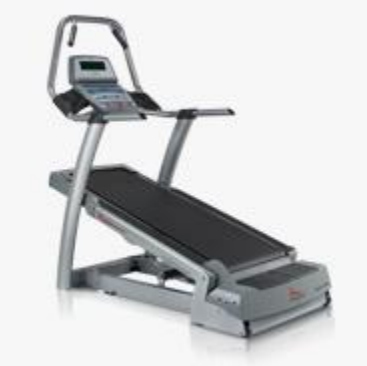
RACE Rx
Academy of Exercise Sciences

Exercise Benefits of Incline Training

Applying Exercise Science to Enhance Training Effectiveness on the FreeMotion Fitness™ Incline Trainer



Exercise Benefits of Incline Training

Applying Exercise Science to Enhance Training Effectiveness on the FreeMotion Fitness™ Incline Trainer

Bioenergetics: The Key to Unlocking Maximally Effective Training

The human body functions through the creation of energy in 3 primary energy systems. Each system utilizes different energy substrates, produces energy at different rates, and enables different physical activities. All three systems (ATP-PCr, Glycolytic, and Oxidative) function at the same time; however, the predominant energy system at work is dependent on the rate, or speed, of the activity. An understanding of energy production can be valuable information for exercise professionals in their attempts to prescribe effective, efficient, and specific training programs.

Most people report that weight loss and increased cardiovascular fitness are their principle goals when beginning an exercise program. Increased muscular fitness and appearance are also high on the list of goals. For the working professional, the over-extended, or the individual not wanting to spend hours and hours at the gym, the search for optimal exercise training is of preeminent importance. This search begins with bioenergetics and, as you will see, ends with incline training on the FreeMotion Fitness® Incline Trainer®.

In order to enhance cardiovascular fitness, the lungs, heart, blood vessels, muscle tissue, mitochondria, and the oxidative energy system must be stressed. This stress, often measured by heart rate, results in improved function by some or all of the physiological components involved. Research has shown that exercise intensities at or above 75% of age-predicted maximal heart rate are needed to stimulate significant improvements in aerobic fitness. Generally, exercisers must speed up their movement pace in order to elicit such a large increase in heart rate. This increase in speed may increase risk of injury and, as seen below, actually decreases the amount of fat utilized during exercise.

The oxidative energy system is the only system capable of utilizing large amounts of fat for energy. In order to function as the predominant source of energy, the oxidative system requires that exercise be performed at a relatively slow pace. This is a result of the many enzyme reactions needed to transform fat tissue into a usable form. While a person is walking, the oxidative system is able to provide the majority of energy, resulting in fat being utilized to fuel. As an individual begins to run, caloric expenditure increases due to greater amounts of muscle tissue activated in order to propel the body at a faster speed; however, the rate of movement requires a gradual shift from reliance on aerobic energy production to greater and greater reliance on anaerobic energy production. Running at faster speeds results in a larger number of calories being burned but those calories are predominantly from

carbohydrate stores rather than stored fat. In order to burn larger amounts of fat, the amount of muscle tissue activated must be increased while maintaining a slower pace of movement.

Enter incline training!

Examining Physiological Changes during Treadmill Exercise

Recent research conducted under the direction of Dr. Matthew Rhea, Director of the RACE Rx Academy of Exercise Sciences, demonstrates the changes that occur when an individual exercises at different speeds and inclines on the Incline Trainer® (Model FMTK7256P). This research used exercise science tools to measure changes in heart rate, oxygen consumption, caloric expenditure, and muscle activation under different exercise conditions. Among a group of 30 year old adults, walking at 3 mph with 12% incline resulted in the same heart rate at running at 6 mph on flat surface. The slower speed can be beneficial to reduce risk of injury during treadmill exercise while still obtaining the needed cardiovascular benefits.

