EFFECT OF RESISTED SPRINT TRAINING ON COORDINATIVE ABILITY, SPEED AND STRENGTH -A MATHEMATICAL ANALYSIS

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ABSTRACT

The study aims to investigate the Effect of resisted sprint training on coordinative ability, speed and strength metrics. Resisted sprint training involves adding weight, like sleds or parachutes, to challenge muscles during sprint exercises. Athletes will be divided into two groups; the experimental group, which will undergo resisted sprint training, and the control group, which will maintain their regular training routine. Coordination will be assessed through agility tests, speed through sprint timings, and strength through vertical leap height and maximal strength workouts. The experimental group will undergo twice-weekly resisted sprint training for 12 weeks, while the control group will continue their usual training. Assessments will occur at the beginning, middle, and end of the intervention to monitor changes in coordinative ability, speed, and strength. It is anticipated that the experimental group will show significant improvements compared to the control group. This study aims to elucidate the effectiveness of resisted sprint training in enhancing athletic performance, aiding athletes in devising better training routines. The results revealed a significant difference between the experimental and control groups, indicating that resistance training positively impacted speed performance.

Keywords: agility, coordinative ability, resisted sprint training, speed, strength.

1. INTRODUCTION

The importance of enhancing athletic performance in various sports through innovative and focused training methods has been increasingly recognized in recent years. Resisted sprint training is one such method gaining popularity, involving running with external resistance devices like sledges, parachutes, or harnesses. This training aims to improve coordination, strength, and speed, crucial for success in sports, by adjusting overload [1-3]. Strength, speed, and coordination are interconnected elements pivotal to an athlete's overall performance. Coordination, the ability to execute complex movements efficiently, relies on integrated muscle connections and movement patterns. Conversely, speed is essential in many sports, enabling players to surpass competitors and cover ground swiftly. Strength, a fundamental physical quality, supports athletic power, stability, and endurance [4-6]. Previous research has shown the effectiveness of resisted sprint training in enhancing these performance factors [7-9]. It induces neuromuscular changes through overload, leading to improved muscle recruitment, force production, and power output. These adaptations positively impact movement coordination, enhancing agility and precision [10-12].

Resisted sprint training offers several advantages over conventional sprint techniques. It allows athletes to exert more force against resistance, resulting in longer and more frequent strides during sprinting [13-15]. By simulating the unique demands of their respective sports, athletes can develop sport-specific strength, speed, coordination, and movement patterns [16-18] Understanding how resisted sprint training influences coordination, speed, and strength metrics is crucial for evidence-based training methods [19-21]. This knowledge aids in devising effective training regimens to enhance athletic performance across various sports [22-25].

2. STATEMENT OF THE PROBLEM

Investigating the impact of adding resisted sprint training on the aforementioned variables is the problem statement for the study on resisted sprint training on coordinative ability, speed, and strength parameters. The specific goal of this study is to determine whether, in comparison to conventional sprint training methods, adding resisted sprint training to an athlete's training programme can enhance their coordinative ability, speed, and strength metrics. By tackling this issue, the research hopes to offer insightful information about the effectiveness of resisted sprint training to improve athletic performance.

3. OBJECTIVES OF THE STUDY

1. To investigate the impact of resisted sprint training on coordinative ability, speed, and strength parameters in a group of athletes.
2. To measure and analyze changes in coordinative ability after a period of resisted sprint training.
3. To assess and compare the improvements in speed parameters before and after resisted sprint training.
4. To determine the relationship between resisted sprint training and coordinative ability, speed, and strength parameters.

4 SIGNIFICANCES OF THE STUDY

Athletic performance requires coordination, especially in sports where rapid direction and movement changes are necessary. By stimulating the neuromuscular system and enhancing inter-muscular communication, resisted sprint training can improve coordination and result in more effective movement patterns. Athletes can raise their power production and sprinting speed by using this increased resistance. Another stimulus for strength training is provided by resisted sprint training. Sprinting adds resistance, which causes the muscles to contract more forcefully and improves the development of strength. Athletes can gain from this by being able to sprint with greater force and strength. The study's conclusions about how resisted sprint training affects coordination, speed, and strength metrics may be useful to players in a variety of sports. It can offer evidence-based training techniques to trainers and coaches to improve athletes' overall performance. Resisted sprint training can help prevent injuries by enhancing coordination, speed, and strength metrics. Increased coordination can lower the chance of injuries from accidents, mishaps, and inappropriate movement patterns. Moreover, an athlete's capacity for explosive movements can be improved with greater speed and strength, which lowers the risk of muscular imbalances and overuse issues. Overall, the importance of this research resides in its ability to influence training plans, enhance athletic performance, and assist in lowering the likelihood of injuries among athletes.

