A Physiological and Subjective Comparison between ElliptiGO Training and Run Training in Trained Runners

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INTRODUCTION

• Running has shown to improve health and fitness parameters, but has been associated with high injury rates (van Gent et al., 2007) in large part due to the impact forces that occurs during running (Hreljac, 2004).

• Injury can partially or completely limit training and can lead to a decrease in fitness and performance.

• Cross-training for runners has been utilized to reduce the effects of detraining, but has been shown to only attenuate fitness and run performance losses, require higher effort (Garlatz, 2008), and to be less enjoyable (Coon et al., 2011).

• The ElliptiGO has been proposed as a low impact, running-specific, cross-training method.

• The **PURPOSE** of this study was to compare 4-week periods of ElliptiGO training (ET) and run training (RT) by measuring physiological and subjective variables in highly fit trained runners.

• The **HYPOTHESIS** was that there would be no significant difference in physiological and subjective variables between ET and RT.

• **SIGNIFICANCE**: Comparing ET to RT would provide runners, coaches and fitness instructors with physiological and subjective knowledge of the ElliptiGO to allow for optimal cross training to prevent injury or during a period of injury.

METHODS

Table 1. Participant Characteristics (Initial)

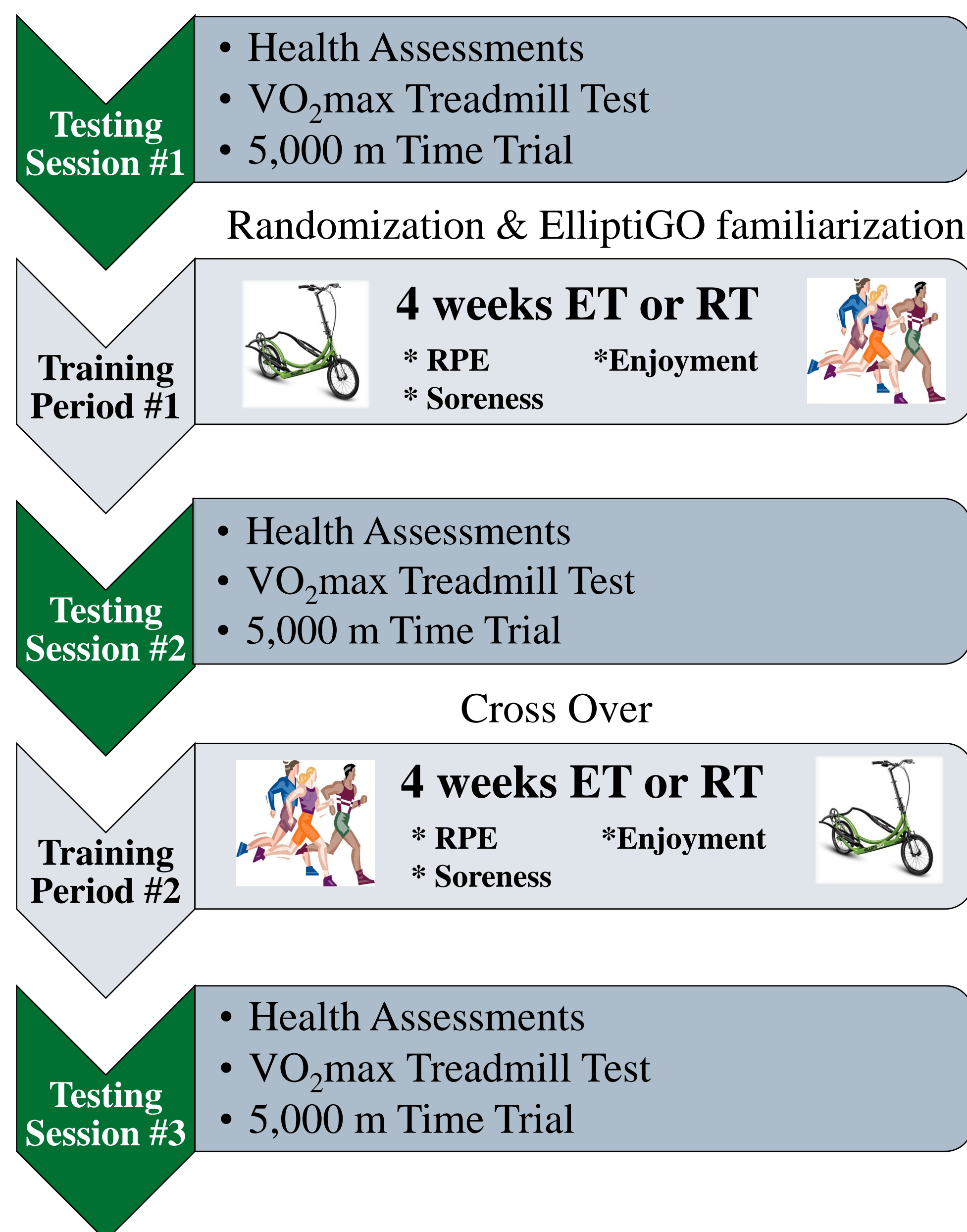| Initial Testing	Both (n = 12)	Men (n = 6)	Women (n = 6)
Age (y)	22.83 ± 3.33	23.00 ± 4.29	22.67 ± 2.42
Body Mass Index (BMI)	21.54 ± 2.29	22.71 ± 2.39	20.38 ± 1.60
Body Fat (%)	10.68 ± 4.79	6.50 ± 1.25	14.85 ± 2.67
VO$_2$max (ml/kg/min)	57.92 ± 9.68	64.17 ± 10.20	51.67 ± 2.86
Running Experience (y)	9.25 ± 4.73	10.17 ± 5.74	8.33 ± 3.78

