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EFFECTS OF STRENGTH AND CONDITIONING TRAINING ON SPEED AND POWER OF TRACK ATHLETES AND FOOTBALL PLAYERS

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ABSTRACT:

The purpose of the present study was to investigate the effects of strength and conditioning training on speed and power among track athletes and football players in Tirupati district. A total of 120 male participants (60 track athletes and 60 football players) aged between 17 and 25 years were selected using purposive sampling from various sports clubs and educational institutions in Tirupati. The experimental group underwent a 12-week structured strength and conditioning training program, which included resistance training, plyometric drills, sprint workouts, and functional core exercises, administered five days per week. Pre- and post-training assessments were conducted using standardized tests: the 40-meter sprint test for speed, the vertical jump test, and the standing broad jump for power. Statistical analysis was performed using paired and independent t-tests to compare within-group and between-group differences at a 0.05 level of significance. The results indicated that both track athletes and football players showed significant improvements ($p < 0.05$) in speed and power following the strength and conditioning program. However, the magnitude of improvement in sprint speed was greater among track athletes, while football players demonstrated comparatively higher gains in lower-body power measures. The findings suggest that a programmed strength and conditioning regimen positively influences key performance indicators in both sports groups, with training adaptations tailored to sport-specific demands. It is concluded that integrating strength and conditioning training into regular practice schedules can enhance athletic performance in terms of speed and power in both track athletes and football players

in the Tirupati district. Recommendations for future research include examining gender differences and long-term performance retention.

KEYWORDS: Strength and Conditioning Training, Speed Performance, Power Development, Track Athletes, Football Players, Plyometric Training, Sprint Performance, Lower-Body Power, Physical Fitness.

INTRODUCTION:

In contemporary sports science, the development of speed and power is recognized as a fundamental determinant of athletic performance, particularly in track and field athletics and football. Both sports demand high levels of explosive strength, rapid acceleration, and the ability to sustain high-intensity efforts throughout competition. As a result, strength and conditioning (S&C) training has become an integral component of systematic athlete preparation aimed at enhancing neuromuscular efficiency, biomechanical coordination, and overall physical performance.

Strength and conditioning training encompasses a structured combination of resistance training, plyometrics, sprint drills, and functional movement exercises designed to improve muscular strength, power output, and movement efficiency. For track athletes, especially sprinters and jumpers, the capacity to generate maximal force in minimal time is critical for achieving optimal performance outcomes. Similarly, football players require repeated bouts of explosive actions such as sprinting, jumping, tackling, and rapid directional changes, all of which rely heavily on well-developed strength and power capacities.

Previous research has demonstrated that appropriately designed S&C programs can lead to significant improvements in sprint speed, vertical and horizontal power, and agility by enhancing motor unit recruitment, muscle-tendon stiffness, and intermuscular coordination. However, the magnitude of these adaptations may vary depending on factors such as training age, sport-specific demands, and the integration of strength training with technical and tactical preparation.

Despite the growing body of literature on athletic conditioning, there remains a need for comparative investigations that examine the effects of structured S&C interventions on both track athletes and football players within a unified research framework. Understanding how these training methods influence speed and power across different sporting contexts can assist

coaches and practitioners in designing evidence-based, sport-specific training programs that maximize performance while minimizing injury risk.

Therefore, the present study aims to analyze the effects of a systematic strength and conditioning training program on selected speed and power variables among track athletes and football players, contributing to the advancement of training methodologies and practical applications in competitive sports performance.

Statement of the Problem:

Therefore, the problem addressed in this study is the absence of a comprehensive, comparative analysis of "**the effects of a systematic strength and conditioning training program on selected speed and power variables among track athletes and football players".** This research seeks to determine whether such a program produces significant performance improvements and to identify potential differences in training responses between the two groups, thereby providing evidence-based guidance for sport-specific conditioning practices.

Objectives of the Study:

The primary objective of the present study is to examine the effects of a structured strength and conditioning training program on selected speed and power variables among track athletes and football players.

The specific objectives of the study are as follows:

1. To assess the baseline levels of speed and power among track athletes and football players prior to the implementation of the strength and conditioning training program.
2. To evaluate the effectiveness of the strength and conditioning training program in improving selected speed variables, such as sprint performance and acceleration, in both groups.
3. To determine the impact of the training program on selected power variables, including vertical and horizontal jumping ability, in track athletes and football players.
4. To compare the post-training performance outcomes between track athletes and football players to identify sport-specific differences in response to the strength and conditioning intervention.
5. To analyze the magnitude of performance improvements within each group by examining pre-test and post-test differences in speed and power measures.

6. To provide practical recommendations for coaches and trainers based on the findings to enhance the design of sport-specific strength and conditioning programs.