5. METHODOLOGY

The research investigated the effects of resisted sprint training on speed and strength parameters of coordination ability. Sixty athletes from Vijayanikethan college of Physical Education, Thimmapuram, Kurnool (Dist), Andhra Pradesh, India, were randomly selected. They were divided into two groups: Group I received resisted sprint training, while Group II served as the control. Speed was measured using a 50-meter sprint test. The experimental groups received specialized instruction six days a week for twelve weeks. Tests were conducted before and after training to assess speed. ANCOVA and Scheffe's post hoc test were used for statistical analysis.

The following research approach was used to examine how resisted sprint training affected coordinative ability, speed, and strength parameters in the context of physical education. We adopted control group design with pre- and post-testing by choosing a sample of physical education pupils at random from the selected educational establishment.

Assessed the participants' coordination skills both before and after the intervention. with 50-meter sprint test to gauge the participants' sprint speed. evaluated participants' strength with exercises such as the handgrip strength test or the standing long jump. Data collected with prior and post training from each participant's level of coordination, speed, and strength.

6. PROCEDURE:

The physical fitness (50 m sprint, SLJ, sit ups, and sit & reach) was the dependent parameters in this study. For every experimental group, these assessments were scheduled at the beginning and conclusion of the training period.

50 m sprint (maximum speed)

Participants in this 50-meter run event, which took place on track two, were instructed to line up behind a start line and run as quickly as they could until the finish line at the sound of the whistle. Every participant's time was recorded using a digital sport stop watch. The best time was recorded for analysis after the subjects were given two chances with a 5-minute break in between each trial.

Sit-ups (muscular endurance)

The sit-ups were performed on a floor mat. The subjects were instructed to lie down in a supine position with their hands crossed over their chests and their knees bent at a ninety-degree angle. One aide was to hold the subjects' legs. The participant was instructed to raise his body from the floor, head up, and contact his knees at the tester's signal. This was counted as one sit-up. In order to begin the next sit-up, he must go back to his starting position. He must do this until the tester gives the all-clear to quit. The number of precisely performed sit-ups in a 30-second time frame was scored. A 5-minute break was taken in between each trail to record the better of two.

Sit and reach (flexibility)

For this examination, a flexibility box was utilised to record. The participants were to sit on the floor with their feet pressed against the box, their knees fully extended, and their trunk bent. They were to place their hands on top of the box, palms facing each other, and reach as far as they could to reach the markings on the box. They were instructed to maintain this posture with their knees locked for a minimum of one to two seconds. Two trails were recorded, the better of which was timed five minutes apart.

Training programs

This study employed the training protocol referred to as resisted sprint training. Many weight machines, including the seated leg press, sitting abdomen, horizontal chest press, pull down, seated row, seated calf raises, seated leg extension, horizontal leg curls, and sat back extension, were used for the training. For twelve weeks, the subjects worked out twice a week for thirty minutes each training session. During the first week, they likewise employed an intensity of 40% of 1 RM, completing three sets of 20 repetitions with a one-minute break in between. Every two weeks, there was a 5% increase in intensity. However, the intensity was lowered to 35% during the penultimate week in order to give the body a chance to recover before the post-test measurements.

Statistical analysis

Mean and Standard Deviation were used to analyse the dependent variables. Independent t-tests were performed to determine whether there was a significant difference between the RT and Control group at pre-training measures and when post-tests were subtracted from pre-tests (mean difference) following training. Paired t-tests were used to estimate the significant difference within groups. The statistical tool utilised was SPSS version 16, and the significance threshold was set at 0.05.

Determined the mean and standard deviation of descriptive statistics for every variable and every group. And also compared the post-test results of the experimental and control groups using suitable statistical tests and ascertain the significance of any differences that are discovered. And also aimed for $p < 0.05$ statistical significance.