Mean ± SD; n = 12

• All participants recruited for this Ohio University IRB approved (#13F054) investigation qualified as trained and fit.

• A health history questionnaire (HHQ), running history questionnaire (RHQ), anthropometric measurements and body fat percentage (BF%) (7 site skin fold method) were measured.

• Minimum 1 year running experience with no interruptions in run training in previous 2 months.

• Twelve runners (n = 12; 6 men; 6 women) qualified as healthy and fit. Fitness levels of at least 90th percentile VO$_2$max for each gender and age group were required.

METHODS

Figure 1. Testing and Training Procedures.

Testing Session #1
• Health Assessments
• VO$_2$max Treadmill Test
• 5,000 m Time Trial

Randomization & ElliptiGO familiarization

Training Period #1
4 weeks ET or RT
* RPE   *Enjoyment
* Soreness

Testing Session #2
• Health Assessments
• VO$_2$max Treadmill Test
• 5,000 m Time Trial

Cross Over

Training Period #2
4 weeks ET or RT
* RPE   *Enjoyment
* Soreness

Testing Session #3
• Health Assessments
• VO$_2$max Treadmill Test
• 5,000 m Time Trial

STATISTICS

• A randomized crossover design was used.

• Statistical analyses were performed with PASW 18.0 (SPSS, Inc., Chicago, Il). All data was reported as mean ± S.D. Statistical significance was accepted at $p \leq 0.05$.

• RM-ANOVA tests were used to compare the physiological variables at the three time points. Paired t-tests compared percent change values. Friedman tests were used to compared subjective variables at three different time points. Wilcoxon tests were used to compare subjective variables between training periods.

