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EFFECT OF PLYOMETRIC AND RESISTANCE TRAINING ON SELECTED FITNESS PARAMETERS IN UNIVERSITY MALE SOCCER PLAYERS

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ABSTRACT

The aim of this study was to examine the impact of plyometric and resistance training on selected fitness variables among university-level male soccer players. A total of sixty participants, aged eighteen to twenty four years, were randomly selected and separated into two groups: the plyometric training group (Group A, N=30) and the resistance training group (Group B, N=30). Both groups underwent a structured training program for 12 weeks, consisting of two sessions per week, each lasting 40 minutes. The selected fitness variables included leg strength (leg press), muscular strength endurance (sit-ups test), muscular power (standing long jump), speed (30-meter sprint), and agility (Illinois agility test). Pre- and post-test data were analyzed using percentages, mean, standard deviation, and t-test in SPSS 16. The results indicated significant improvements in both groups across all fitness variables. The plyometric training group demonstrated notable enhancements in muscular power and speed, with statistically significant results (P=0.00) in leg press, sit-ups test, standing long jump, and sprint performance, while agility showed a significance level of P=0.01. The resistance training group exhibited significant improvements in leg strength, muscular strength endurance, and agility, with all variables showing P=0.00, except for standing long jump (P=0.02). These findings highlight the effectiveness of both training protocols, with plyometric training being more beneficial for muscular power and speed, whereas resistance training contributed more to leg strength, muscular endurance, and agility.

Keywords: Plyometric training, resistance training, soccer players, fitness variables, speed, muscular endurance, agility

INTRODUCTION

Soccer players require a high level of fitness to perform optimally and minimize the risk of injuries. According to Bloomfield et al. (2007), soccer is a physically demanding sport that necessitates various skills, including speed, strength, agility, and quickness. Goran et al. (2007) emphasize that plyometric training, which involves rapid muscle loading and contraction, enhances muscle

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strength and neural activation, allowing athletes to jump higher and run faster based on training objectives.

Plyometric training consists of repeated exercise bouts interspersed with rest periods. Due to its discontinuous nature, this training method enables higher exercise intensity and workload compared to continuous training. It is particularly effective in improving speed, anaerobic endurance, and aerobic capacity. The training protocol can be tailored in terms of intensity, duration, repetitions, and sets to maximize performance benefits.

Resistance training, when appropriately designed, is essential for maximizing strength gains. Kraemer et al. (2002) highlight that structured resistance training enhances muscular strength, which is a critical component of fitness and athletic performance. Plyometric exercises leverage the stretch-shortening cycle to improve concentric muscle contractions, thereby increasing power output (Gehri et al., 1998; Adams et al., 1992; Paul et al., 2003). Strength is a key factor in executing motor skills, making resistance training fundamental in athletic development (Westcott, 1995).

A well-structured resistance-training program improves both muscular strength and endurance by progressively increasing workload demands. It incorporates various modalities such as bodyweight exercises, free weights, machines, resistance bands, and hydraulic equipment (Stratton et al., 2004). Resistance training is crucial for athletes across multiple sports, including cricket, basketball, boxing, baseball, wrestling, and judo (Azeem et al., 2006). Research suggests that while traditional strength training and plyometric training yield similar strength gains, plyometric training may lead to greater improvements in muscle power (Markovic et al., 2007).

Beyond enhancing athletic performance, resistance training contributes to overall well-being. Behringer (2010) notes that optimal joint range of motion is essential for effective resistance training, as muscle overload occurs at specific joint angles. Moreover, Garber et al. (2011) emphasize that resistance training not only enhances sports performance but also plays a crucial role in maintaining overall health and quality of life. Plyometric training, as a key training stimulus, has been proven to enhance explosive movements in athletes (Ingebrigtsen et al., 2013). Souhail et al. (2014) recommend that coaches and strength professionals prioritize plyometric training to enhance performance, particularly in elite male athletes. Additionally, resistance training is vital for promoting muscle hypertrophy and strength development (Hackett et al., 2018).

Recent studies have further elucidated the benefits of plyometric and resistance training for soccer players. A systematic review by Sanchez-Sanchez et al. (2024) concluded that plyometric jump training significantly enhances maximal strength in soccer players. Similarly, a meta-analysis by Ramirez-Campillo et al. (2023) found that both strength and plyometric training improve strength, power, and speed in high-level male youth soccer players. Furthermore, a study by Hammami et al. (2023) demonstrated that an 8-week program combining heavy-resistance and plyometric training led to significant improvements in neuromuscular performance among professional soccer players. Additionally, a systematic review by Asadi et al. (2023) highlighted that plyometric training effectively enhances kicking performance, a critical skill in soccer. Lastly, research by

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Beato et al. (2023) indicated that a 10-week plyometric training program significantly improved sprint performance and reactive strength in soccer players. These findings underscore the importance of incorporating both plyometric and resistance training into soccer conditioning programs to optimize performance. In brief, both plyometric and resistance training are integral components of athletic conditioning. Plyometric training improves power and speed, while resistance training enhances muscular strength and endurance. Together, these training modalities contribute significantly to the performance and fitness levels of soccer players.

METHOD

A total of sixty male university soccer players were randomly selected from King Fahd University of Petroleum & Minerals, Dhahran, Saudi Arabia. The participants, aged between 18 and 24 years, were divided into two groups: the Plyometric Training Group (N=30) and the Resistance Training Group (N=30). The plyometric group followed a plyometric training regimen, while the resistance group adhered to a structured resistance training protocol. Both training programs lasted for 12 weeks, with sessions conducted twice a week for 40 minutes per session.

