Journal of Strength and Conditioning Research, 1996, 10(2), 120-123

Effects of Training in Strength Shoes on 40-Yard Dash Time, Jumping Ability, and Calf Girth

John P. Porcari, Scott M. Pethan, Kevin Ward, Dennis Fater, and Larry Terry

La Crosse Exercise and Health Program, University of Wisconsin–La Crosse, La Crosse, Wisconsin 54601.

Reference Data

Porcari, J.P., S.M. Pethan, K. Ward, D. Fater, and L. Terry. Effects of training in Strength Shoes on 40-yard dash time, jumping ability, and calf girth. *J. Strength and Cond. Res. 10(2):120-123. 1996.*

ABSTRACT

This study was done to determine the effectiveness of training in Strength Shoes. Seventy-two college-age men were randomized into either a control group (CG), a Strength Shoe group (SSG), or a regular shoe group (RSG). SSG and RSG trained 3 times a week for 10 weeks and followed identical programs as prescribed by the manufacturer. SSG wore the Strength Shoe while RSG wore their own shoes. All subjects were pre- and posttested for 40-yd dash time, vertical jump, standing broad jump, and right and left calf girth. Of the 72 subjects, 52 completed the study: 22 CG, 14 SSG, and 16 RSG. Seven SSG and 1 RSG dropped out due to injury. Repeated measures ANOVA revealed that SSG had significant increases in girth, but these changes were not significantly different from either CG or RSG. There were no within- or between-group differences for the other variables as a result of training. These results indicate there was a tendency for the type of training used in the present study to improve performance; however, these improvements were independent of the type of shoe worn in training. Additionally, undergoing this type of training in Strength Shoes resulted in an increased rate of injury compared to training in regular athletic shoes.

Key Words: plyometrics, speed, vertical jump, broad jump

Introduction

Sprinting speed and jumping ability are fundamental to almost every sport, and many training programs and devices have been developed to improve one's ability to run faster and jump higher. A relatively new product that is advertised to increase sprinting speed and jumping ability is the Strength Shoe. It is designed to overload the posterior muscles of the leg and the Achilles tendon. The manufacturer (Strength® Footwear, Inc., Metairie, LA) states that in regular shoes, 70% of the body weight is supported by the heel and 30% by the calf. Strength Shoes elevate the heel so that all of the body weight is supported by the calf muscles. The overload on the calf muscles and Achilles tendon unit is purported to result in substantial increases in sprinting speed, jumping ability, and hypertrophy of the calf muscles.

Strength Footwear, Inc., the manufacturer, has made specific claims as to the effectiveness of the shoes. The company claims that by training in the Strength Shoe, an athlete can expect to see a reduction of up to 0.20 sec in 40-yd dash time and increases of 5 to 9 in. in the vertical jump and up to 2 in. in calf girth. These claims have never been independently tested. Further, while the overload to the calf musculature may have beneficial training effects, when combined with the plyometric nature of the recommended training program this overload may increase the potential for injury.

Therefore this study had a twofold purpose: (a) to test the effectiveness of the Strength Shoe against the company's claims and (b) to investigate the injury rate associated with training in Strength Shoes.

Methods

Subjects

Seventy-two college men (M age $\pm$ SD = 20.7 $\pm$ 2.65 yrs) provided written informed consent to participate in this study. None were involved in any college sports or weight training for the lower extremities at the start of the investigation. They were randomly assigned to a control group (n = 24), Strength Shoe group (SSG, n = 24), or regular shoe group (RSG, n = 24). The controls completed pre- and posttesting only and were instructed not to alter their activity patterns between testing sessions. The training groups followed an identical 10-week program as described by the manufacturer (see Table 1). SSG wore new Strength Shoes during training. RSG wore their own athletic shoes and there were no restrictions on the type or age of those shoes.

Testing

Before and after the training period all subjects were evaluated for right and left calf girth, 40-yd dash time, standing broad jump distance, and vertical jump height. Pre- and posttesting were conducted by the same testers at the same time of day and followed the same order for all subjects. Total test time took approximately 1 hour, with 15 min allowed between each testing station. Three days elapsed between the last training session and posttesting.

