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EFFECT OF RESISTANCE TRAINING ON MOTOR FITNESS OF WOMEN SOCCER PLAYERS

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Abstract
Purpose: This study aimed to examine the effect of resistance training (RT) on motor fitness of women soccer players.
Method: Forty (40) female soccer players, aged 18–21 years, were randomly selected from the YWC Football Club and assigned the Resistance Training (RT) group (n = 20) and the control group (n = 20). The RT group underwent an 8-week resistance training program, while the control group continued regular soccer practice without additional resistance training. Motor fitness components were assessed using the 30m Sprint Test (speed), the Balsom Agility Test (agility), and the Sergent Jump Test (Lewis Nomogram method) (anaerobic power). Data were collected pre and post-training, and covariance (ANCOVA) analysis was employed to determine significant differences between groups.
Results: Statistical analysis revealed significant post-training improvements in motor fitness for the RT group compared to the control group (Speed: $F = 11.52$, Agility: $F = 52.60$, Anaerobic Power: $F = 13.54$; $p < 0.05$).
Conclusion: These findings highlight the effectiveness of resistance training in enhancing motor fitness components in women's soccer players, suggesting its integration into training programs for improved performance.
Keywords: Soccer, Speed, Agility, Anaerobic power (AP), Motor fitness, Resistance training (RT).

I. INTRODUCTION

Soccer is one of the most popular sports worldwide, requiring high levels of technical skill, physical fitness, and tactical awareness (Kalinowski et al., 2019). As a contact sport, soccer places significant physical demands on players, including frequent changes in running direction, high-speed sprints, jumping, and physical duels with opponents (Wilson et al., 1991; Styles et al., 2016). Success in modern soccer depends on technical and tactical skills and motor fitness components such as speed, agility, and power, which are critical for optimal performance.

The market share of women's soccer is still growing significantly, which gives players additional chances to play professionally. There were 30 million soccer players worldwide between 2010 and 2015, a 32% rise in the number of women soccer players. According to FIFA, the "Federation Internationale de Football Association," by 2026, the number of women soccer players would have doubled to 60 million worldwide (Darragi et al., 2024).

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To enhance these physical attributes, structured resistance training (RT) has become an essential component of athletic preparation (Zouita et al., 2023). RT is known to improve muscular strength, power, and neuromuscular coordination, which can contribute to enhanced athletic performance (Christou et al., 2006). Research suggests that soccer-specific movement patterns require a combination of short bursts of high-intensity effort, explosive movements, and endurance (Bangsbo, 1998). Proper fitness preparation through RT can help athletes develop strength, balance, and agility, which are key to excelling in competitive soccer (Sparks & Behm, 2010; Tomljanović et al., 2011).

While previous studies have demonstrated the benefits of RT on balance and strength in untrained individuals (Sparks & Behm, 2010), limited research has explored its effects on female soccer players' speed, agility, and anaerobic power**.** This study aims to address this gap by examining the impact of an 8-week RT program on these key motor fitness components in women soccer players (Soros, J et al., 2024). The RT program focused on dynamic resistance exercises designed to enhance muscular strength, power, and isokinetic movement.

II. OBJECTIVES

This study aimed to examine the effects of resistance training (RT) on the motor of women soccer players.

III. METHODOLOGY

A total of 40 (N=40) women soccer players aged 18–21 years were randomly selected from YWC Football Club. All participants were actively competing in state league and national-level tournaments. The subjects were randomly assigned into two groups: resistance training (RT) or experimental group (n=20) and control group (CG) (n=20). The data were collected before and immediately after the 8 weeks of resistance training. The RT group participated in a supervised resistance training program for 8 weeks in alternate four (4) days per week under the supervision of a certified strength and conditioning coach, and no additional training was provided to the control group except regular practices. Before the resistance training commenced, 1-repetition maximum (1RM) of squats, leg extension, leg flexion, lunges, and bench press were conducted for the experimental group. Each player assessed the maximum weight could lift for a single repetition. The RT exercises included lower body, upper body, and core exercises. The training intensity and volume were progressively increased based on the participants' performance and adaptation to ensure continued strength development. Motor fitness components were assessed using the 30-meter sprint test for speed, Balsom agility test for agility, and Sergeant jump Lewis nomogram test for anaerobic power. The pertaining data were collected before (pre-test) and after (post-test) the eight (8) weeks RT program. The analysis of covariance (ANCOVA) statistical technique was used to determine the significant mean differences between the variables in the experimental and control groups.

IV. RESULT AND INTERPRETATION

The descriptive and ANCOVA analyses to evaluate the significant changes and differences in Speed, Agility, and Anaerobic power between the experimental and control groups, respectively, are shown in Tables 1 and 2.

