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Water-Based Resistance Training And Its Influence On The Flexibility And Vertical Jump Height Of Female Football Players

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ABSTRACT

This study examines the influence of water-based resistance training on the flexibility and vertical jump height of female football players, addressing the need for safer and effective alternatives to traditional land-based strength training. Water-based resistance training provides a low-impact but efficient way to improve important athletic qualities considering the high-impact character of traditional training approaches. Using twenty female football players from the University of Lahore, a quasi-experimental pre- and post-testing study design was used. Comprising five weekly sessions with exercises including water running, aqua squats, water lunges, and plyometric water jumps, participants completed an eight-week water-based resistance training program. The Sit and Reach Test evaluated flexibility; the Vertical Jump Test examined vertical leap height. Using paired sample t-tests and the Wilcoxon Signed Rank Test via SPSS (version 27), data analysis found notable increases in both flexibility and vertical jump height. The mean Sit and Reach Test scores rose from 19.10 cm to 22.50 cm ($p = 0.000$), therefore verifying significant increases in flexibility. With 19 of 20 subjects showing better performance following training, the Wilcoxon Signed Rank Test also revealed a statistically significant increase in vertical jump height ($Z = -3.904$, $p = 0.000$). These results show how well water-based resistance training reduces injury risk while yet enhancing flexibility and explosive lower-body strength. While the resistance promoted strength growth, the buoyant qualities of water most certainly helped to reduce joint tension. The study comes to the conclusion that water-based resistance training presents a good substitute for typical land-based training since it provides a safer and efficient approach for enhancing important physical characteristics in female football players. To validate these results and maximize training approaches, future studies should investigate longer intervention times, greater sample sizes, and direct comparisons with land-based training.

INTRODUCTION

Football performance and training depend critically on flexibility and vertical leap height (1). More effortless and efficient motions needed for dribbling, shooting, and passing (2) are made possible by a player's range of motion enhanced by flexibility. It also helps to improve balance and stability under demanding playing conditions and reduces muscular stress and promotes recovery, therefore preventing injuries. In (3), Conversely, vertical jump height is crucial for defensive as well as offensive plays (4). A better vertical jump helps a player fight for aerial balls, score goals, and guard against aerial there as (5). Performance criteria and general fitness depend critically on resistance and conditioning shown by higher vertical jump height (6). Performance measures and general fitness depend critically on resistance and conditioning—shown by higher vertical jump height (7).

Football's demands for fast direction changes, high-intensity sprints, and physical contact make these features vital; integrating water-based strength training might provide further benefits by using the special qualities of water for increased conditioning (8). In sports like football especially, strength training has long been a fundamental component of athletic growth. Strength training historically took place on ground utilizing free weights and resistance apparatus. These methods were meant to increase general physical performance (9), muscle strength, endurance, and physical capacity. Though these traditional therapies were effective, they sometimes resulted in problems related to musculoskeletal imbalances and usually carried hazards of damage (10). Often referred to as aquatic exercise or hydrotherapy, water-based training first took front stage in the twentieth century (11). This kind of low-impact exercise that can be quite successful for rehabilitation and injury prevention makes use of the properties of water, such buoyancy and resistance (12). First mostly used in rehabilitation environments, water-based training's soft nature allowed for efficient injury recovery with minimal physical strain on the body (11). Scholars and professionals started looking at more general applications of water-based training outside of rehabilitation in the late twentieth and early twenty-first century (13).

Research on how water-based exercises might be changed for strength training, endurance, and flexibility started to show results (14). Football players need flexibility if they are to increase their range of motion and prevent injuries (15). Because the water helps to lower joint tension and allows one to perform dynamic stretches, water-based training has been investigated for its possible ability to improve flexibility (16). Studies indicate that aquatic

exercises could boost joint mobility and muscular flexibility, which would be beneficial for football players since it would enable a larger range of motion and lower the possibility of injury (8). In football, vertical jump height is a crucial performance metric that affects things like aerial duels (17) or jumping to intercept the ball.

