The Human Performance Research Lab
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***Comparative Heart Rate Reserve Attainment and Skeletal Muscle Activation:***

***Helix Lateral Trainer vs. Precor EFX Elliptical Rider***

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**Abstract**

The purpose of this study was to examine the effects of two competing cardiovascular training machines, the Helix Lateral Trainer and the Precor EFX Elliptical Rider, on heart rate attainment and skeletal muscle activation during comparable aerobic activity.

**Introduction**

Cardiovascular training, also known as aerobic or endurance exercise, is physical activity which increases the participant's breathing and heart rate. Researcher Darren Warburton states that there is "irrefutable evidence of the effectiveness of regular physical activity in the primary and secondary prevention of several chronic diseases"[1]. Health benefits of cardiovascular training include, but are not limited to, weight regulation, the improvement of cardiovascular health, the lowering of blood pressure, the regulation of blood sugar, and the strengthening of the immune system[2]. Established guidelines, first released by the United State Surgeon General in 2008, recommend 150 minutes of cardiovascular activity per week for adults[3]. While jogging, walking and swimming are traditional examples of aerobic activity, cardiovascular training machines are popular alternatives in public gymnasiums and institutional settings as well as in

private homes. Between 2006 and 2013, between 24.51 and 26.69 million Americans participated in some form of home gym exercise[4] (e.g. see fig. 1).

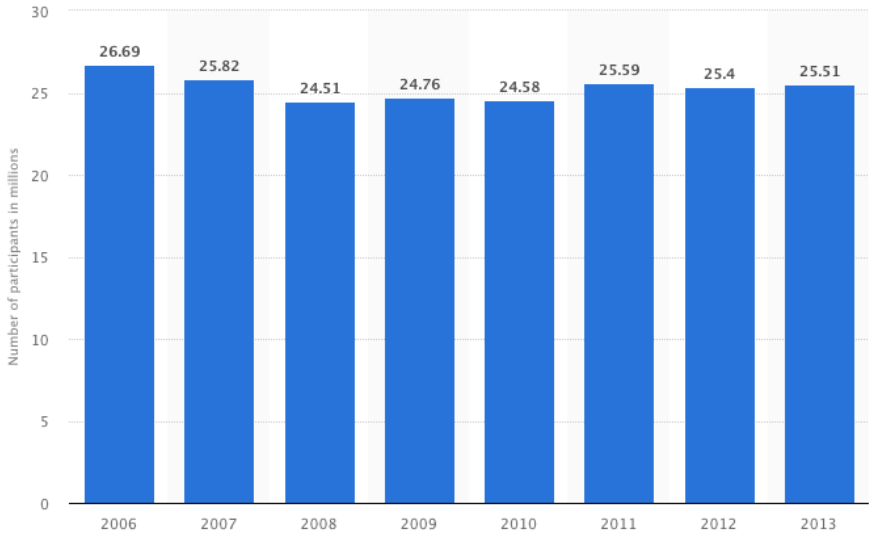



**Fig. 1. Americans 6 and up who participate in some form of home gym exercise (millions)**

The study was undertaken to add to better enable fitness participants to make informed choices regarding their cardiovascular training. Although the recommendations are well-defined and the health benefits undeniable, many Americans cite lack of time as the primary reason for a failure to adhere to weekly cardiovascular activity guidelines. There are many cardiovascular modalities available to Americans, but with limited time for such training, it is desirable for participants to understand the relative effectiveness of the most popular cardiovascular trainers in order to maximize their results and realize optimal health benefits from their training.

**Heart Rate Attainment**

The heart rate level component of the study examined the time it took testing subjects to attain a steady heart rate reserve (HRR) of 65% of maximum. The maximum rate was calculated by subtracting the subject's age from 220, with the corresponding figure equivalent to the maximum number of times per minute that the subject's heart should beat during sustained cardiovascular training.

