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A Comparison of the Nike Vaporfly and Nike Dragonfly's Effect on Running Economy

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ABSTRACT

The purpose of this study was to compare the oxygen consumption, stride rate, and stride length of highly trained distance runners wearing the Nike Vaporfly and Nike Dragonfly spikes while running at competitive speeds. Fifteen (6 men and 9 women) collegiate volunteers (aged 18-22) were recruited from Hope College's Division III cross country team. Participants engaged in a total of 3 visits. On the first visit, all participants were familiarized with the testing protocol. For visits 2 and 3, a planned crossover was completed, and either the Vaporfly or Dragonfly was assigned for each participant to wear. All trials were completed on an antigravity treadmill with body support set at 100%. Participants ran three 4-minute running economy stages, and then immediately performed a maximal test to volitional exhaustion (VO_{2max}). Mean oxygen consumption for females wearing the Vaporfly shoe at 14 and 16 kph were 42.3 ± 1.4 and 47.1 ± 1.71 ml/kg/min respectively, while mean oxygen consumption for females wearing the Dragonfly shoe at 14 and 16 kph were 42.2 ± 1.7 and 45.9 ± 1.6 ml/kg/min, respectively. Mean oxygen consumption for males wearing the Vaporfly shoe at 14 and 16 kph were 43.1 ± 1.0 and 49.2 ± 1.0 ml/kg/min respectively, while mean oxygen consumption for males wearing the Dragonfly shoe at 14 and 16 kph were 43.5 ± 1.9 and 49.3 ± 1.8 ml/kg/min, respectively. No differences were found in oxygen consumption ($p=0.603$ for females, $p=0.930$ for males), stride rate ($p=0.487$), or stride length ($p=0.428$) between shoe types. Based on the results of this study, the Vaporfly and Dragonfly shoes result in similar running economy and stride parameters. Further research should investigate the performance of the Vaporfly and Dragonfly on a traditional treadmill instead of the BOOST antigravity treadmill utilized for the present study.

BACKGROUND

- The Nike Vaporfly racing flat was found to lower the energetic cost of running by 4% (1,2,4).
- The carbon-fiber plate within the midsole of the Vaporfly can cause a spring-like effect, increasing energy return and metabolic savings (3).
- The Nike Dragonfly is a relatively new carbon-plated shoe. To the researcher's knowledge, there is no prior research indicating whether the Nike Dragonfly track spike would outperform the Nike Vaporfly racing flat.
- The Nike Vaporfly and Dragonfly are set apart from other popular racing shoes by their full-length carbon fiber insert, which adds rigidity to the shoe and increases energy return (4).
- The Pebax foam used in the Vaporfly also allows for a greater energy return and is lighter than foam used in the typical trainers. (5).

PURPOSE

The purpose of this study was to compare the effects of two running shoes (Nike Vaporfly and Dragonfly) on running economy (energy consumption at 14, 15, 16, and 18 kph) and stride characteristics (stride length and rate)



Figure 1: The Nike Dragonfly and Nike Vaporfly

A Comparison of the Nike Vaporfly and Nike Dragonfly on Running Economy

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Kinesiology, Hope College

METHODS

Participants

9 female and 6 male participants (ages 18-22 yrs) recruited from the Hope College Cross Country Team

Pre testing: blood pressure, height, weight, heart rate, short and shoe sizing
 2 counterbalanced groups, cross-over design.



Table 1. Participant characteristics

	Height (cm)	Weight (lbs)	Race time (mm:ss) 5k women, 8k men
Female (n=9)	166.5 ± 5.1	129.3 ± 12.1	25:49 ± 55.2
Male (n=6)	179.6 ± 4.3	150.3 ± 18.2	18:13 ± 67.7
Total	172.2 ± 8.1	137.7 ± 17.7	-

