

Effect of Stretching Exercises in an Aquatic Environment on Improving Dynamic Balance in Basketball Players with Knee Joint Injuries

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Abstract

In order to improve dynamic balance in basketball players with knee joint injuries from clubs in the Al-Muthanna Governorate, the current study designed a series of stretching exercises and tested them in an aquatic setting.

Two groups were created from the research sample. Three wounded athletes who adhered to the coach's recovery regimen made up the first group, which served as a control group. The second group was an experimental group made up of three wounded athletes who adhered to the researcher's recovery regimen.

The post-tests of the two groups showed statistically significant differences in favor of the experimental group, according to statistical comparisons. The study came to the conclusion that stretching exercises carried out in an aquatic setting were successful in helping basketball players with knee joint problems regain motor efficiency. Additionally, the study suggested that an aquatic environment be provided as a crucial rehabilitation setting in basketball player rehabilitation facilities.

Keywords: Stretching Exercises, Aquatic Environment, Dynamic Balance, Knee Joint

1. Introduction to the Research

1-1 Introduction and Importance of the Research

Training and physical rehabilitation have seen tremendous advancements in sports sciences in recent years, especially with regard to sports injuries and treatment approaches. Among the most prevalent issues that athletes in general and basketball players in particular deal with are muscular and joint ailments. This is because basketball is a team activity that demands strong physical skills including strength, speed, agility, and repeated jumping. These demands raise the risk of players experiencing exhaustion, injuries, and joint and muscle pain, especially in the lower limbs.

As sports medicine and rehabilitation have advanced, a variety of therapeutic approaches have been developed with the goal of lowering pain and hastening the return of motor function. Among these techniques are therapeutic exercises carried out in an aquatic setting, which make use of the physical characteristics of water, such as buoyancy, resistance, and lowering the strain on muscles and joints during exercise. This reduces pain perception while enabling players to execute therapeutic exercises in a safer manner. In addition to increasing blood circulation and encouraging muscle relaxation, water resistance is thought to be a safe way to progressively improve motor skills and build muscles.

Therefore, the significance of this research is in creating contemporary therapeutic exercises based on earlier research that has been successful in rehabilitation, implementing them in an aquatic setting for basketball players experiencing pain and decreased motor efficiency, particularly following exposure to intense physical exertion during games, and determining their efficacy in lowering pain and enhancing motor performance.

1-2 Research Problem

Basketball players use a fast movement rhythm to accomplish abilities that support tactical goals. Additionally, players are more vulnerable to accidents and joint and muscle soreness due to frequent jumping, landing, and abrupt changes in movement direction. While aquatic treatment is regarded as one of the most significant contemporary therapeutic procedures that help complete activities safely and effectively, players frequently turn to conventional recuperation techniques. Thus, the researcher aimed to investigate the impact of therapeutic exercises carried out in water and ascertain the efficacy of this approach in lowering pain and regaining motor function in basketball players.

1-3 Research Objectives

creating a series of therapeutic activities for basketball players in Al-Muthanna Governorate clubs in an aquatic setting.

determining how therapeutic workouts in an aquatic setting can help basketball players in Al-Muthanna clubs reduce muscle soreness and regain motor efficiency.

1-4 Research Hypothesis

There are statistically significant differences in the acquired scores between the control and experimental groups in favor of the experimental group.

1-5 Research Fields

1-5-1 Human Field

Basketball players of Premier League clubs in Al-Muthanna Governorate.

1-5-2 Time Field

From 5/12/2025 to 5/3/2026.

1-5-3 Spatial Field

Swimming pool located in Ammar Al-Badiri Bodybuilding Hall – Al-Muthanna Governorate.

1-6 Definition of Terms

Stretching Activities:

Exercises that strengthen the muscles supporting the joint to enhance the necessary flexibility and assist prepare and train supporting muscles to bear large loads in order to raise the physical level, especially muscular endurance (5: 2025: 415).

The aquatic environment

A training or rehabilitation setting, such as a swimming pool, where exercises are carried out using the physical characteristics of water, such as buoyancy, resistance, and pressure, to lessen the physical strain on joints and improve the healing process (3: 2026).

Injury to the knee joint:

A disease or injury that affects the ligaments, cartilage, or surrounding muscles of the knee joint and causes problems with motor function (3: 2026).

Dynamic Balance:

The body's ability to maintain stability during movement (7: 2025).