**Muscles Monitored**

Eight separate muscles and muscle groupings were monitored, including: the Vastus lateralis, Adductors, Gluteus maximus, Gluteus medius, Spinal erectors, Rectus abdominals, Hamstrings, and Obliques. Muscle activation was measured with a Delsys® fully wireless, trigon-electromyography system.

**Goals, Methods and Materials**

The primary objectives were to examine skeletal muscle activation of the outer thighs (vastus lateralis), inner thighs (adductors), gluteus maximus, gluteus medius, spinal erectors, rectus abdominals, and oblique muscles while test subjects performed cardiovascular activity at a level needed to obtain 65 % of the subject's heart rate reserve. An HRR 65% of maximum corresponds to the rate at which exercisers expend the greatest number of fat calories relative to training intensity.[5]

The equipment tested included the Helix 3000 Lateral Trainer by Helix (see Fig. 2) and the EFX Elliptical Rider by Precor. See Fig. 3.


**Fig. 3. The Helix Lateral Trainer**


**Fig. 3 EFX Elliptical Rider by Precor**

Fifteen subjects with a mean age of 20 years, and a mean body fat of 9% participated in the study. Prior to the experiment, subjects were familiarized with both machines, including watching instructional videos. After familiarization, subjects were then asked to randomly participate in five separate conditions on five separate occasions. Conditions one and two consisted of riding the elliptical or the Helix in a neutral position and then at maximal incline or the squat position in order to fully engage gluteal muscles.

In conditions three to five, subjects were asked to ride the Helix using the leg pump motion as defined by the manufacturer's instructional video, starting with the motion with the right leg clockwise (emphasizing an outer thigh motion), or the left leg in a counter clockwise motion (emphasizing an inner thigh motion). Subjects then were asked to adopt the squatting motion defined by the manufacturer's instructional video.

**Targeted Heart Rate Reserve Results**

Test subjects using the Helix Lateral Trainer were able to achieve designated HRR at a rate of 23% faster than test subjects using the elliptical.

**Skeletal Muscle Activation Results**

Test subjects using the Helix Lateral Trainer in what the manufacturer termed the 'neutral' position demonstrated increased muscle activity in five muscle groups as compared to test subjects using the Elliptical in a neutral position. See Table 1.

**Table 1: Percentage of increased muscle activity: Elliptical vs Helix (neutral)**

| Muscle Group | Percentage of increased activation |
|---|---|
| Vastus Lateralis | +50% Helix |
| Gluteus Maximus | +39% Helix |
| Gluteus Medius | +33% Helix |
| Obliques | +55% Helix |

Test subjects using the Elliptical in a neutral position demonstrated increased muscle activity in one muscle group as compared to test subjects using the Helix in a neutral position. See Table 2.

**Table 2: Percentage of increased muscle activity: Elliptical vs. Helix (Neutral)**

| Muscle Group | Percentage of increased activation |
|---|---|
| Hamstring | +66% Elliptical |

Test subjects using the Helix Lateral Trainer in what the manufacturer termed the 'squat' position demonstrated increased muscle activity in two muscle groups as compared to test subjects using the Elliptical in the fully inclined position, see Table 3.

**Table 3: Percentage of increased muscle activity: Elliptical vs. Helix (squat)**

| Muscle Group | Percentage of increased activation |
|---|---|
| Gluteus Maximus | +39% Helix |
| Gluteus Medeus | +33% Helix |

**Summary, Heart Rate Reserve Attainment**

The study set out to measure the comparative cardiovascular benefit between two widely available cardiovascular trainers, focusing on the time research subjects took to achieve a target steady heart rate reserve (HRR) of 65%. Results found that the Helix Lateral Trainer users achieved an HRR of 65%, a full 23% faster than elliptical users, translating to more time spent expending fat calories in equivalently timed workouts.

**Summary Muscle Activation Results:**

Researchers also studied the comparative effectiveness on muscle activation during exertion for two widely available cardiovascular trainers.