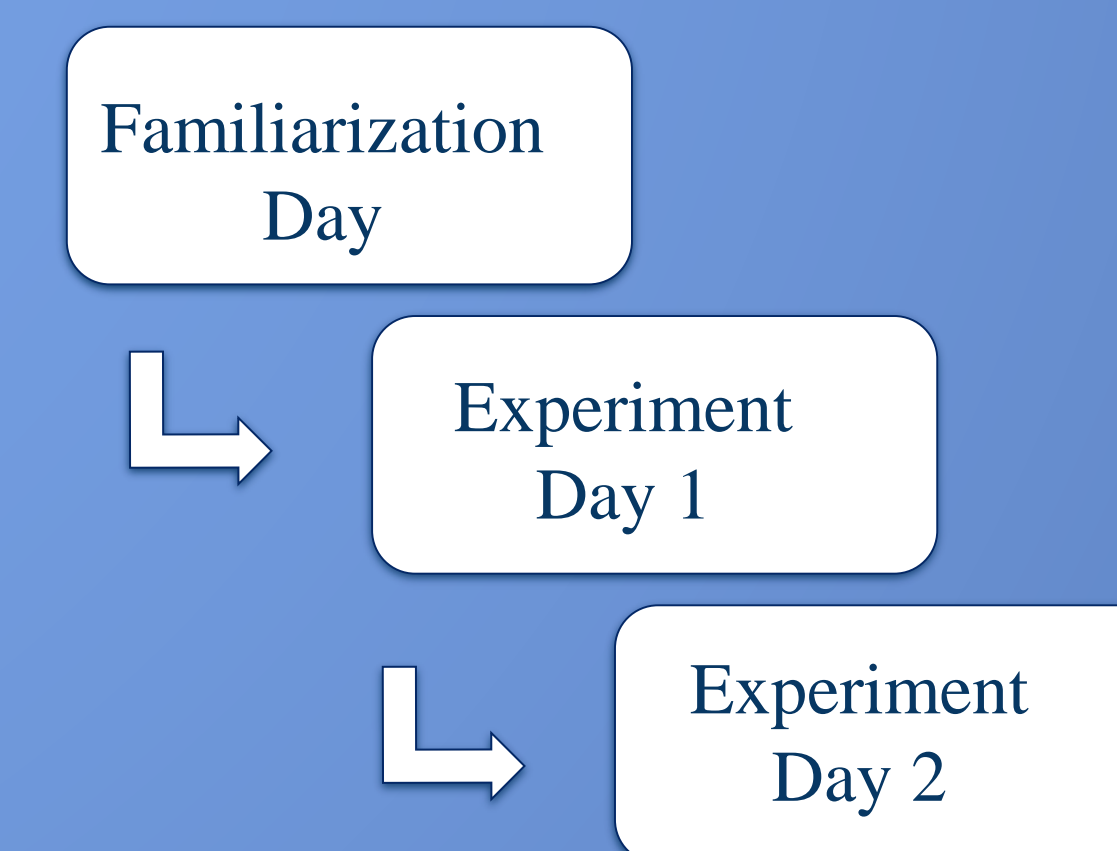
Experimental Design

Day One: Familiarization

Health, Consent, and Behavior questionnaire
 Familiarization run on Boost Treadmill with VO_2 gear

Experimental Days

Behavior questionnaire, pre-race warm up
 Boost treadmill:
 2 min self selected speed warm up
 three 4 min running bouts separated by 90s break
 14 kph, 15kph and 16kph (women)
 14 kph, 16 kph and 18kph (men)
 RAMP increasing grade 1% every 30 sec until fatigue .
 VO_2 and stride characteristics (video analysis) recorded at each stage



