Client Report

For ElliptiGO, Inc

11/09/11

Summary

To determine and compare the energy cost of riding an ElliptiGO bike with conventional cycling and running, an outdoor study was conducted. The energy cost of exercising on the ElliptiGO was, on average, 33 ± 11 % greater compared to cycling at a given velocity. At the two highest velocities (16 and 18.5 mph), the energy cost of exercising on the ElliptiGO was similar to that of running at 7.5 and 8.6 mph, whereas at lower velocities, the energy cost of running at 6.0 and 6.7 mph was greater than exercising on the ElliptiGO. The heart rate responses and perceived exertion were markedly higher on the ElliptiGO than for cycling, but similar to those for running.

Methods

The study was conducted at the San Diego velodrome between 0700-1130 on 10/18/2011, 10/20/2011, and 10/21/2011 . Study subjects completed multiple laps around the flat inner skirt of the oval velodrome track which had an asphalt surface very similar to that found on road surfaces. Subjects completed three different modes of exercise (ElliptiGO, cycling and running), at four pre-determined velocities for 6 minutes duration per bout, ranging in relative intensity from easy to very difficult (see Table 1). Subjects rode the 8 speed ElliptiGO 8S and a conventional 18 speed road bike in an upright touring position with the rider's hands on top of the brake hoods as seen below in Figure 1.

Figure 1. Photos of subjects during testing for ElliptiGO, cycling and running modes.

Gear selection on the ElliptiGO and bike were pre-determined such that subjects would maintain an approximate cadence of 70 and 90 rpm on the ElliptiGO and bike, respectively. One to two minutes of active recovery was allowed between bouts for the same mode of exercise, and a 10-minute sitting recovery was employed between modes during which time the face mask was removed and subjects were encouraged to drink water. Immediately after each bout of exercise, subjects were asked to rate their exertion on a scale of 1-10, with 10 being the most difficult.

Intensity	ElliptiGO			Cycling			Running	
	mph	*Gear*	*Crank RPM*	*mph*	*Gear*	*Crank RPM*	*min/mile*	*mph*
1	11	*4*	*69*	11	*39-25*	*89.8*	10	6
2	13	*5*	*69.4*	13	*39-21*	*89.2*	9	6.7
3	16	*6*	*69.9*	16	*39-17*	*88.9*	8	7.5
4	18.5	*7*	*69.6*	18.5	*39-15*	*90.7*	7	8.6

Table 1. Testing velocities and cadences.

Four male and two female subjects between ages 30 and 41 years old were selected to participate in this study based on the criteria that they all had some familiarity with each of the three test modes. There was variation in the fitness level and exercise mode experience between subjects as described in Table 2. Subjects were selected with a broad range in body size due to the dominant effect of aerodynamics on the power required to propel the test machines and the contrast in riding positions of the two vehicles. Subjects were asked to refrain from caffeine and other stimulants on the morning of testing, and to consume a light meal approximately one hour before their scheduled appointment. Subjects were weighed on a digital scale (Brookstone, Inc.) upon arrival at the test site, then fitted with a chest strap to monitor heart rate, and a Cosmed k4b face mask and portable metabolic unit inserted into a chest harness. The weight of body-worn equipment was 1.9kg which was added to the subject's body weight for all metabolic calculations. A scaled photograph was also taken of each subject in the riding position on both the bicycle and the ElliptiGO in order to measure frontal area for work rate calculations.

Subject	Gender	Age (yr)	Height (cm)	Weight (kg)	BMI (kg/m^2)	A_f- Frontal Area (m^2)		% Inc. Frontal Area ElliptiGO	Mode Experience Rating (1-5)			Fitness Rating (1-5)
						Bike	ElliptiGO		Cycling	ElliptiGO	Running	
1	M	38	177.8	83	26.3	0.425	0.585	37.6	4	5	5	5
2	M	39	170.2	80.8	27.9	0.387	0.570	47.4	2	5	4	5
3	M	41	185.4	119	34.6	0.492	0.674	36.9	2	2	2	1
4	F	34	167	55.5	19.9	0.353	0.525	48.6	4	3	2	3
5	M	30	178	88.4	27.9	0.430	0.617	43.5	3	3	1	3
6	F	34	183	61.5	18.4	0.381	0.589	54.7	3	1	2	3
Mean ± SD		36.0 ± 3.7	176.9 ± 6.5	81.4 ± 20.5	25.8 ± 5.4	0.411 ± 0.045	0.593 ± 0.045	44.8 ± 6.3	3.0 ± 0.8	3.2 ± 1.5	2.7 ± 1.4	3.3 ± 1.4

Table 2. Subject characteristics. Each subject rated their experience level with each exercise mode on a scale of 1-5 with 5 being the highest level of fitness and experience.

Gaseous exchange and heart rate data were collected and stored on the Cosmed k4b system. Data were filtered to remove any non physiological data points. For each 6-minute bout, breath-by-breath data were averaged into 10 second epochs and steady state was determined. In order to be considered, steady state had to be maintained for a minimum of 100 seconds. Actual velocity data during the run was captured using a Garmin Edge 500 GPS device. This data was averaged over the same steady state period as for Cosmed data.

The order of testing of the three modes was held constant for subjects 2-6: bike first, ElliptiGO second, and run third. The first subject used the ElliptiGO followed by the bike and run respectively. It was decided to test the bike and ElliptiGO first and second and not randomize the order in order to minimize variation in the comparison of these two modes due to wind conditions. Ambient conditions on each day were as follows:

10/18/2011 (20-21 ^{o}C, 758 mm Hg, 88-91% rH)
10/20/2011 (17-21 ^{o}C, , 757-758 mm Hg, 75-80% rH)
10/21/2011 (20-28 ^{o}C, 758-759 mm Hg, 60-78% rH).

In many instances the average actual velocity for a bout varied significantly from the target velocity resulting in a significant change in the subject's work rate and corresponding energy expenditure rate. In order to compare the energy expenditure rate at the same velocity for cycling and riding the ElliptiGO the work rate at the actual velocity for each bout was calculated using the work rate model shown below in Figure 2. The variables used in these calculations for each subject and each vehicle are shown in Tables 2 and 3. The work rate was then divided by subject weight plus the weight of the body-worn equipment to get the relative work rate. The relative work rate for each subject as a function of velocity for both the bicycle and ElliptiGO can be seen below in Figure 3.

