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The Impact of Wearable Resistance on Youth Soccer Players' Linear Speed

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ABSTRACT

This investigation examined the impact of the application of wearable resistance (WR) at light weight on the linear speed of youth (under 16-year-old) male soccer players at 5, 20, and 40- yards. WR weighing 200g, 400g, and 600g was used only during warming up for training with an 8-week incremental program. WR was Velcro-ed to sleeves on players' calves for warm-up and removed immediately following warm-up. Teams trained three times per week for 8 weeks. The warm-up protocol prior to each training session had two requirements for testing: three 20- yard sprints and three 40-yard sprints at maximal effort. Testing occurred prior to the 8-week training period and at the conclusion of the program. Both the EC and CG found statistically significant increase in speed at 5 and 20 yards at the $p < 0.05$ level while only the EG found increases at 40-yards. Results between the EG and CG found statistically significant increases in linear speed at 5-yards while no significant increases were reported at 20 and 40-yards. The increases over short distance would have value for youth soccer players while increases over greater distances (e.g., 20 and 40-yards) would be desirable as well. Control over the training effect was limited and a possible contaminating factor. Future study establishing stricter control over training is warranted. Wearable resistance holds much potential for increasing speed in youth soccer players. The ability to impact speed without requiring additional, outside training and movements not found in the activities of soccer players can provide these enhancements at many levels, situations, and training programs.

Introduction

Speed is of tremendous value to a player desiring soccer success (Beato, et al. [1-3]). Practitioners have sought methods to increase speed as an end to increase performance and success. Athletes, coaches, and athletic programs have long desired to learn optimal methods to increase physical speed. Traditionally, speed training involved resistance/strength training and technical (e.g., repeated sprint exercises) training. Many programs use resistance/strength training involving weight lifting (e.g., squats). Generating more speed is done through generating more force. Force is equal to mass times acceleration. Resistance/strength training involves large amounts of mass moved at a slow rate of acceleration. These programs use heavy resistance to produce results but often not to the extent desired as these resistance/strength programs call for great mass at slow acceleration thus limiting the speed and movements of the athlete involved in such training. Combined training using technical and strength training (Kotzamanidis, et al. [4]) as well as resistance/strength training programs (Silva, et al. [5]) have been found to produce increases in linear speed. Wearable resistance is an emerging technology in the performance enhancement field. New ideas regarding wearable resistance (WR) have developed in an attempt to find better methods to enhance speed (Dolcetti, et al. [6]), Macadam, & Feser, 2019; Feser, Macadam, & Cronin, 2020; Feser, Bayne, Loubser, (Bezodis, et al. [7]).

A common WR training protocol uses light weights (resistance) of 200g, 400g, and 600g weights Velcro-ed to extremities of subjects. This use of WR allows athletes to train in similar movement patterns and at speeds much closer to the actual execution of their chosen activity (Xueliang, et al. [8]). Although the weight is light, WR has been shown to increase training load in national level soccer players (Uthoff, et al. [9]) and increases in training load are often a desired method of increasing speed. Several researchers have investigated the effect of WR on various populations; however, many have come upon difficulty in controlling training effects as coaches are hesitant to provide separate teams used as subject groups with identical training

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protocols to allow for such control. Teams of athletes were routinely split with a group outfitted with WR and a group without WR training simultaneously thus a possible anticipatory bias may have been influenced results. This study attempted to observe possible differences in groups training with (experimental condition) and without (control condition) wearable resistance using duplicate training protocols while maintaining separation between groups thus removing any potential anticipatory bias. Teams from the southeastern United States of similar gender, age, and competitive level were recruited in order to fulfill these requirements.