RESULTS

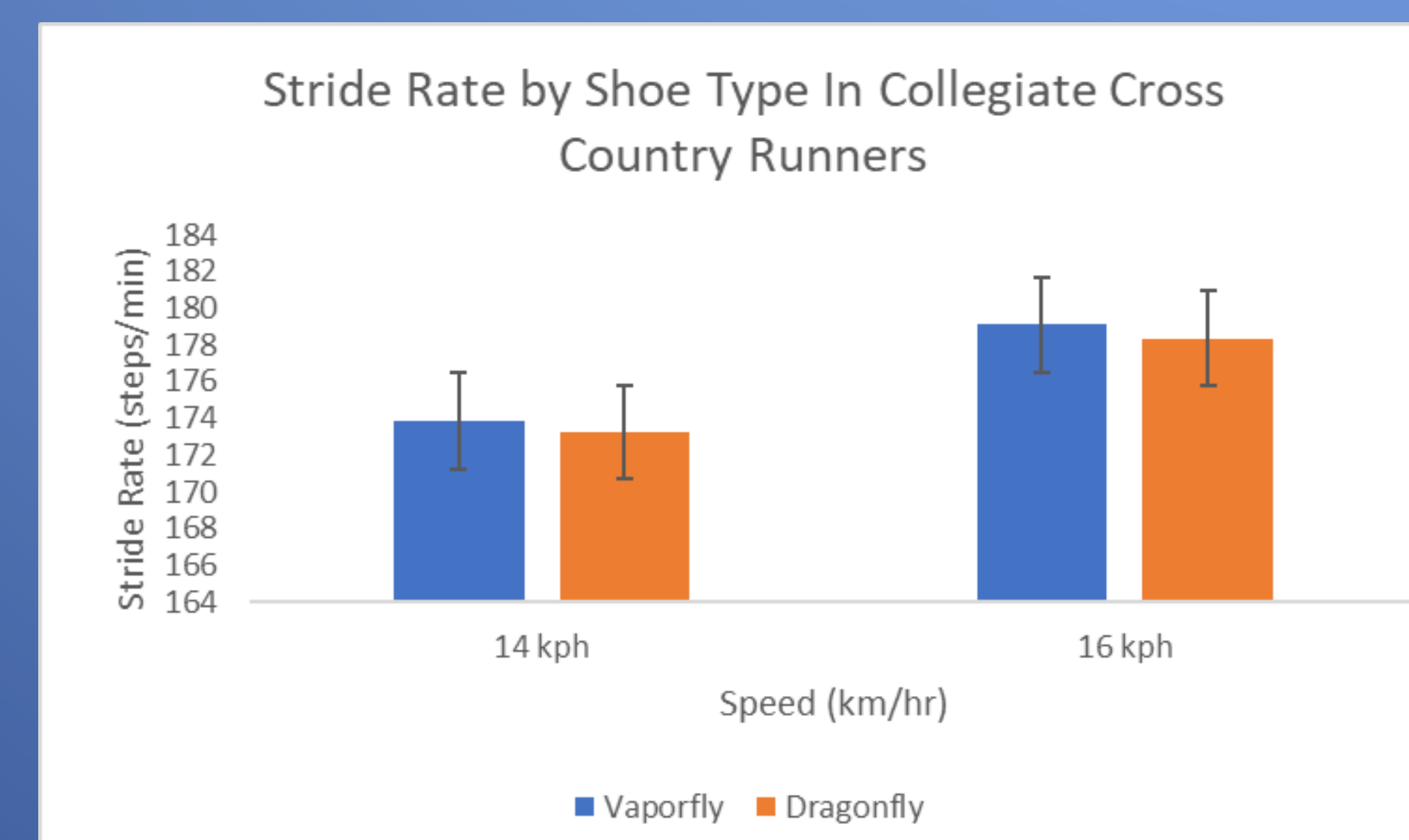


Figure 1. Stride Rate (steps/min) of the Nike Vaporfly and Dragonfly in collegiate cross country runners