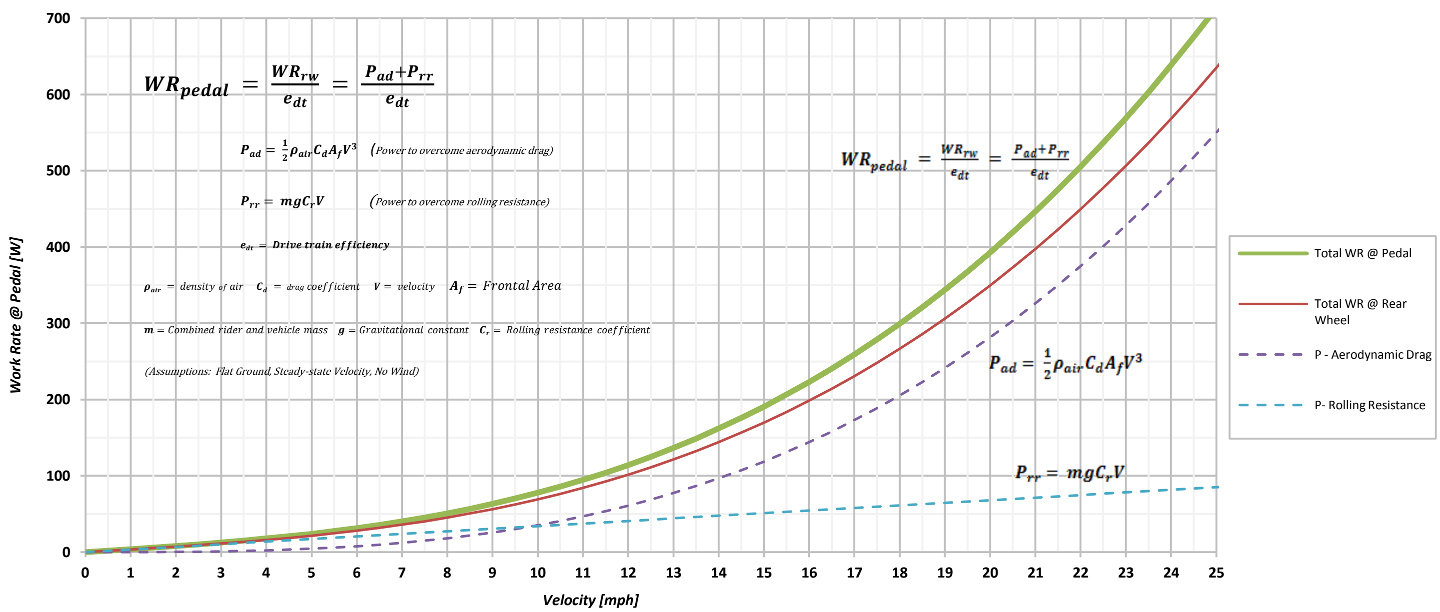


Figure 2. Work rate model for the bike and ElliptiGO. This example shows data for subject #1 -ElliptiGO.

Vehicle	Weight (kg)	Drag Coefficient C_d	Rolling-Res Coefficient C_r	Drive Train Efficiency e_{dt}
Bike 1	8.0	1*	0.005*	95%*
Bike 2	9.0	1*	0.005*	95%*
ElliptiGO	18.5	1.1	0.0075	89%

Table 3. Vehicle Data. All variables listed above were measured with the exception of the variables for the road bikes marked with asterisks(*) which were taken from Wilson, D.G. (2004). *Bicycling Science-Third Edition*. Cambridge, MA: The MIT Press

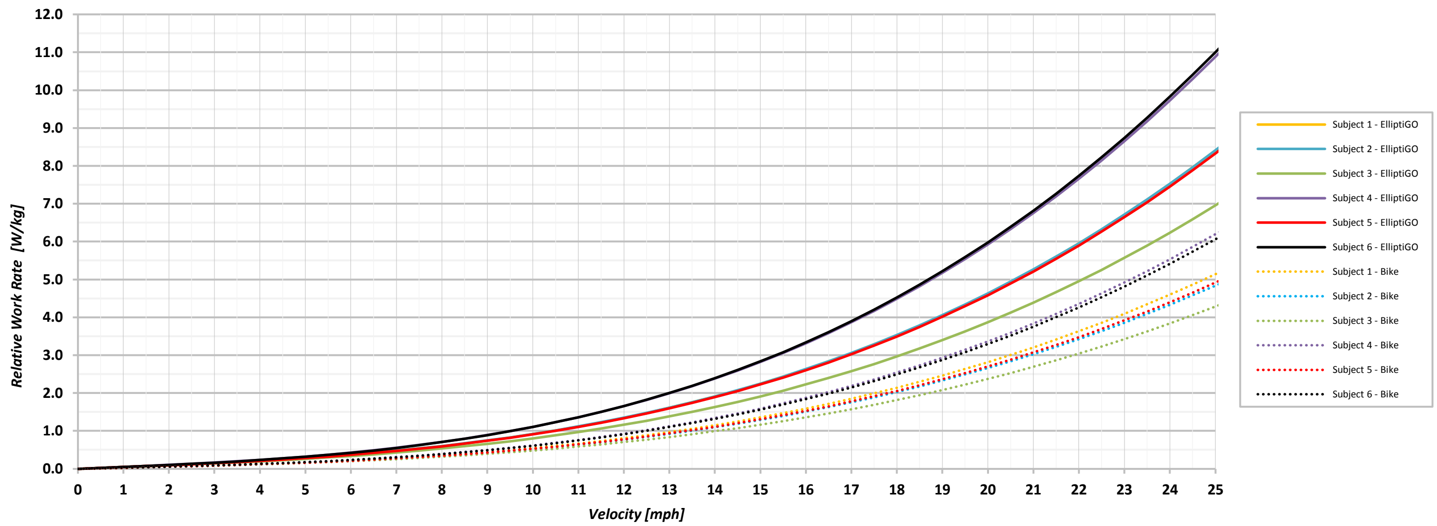


Figure 3. Relative work rate at the pedal as a function of velocity for both the bike and the ElliptiGO.

Linear regression analysis was performed to analyze the energy expenditure data as a function of the actual relative work rate. Plots showing the regressions for each subject for both cycling and ElliptiGO can be seen below (Figure 4). These linear regression equations were then used to generate curves for the "corrected" relative energy expenditure rate as a function of velocity for each subject for both cycling and the ElliptiGO (Figure 5). For the running data, linear regressions were able to be taken directly of the relative energy expenditure rate as a function of actual velocity data as seen in Figure 7.

Results and discussion

The aim of this study was to determine the comparative energy cost of riding an ElliptiGO bike with conventional cycling and running. Variables of interest are reported below for the group (Table 4) and individually in appendix A (Tables 5-10). Blank fields in the individual tables are indicative of data which could not be captured due to either equipment malfunction or inability for the subject to complete the test bout. "Measured" EE values were those that were actually measured during testing at the actual velocities listed. "Corrected" EE values were generated using the linear regressions of the energy expenditure-actual velocity data as outlined in the methods section. These corrected EE values were calculated at the target velocities listed so that direct comparisons could be made at the same velocity for cycling and ElliptiGO.

Table 4. Group averages (mean ± SD) for each exercise mode across all velocities.