2. Research Methodology and Field Procedures

2-1 Research Method

The researcher used the experimental method with equivalent groups due to its suitability for the research problem.

2-2 Research Population

Eight basketball players from different clubs in the Al-Muthanna Governorate were picked by the researcher as the research population due to knee joint ailments. Six players were split into two groups after two were chosen to carry out the pilot study:

Control group consisting of (3) players

Experimental group consisting of (3) players

Table (1) shows the names of basketball clubs in Al-Muthanna Governorate and the sample distribution.

Number of Injured	Club Name	No.
2	Al-Samawah Club	1
2	Al-Rumaitha Club	2
2	Al-Khidr Club	3
1	Uruk Club	4
1	Al-Muthanna Club	5

2-3 Statistical Control

When the sample size was equal to or less than thirty, the researcher used the Shapiro-Wilk test to analyze the data distribution. This process was carried out to ascertain whether parametric or non-parametric statistical tests should be employed.

Table (2) presents the results of the Shapiro–Wilk test for the normal distribution of the data.

Dynamic Balance		Measurement	Groups
Sig	Statistic		
0.643	0.976	Pre-test	Control Group
0.576	0.932	Post-test	
0.123	0.948	Gain (Acquired)	
0.674	0.942	Pre-test	Experimental Group
0.132	0.878	Post-test	
0.301	0.866	Gain (Acquired)	

2-3-2 Homogeneity and Equivalence of the Two Groups

The following actions were taken by the researcher:

To verify the correctness of the statistical analysis and assess the degree of similarity between the two groups in terms of data dispersion, Levene's Test was employed.

The Independent Samples T-Test was used to verify that there were no changes between the two groups' means and to make sure that the independent variable was applied beginning from the same baseline. To put it another way, this process made sure that both groups had the same degree of dynamic balance before the intervention (see Table 3).

Table (3) shows the homogeneity of the two groups at the pre-test measurement level.

Result Description	Sig	T	Sig	Levene	Control and Experimental
Homogeneous & Equivalent	0.613	0.475	0.572	1.443	Dynamic Balance
Homogeneous & Equivalent	0.774	0.265	0.181	1.842	Height
Homogeneous & Equivalent	0.673	0.462	0.394	1.762	Mass

2-4 Tools, Devices, and Means Used in the Research

Arabic and foreign references

Personal interviews

Dynamic balance test

VertiMax device

Data recording sheets

Six medicine balls and elastic resistance bands

Electronic stopwatch

Whistle

3-5 Field Research Procedures

3-5-1 Dynamic Balance Test (6: 2005: 12)

The dynamic balance test employed in this study was chosen by the researcher after analyzing a number of earlier studies and research, as well as after speaking with a group of experts and professionals in sports rehabilitation. A 75% agreement rate led to the test's approval. The following were the test's specifications:

Test Objective

To measure dynamic balance.

Tools Used

Adhesive tape, a three-meter metal measuring tape, two circular adhesive markers with a diameter of ten centimeters each, five markers that are thirty centimeters high, a whistle, and a data entry form.

Test Procedures

The two circular ground markers were spaced 100 cm apart, with one marker positioned halfway at a distance of 50 cm.

The first circular marking was positioned between two more markers, one in front and one behind. The markers and the circular marker were separated by 60 centimeters.

Performance Description

The player extends their arms sideways while standing on the first circular marker. The opposite foot is positioned from the inside next to the marker, with the right foot resting on it. The player raises their left

foot without hitting the ground and tries to contact the front marker when they hear the whistle signal to begin. They then return to touch the rear marker without touching the ground.

The player then does the same forward and backward contacting motion without hitting the ground after bending the supporting leg (right foot), jumping, and landing on the left foot over the second circular marker. Until the player makes a mistake by touching the ground with their free foot, the performance continues.

Test Administration

Caller: Calls the names and signals the start of the test using the whistle

Recorder: Observes performance and records scores

Scoring

One point is awarded for each correct touch of the marker (forward or backward) using the free foot from both sides.

Two points are awarded for each successful transition through jumping between circular markers. No points are awarded if landing occurs outside the markers.

End of Scoring

The total score is calculated from the best attempt out of two trials.

3-5-2 Pilot Study

On Monday, August 12, 2025, the researcher carried out the pilot study to find any challenges and roadblocks that might occur during the main trial. Along with determining the cost and logistical needs, the location of the swimming pool was chosen for the experiment. Additionally, the researcher evaluated the research sample's acceptability for stretching activities in an aquatic setting.