Table 1
Training Protocols

Drill	Distance/ time	Reps	Rest (sec)
Progressions	50 yds	5	40
High knees	25 yds	3	30
Butt kicks	25 yds	3	30
Crazy legs	15 sec	3	30
Power slides	25 yds	4	30
Carioca	25 yds	4	30
Quick feet	15 sec	3	30
Jumping	15 sec	5	30
Sprinting	50 yds	5	30
Intermediate Phase			
Bounding	50 yds	5	30
Around the world	30 sec	5	30
Stutter step	30 sec	5	30
Power skipping	15 sec	5	30
Cone jumps	30 sec	2	30
Jumping rope	60 sec	5	60
Box jumps	n.a.		
Front		3	60
Left		3	60
Right		3	60
Sprinting	100 yds	2	45
	50 yds	4	30
	25 yds	4	25
Advanced Phase			
Progressions	50 yds	5	40
High knees	25 yds	3	30
Butt kicks	25 yds	3	30
Quick feet	15 sec	3	30
Jumping	15 sec	5	30
Bounding	50 yds	5	30
Jumping rope	60 sec	5	60
Box jumps	n.a.		
Front		3	60
Left		3	60
Right		3	60
Sprinting	100 yds	5	45
	50 yds	5	30
	25 yds	5	25

Calf Girth. Left and right calf girth was measured using a spring loaded tape. The subject sat on a table with both legs extended while the investigator palpated the junction of the tibia and femur and measured 15 cm distal to this point. A mark was placed on both legs, and girth was measured at the mark. Two measurements were made on each leg and the average of both was used in the analysis. Measurements were made to the nearest 0.10 cm and later converted to inches, since the manufacturer's claim about increases in calf girth is stated in inches.

40-Yard Dash. The 40-yard dash required the subjects to take their mark and begin running when they were ready. The timer used a digital stopwatch and timed from the subjects' first movement until they crossed the line at the 40-yd mark. No starting blocks were used and the best time of two trials was recorded. Time was recorded to the nearest 0.01 sec.

Standing Broad Jump. For this test the subjects stood with both feet perpendicular to a marked line. They were allowed to swing the arms and flex the knees as much as they wanted prior to jumping. When ready, they jumped out horizontally as far as possible. Measurement was taken from the nearest heel to the starting mark. In order for the jump to count, the subject could not fall forward or backward on landing. A tape measure taped to the floor was used to assess jumping distance to the nearest 1/2 inch; the longest of two jumps was used in the analysis.

Vertical Jump. The vertical jump was measured using a Sargent jump. The subjects stood flat-footed with feet shoulder-width apart. They were able to swing their arms and flex their knees before jumping. They jumped off both feet and reached as high as possible against a Vertec (2), which measures vertical jump height to the nearest 1/2 inch. The best of two jumps was recorded.

Training Protocol

Subjects in the SSG and RSG groups trained 3 times a week for 10 consecutive weeks and followed identical programs. The only difference was that SSG wore the Strength Shoe and RSG wore their own athletic shoes during training. The training protocol was the program the manufacturer distributes with the purchase of their shoes. It consisted of beginner, intermediate, and advanced phases lasting 2, 4, and 4 weeks, respectively. The week before the study began, SSG and RSG met for 3 sessions to practice the drills and exercises they would be using. Additionally, SSG were encouraged to wear the Strength Shoes 15 to 30 min a day outside of the practice sessions, as recommended by the manufacturer, so their calf muscles and Achilles tendon could gradually adapt to the overload.

The training exercises included progressive running and sprinting drills, high knees, butt kicks, various jumping and hopping drills, bounding, cone jumps, box jumps, power slides, and a series of "quick feet" drills. In progressing from beginner to advanced phases, the number of repetitions, types of drills, and rest periods were altered to increase the volume and intensity of training (Table 1). All training sessions were preceded by 10 min of stretching and calisthenics warm-up exercises and were followed by a 5-min cooldown. The only changes to the recommended training program were that subjects had 1 day off during Week 3 in the intermediate phase, due to a school recess, and were given 1 day off during Week 3 of the advanced phase due to fatigue. Thus there were 28 total training sessions. Both training groups were checked for injuries once a week by physical therapists. Only upon recommendation of the physical therapy group were any subjects dropped from the study.

Statistical Analysis

Pretest scores for each variable were compared across groups using a one-way ANOVA. Results of the training program were evaluated using a two-way ANOVA with repeated measures and Scheffé post hoc procedures. Alpha was set at 0.05 to achieve statistical significance for all analyses.

Results

Attendance rate for both training groups was 93%, an average of 26 out of a possible 28 sessions. Of the 72 original subjects, 52 completed the study. Two control group subjects were lost to follow-up. The other 18 dropouts included 10 SSG, of which 7 were due to training injuries, and 8 RSG, of which only 1 was due to injury:

- Time conflict: SSG, 2; RSG, 4
- Ankle injury: SSG, 2
- Knee injury: RSG, 1
- Groin pull: SSG, 1
- Shinsplints: SSG, 2
- Achilles tendinitis: SSG, 1
- Strained Achilles: SSG, 1
- Knee injury unrelated to study: SSG, 1
- Left school: RSG, 1
- Poor attendance: RSG, 2

Descriptive characteristics of the 52 subjects who completed the study are listed in Table 2. There were no significant differences between groups for age, height, or body weight at the beginning of the study, nor were there any significant changes in body weight over the course of the study. The results of the training program are listed in Table 3. SSG had significant increases in both right and left calf girth from pretesting to posttesting; however, these changes were not significantly greater than for either RSG or controls. There were no within- or between-group differences for 40-yd dash time, vertical jump, or broad jump as a result of training.