Limitations:

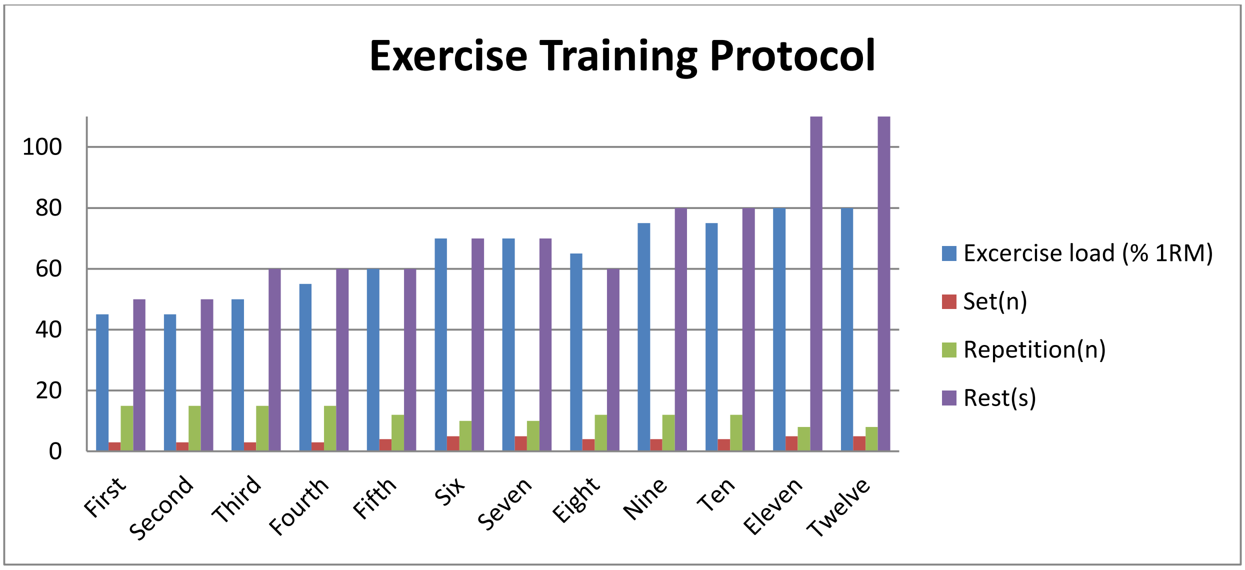
The study has limited sample size or limited generalize ability. And the possible bias resulting from participant assignment to the experimental and control groups. There were some potential differences in the commitment and perseverance of the participants to the programme of resisted sprint training.

7. RESULTS AND ANALYSIS

Table 1: Exercise training protocol in the resistant sprint training group

Week	Exercise load (% 1RM)	Set(n)	Repetition(n)	Rest(s)
First	45	3	15	50
Second	45	3	15	50
Third	50	3	15	60
Fourth	55	3	15	60
Fifth	60	4	12	60
Six	70	5	10	70
Seven	70	5	10	70
Eight	65	4	12	60
Nine	75	4	12	80
Ten	75	4	12	80
Eleven	80	5	8	110
Twelve	80	5	8	110

1RM One-Repetition Maximum



Two weekly sessions of 6–9 maximal hauling a sled over a 20-meter course were conducted by the resisted sprint training group. The individuals rested for three minutes in between each resisted sprint. The 20-meter course was finished by the resistant sprint group in about 4 seconds. Lateral direction resisted sprints made up two of the total prescribed resisted sprints in each session. The control group's training programme lasted the same amount of time as the experimental groups'. Using load-velocity tests as described in previous work, the load for the resisted sprint was ascertained. With one sprint for each loading condition, the individual performed three loaded tests and one unloaded test. To create a unique load velocity profile for every athlete. The maximum power was found at a certain velocity using data from the My Sprint application. The maximal power output for each athlete was then prescribed for the intervention, together with a load that corresponded to that velocity (as determined by the load-velocity profile). Using force and velocity data collected by the My Sprint application, power was calculated as the product of force and velocity (P = F*V). Quadratic equations were then used to model the power-velocity relationship. Maximal power is represented by the maximum value (peak) of the power-velocity relationship, which was calculated using the formula (F*V)/4. Depending on the week, the intervention group's sessions lasted between 20 and 30 minutes. Subjects performed a 10-minute standardised warm-up before every training session, which included body weight exercises that targeted the main upper and lower extremity muscle groups as well as sub-maximal un-resisted sprints. The subjects started their designated training programme after the warm-up. For the length of the study intervention, the athletes did not participate in any other strength and conditioning programme in addition to their allocated study intervention. Every participant took part in two 60-minute weekly physical education classes at their respective colleges in addition to two to three practises and/or games per week. The methodology of training was determined by referencing recent systematic reviews and meta-analyses that highlighted the sprint improvements seen in team-based athletes. The intervention week determined how many resisted sprint repetitions were allowed. Over a 20-meter course, participants engaged in resisted sprints, with three minutes of recovery in between each sprint repetition.