Subjects

The Experimental Group (EG) consisted of 20 male players (mean age = 14.93 years old; sd = 3.2) and the Control Group (CG) consisted of 11 male players (mean age =15.6 years old; sd = 4.09). Parental and subject written consent for the study was obtained prior to the commencement of the institutional review board approved study. The EG and CG groups were separate teams - training and competing independently. Teams were classified as travel teams meaning the teams were among the lesser competitive divisions of youth soccer in the state. 5 players dropped out of the EG (3 injury-related, 1 alternate sport demand-related, and 1 left the team/group) while 4 players left the CG (2 injury-related, 2 left the team/group) [10].

Methods

Coaches of the EG and CG agreed to use the same training protocols (exercises and timing). 15 players from the EG completed the training period while 7 players from the CG completed the training period. Teams trained for 75-minute sessions 3 times per week for the 8 weeks of the program. The study began with baseline testing at 5, 20, and 40 yards. Subjects were timed using Arena-Gear laser timing equipment (McKinney, Texas, USA) model RM 501. Starting and finishing gates were placed at 42" above the running surface. Subjects place both feet upon a line perpendicular to the line of sprint direction located 1 yard behind the starting gates and started on their own volition. There was no measurable wind at on any testing date. Follow-up testing occurred at week 4 and concluded at week 8 with post-intervention testing. Testing occurred on artificial turf (Astro-Turf, Dalton, Georgia, USA). All subjects ware rubber multi- cleated commercially available soccer shoes. Subjects wore the same pair of their individual shoes for all testing. The intervention consisted of the EG wearing light weight resistance packets Velcro-ed onto sleeves covering the subjects' calves during warm-up (LILA Exogen, Malaysia).

The warm-up. protocol had two requirements for testing: three 20-yard sprints and three 40-yard sprints at maximal effort. The remainder of warm-up could vary depending on coaches' impressions of team and players' needs. Weights were light (400g, 600g, and 800g), thus the novel approach to speed training. The schedule of weight and placement is provided in Appendix Table 1. Data analysis included pair (within group) t-tests for both the EG and CG to determine if changes in speed were detected in either group. An unpaired t-test would be completed to determine if one group's training produced different results than the other group. The working hypothesis would be that the EG group would have statistically significant faster velocities from the CG resulting in increases in linear speeds at 5, 20, and 40-yards.

Appendix Table 1: Periodized 8-week loading scheme for Experimental Group (EG).

Weeks	Load - Placement	Session 1	Session 2	Session 3
0				Testing
1	200 gm, posterior, proximal	200	200	200
2	200 gm, posterior, distal	200	200	200
3	400 gm, posterior, proximal	400	400	400
4	600 gm, 400 gm posterior, proximal	600	Unloaded	Testing
5	400 gm, posterior, distal	400	400	400
6	600 gm, 400 gm posterior, proximal	600	600	600
7	600 gm, 400 gm posterior, distal	600	600	600
8	600 gm, 400 gm posterior, proximal	600	Unloaded	Testing

Results

Each group reported different increases in speed when comparing post-intervention testing with pre-intervention testing. Both the EG and CG reported statistically significant increases within each group in linear speed at 5 and 20-yards at the $p < 0.05$ level. However, at 40-yards, only the EG found statistically significant differences between pre-intervention and post- intervention testing within the group. Testing between the EG and CG found a statistically significant decrease in linear sprint times (increase in linear speed) at 5 yards at the $p < 0.05$ level. No significant differences at 20 and 40 yards was reported. Average times for 5, 20, and 40 yards along with changes in times post-intervention for the EG and CG are listed in Table 1. Paired t-tests revealed statistically significant increases in linear speed post-intervention within the EG at 5, 20, and 40-yards at the $p > 0.05$ level. For the CG, paired t-tests indicated statistically significant differences at the 5 and 20-yard distance only. Paired t-test results are listed in Table 2. Data analysis used Excel unpaired t-tests between EG and CG times for 5, 20, and 40 yards to determine if the wearable resistance provided a difference in sprint times. A statistically significant difference at the $p < 0.05$ level was found for the 5-yard sprint times. Results for both the paired and unpaired t-tests are listed in Table 3.