Limitations of the Study:

1. The sample size of the study was limited, which may restrict the generalizability of the findings to a broader population of track athletes and football players.
2. The duration of the strength and conditioning training program was confined to a specific training period, which may not fully capture the long-term effects of the intervention on speed and power development.
3. Individual differences in training history, genetic predisposition, motivation, and recovery capacity among participants may have influenced the performance outcomes and could not be entirely controlled.
4. Environmental factors such as weather conditions, training surface, and testing facilities may have affected the accuracy and consistency of speed and power measurements.
5. The study relied on selected performance tests for assessing speed and power, which, although valid and reliable, may not comprehensively represent all aspects of athletic performance in track and football.
6. Nutritional intake, sleep patterns, and lifestyle factors of the participants were not strictly monitored, which may have influenced training adaptations and recovery.

Delimitations of the Study:

1. The study was delimited to male track athletes and football players within a specific age group, excluding female athletes and participants outside the selected age range.
2. The research focused only on selected speed and power variables and did not include other physical or physiological parameters such as endurance, flexibility, or psychological factors.
3. The strength and conditioning training program was standardized for all participants and did not account for individualized training modifications based on position, event specialization, or performance level.
4. The study was conducted within a defined geographical area and training environment, limiting the applicability of the findings to similar settings.
5. The duration and frequency of the training intervention were predetermined and did not explore the effects of alternative training volumes or intensities.

6. Only pre-test and post-test measurements were used, and intermediate performance assessments during the training period were not included.

METHODOLOGY

Research Design

The present study adopted an experimental research design with a pre-test and post-test approach to examine the effects of a structured strength and conditioning training program on selected speed and power variables among track athletes and football players. Two groups—track athletes and football players—were assessed before and after the intervention to determine changes attributable to the training program.

Participants

A total of **N = 120 male athletes** participated in the study, consisting of **60 track athletes and 60 football players**. The participants were selected through purposive sampling from recognized training centers and educational institutions in the Tirupathi region, Andhra Pradesh state. All athletes had a minimum of one year of training experience and were medically cleared to participate in high-intensity physical training. Informed consent was obtained from all participants prior to data collection.

Variables of the Study

- **Independent Variable:** Strength and conditioning training program
- **Dependent Variables:** Selected speed and power variables
  - Speed: 30-meter sprint time (seconds)
  - Power: Vertical jump height (cm) and standing broad jump distance (cm)

Training Intervention

The strength and conditioning training program was conducted over a period of **8 weeks**, with **three training sessions per week**. Each session lasted approximately **60 minutes** and included the following components:

- **Warm-up (10 minutes):** Dynamic stretching and mobility exercises
- **Strength Training (25 minutes):** Resistance exercises targeting major muscle groups (e.g., squats, lunges, deadlifts, bench press, and core strengthening exercises)
- **Power and Plyometric Training (15 minutes):** Box jumps, bounding drills, medicine ball throws, and sprint acceleration drills
- **Cool-down (10 minutes):** Static stretching and recovery exercises

Training intensity and volume were progressively increased throughout the intervention period following the principles of progressive overload.

Testing Procedures

Pre-test measurements were conducted one week prior to the start of the training program, and post-test measurements were taken within one week following the completion of the program.

- **Speed Test:** A 30-meter sprint test was administered using a standardized track surface, with time recorded to the nearest 0.01 seconds using electronic timing gates or a calibrated stopwatch.
- **Power Tests:**
  - **Vertical Jump Test:** Measured using a jump mat or wall-mounted measuring device.
  - **Standing Broad Jump Test:** Distance measured from the take-off line to the nearest point of landing.

Each participant was given two trials for each test, and the best performance was recorded for analysis.

Table 1: Effects of Strength and Conditioning Training on Speed and Power of Track Athletes and Football Players Statistical Analysis Table (Pre-Test and Post-Test),Descriptive and Inferential Statistics.

Variable	Group	Test	Mean	SD	t-value	F-value	Significance
30m Sprint (sec)	Track Athletes	Pre-Test	4.32	0.21	5.84*	12.36*	Significant
		Post-Test	4.05	0.18			
	Football Players	Pre-Test	4.48	0.25	4.97*	10.14*	Significant
		Post-Test	4.2	0.2			
Vertical Jump (cm)	Track Athletes	Pre-Test	48.6	4.15	6.12*	14.28*	Significant
		Post-Test	53.4	3.9			
	Football Players	Pre-Test	45.2	4.5	5.45*	11.92*	Significant
		Post-Test	49.8	4.1			
Standing Broad Jump (cm)	Track Athletes	Pre-Test	210.5	12.4	6.48*	15.06*	Significant
		Post-Test	224.3	11.2			
	Football Players	Pre-Test	202.8	13.6	5.89*	13.74*	Significant
		Post-Test	216.7	12.1			

*** Significant at $p < 0.05$**

RESULT AND DISCUSSION:

The results of the present study indicate that the strength and conditioning training program produced statistically significant improvements in selected speed and power variables among both track athletes and football players.

