

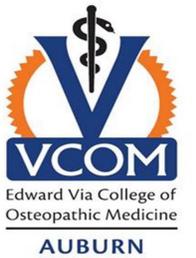


# Characterizing Psychophysiological Fatigue Responses from a Competitive Round of Golf

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## ABSTRACT

The physiological demands of golf are considered low. However, a competitive round of golf requires up to four hours of walking, repetitive golf swings and a high cognitive demand. To our knowledge, no studies have characterized the psychophysiological fatigue response from a competitive round of golf. **PURPOSE:** The purpose was twofold: 1) to describe the physiological demands of a round of golf during a competitive tournament, and 2) determine if markers of psychophysiological fatigue are present during and following a competitive round of golf. **METHODS:** 12 male golfers (34.8 ± 13.9 years, 176 ± 9.0 cm, 81.2 ± 13.1 kg) participated in a round of golf during a competitive tournament. Drive distances were measured using a GPS device. Trunk acceleration (g's) while using a driver, driving and putting trunk posture, breathing rate (BR) and heart rate (HR) were determined during the first and last 3 holes using a Zephyr Bioharness. Workload (% max HR) was estimated using HR's obtained during the round and by estimating max HR using equation: 208 - (0.7 x age). An 8-item visual analogue scale questionnaire was used to assess cognitive measures of energy, fatigue, concentration, alertness and confidence before (pre), during (mid) and after (post) the round. **RESULTS:** Compared to rest (71 ± 2 bpm), HR was significantly (p<0.001) elevated during the front (114 ± 4 bpm) and back (120 ± 5bpm) 9-holes and back was significantly (p=0.004) higher than front. Similarly, BR was significantly (p<0.001) elevated during the front (20.3 ± 2.7 bpm) and back (20.6 ± 2.7 bpm) 9-holes compared to rest (14.4 ± 2.6 bpm), with no difference between front and back. HR over the entire round was 117 ± 13bpm and resulted in an age-predicted %HRmax of 58.7 ± 18.8%. Mean trunk posture immediately prior to hitting the driver was not different between the first and last 3-holes, but was significantly different prior to putting (38.5 ± 5.9 vs 35.7 ± 6.8 degrees, p=0.044). There was no difference in trunk acceleration or drive distance between the first and last 3 holes. Self-reported cognitive measures of energy, concentration, alertness and confidence all significantly (p<0.05) decreased over time, whereas feelings of fatigue significantly (p<0.05) increased. **CONCLUSION:** Our data suggest that competitive golf may be more mentally demanding than physical.

## INTRODUCTION

From an intensity perspective, the physiological demands of golf are considered low. The combination of maximal effort swings, critical shot-making, putting, and long distances walked during the round could result in both physical and mental fatigue; thus potentially having negative effects on golf performance (1,4). Specifically, mental fatigue may impact the ability to select the correct club, shot type, and execution of the golf shot (3), whereas physical fatigue may affect the mechanics of the golf swing (2). Therefore, the purpose of this study was to describe the physiological demands of a competitive round of golf while also determining if markers of psychophysiological fatigue are present during and following a competitive round of golf.

1. Doan BK, Newton R, Kraemer W, Kwon Y, Scheet T. Salivary cortisol, testosterone, and T/C ratio responses during a 36-hole golf competition. *International journal of sports medicine*. 2007;28(6):470-9
2. Higdon NR, Finch WH, Leib D, Dugan EL. Effects of fatigue on golf performance. *Sports Biomechanics*. 2012;11(2):190-6.
3. Smith MF. The Role of Physiology in the Development of Golf Performance. *Sports Medicine*. 2010;40(8):635-55.
4. Stevenson EJ, Hayes PR, Allison SJ. The effect of a carbohydrate-caffeine sports drink on simulated golf performance. *Applied Physiology, Nutrition & Metabolism*. 2009;34(4):681-8.

## METHODS

### Subjects

- 12 Healthy Male golfers
- Between 20-55 years
- USGA handicap of 3-10
- \$250 prize for finishing in 1<sup>st</sup> place.

