

COMPARISON OF A HYDRAULIC RESISTANCE TRAINING SYSTEM AND TYPICAL STRENGTH AND CARDIOVASCULAR PROTOCOLS IN MEN

Paul H. Falcone, Laura R. Carson, Chih-Yin Tai, Michael P. Kim, Jordan R. Moon

Presented By : Paul Falcone - paul@musclepharm.com - MusclePharm Sports Science Research Institute

ABSTRACT

Many innovative exercise devices are emerging from the traditional treadmill, bike, and weights. Some systems, such as a hydraulic resistance platform (HRP), strive to provide a cardiovascular benefit while adhering to a resistance exercise protocol. It is important to determine if these types of devices can provide the same cardiovascular benefit or caloric expenditure as traditional workouts. **PURPOSE:** The purpose of this investigation is to determine the caloric expenditure and anaerobic demand during a typical 30 minute workout using the HRP compared to a standard strength training session and typical cardiovascular training sessions lasting around 30 minutes. **METHODS:** This study followed a repeated measures design and consisted of 11 physically active men (30 +/- 4yrs; 66.5 +/- 2in; 137.5 +/- 13.5lbs.) Every participant completed four separate exercise protocols at least 48 hours apart. Each protocol lasted 30 minutes and were performed in the following order: treadmill, elliptical, HRP, and weights. Subjects completed a choice reaction time protocol as a warm up and cool down using two reaction time devices. The metabolic data were captured by a portable metabolic cart. The outcomes of interest were the rate of perceived exertion, heart rate, grams of carbohydrates and fat burned per minute, and total calories burned per minute. **RESULTS:** Regarding rate of perceived exertion, HRP (16.3 +/- 1.3) was significantly ($p < 0.05$) higher than treadmill (11.4 +/- 1.0), elliptical (11.5 +/- 1.2) and weights (13.1 +/- 2.3). Heart rate was significantly ($p < 0.05$) higher in HRP (136.8 +/- 15.5 bpm) than weights (107.5 +/- 18.3 bpm), but not significantly different compared to treadmill (132.6 +/- 5.1 bpm) or elliptical (132.2 +/- 4.4 bpm). The average grams of carbohydrate burned were significantly ($p < 0.05$) higher in HRP (1.7 +/- 0.4 g/min), compared to treadmill (1.2 +/- 0.3 g/min) and weights (1.0 +/- 0.3 g/min), but not significantly different than elliptical (1.3 +/- 0.3 g/min). The grams of fat burned per minute were significantly ($p < 0.05$) higher in HRP (0.09 +/- 0.03 g/min) than weights (0.02 +/- 0.01 g/min), but were significantly ($p < 0.05$) lower compared to treadmill (0.3 +/- 0.1 g/min), elliptical (0.3 +/- 0.1 g/min). Total calories burned per minute were significantly ($p < 0.05$) higher in HRP (7.6 +/- 1.4 kcal/min) than weights (4.3 +/- 1.2 kcal/min), but not significantly different compared to treadmill (7.5 +/- 0.8 kcal/min) and elliptical (7.9 +/- 0.8 kcal/min). **CONCLUSIONS:** Though the rate of perceived exertion was increased using an HRP, heart rate, grams of carbohydrates, grams of fat and total calories were not significantly different compared to running or elliptical training lasting around 30 minutes. **PRACTICAL APPLICATIONS:** An exercise protocol using a hydraulic resistance system may provide cardiovascular benefits similar to a typical cardio workout, as well as the skeletal and muscular benefits of a typical weight training protocol.

INTRODUCTION

The obesity rates in our society are staggering. Almost 41 million women and more than 37 million men aged 20 and over were obese in 2007-2008¹. Among children and adolescents aged 2-19, more than 5 million girls and approximately 7 million boys were obese¹. Since the development of many chronic diseases has been linked with obesity and physical inactivity², many organizations are increasingly promoting exercise interventions for public health³. However, many individuals do not have a lot of time to spend at the gym. Therefore, there has been a focus on finding exercises or exercise devices that can provide more exercise benefits in less time⁴.

Exercise is often categorized as either cardiovascular exercise or resistance exercise. Both are beneficial and each challenges the body in a specific way. Most training regimens will involve both types of training; however, some exercise devices strive to develop a platform which can provide both types of exercise simultaneously. One such device is the hydraulic resistance platform (HRP). Hydraulic resistance platforms use gravity-free hydraulics, not weights, to create resistance. This is called Omnikinetic Resistance (OMKR). No gravity means no external loading on joints, muscles, and connective tissue, such that an individual can train aggressively without fear of injury. Hydraulic resistance requires a two-way, "push / pull" dynamic vs. the "push and resist" of typical weight-bearing exercise. By combining this device with high intensity interval training protocols, one can effectively train the cardiovascular system while exercising muscles.

Therefore, the purpose of this investigation was to determine the caloric expenditure and anaerobic demand during a typical 30 minute workout using the HRP compared to a standard strength training session and typical cardiovascular training sessions lasting around 30 minutes.