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Table 1: Descriptive analysis of the Experimental group

	Variable	Test	N	Min	Max	Mean	SD
Expt. Group (RT)	Speed	Pre	20	4.07	4.97	4.48	0.23
		Post	20	3.08	4.30	3.59	0.38
	Agility	Pre	20	9.65	11.60	11.04	0.45
		Post	20	8.09	11.24	10.15	0.92
	Anaerobic power	Pre	20	52.06	91.05	72.85	10.25
		Post	20	54.45	92.65	74.37	10.16
Control Group (CG)	Speed	Pre	20	4.13	5.18	4.64	0.29
		Post	20	3.58	4.97	4.22	0.34
	Agility	Pre	20	10.50	13.02	12.04	0.54
		Post	20	8.79	11.87	9.72	0.76
	Anaerobic power	Pre	20	43.70	80.19	62.62	8.21
		Post	20	42.54	81.23	62.32	8.43

Table 1 shows the mean and standard deviations (M±SD) of Speed, Agility, and Anaerobic power for the experimental group in the Pre-test were 4.48±0.23, 11.04±0.45 and 72.85±10.25, respectively, and Post-test were 3.59±0.38, 10.15±0.92 and 74.37±10.16, respectively. The graphical presentation of pre and post-test means of the RT group is shown in Figure 1.
Further, Table 1 shows the mean and standard deviations (M±SD) of Speed, Agility, and Anaerobic power for the control group in the Pre-test were 4.64±0.29, 12.04±0.54 and 62.62±8.22, respectively, and Post-test were 4.22±0.34,9.72±0.76 and 62.32±8.43, respectively. The graphical presentation of pre and post-test means of the control group is shown in Figure 1.

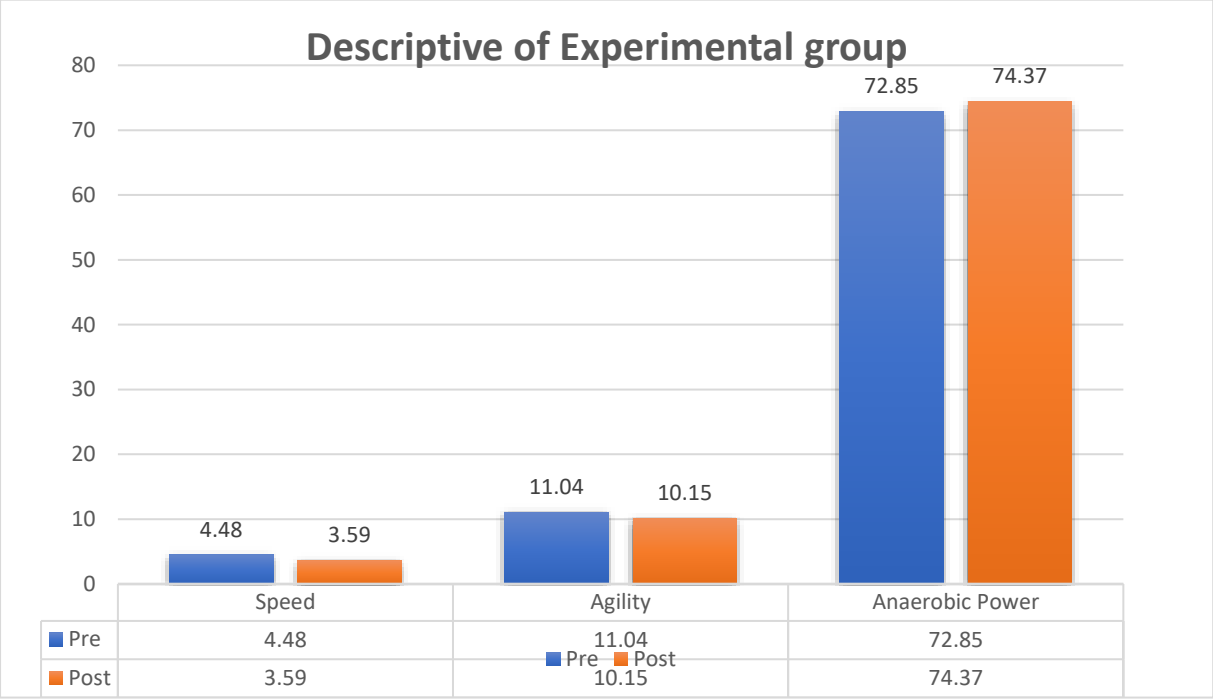

Fig.1. Pre and Post-test means of Experimental group.