EMG measures, which identify the amount of muscle tissue activation, demonstrated important changes with the use of incline as well. At 0% incline, only about 20% of muscle tissue was activated in the legs. As incline was increased, muscle activity in the calf, hamstring, and gluteus increased. At inclines above 15%, muscle tissue activation in the legs approached and exceeded 75% of maximal isometric contraction.

Perhaps the most significant finding of this research was the change in fat utilization at slow speeds and high inclines. With increased muscle activation at higher speeds and inclines, calorie expenditure increases. If only speed is used to increased energy demand, the body must use more and more carbohydrates as fuel because fat utilization takes too long. However, with the use of incline to increase demand while keeping the speed at 2-3 mph, physiological measures and calculations such as oxygen consumption and respiratory exchange ration demonstrated that fat utilization increases dramatically. It was hypothesized that the slower speeds allowed the processes involved in fat utilization to keep up with the energy demand. At 2 mph and 16% incline, over 6 calories per minute from fat were utilized. This was compared to less than 2 calories per minute from fat used at 6 mph and 0% incline.

These data demonstrate the increased physiological demands while walking or running at an incline and present several useful applications of incline training. Individuals seeking increases in muscular fitness, cardiovascular fitness, and weight loss can effectively use incline to enhance the effectiveness of treadmill training. The most apparent benefits in these areas occur at inclines above 10%. The FreeMotion Incline Trainer offers a unique treadmill experience with incline and speed ranges exceeding those of traditional treadmills.

Incline / Speed	0%	3%	6%	9%	12%	15%	18%	21%	24%	27%	30%
2mph	100	106	110	118	126	132	139	146	155	167	180
3mph	104	112	123	134	150	166	176	186	193		
4mph	119	130	141	157	169	183	196				
5mph	140	150	169	181	194						
6mph	152	173	187	196							
7mph	170	186	195								
8mph	182	196									
9mph	195										

Table: Changes in Heart Rate.

Incline / Speed	0%	3%	6%	9%	12%	15%	18%	21%	24%	27%	30%
2mph	1.9	2.9	4.5	5.6	5.2	5.3	5.7	6.5	5.8	2.3	0
3mph	2.2	2.6	2.9	3.6	2.6	3.2	4.1	4.6	2.3		
4mph	3.0	4.3	3.1	3.8	4.6	2.4	2.7				
5mph	2.9	1.9	2.1	2.9	0						
6mph	1.9	2.5	0	0							
7mph	0	0	0								
8mph	0	0									
9mph	0										

Table: Changes in Fat Utilization (Kcal/min).

Incline / Speed	0%	3%	6%	9%	12%	15%	18%	21%	24%	27%	30%
3mph	8%	23%	31%	46%	62%	69%	77%	85%	85%	100%	100%

Table: Changes in Gluteus Activation.

Incline / Speed	0%	3%	6%	9%	12%	15%	18%	21%	24%	27%	30%
3mph	18%	18%	27%	36%	36%	55%	64%	64%	73%	73%	73%

Table: Changes in Hamstring Activation.

Incline / Speed	0%	3%	6%	9%	12%	15%	18%	21%	24%	27%	30%
3mph	40%	40%	50%	50%	60%	60%	80%	80%	80%	80%	90%

Table: Changes in Gastrocnemius Activation.

Demonstrated Benefits of Incline Training

This research, along with principles of exercise bioenergetics, demonstrates valuable benefits of incline training:

- *Increased heart rate and cardiovascular demand without increasing speed to high levels enabling exercisers to increase cardiovascular fitness without increasing risk of treadmill injury.*
- *Increased muscular demands of walking and running enabling a muscular fitness workout during cardiovascular exercise.*
- *Increased ability to burn fat through increased muscular activity at a slower speeds accelerating weight loss.*

Disclaimer

These data may only be attributed to the product brand and model utilized in testing and may not be referred to, nor attributed to any other product or brand. No portion of this report can be utilized, printed, or disseminated without written consent of RACE Rx, LLC. This report may not be altered in any way.