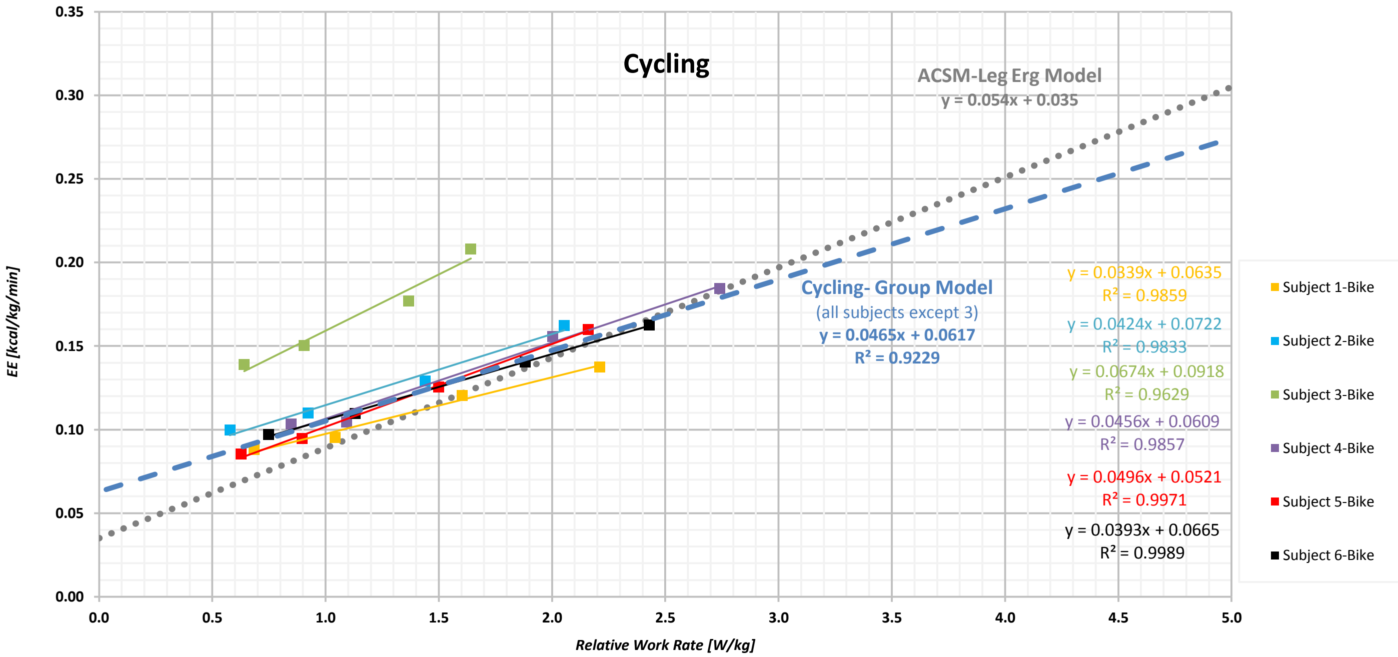
Variables	Mode											
	Cycling				ElliptiGO				Running			
Intensity	1	2	3	4	1	2	3	4	1	2	3	4
V-Target *(mph)*	11.0	13.0	16.0	18.5	11.0	13.0	16.0	18.5	6.0	6.7	7.5	8.6
V-Actual *(mph)*	11.1 ± 0.4	13.1 ± 0.3	16.0 ± 0.2	18.1 ± 0.4	11.3 ± 0.3	13.0 ± 0.2	15.7 ± 0.5	18.2 ± 0.3	6.2 ± 0.2	6.8 ± 0.0	7.6 ± 0.0	8.6 ± 0.4
VO_2 *(ml/kg/min)*	20.35 ± 3.74	22.09 ± 3.91	28.19 ± 4.15	33.76 ± 4.74	26.97 ± 3.98	29.63 ± 3.60	38.08 ± 5.54	39.48 ± 1.42	31.67 ± 2.04	34.14 ± 2.41	37.48 ± 2.69	41.25 ± 1.11
EE -Measured *(Kcal/kg/min)*	0.102 ± 0.018	0.111 ± 0.019	0.141 ± 0.020	0.169 ± 0.022	0.135 ± 0.018	0.147 ± 0.018	0.189 ± 0.026	0.198 ± 0.007	0.158 ± 0.010	0.170 ± 0.012	0.187 ± 0.013	0.206 ± 0.005
Heart rate *(bpm)*	121 ± 17	124 ± 20	142 ± 20	157 ± 18	139 ± 21	150 ± 19	165 ± 18	169 ± 11	144 ± 13	154 ± 16	163 ± 13	169 ± 7
METs[a]	5.82 ± 1.07	6.31 ± 1.12	8.05 ± 1.19	9.64 ± 1.35	7.71 ± 1.14	8.46 ± 1.03	10.88 ± 1.58	11.28 ± 0.41	9.05 ± 0.58	9.75 ± 0.69	10.71 ± 0.77	11.79 ± 0.32
% CHO oxidized	65.31 ± 22.42	76.50 ± 18.67	86.35 ± 20.48	90.16 ± 14.70	66.87 ± 20.29	83.55 ± 11.35	97.03 ± 4.48	88.98 ± 15.58	64.56 ± 22.55	66.33 ± 26.43	78.26 ± 22.98	79.88 ± 16.32
% fat oxidized	34.69 ± 22.42	23.50 ± 18.67	13.66 ± 20.48	9.85 ± 14.70	33.13 ± 20.29	16.45 ± 11.35	2.97 ± 4.48	11.02 ± 15.58	35.44 ± 22.55	31.17 ± 22.76	21.75 ± 22.98	20.12 ± 16.32
RPE[b]	2.25 ± 0.56	3.25 ± 0.69	5.08 ± 1.02	7.33 ± 1.25	3.08 ± 0.61	5.17 ± 1.55	7.50 ± 1.83	9.25 ± 0.80	3.63 ± 0.54	5.38 ± 1.56	6.75 ± 1.95	9.00 ± 0.71
WR -Actual *(W/kg)*	0.69 ± 0.09	1.00 ± 0.09	1.63 ± 0.23	2.21 ± 0.34	1.26 ± 0.21	1.74 ± 0.30	2.59 ± 0.55	3.63 ± 0.17				
WR -Target *(W/kg)*	0.67 ± 0.06	0.98 ± 0.10	1.62 ± 0.18	2.34 ± 0.28	1.17 ± 0.14	1.70 ± 0.23	2.79 ± 0.40	4.03 ± 0.61				
EE-Corrected *(Kcal/kg/min)*	0.10 ± 0.02	0.11 ± 0.02	0.14 ± 0.02	0.17 ± 0.03	0.13 ± 0.02	0.15 ± 0.02	0.19 ± 0.03	0.23 ± 0.04	0.15 ± 0.01	0.17 ± 0.01	0.18 ± 0.01	0.21 ± 0.01
% Inc EE-Corr. ElliptiGO vs Bike	**%32.2 ± %16.8**	**%32.6 ± %12.0**	**%33.4 ± %7.4**	**%34.2 ± %8.4**								