Selected Fitness Variables and Testing Procedures

The study focused on the following fitness variables:

- Leg Strength (assessed through the leg press test)
- Muscular Strength Endurance (measured by the 30-second sit-up test)
- Explosive Power (evaluated using the standing long jump test)
- Speed (assessed through the 30-meter sprint test)
- Agility (measured using the Illinois Agility Test)

Body Mass Index (BMI) was calculated using the formula: BMI = weight (kg) / height (m^2). Weight and height measurements were recorded using an electronic weighing machine and a stadiometer, respectively. All fitness assessments were conducted at the university stadium using standardized sports equipment. Data collection took place both before and after the training intervention, with measurements recorded by the research team.

Plyometric Training Protocol

The plyometric training program was conducted for 12 weeks, with each session lasting 40 minutes, twice a week. Each session included:

- Warm-up and stretching (5 minutes)
- Plyometric exercises: squat jumps, jump-to-box, depth jumps, and bounding
- Training intensity: 3 sets of 10 repetitions per exercise
- Rest intervals: 90 seconds between sets
- Cool-down exercises (5 minutes)
- Resistance Training Protocol

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The resistance-training program included 10 exercises targeting major muscle groups:

- Leg press
- Leg extensions
- Leg curls
- Parallel bench press
- Chest press
- Lat pulldown (front)
- Seated rowing
- Seated shoulder press
- Preacher curls
- Triceps extensions
- Each session incorporated:
- Warm-up and cool-down exercises
- Training intensity: 2 sets of 15 repetitions per exercise
- Rest intervals: 30 seconds between sets

Data Analysis

The collected data were analyzed using statistical tools, including percentages (calculated using an online calculator), mean, standard deviation, and the t-test, which was performed using SPSS software.

RESULT AND DISCUSSION

The analysis of data related to the impact of plyometric and resistance training on the selected fitness variables among the participants from pre- to post-test is presented in Table 2 below.

Table 2 provides a detailed comparison of the selected fitness variables, highlighting the improvements observed among the participants following the training protocols.

Selected Fitness Variables	Groups (N=30)	Pre-test Mean	Pre-test S.D	Post-test Mean	Post-test S.D	P Value
Leg Strength	**Plyometric Training**	60.25	9.85	80.12	7.95	0.00
	Resistance Training	59.78	10.32	88.45	19.80	0.00
Muscular Strength Endurance	**Plyometric Training**	19.15	3.98	22.10	2.85	0.00
	Resistance Training	19.42	4.21	25.30	3.65	0.00
Explosive Power	**Plyometric Training**	1.70	0.14	1.92	0.25	0.00
	Resistance Training	1.68	0.27	1.80	0.16	0.02

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Selected Fitness Variables	Groups (N=30)	Pre-test Mean	Pre-test S.D	Post-test Mean	Post-test S.D	P Value
Speed	Plyometric Training	5.28	0.75	4.50	0.52	0.00
	Resistance Training	5.45	0.72	4.85	0.47	0.00
Agility	Plyometric Training	22.95	2.28	21.50	1.40	0.01
	Resistance Training	23.40	1.58	20.50	1.70	0.00

The analysis of the data for the plyometric and resistance training groups concerning the selected fitness variables from pre- to post-test is as follows: leg strength (P<0.00), muscular strength endurance (P<0.00), muscular power (P<0.00), speed (P<0.00), and agility (P<0.00). Both the plyometric and resistance training groups demonstrated significant improvements in all selected fitness variables from pre- to post-test.

The 12-week plyometric and resistance training intervention demonstrated significant improvements in performance among both groups. The primary objective of this research was to compare the effects of plyometric and resistance training protocols on selected fitness variables among university-level male soccer players. The results indicate that both training methods positively influenced key fitness components, including leg strength, muscular endurance, muscular power, speed, and agility.

Notably, both groups exhibited significant improvements from pre- to post-testing across all selected fitness variables. These findings reinforce the importance of incorporating both plyometric and resistance training as integral components of an athlete's conditioning regimen. The results further suggest that these training protocols are essential for achieving higher levels of fitness and enhanced sports performance.

When comparing the two training methods, resistance training proved to be more effective in enhancing leg strength, muscular endurance, and agility, while plyometric training yielded greater improvements in muscular power and speed. These findings align with previous research:

A 12-week resistance training program was found to significantly increase arm strength (Clayne R. et al., 1979).

Improvements in muscle strength and endurance were observed in male college students following resistance training (Ae-Rim Hong et al., 2014).

Strength and power training have been linked to improved quality of life and reduced risk of fractures, morbidity, and mortality (Von S. et al., 2015).

The influence of different resistance training intensities was found to enhance strength, anaerobic power, and explosive power (K. Azeem, 2016).

These findings emphasize the effectiveness of a twice-weekly plyometric and resistance training program in improving the fitness levels of university soccer players. However, it is evident from the present study that resistance training had a greater impact on leg strength, muscular endurance, and agility, whereas plyometric training was superior for enhancing muscular power and speed.

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A key limitation of this study was the lack of previous research directly comparing plyometric and resistance training protocols. Future studies should aim to explore this relationship further, considering different training durations, intensities, and sample populations.

CONCLUSION

The findings of this study conclude that both plyometric and resistance training significantly improved the selected fitness variables (leg strength, muscular endurance, muscular power, speed, and agility) from pre- to post-test. However, a distinct advantage was observed for each training method:

Plyometric training was more effective in enhancing muscular power and speed.

Resistance training had a greater impact on leg strength, muscular endurance, and agility.

These results highlight the importance of incorporating both training modalities into an athlete's conditioning program to maximize overall performance. Future research should explore longer training durations and different frequencies to determine the most optimal training approach for soccer players and other athletes.

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