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Analysis of the Changes in Selected Speed and Power Parameters in Response to Assisted and Resisted Sprint Training among Male Sprinters

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Abstract

The underlying principle of this study was to assess the effect of assisted and resisted sprint training on selected speed and power parameters among male sprinters. For the purpose of this study, forty five male students from various colleges affiliated to Acharya Nagarjuna University, Ongole, Andhra Pradesh, India, aged 18 to 22 years took part in the study. Subjects were randomly assigned to assisted sprint training group (n=15), resisted sprint training group (n=15) and control (n=15) group. The training regimen lasted for twelve weeks. The assisted sprint training exercises included in this training programme was downhill sprinting, assisted towing and high speed treadmill sprinting. The resisted sprint training exercises included in this training programme was weighted vest, sprint parachutes and harness running. The dependent variables selected were speed, anaerobic power, resting heart rate and Vo2max and they were assessed by using standard tests and procedures prior to and immediately after the training. Analysis of covariance was employed to establish degree of significant modification on chosen dependent variables. The findings of the study revealed that due to the effect of twelve weeks of assisted and resisted sprint training the selected speed and power parameters of male sprinters have significantly improved.

Keywords: Assisted and Resisted sprint training, speed and power parameters.

Introduction

Maximum running speed is an important factor for success in many sports. Different modalities of training have been employed in the development of maximum running speed. Two commonly used forms of speed training are assisted (or over speed) and resisted sprinting. During assisted sprinting, the athlete runs while being pulled along by some type of device, often an elastic cord or a rope-and-pulley system. During resisted sprinting, the athlete runs against some type of resistance, often in the form of a weighted object or a parachute that the athlete tows behind them. It has been speculated by coaches that these training methods will induce changes in an athlete's sprinting ability. Despite the popularity of both resisted and assisted methods of sprint training, and the commercial availability of various devices for carrying out the training, the evidence to support these training methods has been largely anecdotal. As a result, it remains unclear as to what biomechanical, neuromuscular and physiological changes may be induced by this type of training, as well as its effectiveness in improving sprint performance.

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Although sprint assisted and resisted training has been around for many years, there is very little scientific research that has been conducted in this area. However, of the research that has been conducted, much of it has shown that only small changes in assistance or resistance can make significant changes in running mechanics. Once again this points to our concerns for mechanics being a greater focus for sprint speed development. Anecdotal comments from coaches and trainers range from high praise for assisted and resisted training to claims that these techniques aren't worth the time and effort to fit them into a normal practice. The assisted sprint training may be an effective way of developing first-step quickness in athletes, whereas resisted training would be a good choice for a player's wide receiver that needs to turn on the speed when running downfield. "Strength and conditioning professionals might consider using a combination of protocols, perhaps switching off between different days. The key is to recognize the benefits of each technique and to use them in achieving sport-specific training goals. Various studies have demonstrated that the assisted and resisted sprint training can produce significant changes in running speed and running kinematics. However the longer-term training adaptations after assisted and resisted sprint training on speed and physiological parameters remain unclear. Hence, the investigator was much interested to conduct a study to compare the effect of assisted and resisted sprint training on selected speed and power parameters.

Methodology

Subjects and Variables

For the purpose of this study, forty five male students from various colleges affiliated to Acharya Nagarjuna University, Ongole Campus, Ongole, Andhra Pradesh, India in the age group of 18 to 22 years were recruited, with their consent. All of them were healthy, nonsmoking and with a negative medical history. The selected subjects were randomly assigned to both the assisted sprint training group, resisted sprint training group and control group of 15 each. The experimental group-I underwent assisted sprint training and experimental group-II underwent resisted sprint training and group-III acted as control. The selected dependent variables such as speed, speed endurance, anaerobic power and explosive power were assessed by using standard testing procedures before and after the training regimen. The instruments used for testing the dependent variables were standard and reliable as they were purchased from the reputed companies. The variables and tests used are presented in table-I.

