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ISOLATED AND COMBINED IMPACTS OF WEIGHT TRAINING AND LADDER TRAINING ON SELECTED PHYSICAL, PHYSIOLOGICAL AND SKILL PERFORMANCE VARIABLES AMONG WOMEN KABADDI PLAYERS

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ABSTRACT

Background and study aim: To optimize performance in kabaddi, players require a blend of strength, agility, endurance, and speed. While weight training is increasingly popular due to its ability to enhance cardiovascular fitness and functional strength, there is limited understanding of its specific effects on the physical and physiological attributes of kabaddi players. Moreover, skill performance is integral to improving playing abilities. It is important to examine the isolated and combined impact of ladder training and weight training on select physical, physiological, and skill-related performance variables in female kabaddi players.

Material and methods: sixty female kabaddi players were randomly assigned to three experimental groups. Experimental group I weight training group (WTG) (N = 15) (Age21.08±0.9, Height: 168.25±3.86, Weight: 65.16±2.32) Experimental group II Ladder training group (N=15) (LTG) (Age: 21.15±1.20, Height: 159.28±2.59, Weight: 60.12±2.42) Experimental group III Combined Training Group (CTG) N = 15) (Age: 21.11±0.52, Height: 168.251±3.86, Weight: 65.16±2.32) and Combined Group (CG) (N = 15) (Age: 21.08±0.9, Height: 160.10±2.11, Weight: 59.17±2.02)their age ranged between 18 and 25. Subjects were randomly selected from the Dr.Sivanthi Aditanar College of Engineering, Tiruchendur, Govindammal Aditanar College for Women, Tiruchendur, Wavoo Wajeeha Women's College of Arts and Science, Kayalpatnam, Thoothukudi, India.

Testing Variables: The study assessed various physical, physiological and skill performance variables to evaluate in the impact of combined weight and ladder training. Agility was measured using the Illinois Agility Test, while Leg Explosive Power was assessed through the Standing Broad Jump. Muscular Strength Endurance was determined via the Sit ups test and physiological variables namely VO2 Max was measured by Cooper 12 Minutes run and walk and Breath Holding Time was measured by Nostril Clip Method. Additionally, skill performance variable namely toe touch ability was assessed by Toe Touch Test and considered a dependent variable for overall assessment.

Statistical Analysis: statistical analysis using dependent 't' test and Analysis of covariance (ANCOVA) to find out the significance among the mean differences, whenever the 'F' ratio for adjusted test was found to be significant, Scheffe's post-hoc test was used. In all cases level of significance 0.05.

Results: Participants who followed the combined weight and ladder training program showed substantial improvements in their physical, physiological, and skill performance indicators when compared to the control group ($p < 0.05$). Female kabaddi players overall physical, physiological, and skill performance variables were significantly improved by combined weight and ladder training.

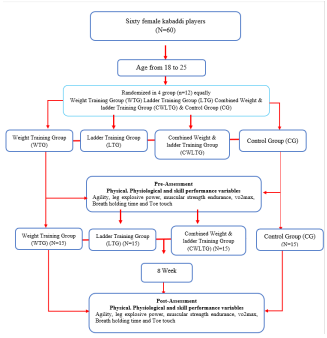
Conclusion: The combination of weight training and ladder training significantly enhanced the physical, physiological, and skill-related performance of female kabaddi players. This integrated approach proved more effective than either training method alone, demonstrating that a comprehensive training regimen can maximize overall athletic performance and help players achieve their full potential.

Keywords: Combined weight and ladder training, physical physiological, skill Performance variables and female kabaddi players.