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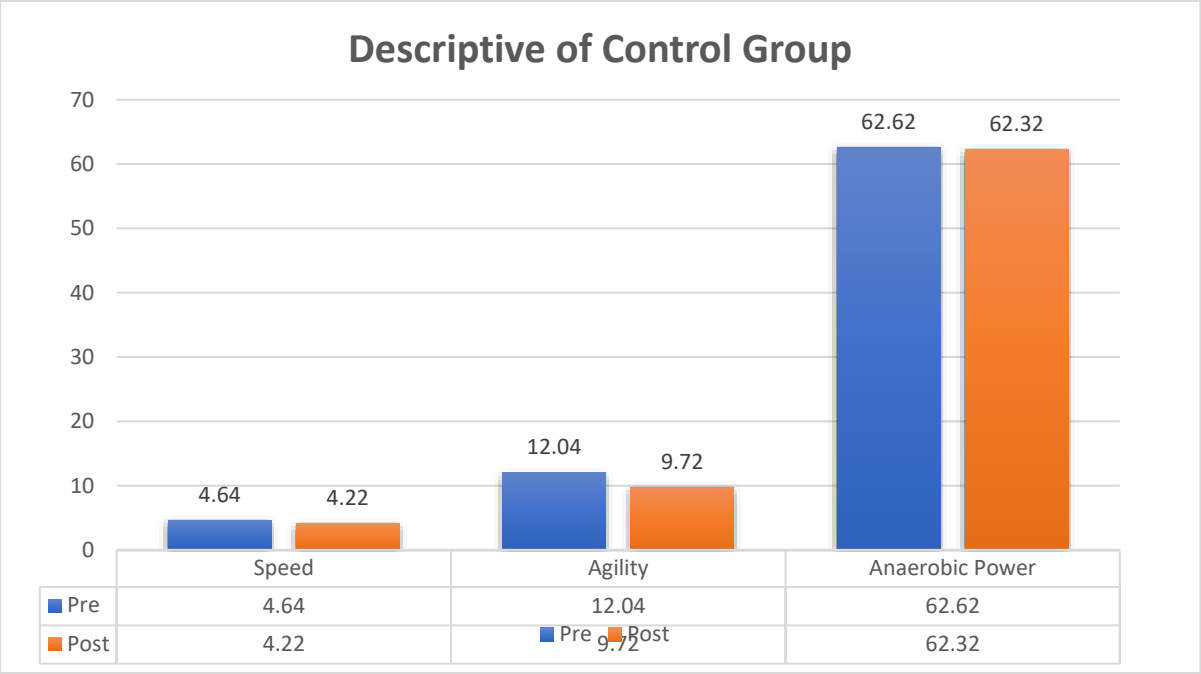

Fig.1. Pre and Post-test means of the Controlled group.

Table 2: Mean comparison of Pre and Post-test data.

Variables	Source	Types III sum of Squares	df	Mean square	F		Sig.(P)
Speed	Group	0.67	1	.67	11.52		.002
	Error	2.16	37	.05			
	Total	835.18	40				
Agility	Group	8.44	1	8.44	52.60*		.000
	Error	5.93	37	.160			
	Total	5349.24	40				
Anaerobic Power	Group	19.47	1	19.47	13.54*		.001
	Error	53.19	37	1.43			
	Total	187884.03	40				

***Significant at 0.05 Level of Confidence, where tabulated 0.05(1,37) = 4.08 (P<0.05)**

Table 2 shows that the experimental and control group pre and post-test means significant differences in terms of speed, agility, and anaerobic power as the calculated F values of 11.52, 52.60, and 13.54, respectively, are more significant than the tabulated F = 4.08 at the 0.05 level of significant ($p \leq 0.05$). Thus, the study's findings demonstrated that increasing motor fitness through eight (8) weeks of resistance training could enhance speed, agility, and anaerobic power.

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V. DISCUSSION

According to the relevant data, the experimental and control group pre and post-test means for Speed, Agility, and Anaerobic power showed significant differences. The calculated F = 11.52, 52.60, and 13.54, respectively, were more significant than the tabulated F = 4.08 at the 0.05 level of significance ($p<0.05$). During the routine football training, the players in the control group were actively involved. As a result, it might be possible to enhance the motor fitness conditionally.

Resistance training significantly impacts the motor fitness of women soccer players, enhancing various physical attributes crucial for performance. This type of training improves strength, power, speed, and agility, which are essential for soccer players to perform optimally on the field. The integration of resistance training into the training regimen of female soccer players can lead to substantial improvements in their overall physical fitness and performance capabilities (Kalinowski et al., 2020).

Resistance training enhances muscle strength and power, which are critical for executing explosive movements such as sprints and jumps. A study showed significant improvements in dynamic muscle strength and jump performance in female soccer players following a 12-week strength training program (Darragi et al., 2024). Resistance training boosts physical fitness and plays a role in injury prevention. A study found that female soccer players who engaged in strength training experienced significantly fewer non-contact injuries compared to those who did not, highlighting the protective benefits of such training (Darragi et al., 2024). Resistance training significantly improves women's strength, power, and performance in military-related tasks over a six-month period. This improvement is linked to the specific type of training program used, highlighting the importance of tailored exercise regimens for optimal results (Kraemer et al., 2001). Strength and power are greatly increased by resistance training, as evidenced by improvement in the 1-repetition maximum (1RM) test and jump performance metrics such as countermovement jump (CMJ) and squat jump (SJ) (Darragi et al., 2024).

VI. CONCLUSION

The current study discovered that RT for eight weeks improved the motor fitness of women soccer players. By improving muscle strength, power, and coordination, RT enables athletes to execute precise motor fitness such as speed, agility, and anaerobic power. RT intervention may be suggested as a crucial training element to be added to football training regimens.

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