Table I. Dependent Variables and Test

S. No.	Variables	Tests / Instruments	Unit of Measurement
1.	Speed	50m run	Second
2.	Speed endurance	150 meters run	Second
3.	Anaerobic power	Running based anaerobic sprint test	Watts
4.	Explosive power	Sarjent jump	Centimeters

Training protocol

During the training period the experimental groups underwent their respective training programme three days per week (*alternate days*) for twelve weeks in addition to their regular programme of the course of study as per their curriculum. The first group performed assisted sprint training and the second group performed resisted sprint training. The assisted sprint training exercises included in this training programme was downhill sprinting, assisted towing and high speed treadmill sprinting. The resisted sprint training exercises included in this training programme was weighted vest, sprint parachutes and harness running. More specifically, the training distance comprised of 50 meters and the initial intensity was fixed at 75% and it was increased once in two weeks by 5%. The subjects performed these runs at maximum relaxed speed with the specified intensity.

Experimental Design and Statistical Procedure

The experimental design used for the present investigation was random group design involving forty five subjects. Analysis of covariance (ANCOVA) was used as a statistical technique to determine the significant difference, if any, existing between pretest and posttest data on selected dependent variables. Whenever, the adjusted posttest 'F' ratio value was found to be significant, Scheffe's post hoc test was applied to find out the paired mean differences. The level of significance was accepted at $P < 0.05$.

Results

Analysis of covariance (ANCOVA) was employed to determine the significant impact of assisted and resisted sprint training on selected speed and power parameters and it is presented in table-II.

Table II. Adjusted Posttest Mean on selected Speed and Power Parameters of Experimental and Control Groups

Variable	Assisted Sprint Training	Resisted Sprint Training	Control Group	S o V	Sum of Squares	df	Mean squares	'F' ratio
Speed	7.47	7.43	7.87	B	1.75	2	0.88	30.13*
				W	1.19	41	0.03	
Speed endurance	17.05	17.79	18.523	B	16.040	2	8.020	67.97*
				W	4.832	41	0.118	
Anaerobic power	303.30	332.61	231.42	B	226.30	2	113.15	113.90*
				W	59.60	41	1.45	
Explosive power	37.77	41.19	32.77	B	537.56	2	268.78	70.98*
				W	155.26	41	3.79	

The required table value for significance at 0.05 level of confidence with degrees of freedom 2 and 41 is 3.23.

The result of this study shows that there was significant difference existing between experimental and control groups, since the obtained 'F' ratio for adjusted posttest means 30.13, 67.97, 113.90 and 70.98 on speed, speed endurance, anaerobic power and explosive power are greater than the required table value of 3.23 for given degrees of freedom at 0.05 level of confidence. Since, the adjusted posttest 'F' ratio value was found to be significant, Scheffe's post hoc test was applied to find out the paired mean difference.

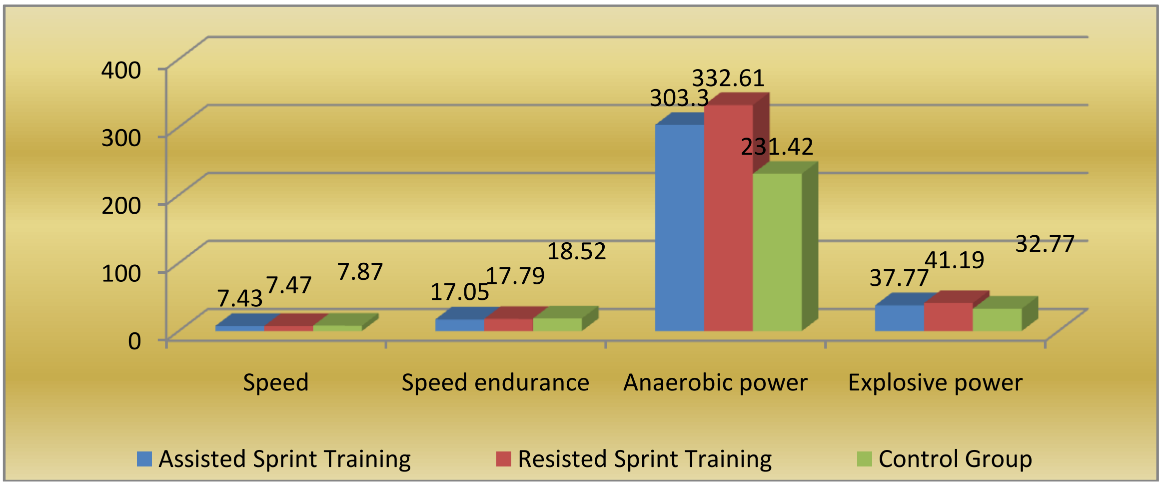
Table III. Scheffe's Post Hoc Test for Paired Mean difference on Selected Speed and Power Parameters