Table 2
Descriptive Characteristics of 52 Subjects Who Completed the Study

Group (*n*)	Age (yrs) *M*	Age (yrs) *SD*	Height (in.) *M*	Height (in.) *SD*	Weight (lbs) *M*	Weight (lbs) *SD*
Control (22)	20.5	2.06	71.6	2.58	171.7	27.19
Strength Shoe (14)	20.4	2.24	71.5	1.65	169.9	15.42
Regular shoe (16)	21.3	3.61	71.2	2.41	175.9	20.23

Table 3
Changes in Measurements Over the Course of the Study

Variable & group	Pretesting *M*	Pretesting *SD*	Posttesting *M*	Posttesting *SD*	Change
40-yd dash (sec)					
Control	5.04	0.27	5.08	0.27	+0.04
Strength Shoe	5.02	0.14	4.96	0.14	–0.06
Regular shoe	5.00	0.23	4.97	0.24	–0.03
Vertical jump (in.)					
Control	23.3	3.24	22.9	3.94	–0.4
Strength Shoe	23.6	2.86	24.0	2.45	+0.4
Regular shoe	22.2	2.46	22.3	1.93	+0.1
Broad jump (in.)					
Control	97.6	8.89	97.6	10.03	+0.0
Strength Shoe	97.6	4.59	98.5	5.62	+0.9
Regular shoe	94.7	5.38	95.8	6.08	+1.1
Right calf girth (in.)					
Control	14.3	1.17	14.4	1.18	+0.1
Strength Shoe	14.2	0.94	14.6*	1.15	+0.4
Regular shoe	14.1	1.12	14.3	1.11	+0.2
Left calf girth (in.)					
Control	14.4	1.26	14.4	1.16	+0.0
Strength Shoe	14.1	0.99	14.4*	1.04	+0.3
Regular shoe	14.0	1.12	14.1	1.11	+0.1

*Significantly greater than pretesting, $p < 0.05$.

Discussion

This study found that training in Strength Shoes provided no significant advantage over training in regular athletic shoes. In fact there were no significant differences between either training group and the controls for any of the variables assessed. The nonsignificant improvement of 0.06 sec in 40-yd dash time and 0.4 in. in the vertical jump fell well short of the company's claims of 0.20 sec and 5 to 9 in., respectively. Thus the results indicate that the type of training used in this study may slightly increase performance but the changes noted were independent of the type of shoes worn.

The only other study we know of that looked at the effects of training in the Strength Shoe was an unpublished master's thesis by Cody (6). Similar to the present study, Cody found that training in the Strength Shoe had no significant effect on vertical jump performance for 6 college basketball players when compared to a control group of players who trained in their regular basketball shoes. In fact the magnitude of the changes were almost identical to those of the present study, as our Strength Shoe group had a nonsignificant increase in vertical jump height of 0.33 in. and Cody's basketball group had a nonsignificant increase of 0.10 in. Many of the training drills in Cody's study were plyometric in nature (e.g., bounding, hopping, depth jumps), similar to those used in the current study. A major limitation of Cody's study, however, was that the training period was only 4 weeks long.

A major question concerning our results is why neither group's performance improved significantly. Our protocol used a combination of plyometric and speed drills which are commonly recommended and used in training sprinters and jumpers (5, 7–9, 12, 13). The literature on the effects of plyometrics on vertical jump provides limited information and inconclusive findings.

Brown et al. (4) found a 2.87-in. increase in vertical jump in high school basketball players who supplemented regular practice with a series of depth jumps over the course of a 12-week season. A control group (players on the same team who practiced, but did not incorporate the depth jumps) had a 1.46-in. increase. Blattner and Noble (3) reported a 2.05-in. increase in vertical jump after 8 weeks of weighted depth jumps. However, an isokinetically trained comparison group increased their vertical jump by 1.95 in. over the same period. Scoles (11) found a nonsignificant increase of

0.79 in. in vertical jump after 8 weeks of depth jumping. Adams et al. (1) reported an increase in vertical jump of 1.5 in. following 6 weeks of plyometric training.

Therefore our results are consistent with studies using a similar design. Adams et al. (1), however, found that subjects who combined periodized squat lifts and plyometric training increased their vertical jump by 4.2 in. The present study did not include strength training in the experimental protocol, thus comparisons to the study by Adams et al. are not appropriate.

To our knowledge there have been no controlled studies on the effects of plyometrics on sprinting speed. However, a number of training guides link plyometrics and speed (5, 7–9, 12, 13). Chu was quoted in Duda (10) as saying it is difficult to conduct studies on plyometrics because of the many uncontrollable variables, which leads coaches to rely on their own experience to judge the value of plyometrics.