Well-documented advantages on vertical leap height (18) abound from conventional strength training methods (34). With its different resistance properties, water-based training offers a special approach. By increasing muscle strength and power, working against water resistance can help to improve vertical jump performance (19). Early studies looked at whether water-based strength training may provide either similar or even better benefits for vertical leap height than conventional methods (20). A lot of studies on the value of water-based strength training for athletes have lately attracted attention (21).

Research on several factors, including the intensity, duration, and kinds of water exercises that best support strength, flexibility, and power, has found (22). Water-based training has been looked at as a means of complementing land-based training and providing a complete approach to player development (23). Often referred to as aquatic or hydrotherapy exercise, water-based strength training has drawn a lot of attention recently because of its possible advantages in many kinds of sports (24). This training approach, a tempting substitute for conventional land-based strength training (25) since it uses the special properties of water, such buoyancy, resistance, and reduced impact. Water's therapeutic environment lets your variety of motions that can be challenging on land, hence maybe improving athletic performance (26). In sports like football (27), training programs that increase flexibility and explosive force are quite crucial. A range of activities requires flexibility; quick directional shifts, reaching, and avoiding harm (28). It helps sportsmen to preserve control of their bodies in dynamic surroundings and move quickly and precisely (29). Conversely, a vital indication of lower body power and explosiveness—which directly affects an athlete's capacity to engage in high-intensity events including jumping, sprinting, and tackling—30 is vertical jump height (35). This study aims to explore, mostly in football players (31), the effects of water-based strength training on flexibility and vertical leap height. Pre- and post-testing experimental research in the study will provide empirical data on the effectiveness of aquatic training programs (32). Participants will follow a special water-based strength training program meant to target muscle groups required for both flexibility and vertical leaping ability (24). Before and after the intervention, their performance will be compared with an eye toward changes in

flexibility and vertical leap height (33). To excel on the field, football players have to combine power, agility, and strength. Usually used to build the necessary muscle strength and power, traditional strength training can occasionally cause overuse injuries or too tight muscles, therefore compromising flexibility.

OBJECTIVES

To measure the influence of water-based resistance training on flexibility and vertical jump height of football players.

HYPOTHESIS

H1: There is a positive influence of water-based resistance training on flexibility and vertical jump height.

RESEARCH METHODOLOGY

PROPOSED PLACE OF WORK AND FACILITIES AVAILABLE

The study was held at The University of Lahore Swimming facility

PLAN OF WORK AND METHODOLOGY ADOPTED

This study aims to Water-based resistance training and its influence on the flexibility and vertical jump height of female football players through a pre- and post-testing and Quasi experimental research design. The methodology involves assessing athlete flexibility and vertical jump height using the sit and reach test for measuring flexibility and the Vertical jump test for measuring vertical jump height before and after the intervention period with water-based strength training. Data analysis was employed paired sample t-tests and descriptive statistics to compare the results and measure any significant changes in flexibility and vertical jump height performance. This approach provide valuable insights into how water-based resistance training can potentially enhance flexibility and vertical jump height capabilities among football players.

INTERVENTIONS

Duration: The training program was last for 8 weeks.

Session: 5 sessions of water-based resistance training per week.

Exercise: 60 minutes of water-based resistance training

(Interval training).

Intensity: 60-70% of MHR

TABLE 1: TRAINING PROGRAM

Day	Exercise	Duration/Reps	Notes
Mon	Water Running	10 min	Maintain consistent pace
	Aqua Squats	3x20 reps	Focus on depth and form
	Water Lunges	3x18 reps per leg	Keep core engaged
Tue	Water Plank	3x30 secs	Engage core and maintain form
	Static Stretches	15 min	Focus on core muscles
Wed	Water Plyometric Box Jumps	4x20 reps	Focus on height and control
	Gentle Water Walking	15 min	Cool-down
Thu	Water Trunk Rotations	3x30 secs	Rotate gently for flexibility
	Aquatic Yoga Poses	20 min	Focus on deep stretching and breathing
Fri	Water Pull-Ups	3x8-10 reps	Focus on full range of motion
	Water Arm Circles	3x30 secs	Focus on shoulder mobility
Sat	Rest		Active recovery day
Sun	Rest		Active recovery day

Cool Down: Always include a cool-down period at the end of each session with gentle stretches and relaxed movements in the water.