[a] multiples of resting energy expenditure; 1 MET = 3.5 ml O_2/kg/min. [b] RPE = Rating of Perceived Exertion

As an internal control, the energy expenditure of our test subjects was compared with a well characterized leg ergometry model produced by The American College of Sports Medicine (ACSM), which defines the relationship between relative energy expenditure rate and work rate for riding a stationary bike at a constant cadence of 50 rpm. The ACSM Leg Ergometry Model can be seen plotted against our bike and ElliptiGO data in Figure 4. The y intercept of the ACSM model occurs at a relative energy expenditure rate equivalent to 2 METs (0.035 kcal/kg/min) where 1 MET (0.0175 kcal/kg/min) is attributed to the resting metabolic rate (RMR) of the subject and the other 1 MET is the energy cost of the subject moving their legs at a rate of 50 rpm while doing no actual work output. Similar but higher y intercept values were seen in both the cycling and ElliptiGO data. This can most likely be attributed to the fact that the testing was conducted at higher constant pedaling cadences; 90 rpm for cycling and 70 rpm for the ElliptiGO. It is reasonable that the ElliptiGO y intercept would be significantly higher than the cycling y intercept even though the pedaling cadence was lower due to the stand up weight bearing riding position and long stride length of the elliptical pedal stroke.

The subjects' varying levels of specific mode experience and fitness can be seen in Figure 4. For comparative purposes, group models have been constructed for each activity which are linear regressions of all of the subject data together with exception of subject 3. R^2 correlation factors of approximately 0.9 were obtained for these regressions indicating a very good fit to the subject data included in the model. Subject 3 was excluded from these group models due to energy expenditure rates for a given relative work rate which were significantly higher than the rest of the group for both cycling and ElliptiGO. At 185.4 cm tall and 119 kg, subject 3 was the largest subject. Subject 3 was 35% heavier than the next heaviest subject (subject 5) but had a frontal area which was only 9% greater for ElliptiGO and 15% greater for cycling than the subject with next largest frontal area (also subject 5). This high weight to frontal area ratio actually resulted in the lowest relative work rate within the group for both cycling and ElliptiGO modes (as seen in Figure 3) and therefore does not explain the high energy expenditure rates observed for this subject. The high relative energy expenditure rates of subject 3 are likely due to his lower overall fitness level compared with the rest of the group as shown in Table 1 and also reflected by the relatively high heart rate and %CHO Oxidized data for this subject (Table 7). For example, this subject's heart rate of 166 bpm was at 93% of his predicted max heart rate (179 bpm) at the 2nd intensity into the cycling mode which was a relatively mild work rate for the least energy intensive mode.

Another interesting comparison can be made between subjects 1 and 2 which had the highest overall fitness ratings (Table 1) of the group. These subjects had very similar mode experience ratings for both the ElliptiGO and running but very different cycling experience levels with subject 1 being one of the most experienced cyclists in the group and subject 2 being one of the least experienced cyclists. Figure 4 shows that subject 2 has the lowest cycling exercise economy of the subjects that fit the group model while subject 1 has the highest economy. The other subjects with the exception of subject 3 fall between these two. Also in Figure 4 it can be seen that subjects 1 and 2 have nearly identical exercise economies for the ElliptiGO which are the lowest of the group and is consistent with their high experience level on the device.



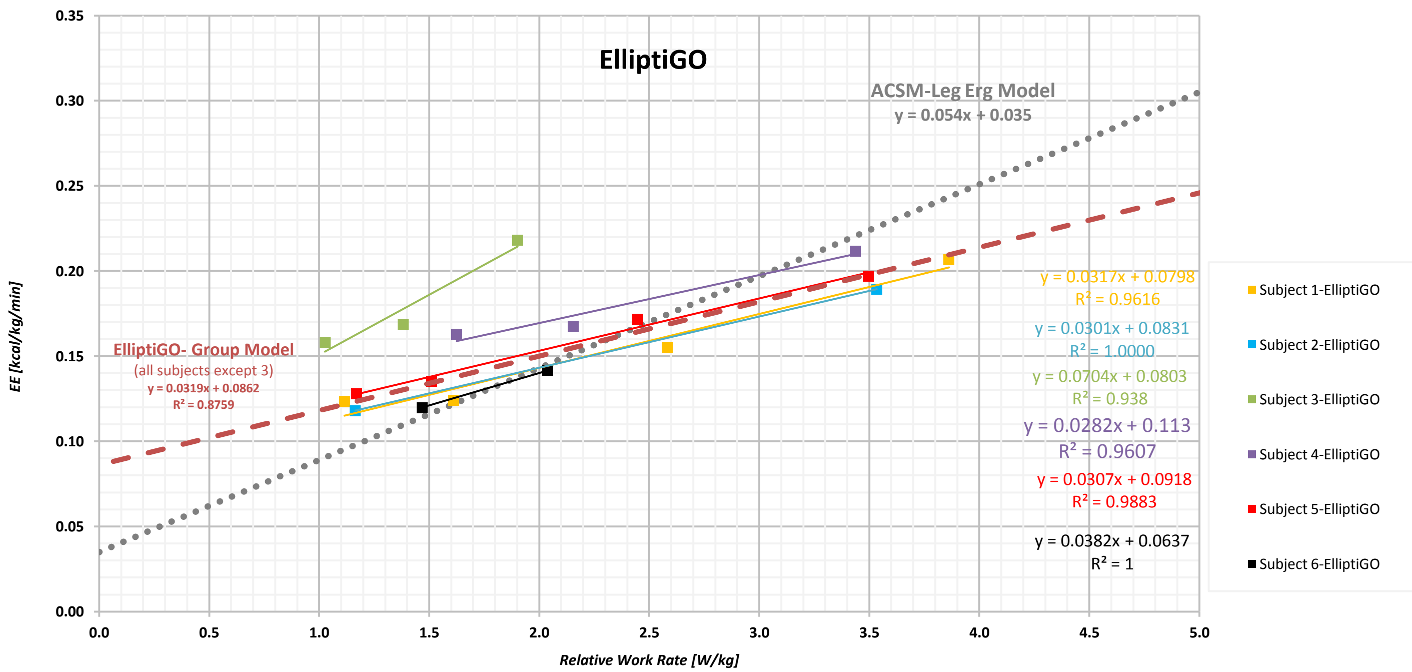


Figure 4. Relative energy expenditure rate as a function of relative work rate for cycling and ElliptiGO. The equations of the linear regressions for each subject and the corresponding R^2 values are shown above. The ACSM Leg Ergometry Model and a linear regression for the entire set of group data (with exception of subject 3) have also been shown for comparison. For subjects 2 and 6 only two of the four data points in the ElliptiGO exercise bout were able to be captured, resulting in R^2 values of 1. This was due to an equipment malfunction during subject 2's bouts #2 and #3 and subject 6's inability to complete bout #3 and #4. Additionally subjects 3 and 4 were unable to complete ElliptiGO bout #4.