METHODS

Exercise protocols

4 Repeated Measurements at least 48 hours apart

- 30 minute treadmill running (Woodway USA, Inc., Waukesha, WI) at 70% max heart rate (Moderate as described by the ACSM)
- 30 minute bicycle (Nordic Company Inc., Boston, MA) at comfortable RPM at a resistance relative to 70% max heart rate (Moderate as described by the ACSM)
- 32 minute HRP protocol (Surge Performance Training Inc., Austin TX)
 - 4 sets per exercise; 20 seconds work, 40 seconds recovery
- 30 minute standard lifting session (Keiser Inc., Fresno, CA)
 - 3 sets per exercise with 60 seconds recovery



Hydraulic Resistance Platform Protocol

- Chest Press-Push/Pull -Bilateral
- Circles inside
- Circles outside
- 360 Twist
- Fly's -Two handed
- Bent over Shoulder Press/Pull
- Torso Rotation
- Power X



Lifting Protocol

- Performed to failure at 70% 1RM (Goal of 8-12 reps)
- Squat
 - Chest Press
 - Leg Extension
 - Shoulder Press
 - Leg Curl
 - Seated Row



Portable Metabolic Cart

The device used to measure indirect calorimetry and pulmonary gas exchange was the Cosmed Pulmonary Function Equipment K4B² unit (Rome, Italy.) Prior to arrival of subjects, 4 calibrations were performed (gas, flow, delay, and room air) to ensure accurate measurements. Upon arrival, the device was placed snugly on the subjects, along with a heart rate monitor (Polar Electro Inc., Lake Success, NY). The primary variables measured were VO₂, VCO₂, heart rate, and respiratory exchange ratio. The device collected data for 5 minutes before exercise, during the 30 minute exercise bout, and then after exercise until heart rate fell to resting levels in order to obtain resting, exercise and excess post-exercise oxygen consumption values, respectively.

K4 b²

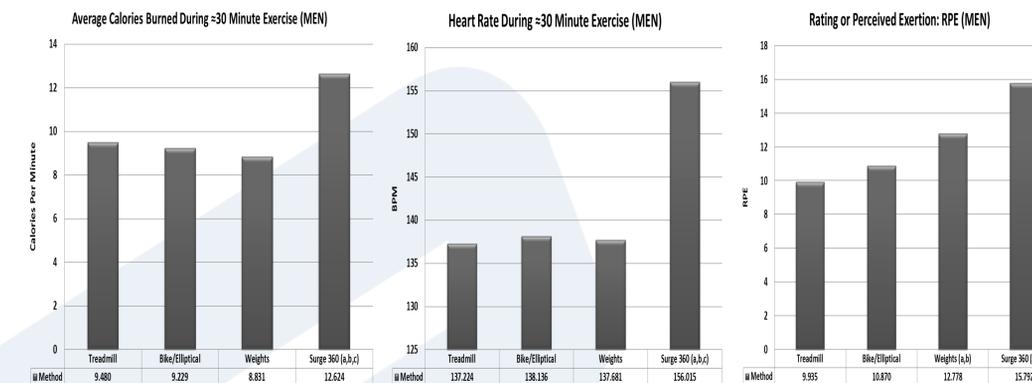


Subject Characteristics

	n	Age (yrs)	Height (in)	Weight (lbs)
Men	9	25 (7)	71.5 (3)	191 (16.5)

RESULTS

	n	BMI	Training Days/Week	Training Hours/Day
Men	9	23.79 (2.92)	6 (1)	2 (1)



Sig Different from Treadmill: a
Sig Different from Bike: b
Sig Different from Weights: c

Sig Different from Treadmill: a
Sig Different from Bike: b
Sig Different from Weights: c

Sig Different from Treadmill: a
Sig Different from Bike: b
Sig Different from Weights: c

CONCLUSIONS

Subjects burned significantly more calories during a 32 minute HRP exercise compared to typical cardiovascular machines and a lifting session lasting a similar amount of time. Heart rate was significantly increased while exercising on an HRP compared to typical cardiovascular machines and a lifting session. Subjects felt they were working harder (RPE) during the HRP protocol compared to typical cardiovascular machines and a lifting session.

PRACTICAL APPLICATIONS

Considering that the HRP protocol only has 10.6 minutes of actual "work," subjects essentially burned twice as many calories in half the time compared to cardiovascular machines. This finding has important implications, considering that individuals desire to spend less time exercising but want to obtain similar or increased benefits. Future studies can investigate the long term use of an HRP compared to typical cardiovascular machines or lifting protocols to determine if the increased calories burned per session would result in faster improvement in cardiorespiratory fitness as well as body composition, muscular strength and other health parameters.

ACKNOWLEDGEMENTS

This study was funded by MusclePharm, Inc. (Denver, CO) and Surge Performance Training Inc. (Austin, TX)



REFERENCES

- Flegal KM, Carroll MD, Ogden CL, Curtin LR. Prevalence and trends in obesity among US adults, 1999-2008. *JAMA* 303(3):235-41. 2010.
- Booth FW, Chakravarthy MV, Gordon SE, Spangenburg EE. Waging war on physical inactivity: using modern molecular ammunition against an ancient enemy. *J Appl Physiol*. 2002 Jul;93(1):3-30.
- Pate RR, Pratt M, Blair SN, et al. Physical activity and public health: a recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *JAMA*. 1995; 273: 402-407.
- Klika B, Jordan C. High-Intensity Circuit Training Using Body Weight: Maximum Results with Minimal Investment. *Health & Fitness Journal*. May 2013. Accessed May 29, 2013.