Table 1. Baseline subject characteristics (Mean ± SD)

	N=12
Age (yr)	34.8 ± 13.9
USGA Handicap	5.5 ± 2.7
Height (cm)	176 ± 9.0
Weight (kg)	81.2 ± 13.1
BMI (kg/m <sup>2</sup> )	26.3 ± 3.6

### Drive Distance, Physiological and Accelerometry Measures

Drive distance was measured using a SkyCaddie LINX GPS device (SkyHawke Technologies, LLC, Ridgeland, MS). A Zephyr Bioharness™ 3 (Zephyr Technology, Annapolis, MD) was used to measure Heart rate (HR), breathing rate (BR), trunk posture (°) while putting, and peak trunk acceleration (g's) while teeing off during the first and last 3 holes of the 18-hole competitive round.

### Energy / Mood Questionnaire

A five-item visual analog scale (0-100mm) questionnaire was administered at the beginning (pre), after 9 holes (mid) and after 18 holes (post) to assess:

- Self-perceived ratings of concentration
- Energy
- Fatigue
- Alertness
- Overall confidence

## RESULTS

Table 2. Changes in physiological, performance and accelerometry measures over the round (mean ± SD)

Variable	Front (N=12)	Back (N=12)	p
HR (beats·min <sup>-1</sup> )	114 ± 4	120 ± 5	0.001
BR (breaths·min <sup>-1</sup> )	20 ± 3	21 ± 3	0.58
HR <sub>max</sub> (%)	56.1 ± 19.1	61.1 ± 20.9	0.023
Putting Posture (°)	38.5 ± 5.9	35.7 ± 6.8	0.044
Driving Posture (°)	22.3 ± 6.5	21.1 ± 6.2	0.223
Peak Trunk Acceleration (g's)	3.75 ± 0.97	3.77 ± 1.05	0.808
Drive Distance (m)	234.6 ± 30.3	234.9 ± 31.2	0.926

## RESULTS

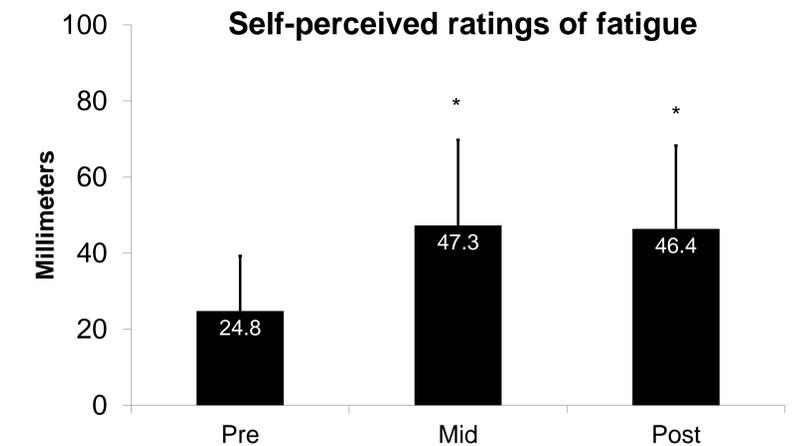


Figure 1. \* Significantly different from Pre, p≤0.017

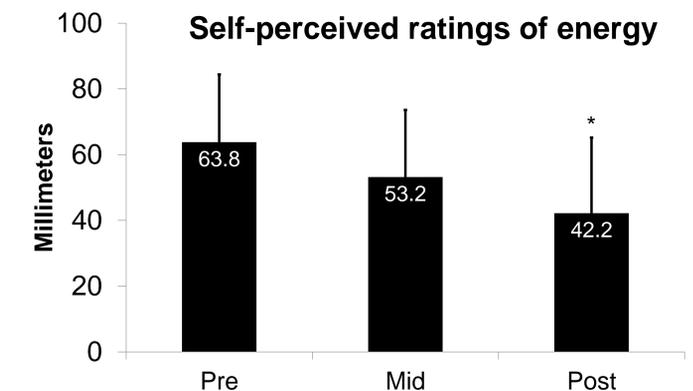


Figure 2. \* Significantly different from Pre, p≤0.036

## ACKNOWLEDGMENTS

This study was funded by MusclePharm, Inc. (Denver, CO)



## CONCLUSIONS

During a competitive round of golf, both psychological and physiological measures of fatigue are present which may negatively affect performance.