The relative energy expenditure rates for each subject riding the ElliptiGO were significantly higher than those for cycling at the same speed (Figure 5). As seen below the energy expenditure curves approach horizontal asymptotes at the y axis which are many times higher than the expected resting metabolic rates (RMR) of the subjects. This is an artifact of the testing due to maintaining constant cadences of 70 and 90 rpm for the ElliptiGO and bike respectively at all 4 velocity points. At speeds below 10 mph, on flat terrain these cadences are artificially high resulting in lower exercise efficiency. In reality, a rider would most likely change to a higher gear at these low speeds in order to turn a lower pedal cadence at a higher torque to be more efficient. The main focus of this study was to investigate energy expenditure in the most usable, sustainable exercise range of the ElliptiGO from 10 mph to 20 mph. In an attempt to minimize some of the variables in the testing, the pedal cadences were held constant at 70 rpm for the ElliptiGO and 90 rpm for the bike which were considered to be optimal cadences in this velocity range.

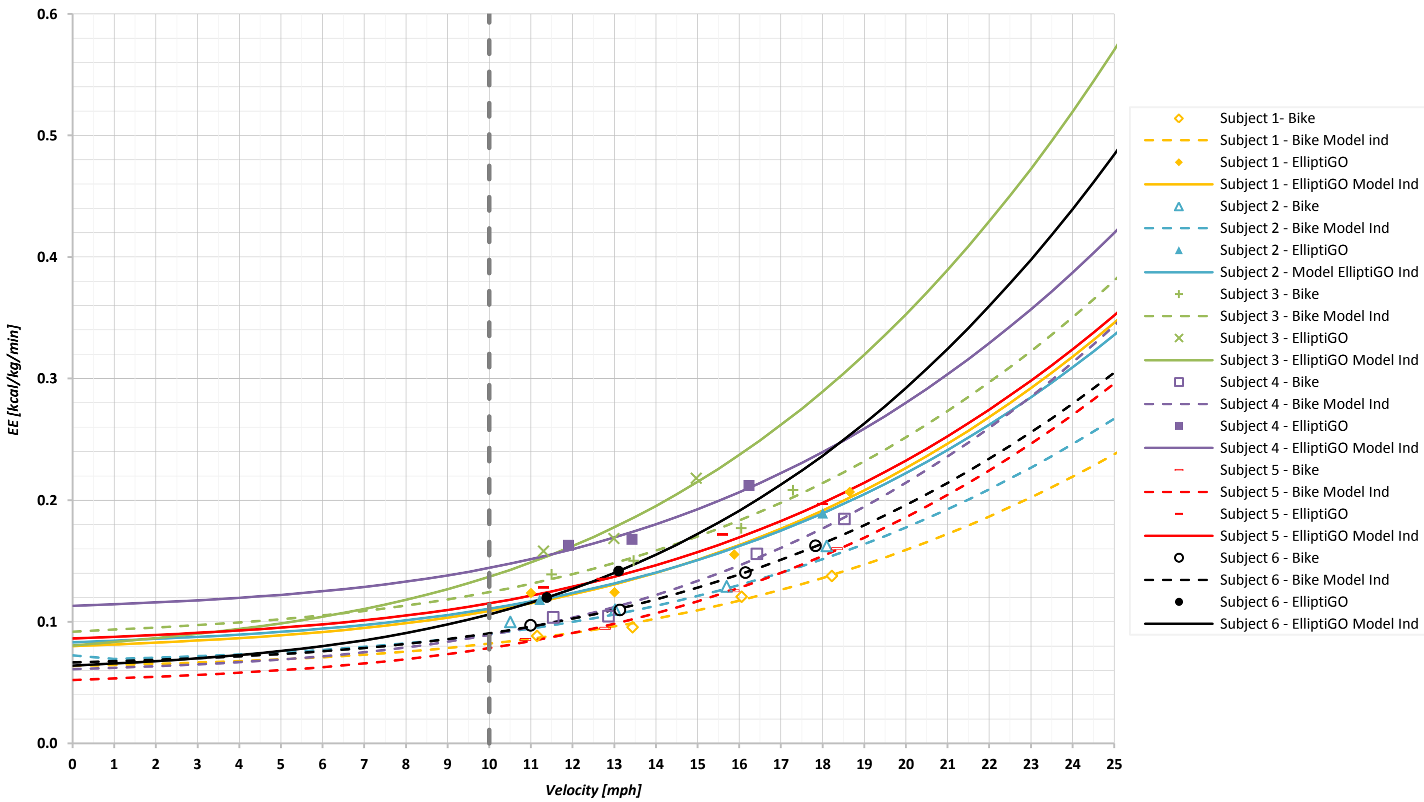


Figure 5. Relative energy expenditure rate as a function of velocity - cycling and ElliptiGO.

To better characterize the difference between the two activities, the % increase in energy expenditure for the ElliptiGO vs. cycling was plotted at the four target velocities (Figure 6). Figure 6 shows that at a given velocity within the range tested in this study, the energy cost of exercising on the ElliptiGO was, on average, 33% greater compared to cycling. While the variation of the subject group average from one velocity to another was small (std dev = ± 1%), there was significant subject to subject variation at a given velocity, ranging from a standard deviation of ± 17% at the lowest test velocity to ±8% at the highest test velocity with an average standard deviation of ± 11.2%. This large subject to subject variation can be correlated to varying levels of subject mode experience as seen in Table 2. In particular there was significantly higher variability at the two lowest test velocities of 11 and 13 mph. This was most likely due to the increased level of mode specific skill required for maintaining the high test cadences at these low speeds which further amplified differences in the mode experience levels between the subjects.