In the current study the dropout rate due to injury was much greater in SSG than in RSG, as noted earlier. The seven training injuries in SSG ranged from ankle problems to muscle strains of the groin. Subjects in both training groups experienced calf soreness and leg fatigue throughout the study. However, RSG could usually continue training whereas SSG were forced to drop out due to the more severe nature of the injuries. It should be emphasized that the injured subjects were dropped from the study only upon the recommendation of the physical therapists.

We felt the injuries were due in part to the plyometric nature of the training protocol, the program's accelerated rate of progression, and the design of the Strength Shoe itself. Subjects trained 3 times a week in high intensity workouts, with no periodization and no breaks between phases of the study. Duda (10) quotes Costello as stating that because of the nature of plyometrics and their potential for injury, they should not be done more than twice a week. Costello recommends that plyometrics be performed only by individuals who are at least moderately trained. Yessis (13) recommends any training program designed to increase speed, power, or jumping ability be preceded by a weight training program.

In the current study, training was preceded by 1 week of adaptation and subjects were not required to have any previous training background. For future studies we would recommend that subjects have a weight training base as well as a more gradual lead-in to the training program. By increasing muscle and tendon strength first, an athlete can reduce the chance for injury once Strength Shoes are incorporated into the training program. Also, a more gradual introduction to plyometrics is important, since every step in the Strength Shoe is actually a plyometric contraction which, when coupled with the plyometric nature of the training program, increases the overload exponentially.

Many subjects felt that the design and overall quality of the Strength Shoe was poor. In general they felt the shoe had inadequate arch support, inadequate cushioning, and an inadequate heel cup, all of which could have been related to the injuries seen in the present study.

One final factor to consider is, how much added improvement can be realized when training in Strength Shoes versus training alone? How much additional overload is there when wearing Strength Shoes during the drills, versus doing the drills in conventional athletic shoes? Is this difference in training stimulus the key factor? An initial study might measure EMG activity in the posterior calf while wearing Strength Shoes in order to quantify the magnitude of the proposed overload.

Our results indicate that training in Strength Shoes for 10 weeks had no significant effect on jumping ability or sprinting speed. In fact, neither training group differed significantly from the control group after the training program. Additionally, training in Strength Shoes increased the rate of injury in this group of subjects.

Practical Applications

The concept behind the Strength Shoe seems sound: any time you can increase the overload to a muscle-tendon unit, the results of training should be enhanced. However, whenever you increase the overload while simultaneously altering the biomechanics of a movement, the potential for injury is also increased. More research needs to be conducted to determine the best combination of exercises, repetitions, and frequency of exercise to maximize performance and minimize injury before recommending Strength Shoes for general use.

References

1. Adams, K., J.P. O'Shea, K.L. O'Shea, and M. Climstein. The effects of six weeks of squat, plyometric and squat-plyometric training on power production. *J. Appl. Sports Sci. Res.* 6(1):36-41. 1992.
2. Beal, D.P. The use of the vertec in power jump training. *Amer. Fitn. Quar.* 7(3):56-62. 1988.
3. Blattner, S.E., and L. Noble. Relative effects of isokinetic and plyometric training on vertical jump performance. *Res. Quar.* 50:583-588. 1979.
4. Brown, M.S., J.L. Mayhew, and L.W. Boleach. The effect of plyometric training on the vertical jump of high school boys basketball players. *J. Sports Med. Phys. Fitn.* pp. 1-4. March 1986.
5. Chu, D.A. Plyometrics: The link between strength and speed. *NSCA Journal* pp. 20-21. April/May 1983.
6. Cody, S.M. *The effects of the Strength Shoe on vertical jump performance in male collegiate basketball players.* Unpublished master's thesis, University of North Carolina at Chapel Hill.
7. Costello, F. *Bounding to the top: The complete book on plyometric training.* West Bowie, MD: Athletic Training Consultants, Inc., 1986.
8. Dare, B., and B. Kearney. Speed training. *Track Techn.* 103:3289-3295. 1988.
9. Dentiman, G.B., and R.D. Ward. *Sport Speed: The #1 speed improvement program for all athletes.* Champaign, IL: Leisure Press, 1988.
10. Duda, M. Plyometrics: A legitimate form of power training? *Phys. Sportsmed.* 16(3):213-218. 1988.
11. Scoles, G. Depth jumping: Does it really work? *Athl. J.* 1:48-50. 1978.
12. Von Duvillard, S., D. Flynn, K. Jones, and V. Vetro. Plyometrics for speed and explosiveness. *Schol. Coach* 59(8):80-81. 1990.
13. Yessis, M. Speed/explosiveness with plyometrics. *Schol. Coach* 60(7):32-34. 1989.