INCLUSION CRITERIA

Female Football Players who are from University of Lahore.

The players who are part of University of Lahore football team for one or more years.

Female Football players, who was consent to the participation in this study.

Female Football players whose age should be between 18-25 Years.

EXCLUSION CRITERIA

The players with any physical injury were not be a part of the study.

The players with hydrophobia were not participate in the study.

TREATMENTS TO BE STUDIED

The influence of water-based resistance training on the flexibility and vertical jump height of football players.

RESEARCH LAYOUT PLAN

This study was being pre & post-testing in nature, which will have based on Quasi

experimental research design.

PARAMETERS/VARIABLES TO BE STUDIED

Independent Variable: Water-based resistance training

Dependent Variable: Flexibility, Vertical Jump Height

METHODS OF DATA COLLECTION

- Participants' consent was obtained and then demographic and data related to the history of any medical condition will be collected.
- Within 3 to 5 days after base training pre-test were conducted by using sit and reach test and vertical jump test.
- Post-test were being conducted after completion of water-based resistance training program.

SAMPLING TECHNIQUE AND PROCEDURE

Purposive sampling Technique were used.

SAMPLE SIZE

A total number of 20 female football players was recruited in the study.

STATISTICAL ANALYSIS/TEST TO BE USED

Paired sample t-Test and Inferential statistics were used.

All statistical analysis was being calculated by using the Statistical Package for the Social Sciences (SPSS), version 27.

Statistical significance was being kept at an alpha level less than or equal to 0.05.

To note whether there were be differences in football player's flexibility and vertical jump height performance in response to the water-based resistance training program. In addition, to examine the pre -post training effect of training program sit and reach test and vertical jump test were being employed.

RESULTS

TABLE 2

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Vertical Jump Pre-Testing	.287	20	.000	.731	20	.000
Vertical Jump Post	.309	20	.000	.696	20	.000

Testing						
Sit and Reach Pre-Testing	.194	20	.047	.935	20	.194
Sit and Reach Post Testing	.163	20	.173	.936	20	.198

The results from the Tests of Normality using the Kolmogorov-Smirnov and Shapiro-Wilk tests indicate whether the data follows a normal distribution. For the Vertical Jump Pre-Testing and Vertical Jump Post-Testing, both tests yielded significance values (p-values) of 0.000, which are below the standard threshold of 0.05, indicating that the data does not follow a normal distribution. Similarly, for the Sit and Reach Pre-Testing, the Kolmogorov-Smirnov test produced a significance value of 0.047, which is slightly below 0.05, suggesting that this dataset may also deviate from normality, while the Shapiro-Wilk test resulted in 0.194, which is above 0.05, indicating normality. For the Sit and Reach Post-Testing, both tests produced p-values of 0.173 and 0.198, respectively, both of which exceed 0.05, suggesting that this dataset is normally distributed. These results imply that while the sit and reach post-testing data satisfies normality assumptions, the vertical jump data does not follow a normal distribution, which could affect the statistical tests applied for more investigation.

TABLE 3: T TEST

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	SARTPRE	19.1000	20	5.34986	1.19627
	SARTPOST	22.5000	20	5.12476	1.14593

From an average pre-test score of 19.10 cm to a post-test score of 22.50 cm following the 8-week water-based resistance training program, the paired samples data for the Sit and Reach Test (SART) expose an increase in flexibility. This indicates that the intervention improves flexibility really nicely. From 5.35 cm pre-test to 5.12 cm post-test, the standard deviation somewhat dropped to suggest that people's flexibility improved more regularly. The measurement accuracy of both tests—1.20 cm for the pre-test and 1.15 cm for the post-test—showcases the standard error of the mean. This outcome implies that flexibility of female football players could be much enhanced by water-based resistance training.

TABLE 4

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	SARTPRE & SARTPOST	20	.983	.000

The table shows the results of the Paired Samples Correlations study, which examines the correlation between the pre-test and post-test outcomes of the Sit and Reach Test (SART), so gauging flexibility. With a sample size (N) of 20, the research was presumably carried out utilizing information on 20 female football players. Pre-test and post-test findings show a quite substantial positive link with a correlation value of 0.983. This strong association implies that flexibility increases were consistent across all people since the scores before and after the water-based resistance training program are somewhat similar. Moreover, the p-value is 0.000, which is well below the 0.05 significance level, implying that the link is statistically significant. This implies that the noted increases in flexibility are not random but rather reflect the real effect of water-based resistance training. These findings reveal generally that the water-based training program consistently and favorably affected the participants' flexibility.