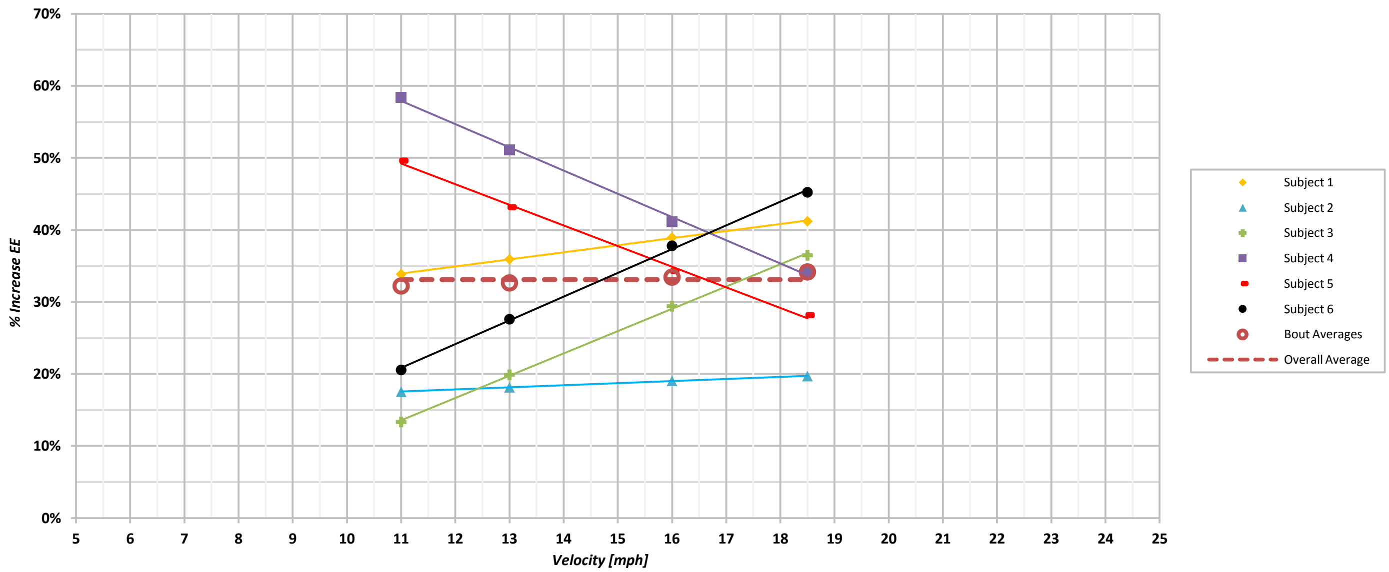


Figure 6. % increase relative energy expenditure rate as a function of velocity for the ElliptiGO vs. cycling.

The relative energy expenditure rate as a function of velocity for running can be seen below in Figure 7. All of the subjects who completed the run testing with the exception of subject 5 had linear regression slopes that were generally parallel with the ACSM Run Model. Subjects 1 and 2 had data which was offset below the ACSM model while subject 4 was offset above the ACSM model which seems consistent with the running experience levels as seen in Table 1. Subject 5 had a slope which was significantly different from the ACSM model and the other subjects. This is most likely due to his relatively low level of running experience. This can also be inferred from his relatively elevated heart rate and %CHO oxidize data during the first 3 running bouts (Table 9) and his inability to complete the 4th bout at the highest velocity.

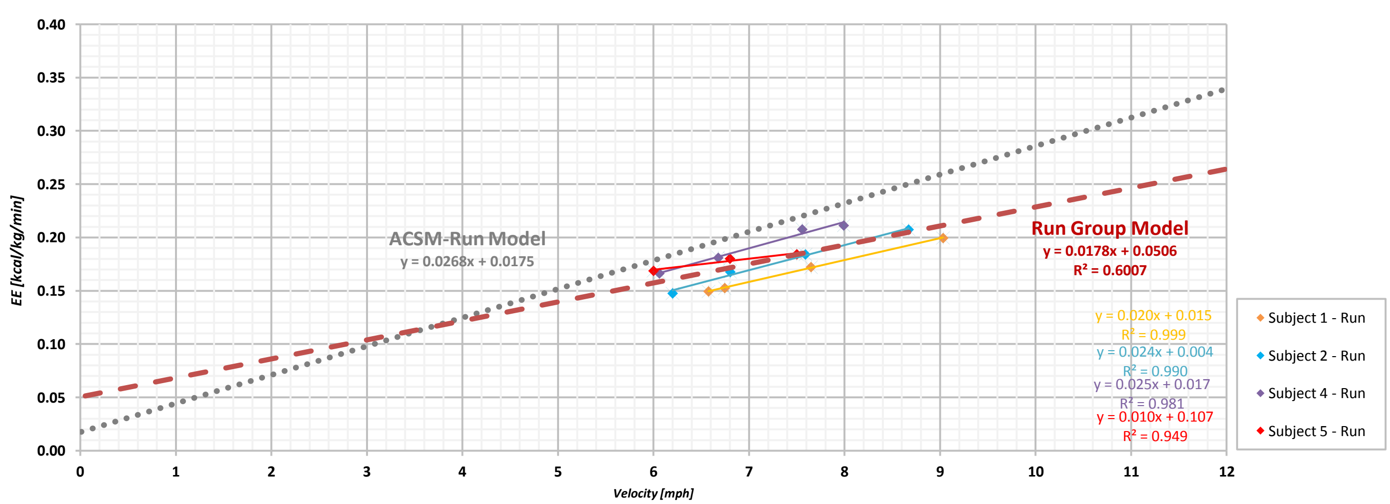


Figure 7. Relative energy expenditure rate as a function of velocity for running. The equations of the linear regressions for each subject and the corresponding R^2 values are shown above. The ACSM Run Model and a linear regression for the entire set of group

data have also been shown for comparison. Subjects 3 and 6 were unable to complete any of the running test bouts. Subject 5 completed 3 of the 4 bouts but could not finish the bout at intensity #4

As can be seen below in Figure 8, the energy expenditure for running at 7.5 and 8.6 mph is very similar to that of riding the ElliptiGO at 16 and 18.5 mph respectively. The average energy expenditure is about 5% lower for the ElliptiGO at 16 mph and about 5% greater at 18.5 mph. The average energy expenditure is about 20% higher for running as compared to the ElliptiGO for bouts 1 and 2. The energy expenditure for cycling is significantly lower than running for all bouts, ranging from 71 to 26 % from bouts 1 to 4.