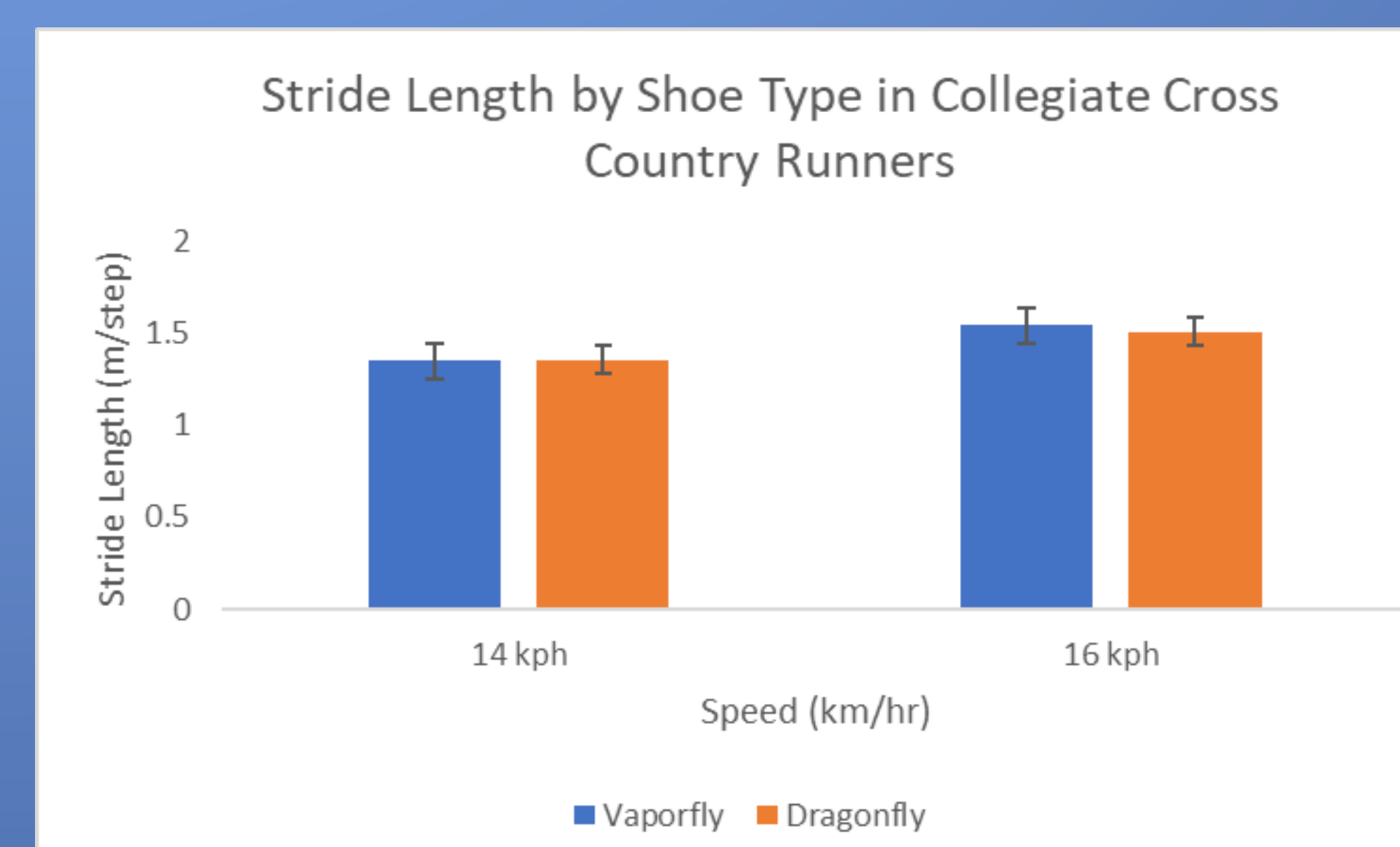


Figure 2. Stride Length (m/step) of the Nike Vaporfly and Dragonfly in collegiate cross country runners