RESULTS

Table 2. Physiological Variables

	Initial	Post ElliptGO	Post Run
VO$_2$max (ml/kg/min)	57.92 ± 9.68	58.89 ± 9.78	59.01 ± 9.46

Percent Change

Initial to PE: 1.72 %	**Initial to PR: 2.04 %**

	Initial	Post ElliptGO	Post Run
Anaerobic Threshold (ml/kg/min)	40.17 ± 6.47	42.33 ± 6.96*	41.60 ± 6.15*

Percent Change

Initial to PE: 5.59 %	**Initial to PR: 3.83 %**

	Initial	Post ElliptGO	Post Run
Respiratory Compensation Point (ml/kg/min)	51.50 ± 9.49	52.80 ± 9.33	52.30 ± 9.58

Percent Change

Initial to PE: 2.74 %	**Initial to PR: 1.70 %**

	Initial	Post ElliptGO	Post Run
Running Economy (ml/kg/km)	204.69 ± 17.43	202.94 ± 16.28	200.46 ± 15.41

Percent Change

Initial to PE: -0.74 %	**Initial to PR : -1.87 %**

Mean ± SD; * indicates significance at (p < 0.05) with initial time point..
PE = Post ElliptiGO   PR = Post Run

Graph 1. 5,000 m Time Trial Times

Initial: 1303.00 ± 210.05
Post ElliptiGO: 1303.17 ± 224.13
Post Run: 1269.00 ± 188.62
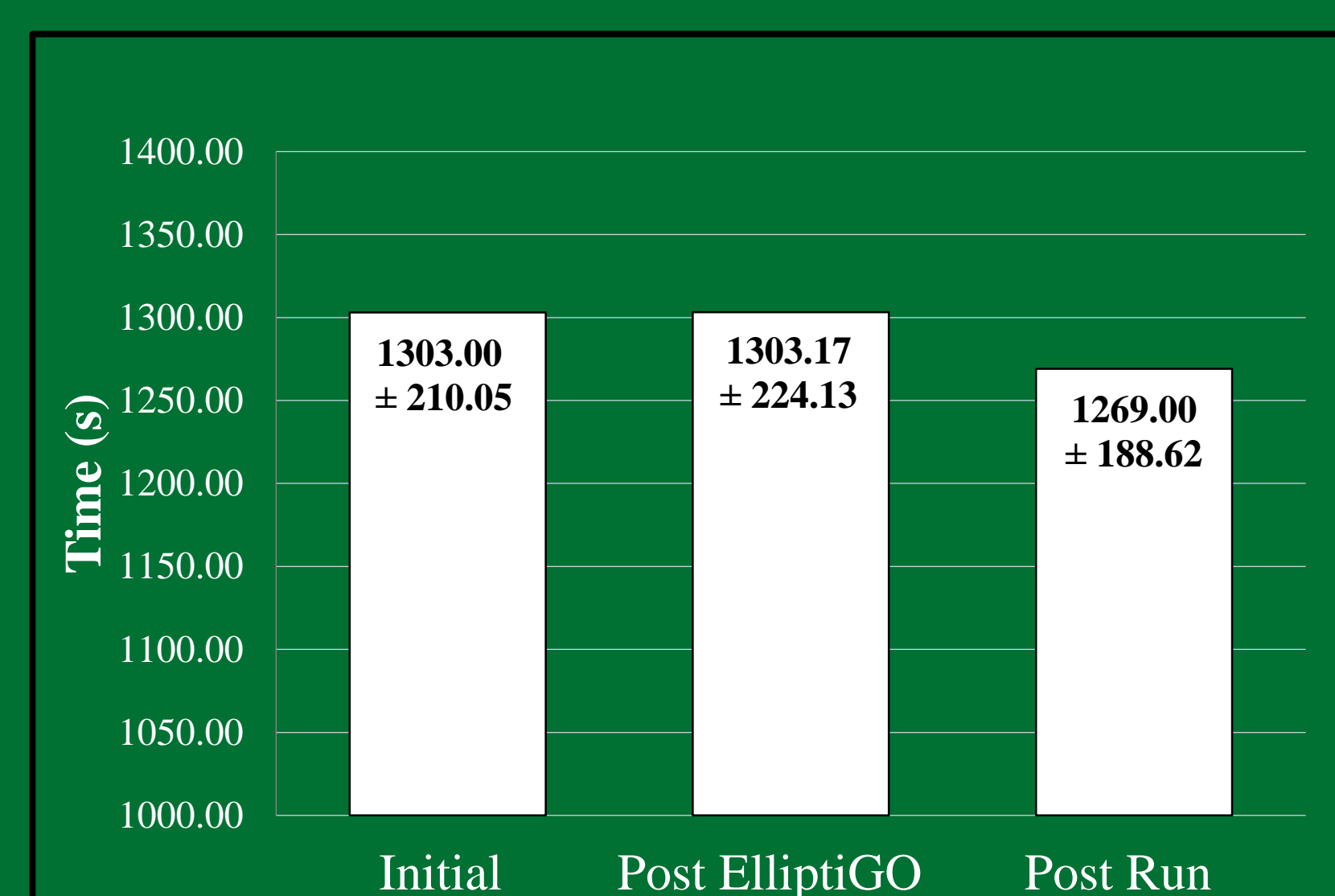
Mean ± SD; * indicates significance at (p < 0.05)