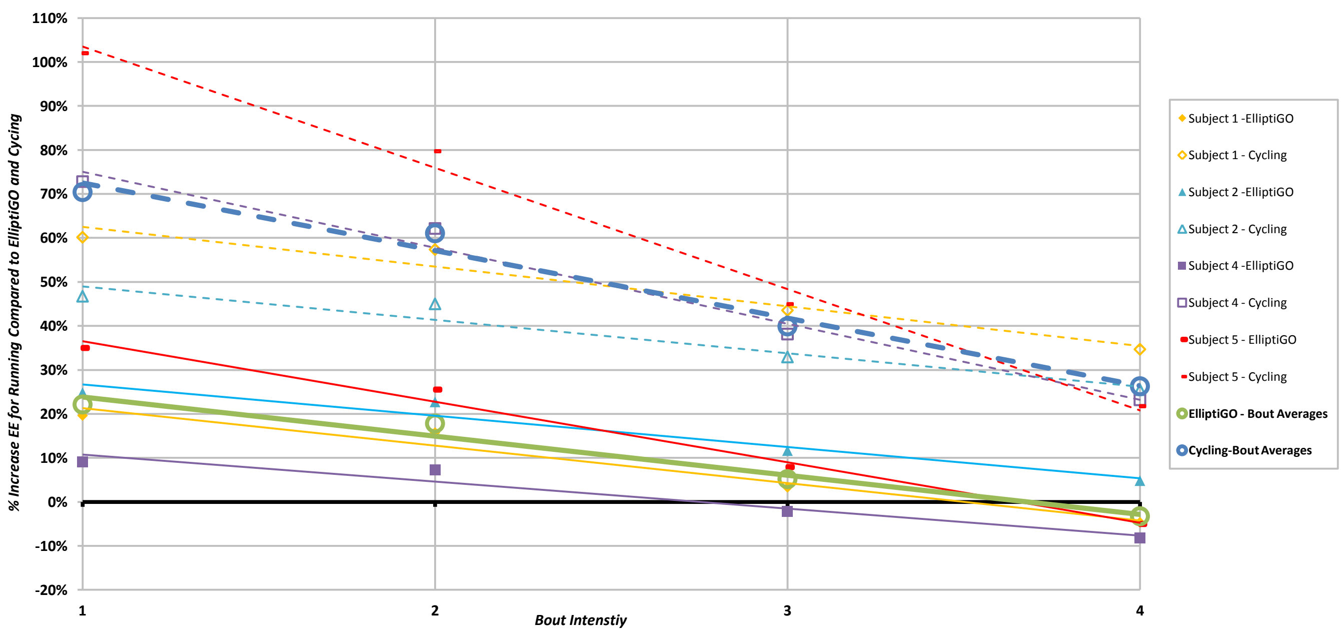


Figure 8. % Increase in energy expenditure for running compared to ElliptiGO and Cycling.

Conclusions

- At a given velocity within the range tested in this study, the energy cost of exercising on the ElliptiGO was, on average, 33 ± 11 % greater compared to cycling.

- At the two highest velocities (16 and 18.5mph), the energy cost of exercising on the ElliptiGO was similar to that of running at 7.5 and 8.6 mph, whereas at lower velocities, the energy cost of running at 6.0 and 6.7 mph was greater than exercising on the ElliptiGO.

- The heart rate responses and perceived exertion were markedly higher on the ElliptiGO than for cycling, but similar to those for running.

Appendix A - Tables 5-10. Individual data for each exercise mode across all velocities.

Table 5. Subject 1. Male, 38 yr, 83.0 kg, 177.8 cm.

Variables	Mode											
	Cycling				EllipiGO				Running			
Intensity	1	2	3	4	1	2	3	4	1	2	3	4
V-Target *(mph)*	11.0	13.0	16.0	18.5	11.0	13.0	16.0	18.5	6.0	6.7	7.5	8.6
V-Actual *(mph)*	11.1	13.4	16.1	18.2	11.0	13.0	15.9	18.7	6.6	6.7	7.6	9.0
VO_2 *(ml/kg/min)*	17.43	19.05	24.08	27.47	24.64	25.76	30.95	41.2	29.86	30.5	34.42	39.85
EE -Measured *(Kcal/kg/min)*	0.088	0.095	0.120	0.138	0.124	0.124	0.155	0.207	0.149	0.153	0.172	0.200
Heart rate *(bpm)*	116	117	126	137	117	123	141	170	134	139	153	171
METs[a]	4.98	5.44	6.88	7.85	7.04	7.36	8.84	11.77	8.53	8.71	9.83	11.39
% CHO oxidized	49.9	67.54	75.68	78.66	62.41	81.51	89.28	100	57.55	64.52	70.29	79.62
% fat oxidized	50.1	32.46	24.32	21.34	37.59	18.49	10.72	0	42.45	35.48	29.71	20.38
RPE[b]	3.0	4.0	5.0	6.5	2.0	4.0	5.5	8.0	3.5	4.5	5.5	8.5
WR -Actual *(W/kg)*	0.68	1.04	1.60	2.21	1.11	1.61	2.58	3.86				
WR -Target *(W/kg)*	0.66	0.97	1.59	2.30	1.11	1.61	2.63	3.78				
EE-Corrected *(Kcal/kg/min)*	0.086	0.096	0.117	0.141	0.115	0.131	0.163	0.200	0.138	0.151	0.168	0.190
% Inc EE-Corr. ElliptiGO vs Bike	33.9%	35.9%	39.0%	41.2%								

[a] multiples of resting energy expenditure. 1 MET = 3.5 ml O_2/kg/min.
[b] RPE = Rating of Perceived Exertion.

Table 6. Subject 2. Male, 39 yr, 80.8 kg, 170.2 cm.

Variables	Mode											
	Cycling				ElliptiGO				Running			
Intensity	1	2	3	4	1	2	3	4	1	2	3	4
V-Target *(mph)*	11.0	13.0	16.0	18.5	11.0	13.0	16.0	18.5	6.0	6.7	7.5	8.6
V-Actual *(mph)*	10.5	13.0	15.7	18.1	11.2			18.0	6.2	6.8	7.6	8.7
VO_2 *(ml/kg/min)*	19.88	21.89	25.69	32.33	23.52			37.72	29.42	33.43	36.69	41.34
EE -Measured *(Kcal/kg/min)*	0.100	0.110	0.129	0.162	0.118			0.189	0.148	0.168	0.184	0.207
Heart rate *(bpm)*	109	115	122	137	109			154	129	139	147	159
METs[a]	5.68	6.25	7.34	9.24	6.72			10.78	8.41	9.55	10.48	11.81
% CHO oxidized	22.05	39.28	44.88	62.27	30.25			66.94	37.62	26.42	44.16	60.03
% fat oxidized	77.95	60.72	55.12	37.73	69.75			33.06	62.38	63.58	55.84	39.97
RPE[b]	3.0	4.0	5.5	7.5	3.0	5.0	6.5	8.5	3.5	5.0	6.5	8.5
WR -Actual *(W/kg)*	0.58	0.92	1.44	2.05	1.16			3.53				
WR -Target *(W/kg)*	0.64	0.92	1.51	2.17	1.12	1.61	2.63	3.79				
EE-Corrected *(Kcal/kg/min)*	0.099	0.111	0.136	0.164	0.117	0.131	0.162	0.197	0.146	0.161	0.181	0.206
% Inc EE-Corr. ElliptiGO vs Bike	17.5%	18.2%	19.1%	19.7%								

[a] multiples of resting energy expenditure. 1 MET = 3.5 ml O_2/kg/min.
[b] RPE = Rating of Perceived Exertion.

Table 7. Subject 3. Male, 41 yr, 117.4 kg, 185.4 cm.

