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## The Effectiveness of an 8-week High Speed Treadmill Training Program on High School Athletes.

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### Abstract

Since the mid 1980's, high speed treadmills have been steadily gaining popularity as a tool for increasing running speed for speed and power sports (i.e. football, soccer, basketball, etc.). It has been used in a variety of settings with mixed results. This study looked at integrating the technology of the high speed treadmill into an established strength and conditioning program. A group of 29 high school athletes (28 male and 1 female) between the ages of 14 and 17 (mean=16.1) participated in an 8 week summer strength and conditioning program which consisted of linear speed, lateral speed and agility, strength training, and the EXSpeed™ Pro treadmill program. Mean improvements in performance were .17s in 10-yd dash, .15s in 40-yd dash, and 1.5 in. in Vertical Jump scores respectively. The study shows that the EXSpeed™ Pro high speed treadmill training program when performed on a treadmill with elevations up to 25% is an effective tool for speed training when properly integrated into a successful strength and conditioning program.

### Background

Since the mid 1980's, high speed treadmills have been steadily gaining popularity as a tool for increasing running speed for speed and power sports (i.e. football, soccer, basketball, etc.). It has been used in a variety of settings with mixed results. Oftentimes, it has used as the sole means of speed training in small private settings where the technology is the main driver for training, rather than focusing on the integrating the technology as a tool in the athlete's overall strength and conditioning program.

If we break speed down into its various segments, there has been a multitude of research to support the use of the high speed treadmill as an effective speed training modality. Increased stride length is a product of power development and speed strength (1). Research has shown that running uphill on a treadmill will increase the muscle activity of the quads, glutes, and posterior muscles of the calf (12, 17, 21, 23). These are the muscles primarily responsible for power development and movement of the body (5). This increase of up to 75% in propulsive forces takes place with no impact, making it not only an effective tool, but a very safe training method (8).

Stride frequency is improved by forcing the leg to get through the leg cycle at a faster rate (3), typically performed with overspeed training. Decreasing the time spent in the flight phase of running will dramatically improve stride frequency. Caldwell and Swanson proved that running at high speeds at elevation force the body to spend and increased amount of time in the stance phase of running, thus decreasing recovery time (23). This is especially true when spotting the athlete at speeds which are higher than they are accustomed to running. It is understood that overspeed training is largely a neuromuscular response. Thus, initial improvements are rather temporary, but once the movement is performed repeatedly for 2-5 weeks, more permanent muscular changes will take place (9, 14).

Other positive effects of treadmill running include improved mechanics (16) and a great deal of metabolic improvements in anaerobic conditioning (10, 13, 18, 19).

### Methods

A group of 29 high school athletes (28 male and 1 female) between the ages of 14 and 17 (mean=16.1) participated in an 8 week summer strength and conditioning program. The program consisted of linear speed, lateral speed and agility, and strength training.

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Athletes were tested upon initiating the 8 week program on 10 yard dash, 40 yard dash, and Vertical Jump. Sprint times were collected using a Speed Trap® electronic timing system and the Vertical Jump was performed on a Vertec® measuring system. Both systems were properly calibrated and checked for accuracy prior to testing.

Linear speed training was performed two days per week with one workout performed on a high speed treadmill (Woodway Desmo; 0-18.0 mph; 0-25% elevation) utilizing the EXSpeed™ Pro treadmill workouts by Maximum Training Solutions, LLC. EXSpeed™ Pro is a treadmill training system which prescribes semi-customized workouts for multiple athletes for speed and power development. These workouts consist of multiple runs of varying speeds (3.0-18.0 mph) and elevations (0-25%) during each workout. Specific volumes and intensities were prescribed for each athlete during the initial evaluation upon entering the EXSpeed™ Pro system. The coaches performing the treadmill workouts were trained on proper implementation of the EXSpeed™ Pro system. Proper spotting was performed by the trained coach to ensure quality overspeed training and guarantee safety.

The ground based workouts were prescribed by the coach on site and consisted of traditional speed training programming, including acceleration drills, sprints of varying distances (10-60yds), and towing drills. The ground based speed workout also included drills to improve lateral speed and agility. Both speed training workouts included a dynamic warmup and sprint mechanics drills (i.e. A skips, High Knees, Butt Kicks, Leg Cycles, etc.).

Strength training workouts were performed 3 days per week. They consisted of High Intensity Training (HIT) for the total body. These workouts consisted of 2 sets, each performed to failure, on 8-12 exercises.