1. INTRODUCTION

Kabaddi is a contact sport that started in ancient India and is now played in many countries all over the world. It requires quick reflexes, agility, and strategic thinking, making it a challenging and exciting game to watch and play. Kabaddi became an integral part of their culture and tradition, and it was not just a game but a way of life. People were systematically trained in earlier times, but in modern times, athletes train to enhance physiological goals and maximise sports performance. The goal of training is to raise athletes' productivity and skill level in order to foster the development of powerful psychological qualities (Bompa, 1999). The size or rate of increase of training effects brought on by a later training programme is not significantly influenced by training (Edward & Donald, 1981). Combined training methods are well recognised as efficient alternatives to increase neuromuscular performance during difficult skills such as maximal sprints and jumps (Saez de Villarreal E. 2013). Therefore, coaches and sport scientists have been making substantial efforts to identify the best combinations between different forms of strength-power exercises and training techniques (Loturco I. 2015). This study compared female Kabaddi players with mild breathy voices (BV) to those with severe BV in terms of their maximal oxygen uptake (VO2max) and rating of perceived exertion (RPE). The participants in this study were 70 female Kabaddi players from club and national teams (Samaneh Ebrahimi, 2020). Weight training, a crucial aspect of modern athletic preparation, plays a significant role in enhancing kabaddi players' physical attributes. It focuses on improving muscle strength, explosive power, and core stability, all of which are essential for executing powerful tackles and agile raids while minimizing injury risks. The incorporation of weight training into kabaddi training programs is supported by evidence demonstrating its effectiveness in enhancing biomotor skills critical to performance. (Kumar et al. 2020). A study by Singh et al. (2020) emphasizes that integrating weight training with sport-specific drills improves kabaddi players' explosive power and tackling efficiency by up to 18%. This evidence highlights the importance of adopting scientifically designed resistance training regimens to enhance the physical and competitive performance of players. Ladder drills demand quick and precise foot movements, simulating the rapid directional changes required in a toe touch. Exercises like the high-knee run and lateral quick steps prepare players for explosive movements (Srinivasan, R. 2021). Ladder training involves drills that require fast responses to cues, improving a player's reaction time during game situations where a toe touch needs to be executed quickly (Singh, H. 2019). Weight training helps develop the muscle groups required for tackling opponents, making quick escapes, and explosive movements. By increasing strength, female kabaddi players can improve their force generation during raids and defense (Kumar, R. 2020). Kabaddi players need endurance to sustain high-intensity movements throughout the match. Weight training, particularly with moderate loads and higher repetitions, can help build muscular endurance in key areas like the legs, back, and core (Verma, A. 2017)). Combining weight training with ladder drills offers significant benefits for enhancing the performance of kabaddi players. Weight training focuses on improving muscular strength and power, essential for the explosive movements needed in kabaddi, such as tackling, raiding, and evading opponents. Ladder training, on the other hand, improves agility, coordination, and foot speed, which are crucial for quick directional changes on the court.

Figure 1. Schematic of the study design



2. STUDY PARTICIPANTS

Sixty female kabaddi players were randomly assigned to 4 groups (i.e., WTG, LTG, CWLTG and GG). using the method of randomly permuted blocks using Research Randomizer, a program published on a publicly accessible official website (www.randomizer.org) their ranged from 18 to 25 years. All subjects were advised not to decrease or increase their daily sports and regular activities over the course of the study.

2.1. PROCEDURES

To minimize learning effects, participants underwent two familiarization sessions for the testing procedures and three sessions to acquaint themselves with weight training, ladder training, and the combined weight-and-ladder training prior to the intervention. These sessions were conducted just before the baseline assessments. Demographic data was collected, and participants were advised to maintain a clean, healthy diet, abstain from caffeine for at least three hours before testing, and refrain from engaging in intense physical activity for 24 hours prior. To account for daily variability, pre- and post-tests were scheduled at consistent times for all participants, and specific workouts were assigned to the same days. Testing followed a standardized protocol, maintaining uniformity in procedures and sequence. On test days, participants performed a ten-minute general warm-up before starting the assessments.

2.2. TRAINING INTERVENTION

The Dr.Sivanthi Aditanar College of Engineering, Tiruchendur, Govindammal Aditanar College for Women, Tiruchendur, Wavoo Wajeeha Women's College of Arts and Science, Kayalpatnam, Thoothukudi, India, in collaboration with qualified trainers and research scholars, has gathered a comprehensive range of resources to support effective training programs. These resources are carefully curated to ensure that individuals receive well-rounded guidance in physical fitness, sports performance, and overall wellness. For eight weeks, weight training, ladder training, combined weight and ladder training was conducted on alternative 3 days and 2 days for game practices, with two non-consecutive sessions each week. In along to the weight training, ladder training, combined weight and ladder training, which was integrated into their game related training routine, the kabaddi players also completed 60-minute workouts per week and participated in two game day. Each training session began with a prescribed warm-up, including dynamic and static stretches lasting about ten minutes, followed by progressively faster running, guided by research scholars. The weight training, ladder training, combined weight and ladder training program, designed to enhance agility, explosive power, muscular strength endurance, functional and skill performance, included exercises such as weight. These movements targeted multiple muscle groups, improving core stability, mobility, and endurance [12]. The intensity of the training was measured using a 1RM test and the number of kettlebell swings, with volume and complexity increasing weekly. A technique-based 1RM progression was used to determine exercise intensity. For kabaddi players, kettlebell training intensity was measured by weight, repetitions, rest intervals, agility, power output, and heart rate, with all swings and lifts performed with maximum effort [13]. The training protocol was discussed with qualified. The training program was developed using