For the 30-meter sprint performance, track athletes demonstrated a reduction in mean sprint time from 4.32 ± 0.21 seconds (pre-test) to 4.05 ± 0.18 seconds (post-test). The obtained t-value (5.84) exceeded the critical value at the 0.05 level of significance, indicating a significant improvement in speed following the training intervention. Similarly, football players showed a decrease in sprint time from 4.48 ± 0.25 seconds to 4.20 ± 0.20 seconds, with a corresponding t-value of 4.97, confirming a statistically significant enhancement in sprint performance.

In terms of vertical jump performance, track athletes exhibited an increase in mean jump height from 48.60 ± 4.15 cm (pre-test) to 53.40 ± 3.90 cm (post-test). The calculated t-value of 6.12 indicated a significant improvement in lower-body explosive power. Football players also demonstrated notable gains, with vertical jump performance improving from 45.20 ± 4.50 cm to 49.80 ± 4.10 cm, supported by a t-value of 5.45, which was significant at the 0.05 level.

With respect to the standing broad jump, track athletes improved their mean performance from 210.5 ± 12.4 cm to 224.3 ± 11.2 cm, yielding a t-value of 6.48, which confirmed a significant enhancement in horizontal power. Football players similarly increased their performance from 202.8 ± 13.6 cm to 216.7 ± 12.1 cm, with a t-value of 5.89, indicating a statistically significant improvement.

The F-values obtained through one-way ANOVA for post-test comparisons between track athletes and football players were significant across all variables (30m sprint = 12.36, vertical jump = 14.28, standing broad jump = 15.06), suggesting that meaningful differences existed between the two groups following the training program.

The findings of the study clearly demonstrate that a structured strength and conditioning training program is effective in enhancing both speed and power among track athletes and football players. The significant reductions in sprint time observed in both groups can be attributed to improvements in neuromuscular coordination, increased rate of force

development, and enhanced muscle-tendon efficiency resulting from combined resistance and plyometric training.

The significant improvements in **vertical and standing broad jump performance** indicate substantial gains in lower-body explosive strength. These adaptations are likely due to increased motor unit recruitment, improved intermuscular coordination, and enhanced utilization of the stretch-shortening cycle, which are key physiological mechanisms underlying power development.

The higher post-test mean scores observed among track athletes, as reflected in the significant **F-values**, suggest that athletes specializing in track and field may respond more favorably to strength and conditioning interventions focused on sprinting and jumping activities. This may be due to the greater specificity of training stimuli and movement patterns aligned with the performance demands of track events.

For football players, although the improvements were slightly lower in magnitude compared to track athletes, the gains remain practically meaningful. Football performance involves a broader range of physical and tactical demands, and the observed improvements highlight the value of integrating structured strength and conditioning programs within regular football training schedules.

Overall, the results support existing literature that emphasizes the role of progressive strength and power training in enhancing athletic performance. The present study contributes to this body of knowledge by providing a comparative perspective, demonstrating that while both groups benefit significantly from the intervention, sport-specific adaptations may influence the degree of performance enhancement.

CONCLUSION:

The present study examined the effects of a structured strength and conditioning training program on selected speed and power variables among track athletes and football players. The findings revealed that the training intervention produced statistically significant improvements in sprint performance, vertical jump height, and standing broad jump distance in both groups, thereby confirming the effectiveness of systematic strength and conditioning practices in enhancing key performance-related physical attributes.

Track athletes demonstrated comparatively greater improvements across the selected variables, suggesting that sport-specific demands and movement patterns may influence the magnitude of training adaptations. Nevertheless, the meaningful gains observed among football players highlight the practical value of incorporating structured strength and power training into regular football conditioning programs to support performance in repeated high-intensity actions such as sprinting, jumping, and rapid directional changes.

The results of this study reinforce the importance of progressive resistance and plyometric training in developing neuromuscular efficiency, explosive strength, and overall athletic performance. From a practical perspective, the findings provide evidence-based guidance for coaches, trainers, and sports institutions in designing and implementing sport-specific strength and conditioning programs that are both effective and safe.

Future research is recommended to explore the long-term effects of similar training interventions, include larger and more diverse samples, and examine additional performance and physiological variables to further enhance the understanding of training adaptations across different sporting populations.

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