RESULTS

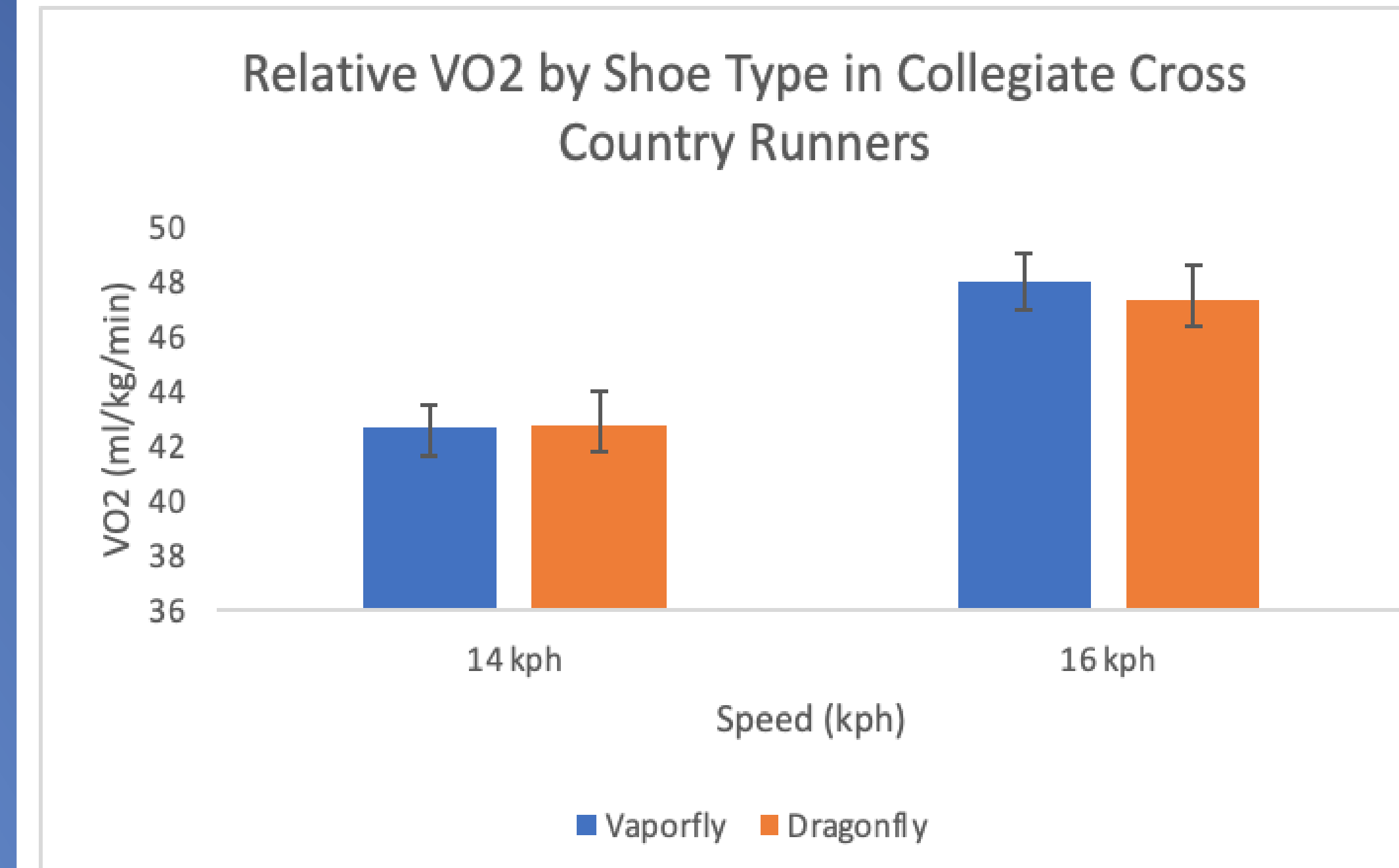


Figure 3. Running economy (ml/kg/min) of the Nike Vaporfly and Dragonfly in female and male collegiate cross country runners.

CONCLUSION

No significant differences were found in running economy or stride characteristics between shoe types. The results of the current study are in disagreement with prior studies which have shown that the Vaporfly tends to outperform un-plated track spikes (2). Based on the results of this study, athletes should choose a shoe based on personal preference.

LIMITATIONS

- Boost Treadmill
 - Inconsistencies in the mechanics of the anti-gravity system
 - Alters weight and range of motion of runners
- Removal the spikes on the Dragonfly shoe
- Differences of level of wear between shoes
- Possible training effect among participants

IMPLICATIONS

Further research needs to be performed to determine the effects of shoe type on VO_2 outside of an antigravity treadmill, as well as the effects of VO_2 and stride characteristics of the Dragonfly with spikes remaining inserted into the shoe.

BIBLIOGRAPHY

- Hoogkamer W, Kipp S, Frank JH, Farina EM, Luo G, Kram R. A comparison of the energetic cost of running in marathon racing shoes. *Sports Med.* 2018 Apr;48(4):1009-1019.
- Barnes KR, Kilding AE. A randomized crossover study investigating the running economy of highly-trained male and female distance runners in marathon racing shoes versus track spikes. *Sports Med.* 2019 Feb;49(2):331-342.
- Hoogkamer W, Kipp S, Kram R. The biomechanics of competitive male runners in three marathon racing shoes: A randomized crossover study. *Sports medicine*; 2018;49(1):133-143.
- Hunter I, McLeod A, Valentine D, Low T, Ward J, Hager R. Running economy, mechanics, and marathon racing shoes. *J Sports Sci.* 2019 Oct;37(20):2367-2373.
- Fuller JT, Bellenger CR, Thewis D, Tsiros MD, Buckley JD. The effect of footwear on running performance and running economy in distance runners. *Sports Med.* 2015 Mar;45(3):411-22.