Test subjects used the Elliptical Rider in a neutral position and the Helix Lateral Trainer in a neutral position. Researchers found that the Helix Lateral Trainer had superior results in 7 of 8 muscles tested. The Helix Lateral Trainer test subjects demonstrated greater electrical activity (a marker indicating muscle involvement) as follows: vastus lateralis 50% greater (see Table 4), the obliques 55% greater (see Table 5), and adductors 37% greater (see Table 6) compared to the Elliptical. Additional increased muscle activity was seen in the Helix Lateral Trainer test subjects for the spinal erectors (see Table 7), and the abdominals (see Table 8).

**Table 4: Vastus Lateralis: Helix Lateral Trainer vs. Elliptical neutral**

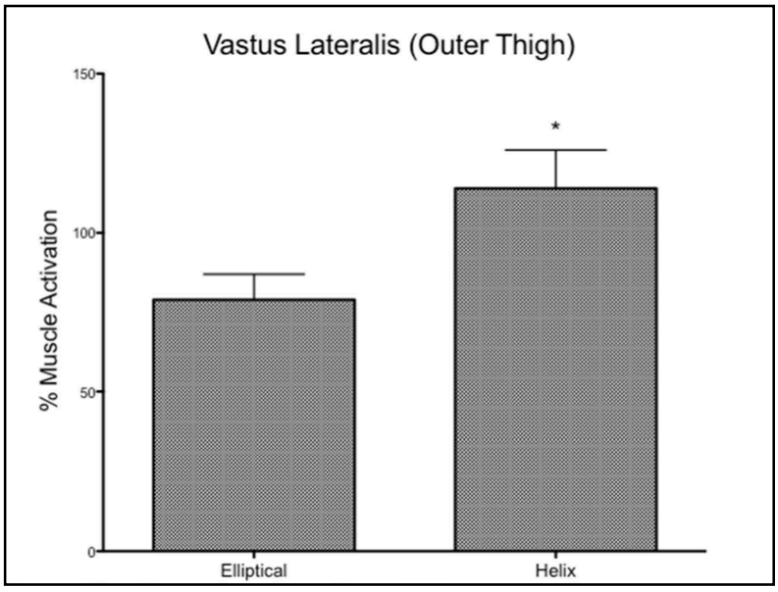


