reading in the control condition. Subjective ratings of perceived mood, fatigue, and motivation to exercise were assessed before and after the cognitive task. Perceptual and physiological responses were collected throughout the exercise test. **RESULTS:** Significant decrease in perceived mood ($p < 0.001$) and motivation ($p = 0.001$), and significant increase in fatigue ($p = 0.028$) were found in the mental fatigue condition. Participants were found to rate their perceived physical exertion higher during the exercise test in the mental fatigue condition ($p = 0.042$). However, there were no significant differences in physiological responses and test exhaustion time. **CONCLUSIONS:** Mental fatigue increased perceived physical exertion during maximal treadmill walking exercise but did not impair exercise performance in both active and sedentary adults.

INTRODUCTION

- There has been increasing interest in understanding the effects of mental fatigue on physical performance
- Existing literature have shown that mental fatigue impairs self-paced endurance performance
- Mental fatigue was found to increase perception of effort without changes in physiological responses
- However, less is known about the effects of mental fatigue on externally paced performance and individuals of different gender and activity levels
- The purpose of this study was to examine the effects of mental fatigue on maximal treadmill walking exercise performance in physically active and sedentary adults
- Mental fatigue was hypothesized to impair exercise performance, and negatively influence perceptual responses

PARTICIPANTS

Table 1. Descriptive Statistics of Participants (*mean* ± *SD*)

	Sedentary Females (*n* = 15)	Active Females (*n* = 10)	Sedentary Males (*n* = 10)	Active Males (*n* = 15)
Age (years)	23.67 ± 3.44	23.90 ± 2.47	26.40 ± 3.50	26.40 ± 4.32
Height (cm)	155.13 ± 3.72	160.40 ± 5.38	173.30 ± 9.46	174.00 ± 5.61
Weight (kg)	51.54 ± 6.82	54.41 ± 6.79	66.88 ± 12.01	62.67 ± 6.47
Body fat (%)	26.99 ± 5.15	24.21 ± 6.34	16.14 ± 5.38	12.01 ± 4.59
VO_{2max} ($ml \cdot kg^{-1} \cdot min^{-1}$)	34.43 ± 4.55	38.02 ± 5.89	36.83 ± 5.29	49.69 ± 5.73

METHODS

- Participants performed a maximal treadmill walking exercise test to volitional exhaustion on two separate occasions
- Prior to the exercise, participants underwent a cognitive task in a randomized, counterbalanced crossover manner for 30 minutes
- Psychological measures such as perceived mood, perceived level of fatigue, and motivation to exercise were measured on visual analogue scales (0-100) before and after the cognitive task
- Participants rated their perceived physical exertion (0-10), mental effort (0-10), and affect (-5–5) every minute during the exercise
- Physiological responses such as oxygen uptake and heart rate were measured throughout the exercise
- Mixed analysis of variance was performed to examine the effects of mental fatigue on performance, perceptual and physiological responses

Mental Fatigue Condition

- Participants performed an incongruent version of the Stroop color-word task on the computer

Control Condition

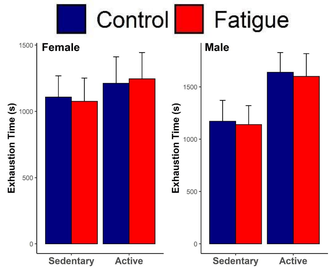
- Participants read leisurely from a selection of car and travel magazines

Maximal Treadmill Exercise Test Protocol

- Treadmill was set at constant speed of 5.44km/hour
- Treadmill grade increases by 1% every minute
- Test was terminated upon volitional exhaustion

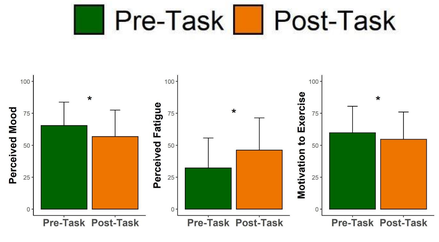
RESULTS

Performance



No significant differences in performance found between mental fatigue and control conditions among all subgroups

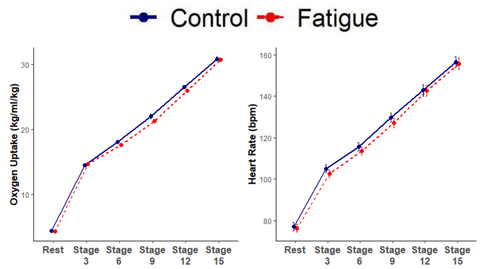
Psychological Measures



* Significant differences in psychological measures found between pre- and post-cognitive task suggest that mental fatigue was successfully induced

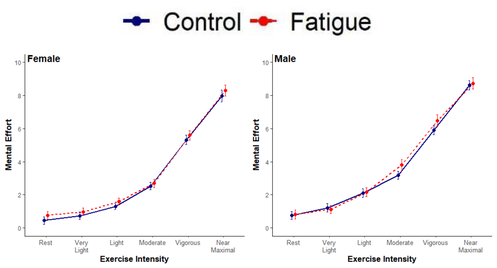
RESULTS

Physiological Measures



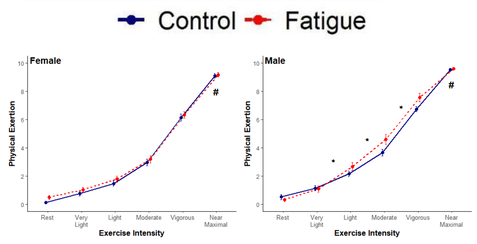
No significant differences in oxygen uptake and heart rate found between mental fatigue and control conditions

Mental Effort



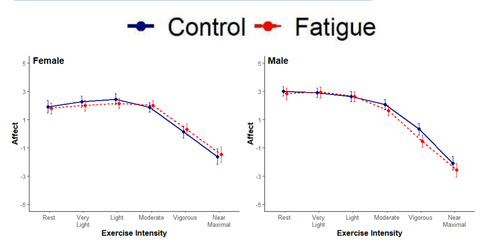
No significant differences in perceived mental effort found between mental fatigue and control conditions

Physical Exertion



\# Significantly higher physical exertion was found in mental fatigue condition. * Such increase was significantly higher in males as compared to females at certain exercise intensity levels

Affect



No significant differences in affective responses found between mental fatigue and control conditions

SUMMARY AND CONCLUSION

- Contrary to the hypothesis, mental fatigue did not impair maximal treadmill walking exercise performance across participants of different gender and physical activity levels
- Aligned with previous studies, mental fatigue did not affect physiological responses during exercise
- In partial agreement with the hypothesis, perceived physical exertion was found to increase under mental fatigue condition
- The increase in physical exertion was more pronounced in males as compared to females
- However, mental fatigue did not have any effects on mental effort and affective responses
- The results suggest that mental fatigue could have different effects on self-paced versus externally-paced exercise performance
- The results also demonstrate that greater perceived physical exertion does not necessarily translate to deterioration in performance

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