At the end of the 8 week training session, all of the athletes were re-tested on the same parameters as in their initial test (10 yard dash, 40 yard dash, Vertical Jump) to assess their progress.

## **Results**

Mean scores for the initial test were as follows: 10 yard dash=1.92s (range=1.72s-2.2s); 40 yard dash=5.44s (range=4.88s-6.36s); and Vertical Jump=24.2in. (range=16.5in.-30.5in.).

Mean scores for the post test were as follows: 10 yard dash=1.75s (range=1.53s-2.03s); 40 yard dash=5.29s (range=4.69-6.16); and Vertical Jump=25.7in. (range=17in.-31in.).

Mean improvements during the program were as follows: 10 yard dash=.17s (range=0.00s-0.29s); 40 yard dash=.15s (range=(-)0.29s-0.44s); and Vertical Jump=1.5in. (range=(-)1.0in.-5.5in.).

## **Discussion**

While high speed treadmill training has been widely accepted to be an effective means of speed training, it has historically been performed on a treadmill with much larger capabilities (0-40% elevation and 0-30 mph) than used here. The current study looked at the effectiveness of a treadmill training system which was performed on a treadmill with much smaller capabilities (0-25% elevation and 0-18 mph).

Much of the traditional tools of treadmill training have been narrowly focused on isolated 6 week programs just focused on speed development with little focus on the development of the entire athlete. This study looked at the integration of the high speed treadmill program into an established total strength and conditioning program. The program was highly successful due to the well-rounded nature of the overall program and seamless integration into the previously established program. The transition was easy as the speed training system prescribes specific high speed treadmill training programming, while allowing the coach to perform their own speed training techniques through their ground based workouts to fit the needs of their athletes and take full advantage of their specific facilities. The semi-customized individual programming component of the EXSpeed™ Pro system was also a positive contributing factor for the success of the speed training program.

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This study is also unique in that it was performed by novice coaches who had no experience with treadmill training prior to the study. So, not only does it show the effectiveness of the speed training program, but it shows the ability for multiple coaches and trainers to bring the EXSpeed™ Pro system into their facilities as an excellent tool for their speed training needs.

The pretest scores show a broad spectrum of athletes of ages and abilities upon entering the program which demonstrates a quality cross-section of athletes which participated in the study. The EXSpeed™ Pro system is most effective for speed and power sports, including football, basketball, soccer, baseball, softball, field hockey, lacrosse, volleyball, sprint events, and combine preparation. This is due the anaerobic nature of the interval training and power development that is created by the high speed running at very high elevations.

It is notable that the 10 yard dash times were significant improvements. Typically, a 0.10s improvement over 10 yards is considered a success. This improvement is most likely due to the increased power development created by the running at elevations. This is further exemplified by the impressive improvements in vertical jump. The power development can be almost completely attributed to the treadmill training as there was very little explosive training that was performed within their strength workouts. By definition, HIT training does not include traditional means of power development (i.e. Olympic movements, plyometrics, etc.). Thus, the majority of their explosive training took place during their sprint workouts.

It is also interesting that within this study, the improvements in speed were made in their first 10 yards. This is interesting due to the fact that many opponents of treadmill training cite that it is merely training the athlete's ability to run at top speeds. This study shows that due to the power development created during sprinting at high speeds and elevations on the treadmill have significant effects on the athlete's ability to accelerate quickly during sport. This is most likely due to the increase in motor unit recruitment patterns of the propulsive muscles of the lower extremity.

The most impressive improvement during the program was that of a 17 year old male football player who's sprint times improved from a 1.75s 10 yard dash to a 1.53s and 40 yard dash times that included a 5.11s on his pre-test and a 4.69s post-test. It is oftentimes quite difficult to see large improvements of this nature in high school athletes who start in the low 5.00s range. This athlete responded very well to the training stimulus and demonstrating an improvement of 0.42s.

## **Conclusion**

The EXSpeed™ Pro high speed treadmill training program when performed on a Woodway treadmill with elevations up to 25% is an effective tool for speed training when properly integrated into a successful strength and conditioning program. This study shows a lot of promise for high speed treadmill training as it was performed on a quality cross-section of high school athletes and was performed by a novice coach with great results and no safety concerns, thus making this system easily used in a variety of areas and settings in the area of sports performance enhancement.

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