**Table 5: Obliques: Helix Lateral Trainer vs. Elliptical neutral**

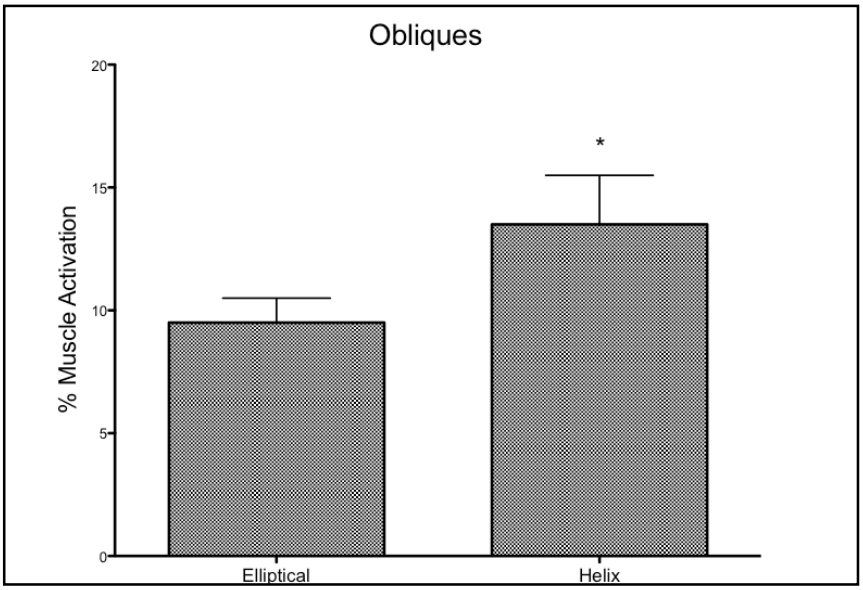



**Table 6: Adductors: Helix Lateral Trainer vs. Elliptical neutral**

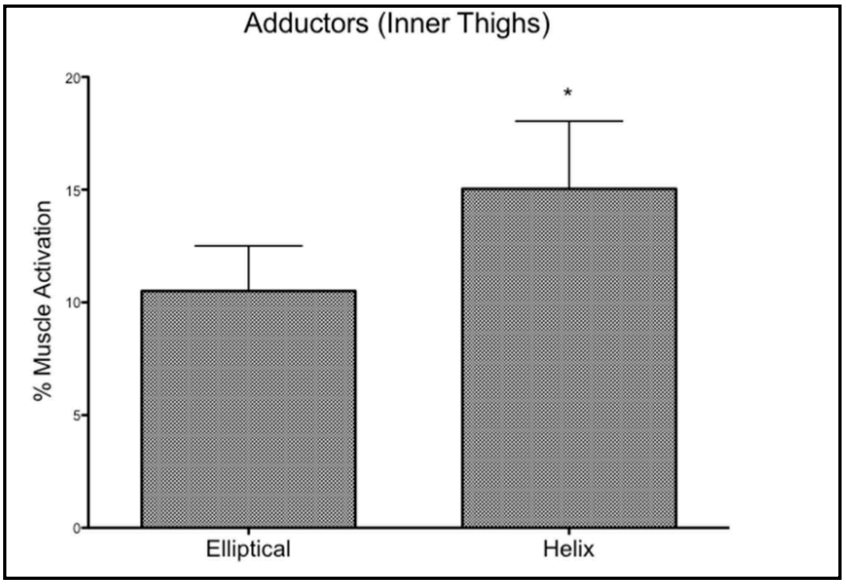


**Table 7: Spinal Erectors: Helix Lateral Trainer vs. Elliptical neutral**

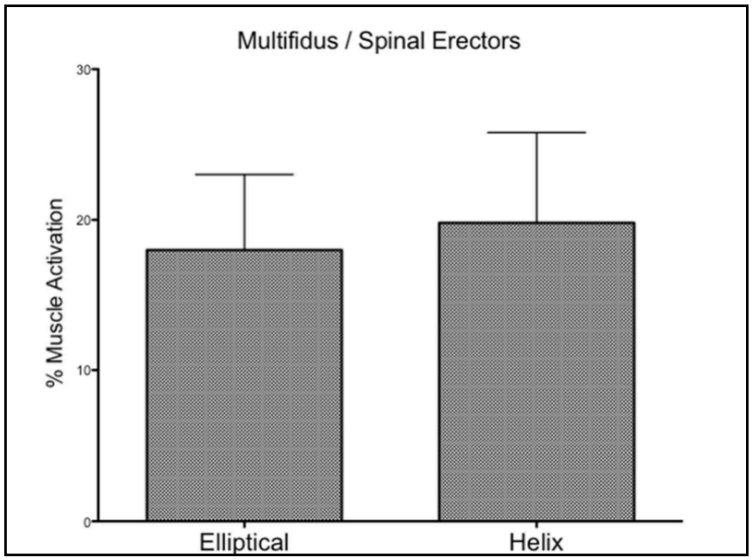
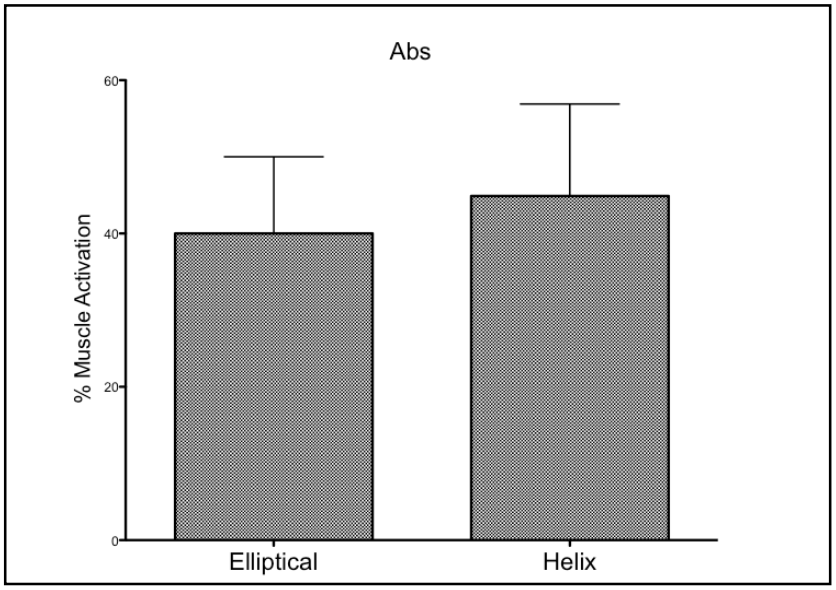
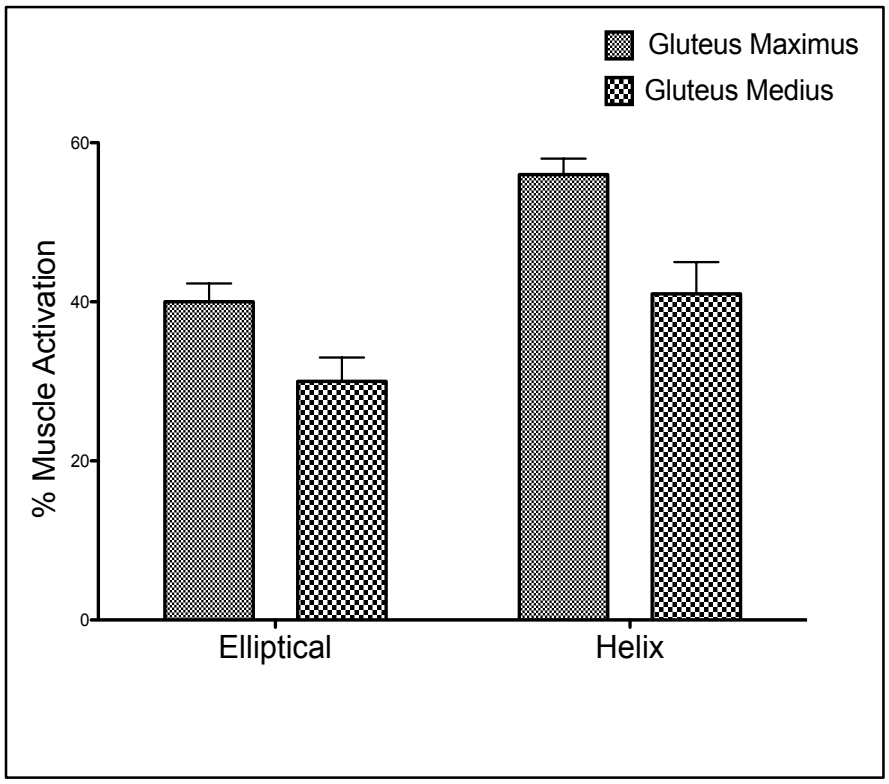