Variables	Mode											
	Cycling				ElliptiGO				Running			
Intensity	1	2	3	4	1	2	3	4	1	2	3	4
V-Target *(mph)*	11.0	13.0	16.0	18.5	11.0	13.0	16.0	18.5	6.0	6.7	7.5	8.6
V-Actual *(mph)*	11.5	13.5	16.0	17.3	11.3	13.0	15.0					
VO_2 *(ml/kg/min)*	28.19	30.5	35.9	42.28	32.09	34.19	44.26					
EE -Measured *(Kcal/kg/min)*	0.139	0.150	0.177	0.208	0.158	0.168	0.218					
Heart rate *(bpm)*	153	166	180	189	170	176	192					
METs[a]	8.05	8.71	10.26	12.08	9.17	9.77	12.65					
% CHO oxidized	80.6	86.44	100	100	82.29	92.17	100					
% fat oxidized	19.4	13.56	0	0	17.72	7.84	0					
RPE[b]	2.0	3.5	6.0	8.5	3.0	5.0	10.0	10.0				
WR -Actual *(W/kg)*	0.64	0.91	1.37	1.64	1.03	1.38	1.90					
WR -Target *(W/kg)*	0.58	0.84	1.36	1.94	0.97	1.38	2.23	3.18				
EE-Corrected *(Kcal/kg/min)*	0.131	0.148	0.183	0.223	0.149	0.178	0.237	0.304				
% Inc EE-Corr. ElliptiGO vs Bike	13.3 %	19.9 %	29.4 %	36.5 %								

[a] multiples of resting energy expenditure. 1 MET = 3.5 ml O_2/kg/min.
[b] RPE = Rating of Perceived Exertion.

Table 8. Subject 4. Female, 34 yr, 55.5 kg, 167 cm.

Variables	Mode											
	Cycling				ElliptiGO				Running			
Intensity	1	2	3	4	1	2	3	4	1	2	3	4
V-Target *(mph)*	11.0	13.0	16.0	18.5	11.0	13.0	16.0	18.5	6.0	6.7	7.5	8.6
V-Actual *(mph)*	11.5	12.9	16.4	18.5	11.9	13.4	16.2		6.1	6.7	7.6	8.0
VO_2 *(ml/kg/min)*	20.86	21.05	31.36	37.14	32.85	33.79	42.64		33.5	36.46	41.81	42.57
EE -Measured *(Kcal/kg/min)*	0.103	0.105	0.156	0.184	0.163	0.168	0.212		0.166	0.181	0.208	0.211
Heart rate *(bpm)*	132	114	146	158	147	152	168		150	158	171	177
METs[a]	5.96	6.01	8.96	10.61	9.39	9.65	12.18		9.57	10.42	11.95	12.16
% CHO oxidized	76.97	88.66	100	100	54.65	68.15	99.37		63.07	74.39	98.57	100
% fat oxidized	23.03	11.34	0	0	45.36	31.85	0.63		36.93	25.61	1.43	0
RPE[b]	1.5	2.0	3.0	5.0	4.0	4.5	7.0	10.0	3.0	4.0	5.0	10.0
WR -Actual *(W/kg)*	0.85	1.09	2.00	2.74	1.63	2.15	3.44					
WR -Target *(W/kg)*	0.76	1.12	1.87	2.73	1.36	1.99	3.32	4.82				
EE-Corrected *(Kcal/kg/min)*	0.096	0.112	0.146	0.185	0.151	0.169	0.206	0.249	0.165	0.182	0.202	0.229
% Inc EE-Corr. ElliptiGO vs Bike	58.4%	51.1%	41.2%	34.2%								

[a] multiples of resting energy expenditure. 1 MET = 3.5 ml O_2/kg/min.
[b] RPE = Rating of Perceived Exertion.

Table 9. Subject 5. Male, 30 yr, 88.4 kg, 178 cm.

Variables	Mode											
	Cycling				ElliptiGO				Running			
Intensity	1	2	3	4	1	2	3	4	1	2	3	4
V-Target *(mph)*	11.0	13.0	16.0	18.5	11.0	13.0	16.0	18.5	6.0	6.7	7.5	8.6
V-Actual *(mph)*	10.9	12.8	15.9	18.3	11.3	12.7	15.6	18.0	6.0	6.8	7.5	0.0
VO_2 *(ml/kg/min)*	17.12	18.98	25.15	32.1	25.69	27.17	34.47	39.51	33.88	36.16	36.98	
EE -Measured *(Kcal/kg/min)*	0.085	0.095	0.125	0.160	0.128	0.135	0.172	0.197	0.169	0.180	0.184	
Heart rate *(bpm)*	100	106	128	155	137	137	159	182	163	178	179	
METs[a]	4.89	5.42	7.19	9.17	7.34	7.76	9.85	11.29	9.68	10.33	10.57	
% CHO oxidized	77.11	81.85	97.51	100	84.15	75.94	99.46	100	100	100	100	
% fat oxidized	22.89	18.15	2.49	0	15.85	24.06	0.54	0	0	0	0	
RPE[b]	2.0	3.0	5.0	8.0	3.0	4.0	6.0	9.0	4.5	8.0	10.0	
WR -Actual *(W/kg)*	0.628	0.897	1.499	2.159	1.169	1.511	2.448	3.494				
WR -Target *(W/kg)*	0.644	0.932	1.529	2.205	1.104	1.593	2.604	3.747				
EE-Corrected *(Kcal/kg/min)*	0.084	0.098	0.128	0.161	0.126	0.141	0.172	0.207	0.170	0.177	0.185	0.197
% Inc EE-Corr. ElliptiGO vs Bike	49.6%	43.2%	34.3%	28.2%								

[a] multiples of resting energy expenditure. 1 MET = 3.5 ml O_2/kg/min.
[b] RPE = Rating of Perceived Exertion.

Table 10. Subject 6. Female, 34 yr, 61.5 kg, 183 cm.

Variables	Mode											
	Cycling				ElliptiGO				Running			
Intensity	1	2	3	4	1	2	3	4	1	2	3	4
V-Target *(mph)*	11.0	13.0	16.0	18.5	11.0	13.0	16.0	18.5	6.0	6.7	7.5	8.6
V-Actual *(mph)*	11.0	13.1	16.1	17.8	11.4	13.1						
VO_2 *(ml/kg/min)*	18.64	21.06	26.96	31.21	23.04	27.22						
EE -Measured *(Kcal/kg/min)*	0.097	0.110	0.140	0.162	0.120	0.142						
Heart rate *(bpm)*	113	125	151	163	155	162						
METs[a]	5.33	6.02	7.70	8.92	6.58	7.78						
% CHO oxidized	85.25	95.21	100	100	87.47	100						
% fat oxidized	14.75	4.79	0	0	12.53	0						
RPE[b]	2.0	3.0	6.0	8.5	3.5	8.5	10.0	10.0				
WR -Actual *(W/kg)*	0.749	1.130	1.882	2.430	1.469	2.038						
WR -Target *(W/kg)*	0.75	1.10	1.84	2.68	1.36	2.00	3.34	4.86				
EE-Corrected *(Kcal/kg/min)*	0.10	0.11	0.14	0.17	0.12	0.14	0.19	0.25				
% Inc EE-Corr. ElliptiGO vs Bike	20.6%	27.6%	37.8%	45.2%								

[a] multiples of resting energy expenditure. 1 MET = 3.5 ml O_2/kg/min.
[b] RPE = Rating of Perceived Exertion.

END