3. ASSESSMENT PROTOCOLS

Assessment protocols for kabaddi players are standardized procedures using specific test items to evaluate their performance and abilities, ensuring consistent, accurate measurements and comparison across different players and teams [16]. All participants received a comprehensive briefing on the research protocol and detailed information regarding the study's objectives. Baseline profiles, including subject characteristics such as age, height, weight, bio motor abilities, and performance variables, were measured. The necessary resources, including a cone, measuring tape and other required testing equipment, were organized at the Department of Physical Education (equipment room). All tests were conducted by a research scholar under the supervision of a research supervisor, ensuring a smooth and efficient research process.

3.1. ANTHROPOMETRIC MEASUREMENTS:

A stadiometer was used to measure participants' height, while a portable digital scale with 0.1 kg precision was used to record their weight, with participants wearing minimal clothing and no shoes. Height was measured using a tape measure following a standardized procedure. Body Mass Index (BMI) was calculated using the formula: weight (kg) divided by height (m^2), where height is squared [4].

Group	No. of Subject	Age In Years	Height In Centimetres	Weight In Kilogram
WTG	15	21.08±0.9	168.25±3.86	65.16±2.32
LTG	15	21.15±1.20	159.28±2.59	60.12±2.42
CWLTG	15	21.11±0.52	160.10±2.11	59.17±2.02
CG	12	20.03±0.84	165.02±4.81	57.83±4.36

3.2. AGILITY WITH TOE TOUCH

Explain the agility (Illinois Agility Test) and toe-touch kabaddi skill test procedures clearly to the participants. Conduct a health risk screening and obtain their informed consent before proceeding. Prepare forms to record basic details, including age, height, body weight, gender, and specific test conditions. Set up the test area by measuring and marking it appropriately with cones to ensure accuracy and consistency. Inspect the timing gate equipment, calibrate it if necessary, and verify its proper functioning. Ensure participants understand the objectives and steps of the agility and toe-touch skill test before starting.

3.3. LEG EXPLOSIVE POWER WITH TOE TOUCH

To assess leg explosive power combined with the toe-touch kabaddi skill, ensure the testing area has a non-slip surface for the take-off and a soft-landing area to minimize injury risk. A tape measure can be used to record the jump distance, and commercial long jump landing mats are recommended for enhanced accuracy and safety. Before the test, clearly explain the procedures to participants to ensure they understand the objectives. Conduct a health risk screening and obtain informed consent from all participants. Record essential details such as age, height, body weight, gender, and test conditions on prepared forms. Inspect and calibrate the equipment as needed to ensure precise measurements. Participants should complete a standard warm-up routine to prepare their muscles for the test. The takeoff line must be clearly marked to maintain consistency and accuracy. Once all preparations are complete, participants can perform the test to evaluate their leg explosive power integrated with the toe-touch kabaddi skill.

3.4. MUSCULAR STRENGTH ENDURANCE WITH TOE TOUCH

Muscular strength endurance and Core strength are essential for female kabaddi players to perform toe-touch skills effectively. This sit-up test evaluates abdominal and hip-flexor muscle strength and endurance, which are crucial for stability and explosive movements. To begin, lie on a cushioned or carpeted surface with your knees bent at approximately 90 degrees and feet flat on the floor, ensuring your hands rest on your thighs without anchoring your feet. Engage your core by squeezing your stomach and flattening your back against the floor. Lift your upper body enough for your hands to slide along your thighs and touch the tops of your knees, mimicking the explosive motions required in kabaddi toe-touch actions. Avoid using your neck or head to pull yourself up, and keep your lower back in contact with the floor. Return to the starting position in a controlled manner, maintaining proper form throughout the movement. This test effectively measures the core strength and endurance necessary to support muscular strength endurance in kabaddi.

3.5. PHYSIOLOGICAL FACTORS WITH TOE TOUCH

VO2max and breath-holding time are crucial physiological factors for female kabaddi players. A high VO2max enhances aerobic capacity, enabling sustained performance during intense matches. Breath-holding time reflects lung

capacity and control, supporting defensive maneuvers and recovery during gameplay. Both factors contribute significantly to endurance, agility, and overall kabaddi performance.