TABLE 5

Paired Samples Test

		Paired Differences					t	Df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	SARTPRE - SARTPOST	-3.40000	.99472	.22243	-3.86554	-2.93446	-15.286	19	.000

The results of the paired sample t-test reveal that following the water-based resistance training program, female football players' flexibility considerably changed. The mean difference of -3.40 indicates that post-test results were higher than pre-test scores, thereby indicating more flexibility as judged by the Sit and Reach Test (SART). The standard deviation (0.99) and standard error mean (0.22), which show that the outcomes are consistent among participants, support this development even more. The 95% confidence interval (-3.87 to -2.93) implies that the real mean difference is most likely within this range, which adds to the findings'

dependability. Furthermore, the t-value (-15.286) reflects a significant difference between pre- and post-test results. While possibly minimizing the risk of damage associated with traditional land-based. With 19 degrees of freedom (df = 19), the study indicates that the observed flexibility increases were not the result of random chance. Most significantly, the p-value (0.000) is considerably below the significance level of 0.05, indicating that the gain in flexibility is statistically significant. This shows that water-based resistance training had a significant and beneficial effect on the participants' flexibility. These data demonstrate the usefulness of this training strategy in improving critical physical attribute training.

TABLE 6: WILCOXON SIGNED RANK TEST

Ranks

		N	Mean Rank	Sum of Ranks
Vertical Jump Post Testing - Vertical Jump Pre-Testing	Negative Ranks	1[a]	1.00	1.00
	Positive Ranks	19[b]	11.00	209.00
	Ties	0[c]		
	Total	20		

The results of the Wilcoxon Signed Rank Test indicate a significant improvement in vertical jump height following the water-based resistance training program. The Positive Ranks (N = 19, Mean Rank = 11.00, Sum of Ranks = 209.00) suggest that 19 out of 20 participants showed an increase in their vertical jump height after training. Conversely, only one participant (Negative Rank = 1, Mean Rank = 1.00, Sum of Ranks = 1.00) experienced a decrease in performance, and there were no ties (N = 0), meaning no participant maintained the same vertical jump score before and after training. These results strongly indicate that the intervention led to notable improvements in vertical jump height among the female football players, further supporting the hypothesis that water-based resistance training positively influences explosive power and lower-body strength.

TABLE 7: WILCOXON SIGN RANKED TEST

Test Statistics

	Vertical Jump Post Testing - Vertical Jump Pre-Testing
Z	-3.904[b]
Asymp. Sig. (2-tailed)	.000

The results of the Wilcoxon Signed-Rank Test indicate a significant improvement in vertical

jump height following the water-based resistance training program. The Z-value (-3.904) is highly negative, suggesting a strong difference between pre-test and post-test scores. Furthermore, well below the 0.05 criterion is the Asymptotic Significance (p-value = 0.000), therefore verifying the statistically significant rise in vertical leap height. These results imply that lower-body power and explosive strength enhanced by water-based resistance training, hence enhancing vertical leap performance among the female football players.

CONCLUSION

The results of this study show convincing proof that water-based resistance training greatly increases vertical leap height and flexibility in female football players. The Sit and Reach Test shows a clear improvement in flexibility; post-training scores were much higher than pre-training scores ($p = 0.000$), therefore validating the success of the intervention. Likewise, vertical leap height showed significant increases, as shown by Wilcoxon Signed Rank Test results ($Z = -3.904$, $p = 0.000$), therefore underscoring the favorable effect of water-based training on explosive lower-body strength. These findings imply that including water-based resistance exercises into training programs can be a safer and similarly efficient substitute for conventional land-based strength training, therefore reducing injury risks and optimizing sports performance. Thus, the study emphasizes the possibility of water-based resistance training in enhancing important physical traits necessary for football performance and supports its wider use in athletic conditioning courses.

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