• The mean for anaerobic threshold was significantly greater from the initial time point for either PE ($p = 0.024$) or PR ($p = 0.035$) training.

• There were no significant differences among means for VO$_2$max ($p = 0.235$), respiratory compensation point ($p = 0.400$), running economy ($p = 0.230$) , or 5,000 m times ($p = 0.051$) between the ET and RT.

RESULTS

Table 3. RPE and Enjoyment

		ElliptiGO	Run
RPE (6-20)	Whole	14.35 ± 0.70	14.28 ± 0.59
	Upper	12.07 ± 2.36	12.62 ± 1.93
	Lower	14.73 ± 0.66	14.58 ± 0.69
Enjoyment (1-7)		5.08 ± 0.17	5.43 ± 0.14

Mean ± SD; n = 12   RPE = Ratings of Perceived Exertion (6-20)

• There were no significant differences in whole, upper or lower body RPE values between training periods.

• Levels of enjoyment also had no significant differences ($Z = -1.33$; $p = 0.182$) between ET (5.43 ± 0.14) and RT (5.08 ± 0.17) values.

Graph 2. Subjective Muscle Soreness

Whole ElliptiGO: 0.23
Whole Run: 0.32
Lower ElliptiGO: 0.56
Lower Run: 0.84 *
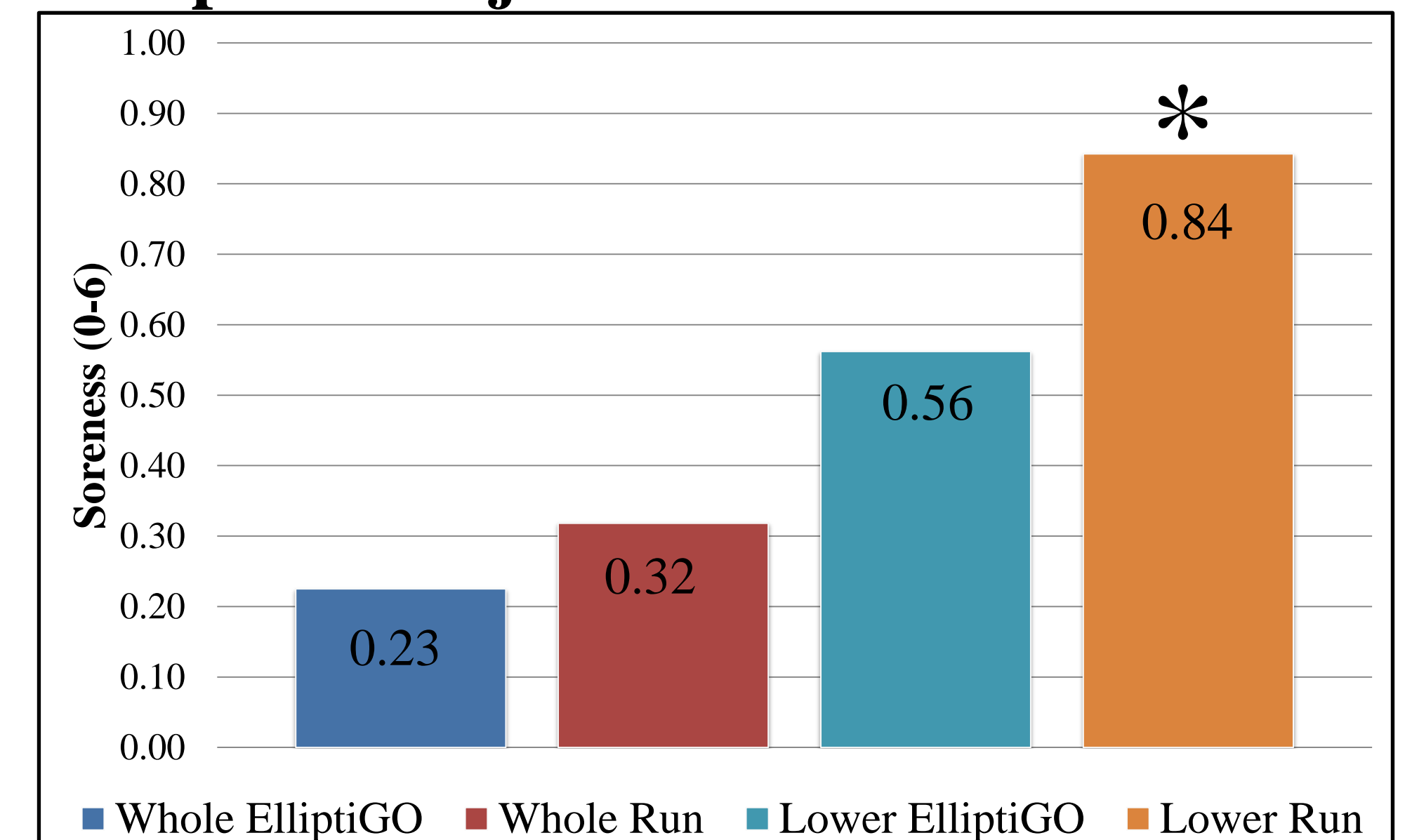
* indicates significance at (p < 0.05) between ElliptiGO and Run training.

• Lower body soreness was significantly lower ($p = 0.016$) for ET, (0.56 ± 0.72) compared to RT (0.84 ± 0.73).

CONCLUSIONS

• Overall, the ElliptiGO provided similar maintenance or improvements in physiological variables over a 4-week training period.

• ET was also seen to be a subjectively similar experience to RT for RPE, enjoyment, and soreness, except for displaying reduced lower body soreness.

• These results suggest that coaches, athletes, and fitness instructors can prescribe ElliptiGO exercise as a form of cross training to elicit similar physiological and subjective outcomes in fit and trained runners.

REFERENCES

• Garlatz, T. J., Brilla, L. R., Knutzen, K. M., & Chalmers, G. R. (2008). Physiological responses of elliptical and treadmill exercise in collegiate distance runners. *Journal of the Federation of American Societies for Experimental Biology*, 22, 1175-1178.
• Hreljac, A. (2004). Impact and overuse injuries in runners. *Medicine & Science in Sports & Exercise*. 36(5), 845-849.
• van Gent, R. N., Siem, D., van Middelkoop, M., van Os, A. G., Bierma-Zeinstra, S. M. A., & Koes, B. W. (2007). Incidence and determinants of lower extremity running injuries in long distance runners: A systematic review [Review]. *British Journal of Sports Medicine*, 41(8), 469-480. doi:10.1136/bjsm.2006.033548