**Table 8: Spinal Erectors: Helix Lateral Trainer vs. Elliptical neutral**



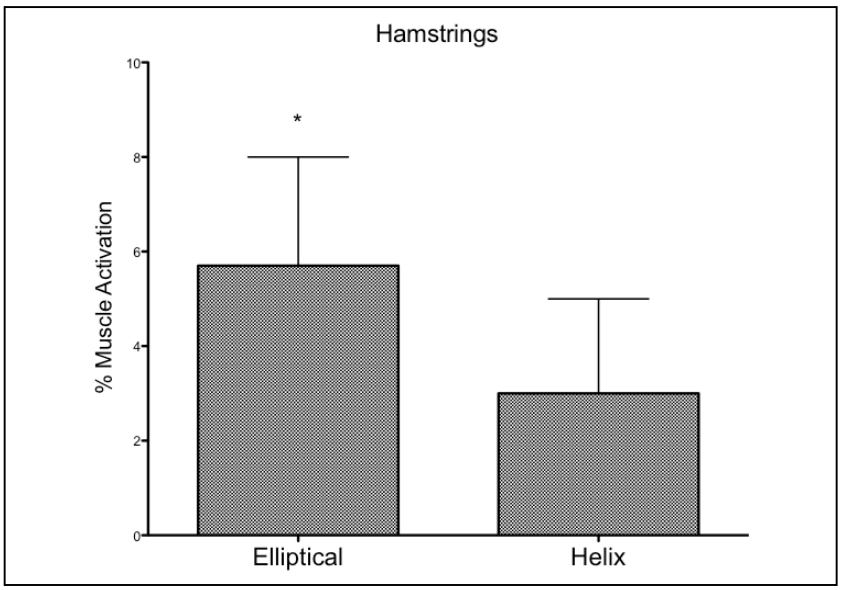
When comparing the Helix Lateral Trainer in a squatting position with the Elliptical Rider at a full incline, researchers noted 39% more activity in the gluteus maximus and 33% in the gluteus medeus with the Helix Lateral Trainer. See Table 9.

**Table 9: Gluteus: Helix Lateral Trainer vs. Elliptical squat/full incline**




Muscle activation in the Elliptical test subjects was found to be greater in the hamstrings than in the Helix Lateral Trainer when both machines were used in a neutral position. See Table 10.

**Table 10, Hamstring: Helix Lateral Trainer vs. Elliptical neutral position**




**Conclusions:**

The purpose of the study was to analyze the relative benefits of exercising on two widely available cardiovacular trainers. The Helix Lateral Trainer outperformed the Elliptical in nearly all tested categories and conditions. A notable benefit to the Helix Lateral Trainer was the test subjects' speedier attainment of targeted 'fat burning' heartrates. It can be conferred that users who achieve targeted heart rates earlier will expend more calories during their workout activity, thus aiding in weight maintenance and control.

The Helix Lateral Trainer test subjects demonstrated markedly increased muscle activation in seven of the eight muscles tested in the study. Increased muscle activation confers

beneficial results to exercisers via increased calorie burn and its subsequent aid in weight loss and maintenance. Additionally, regular use of cardiovascular trainers that better target and strengthen muscles can lead to desired benefits such as boosted metabolism and injury prevention. For example, the 33% increased activity in the Gluteus Medeus seen in test subjects using the Helix Lateral Trainer would, over time, serve to strengthen muscular support system for the knee and hip joints.

Researchers concluded that cardiovascular training on the Helix Lateral Trainer was more beneficial than cardiovascular training on the Precor EFX Elliptical Rider.

**Endnotes:**

**Contributors:** Jacob M. Wilson was responsible for the conception and execution of the study. Lisey Bennett Good provided assistance with the writing of the paper.

**Competing interests:** This study was funded by Helix Co.

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[5]Carey, DG, "Quantifying differences in the fat burning zone and the aerobic zone: implications for training," *Journal of Strength and Conditioning Research* (2009)

**Author Information**

Jacob M. Wilson, Ph.D.

**Education:**

2004 California State University, B.S.

2006 California State University, M.S.

2010 Florida State University, Ph.D.

**Career specialties:**

Dr. Wilson's specialization is on the effects of amino acids, their metabolites and resistance training on skeletal muscle tissue morphology (hypertrophy and sarcopenia), adipose tissue, strength, and function in young and aging populations.

**Honors and awards:**

2009 Sandals Research Fellowship, Florida State University

2008 Research and Creativity Award, College of Human Sciences, Florida State University for "The Effects of Static Stretching on Energy Cost and Endurance Performance during a 60-minute Time Trial"

2006-2008 College of Human Sciences Doctoral Research Fellowship

2006 Attained Certified Strength and Conditioning Specialist certification, National Strength and Conditioning Association