Variables	Adjusted Post Test Mean			Mean Differences	Confidence Interval
	Assisted Sprint Training	Resisted Sprint Training	Control Group		
Speed	7.43	7.47		0.04*	0.16
	7.43		7.87	0.44*	0.16
		7.47	7.87	0.40*	0.16
Speed endurance	17.05	17.79		0.75*	0.32
	17.05		18.52	0.73*	0.32
		17.79	18.52	1.48*	0.32
Anaerobic power	303.30	332.61		29.31*	15.79
	303.30		231.42	71.88*	15.79
		332.61	231.42	101.19*	15.79
Explosive power	37.77	41.19		3.42*	1.80
	37.77		32.77	5.00*	1.80
		41.19	32.77	8.42*	1.80

**Significant at .05 level.*

Table-III shows that both the training groups were significantly contributing to the improvement of selected speed and power parameters such as speed, speed endurance, anaerobic power and explosive power of the subjects, however assisted sprint training is significantly better than resisted sprint training in improving speed and speed endurance and resisted sprint training is significantly better than assisted sprint training in improving anaerobic power and explosive power. The adjusted post tests mean values of assisted and resisted sprint training and control groups on selected speed and power parameters are graphically represented in figure-I

Figure I. Diagram Showing the Adjusted Post Test Mean Values of Assisted and Resisted Sprint Training and Control Groups on selected Speed and Power parameters



Discussion

The literature thoroughly supports the evidence that assisted and resisted sprint training is an effective training strategy for the promotion of speed and power parameters. Resistance during sprinting has been proposed to increase force output in the lower extremity, increase stride length, and increase explosiveness during initial strides (Costello, 1985; Delecluse, 1997; Klinzing, 1984; Korchemny, 1992). Another possible benefit of sprinting under resistance is increased kinaesthetic feedback, allowing the athlete to better improve technique (Korchemny, 1992). Knicker (1997) examined the effects of external resistance on sprinting mechanics and found that even small resistance loads could result in considerable changes in kinematics and coordination of muscular activity. Corn and Knudson (2003) found that towing with an elastic cord during the acceleration phase resulted in significant differences in running speed, stride length and touchdown distance of the contact foot between the free sprint and the assisted sprint. Hence it is suggested that for long-lasting change, there needs to be a systematic administration of a sufficient stimulus, followed by an adaptation of the individual, and then the introduction of a new, progressively greater stimulus.

Resisted sprint towing has become a popular training method with many sports teams and athletes (Schnier, 1982). This can involve an athlete towing a weighted sled, speed parachute, or some other device over a set distance (Faccioni, 1994). It has been said that such techniques will increase muscular force output, especially at the hip, knee, and ankle, leading to a potential increase in stride length over time (Artingstall, 1990; Costello, 1985; Donati, 1996; Faccioni, 1994; Pauletto, 1993). After 12 weeks of training the experimental groups showed significant improvement in anaerobic power. Most of the former studies also show a substantial increase in anaerobic power following short bouts of intense exercises. These results are support the observation by Laursen et al., (2005) that, peripheral adaptation rather than central adaptation are likely responsible for the improved anaerobic capacity following various forms of high intensity training. Roads et al., (2000) suggested that, training of short duration, high loads and long recovery periods seems to be an effective programme for improving the enzymatic actives of the energetic pathways in a short period of time,

Conclusion

The result of this study demonstrated that the speed and power parameters such as speed, speed endurance, anaerobic power and explosive power can be developed by both assisted and resisted sprint training. However assisted sprint training is significantly better than resisted sprint training in improving speed and speed endurance and resisted sprint training is significantly better than assisted sprint training in improving anaerobic power and explosive power. Hence, it is suggested that, when properly performed, assisted and resisted sprint training can provide significant functional benefits and improvement in overall fitness.

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