3.6. SKILL PERFORMANCE (TOE TOUCH)

The purpose of this test is to evaluate the toe-touch performance of female kabaddi players, a critical skill for agility and precision during gameplay. The player begins in a parallel stance at the starting point (A), facing forward. On command, she moves to her left using side steps and touches a line marked 20 cm away with a toe-touch motion before returning to the starting point. She then performs the same movement to the right side. After completing these actions, the player makes a 90-degree left turn and repeats the movements toward the left and right directions using the same technique. The total time taken to complete the sequence is recorded in seconds as the score. This test not only assesses agility and explosive leg power but also improves coordination, directional control, and reaction time, essential for success in kabaddi.

4. RESULT OF THIS STUDY

Based on the results of Table 2 above and from the results of the hypothesis test with the Paired Sample t- Test, the bio motor abilities and performance variables of experimental group results obtained sig (2-tailed) value of 0.000 <0.05, it can be concluded that there is a significant improvement in the selected variables due to eight weeks of training program.

Table 2. The mean and t-ratio for pre and post-test on weight and ladder training (CTG), weight training (WTG), ladder training (LTG) and control group (CG) on selected physical, physiological and performance variables among women Kabaddi players

Table 2 Paired Sample t Test

Variables	*Test*	*WTG*	*LTG*	*CWLTG*	*CG*
Agility	PRE	18.72	18.65	18.86	18.72
	POST	17.05	17.92	16.19	18.65
	T-Ratio	***6.85****	***3.73****	***7.22****	***0.55***
Leg explosive power	PRE	1.81	1.83	1.79	1.79
	POST	2.07	1.96	2.16	1.83
	T-Ratio	***12.27****	***9.17****	***13.94****	***0.99***
Muscular strength endurance	PRE	29.52	27.94	29.64	28.63
	POST	36.74	32.51	39.41	29.08
	T-Ratio	***14.38****	***10.79****	***9.65****	***0.31***
VO2max	PRE	35.81	34.21	36.86	34.57
	POST	42.64	39.57	45.52	35.63
	T-Ratio	***11.61****	***13.05****	***15.07****	***1.02***
Breath holding time	PRE	30.97	29.93	31.05	29.85
	POST	35.21	32.89	37.22	30.07
	T-Ratio	***8.46****	***6.72****	***10.45****	***0.95***
Toe touch	PRE	21.74	21.93	21.89	21.85
	POST	18.01	19.58	16.84	21.56
	T-Ratio	***9.11****	***6.92****	***10.94****	***0.84***

Note: Combined weight and ladder training (CWLTG), weight training (WTG), ladder training (LTG) and control group (CG)

Table 2 The adjusted post-test means of of Table 2 above and from the results of the hypothesis test with the Analysis of Co-Variance, the physical physiological and skill performance variables of experimental groups results obtained sig (2-tailed) value of 0.000 <0.05, it can be concluded that there is a significant improvement in the selected variables due to eight weeks of training program.

Table 4.2 The adjusted post-test means of on weight and ladder training (CTG), weight training (WTG), ladder training (LTG) and control group (CG) on selected physical, physiological and performance variables among women Kabaddi players.

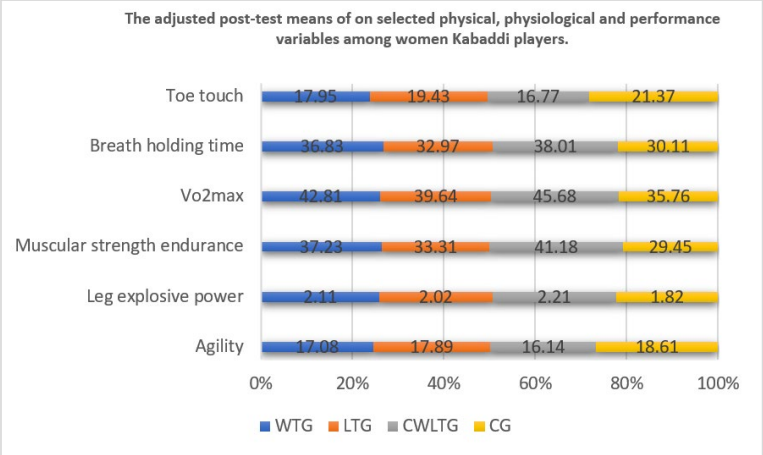
Variables	*WTG*	*LTG*	*CWLTG*	*CG*	*Sources of Variance*	*Sum of square*	*Df*	*Mean squares*	*F ratio*
Agility	17.08	17.89	16.14	18.61	**Between**	26.13	3	8.71	28.11
					Within	17.05	55	0.31	
Leg explosive power	2.11	2.02	2.21	1.82	**Between**	0.879	3	0.293	41.87*
					Within	0.385	55	0.007	
Muscular strength endurance	37.23	33.31	41.18	29.45	**Between**	812.33	3	270.78	20.56*
					Within	724.35	55	13.17	
Vo2max	42.81	39.64	45.68	35.76	**Between**	949.71	3	316.57	50.17*
					Within	347.05	55	6.31	
Breath holding time	36.83	32.97	38.01	30.11	**Between**	130.81	3	43.60	37.59*
					Within	63.80	55	1.16	
Toe touch	**17.95**	19.43	16.77	21.37	**Between**	110.16	3	36.72	29.85*
					Within	67.65	55	1.23	