Table 1: Sprint times for 5, 20, and 40 yards for EG and CG (times in seconds).

Experimental Group						
Pre				Change		
5 yd	20 yd	20 yd	40 yd	5 yd	20 yd	40 yd
1.17	3.43	3.13	5.6	-0.13	-0.28	-0.33
Control group						
Pre		Post		Change		
5 yd	20 yd	5 yd	20 yd	5 yd	20 yd	40 yd
1.16	3.2	1.03	23.95	-0.1	-0.19	-0.14

Table 2: Paired t-tests for linear speed differences within the EG and within the CG at 5, 20, and 40-yards.

	5-yards	20-yards	40-yards
Experimental Group	$p > 0.0001$	$p > 0.0002$	$p > 0.0004$
Control Group	$p > 0.0008$	$p > 0.0386$	$p > 0.0828$

Table 3: Unpaired t-tests for differences between the EG and CG at 5, 20, and 40-yards.

	5 yards	20 yards	40 yards
p =	0.0327	0.2966	0.2377

Discussion

These results may indicate training with wearable resistance may improve speed over the first 5 linear yards in male youth soccer players. This is a desired result as quickness and speed over a short distance assists in successful soccer performance. The lack of significant decreases in linear sprint times at 20 and 40 yards is somewhat surprising given previous research. There are several possibilities for this. Several players dropped out of the study for various (travel, alternate activities, lack of commitment) reasons. Additionally, training sites were moved prohibiting coaches from both the EG and CG observing each other to duplicate training. Additionally, the small sample size impacted the ability to detect differences. The resulting difference in 5-yard speed is still a significant finding. Soccer involves quick accelerations to maneuver past opponents when attacking and similar accelerations to prohibit opponents from successfully operating towards a goal. This result could be beneficial to soccer players. There was no statistically significant increase in speed at the 40-yard distance between groups at pre- and post-intervention. Although the EG had a statistically significant increase at 40-yards and the CG did not, this increase was not large enough to establish a statistically significant difference between the EG and CG in linear speed. This study attempted to investigate the ability of wearable resistance on male youth soccer players.

Results indicated a statistically significant decrease in 5-yard linear sprint times for under 15 male youth soccer players. The working hypothesis was supported at 5-yards while not supported at 20 and 40-yards. The value of these results is in the increases in speed over short distances accomplished with a minimum impact or demands on players with no demands for additional training. Additionally, all training for these increases use similar movements at similar speed, thus removing the need to learning new tasks to achieve gains in speed. The difficulties in obtaining coaches to use identical training programs throughout the investigation was a large obstacle given the nature of coaching and coaches. As discussed earlier, control for training of subjects was a difficulty. Preferences of coaches with training protocol and exercise design would play a role in results. Future studies may incorporate a cross-over design to address anticipatory bias.

Limitations

The study encountered several difficulties recruiting coaches meeting the study requirements. Coaches for the experimental and control groups were hesitant to adhere to a strict training protocol as a condition for the study. During this study, training sites were initially side-by-side providing coaches with an ability to confirm training exercises were similar regarding activity and duration. However, after 2 weeks, the control group was moved to a different site and different dates. Thus, control for training was lessened.

Conclusion

The use of wearable resistance at light weight (200g, 400g, and 600g) was found to increase the speed of male youth soccer players over a distance of 5-yards greater than male youth soccer players training without wearable resistance. Increases were not found at 20 and 40-yards.

Applications to Sport

Faster speeds attained by soccer players can lead to better performances. The use of weighted resistance offers great potential towards this end. It does not require special training for either the coach administering the use of this type of resistance training nor the player. As such equipment and training becomes more common, different training programs using said resistance may develop to enhance other relevant techniques.

Disclosure Statement

There were no conflicts of interest in this investigation.

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William Steffen. Biomed J Sci & Tech Res