Training regimens were adjusted in accordance with the results of 1RM measurements taken at the start, the sixth week, and the conclusion of interventions. Table 1 provides information on workout protocol and overload. The exercise determines the overload, and the resistance weight is increased depending on 1RM. The maximal effort time was increased from 10 to 40 s. The same two sessions each week were used for the technical instruction. The rest period was changed in light of the groups' repeated performance, and the outcomes were tracked. The rest period was set at 110 minutes after the maximum effort of 80 was achieved.

Table 2: Physical Fitness Parameters (means ± SD)

Parameters	Tests	RST Group	Control Group	P-Values Independent t test
50m Sprint (sec)	Pre	5.03±0.28	4.98±0.41	0.028
	Post	3.86±0.29	4.98±0.39	0.004
	Change	-0.34±0.19	-0.08±0.27	0.203
	P-Value (Paired t test)	0.014 (5.9%)	0.397	
SLJ (cm)	Pre	211.12±32.66	170.02±17.74	0.014
	Post	223.03±29.14	175.96±18.22	0.003
	Change	12.97±10.68	5.98±13.85	0.324
	P-Value (Paired t test)	0.003 (6.1%)	0.197	
Sit ups (30 sec)	Pre	26.20±3.01	22.44±3.02	0.014
	Post	29.44±6.01	22.98±2.98	0.009
	Change	2.98±5.03	0.98±1.68	0.344
	P-Value (Paired t test)	0.057 (11.8%)	0.099	
Sit and Reach (cm)	Pre	25.98±10.03	26.04±8.03	0.768
	Post	30.03±6.97	29.98±5.78	0.796
	Change	3.42±2.67	5.04±2.98	0.298
	P-Value (Paired t test)	0.008 (11.9%)	0.029 (18.7%)	

For every physical fitness metric, there were no mean differences (post minus pre) between the groups ($P > 0.05$). But when the post-tests and pre-tests in each group were evaluated separately (using a paired t-test), the RT group saw a decrease ($P \leq 0.05$) of 5.9% in SLJ, 11.8% in sit-ups, 11.9% in sit-and-reach, and 6% in 50 m run time. Although there was a notable 18.7% decrease in sit and reach ($P = 0.029$) for the Control group, there were no changes observed in the other fitness indicators ($P \geq 0.05$). Table 2 contained illustrations of these findings. The study's conclusions indicated that the RT programme outperforms the Control group. The BM and BMI of the RT subjects rise more than those of the Control group subjects. This outcome makes sense given that the resistance sprint training regimen can cause muscular hypertrophy. The RT group may have improved more on the 50-meter sprint, SLJ, and sit-ups due to the intermediate intensity (40–60%), high frequency (20 repetitions), number of sets (5), and brief rest intervals (60–90 seconds). The current study's comparable increase in flexibility revealed that both training regimens had a beneficial contribution. Resistance training improves a muscle's capacity to stretch when a participant engages in a variety of weightlifting exercises.

8. CONCLUSION

It was discovered that resisted sprint training improved coordination. Enhancing one's coordination can greatly affect an athlete's capacity to perform accurate and effective motions during a sprint and resisted sprint training resulted in significant improvements in speed characteristics.

In summary, research on how resisted sprint training affects coordinative ability, speed, and strength metrics has produced encouraging results. The results show that adding resisted sprint training to an athlete's training programme can help them perform better in a few different ways.

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