Table 4.3 The scheffe's post hoc test physical, physiological and performance variables among women Kabaddi

Variables	**CTG**	**WTG**	**LTG**	**CWLTG**	**MD**	**CI**
Agility	16.41	17.08	-	-	0.67*	0.59
	16.41	-	17.89	-	1.48*	
	16.41	-	-	18.61	2.20*	
	-	17.08	17.89	-	0.81*	
	-	17.08	-	18.61	1.53*	
	-	-	17.89	18.61	0.72*	
LEP	2.21	2.11	-	-	0.10*	0.09
	2.21	-	2.02	-	0.19*	
	2.21	-	-	1.82	0.39*	
	-	2.11	2.02	-	0.09*	
	-	2.11	-	1.82	0.29*	
	-	-	2.02	1.82	0.20*	
Muscular strength endurance	41.18	37.23	33.31	29.45	3.95*	3.82
	41.18	-	33.31	-	7.87*	
	41.18	-	-	29.45	11.73*	
	-	37.23	33.31	-	3.92*	
	-	37.23	-	29.45	7.78*	
	-	-	33.31	29.45	3.86*	
Breath holding time	38.01	36.83	-	-	1.18*	1.13
	38.01	-	32.97	-	5.04*	
	38.01	-	-	30.11	7.90*	
	-	36.83	32.97	-	3.86*	
	-	36.83	-	30.11	6.72*	
	-	-	32.97	30.11	2.86*	
VO2max	45.68	42.81	-	-	2.87*	2.64
	45.68	-	39.64	-	6.04*	

	45.68	-	-	35.76	9.92*	
	-	42.81	39.64	-	3.17*	
	-	42.81	-	35.76	7.05*	
	-	-	39.64	35.76	3.88*	
Toe Touch	16.77	17.95	-	-	1.18*	1.17
	16.77	-	19.43	-	2.66*	
	16.77	-	-	21.37	4.60*	
	-	17.95	19.43	-	1.48*	
	-	17.95	-	21.37	3.42*	
	-	-	19.43	21.37	1.94*	

Figure II shows The mean and t-ratio for pre and post-test on weight and ladder training (CTG), weight training (WTG), ladder training (LTG) and control group (CG) on selected physical, physiological and performance variables among women Kabaddi players



5. DISCUSSION ON FINDINGS

The result of study indicates that there was significant improvement on selected physical, physiological and skill performance variables such as agility, leg explosive power, muscular strength endurance, vo2 Max, breath holding time and toe touch ability among women Kabaddi players due to the impact of combined training, weight training and ladder training programmes. Weight training improves overall physical performance, which is essential for enduring the physical demands of kabaddi, such as tackling and sprinting. This type of training helps athletes increase their explosive strength, making them more effective in offensive and defensive maneuvers. Ladder training, on the other hand, is particularly beneficial for improving agility, speed, and coordination which is essential for kabaddi players to execute their skills perfectly. Together, these combining training modalities contribute to better overall athletic performance, enhancing players' ability to execute skills effectively during matches. However, the control group had not shown any significant changes on selected physical, physiological and skill performance variables among women Kabaddi players. In addition to this, the following references were also strongly supporting the formulated

6. CONCLUSION

Combined weight training with ladder training significantly improved the physical, physiological, and skill performance variables of female kabaddi players. This combined approach proved to be more effective than using either method on its own, showing the value of a diverse training program. By utilizing the unique benefits of both techniques, this well-rounded strategy helps players enhance their overall performance and reach their highest potential.

CONFLICT OF INTERESTS

None.

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