3-5-3 Pre-Test

On Wednesday, October 12, 2025, the researcher took pre-test measures for both the experimental and control groups. Statistical control methods were used based on the extracted data.

3-5-4 Experimental Variable (Stretching Exercises in Aquatic Environment)

After evaluating a number of earlier studies, including (4: 2023), (8: 2024), and (10: 2025), as well as internet resources (YouTube), the researcher created a series of stretching exercises, especially those that used resistance bands and the VertiMax device. A panel of experts and specialists in sports training and rehabilitation that the researcher spoke with approved these activities.

According to the following information, the experimental intervention (stretching exercises in the aquatic setting) was carried out from Sunday, December 14, 2025, to Wednesday, February 25, 2026.

Ten weeks is the length of the rehabilitation program.

There are three sessions a week (Saturday, Monday, and Wednesday).

Thirty rehabilitation sessions in total

Implementation site: Ammar Bodybuilding Hall's swimming pool

Exercise intensity: Based on perceived discomfort and degree of tiredness

3-5-5 Post-Test

On Thursday, 26/2/2026, the researcher carried out the post-test measures for the experimental and control groups in the same settings as the pre-tests.

3-6 Statistical Methods

The researcher used the SPSS statistical package by applying several statistical concepts and tests, including:

Shapiro–Wilk test

Levene's test

Independent samples T-test

Paired samples T-test

Percentage

Arithmetic mean

Standard deviation

Acquired score

3-2 Discussion of Results

Table (4) shows statistically significant differences in the acquired scores (the difference between post-test and pre-test) between the control and experimental groups in the dynamic balance test.

Sig	t -test	Experimental Group		Control Group		Dynamic Balance
0.000	5.628	Std	M	Std	M	
		3.301	10.30	3.062	4.40	

The experimental group recorded a mean difference of 7.30, which is significantly larger than the control group's mean difference of 2.40. The two values' arithmetic difference came to 4.90.

At a significance level of 0.000, the computed t-value for the t-test between the two groups was 5.628, indicating a high level of statistical confidence in the experiment's findings.

It's crucial to remember that individuals in the control group engaged in the same stretching activities as those in the experimental group. However, as a number of other research have shown that stretching exercises and the aquatic environment are both helpful on their own, the aquatic environment served as the experimental variable. For instance, Tahseen's study looked at the impact of isometric contraction workouts in an aquatic setting and showed how they helped basketball players with ankle joint problems improve their dynamic balance (1: 2021).

Furthermore, Sarah's study examined the impact of range-of-motion active stretching exercises and demonstrated their efficacy in enhancing specific physical skills in young discus throwers (2: 2026).

As a result, the current study was unique in that it looked at how stretching exercises and the utilization of an aquatic environment could help people with knee joint problems recover more quickly. The study's findings also supported the experimental variable's ability to enhance dynamic equilibrium.

By using this experimental variable, the researcher hopes to provide a scientific explanation for the benefits that have been seen. Stretching exercises improved movement capabilities by improving the function of the working muscles, especially those around the joint. According to I. Shrier, "exercises focusing on active and dynamic stretching help muscles surrounding joints adapt to various movements, enhance control of the center of gravity during athletic performance, reduce injury risk, and enable athletes to perform movements more efficiently and smoothly" (12: 2004: 264).

Additionally, the researcher thinks that by improving blood circulation and removing lactic acid from muscles, the aquatic environment greatly accelerated recuperation. Research has shown that, especially during low-intensity exercise, lactic acid is eliminated from the blood more quickly during active recovery than during passive rest (9: 1997: 189). Additionally, the findings of this study were in line with a number of related investigations, including one by Yasser Abdul Amir that looked at the impact of resistance training in an aquatic setting. 100-meter freestyle swimmers' performance improved as a result of the training program (11: 2024).

4. Conclusions and Recommendations

4-1 Conclusions

1. Players with knee joint problems found that stretching workouts in an aquatic setting helped them regain motor efficiency.
2. The experimental group's outcomes were improved by the usage of integrated rehabilitation units that combined multiple techniques (such as stretching exercises and an aquatic environment).

4-2 Recommendations

1. the importance of offering basketball players an aquatic environment as a crucial rehabilitation setting.
2. distributing the research results to regional and national sports federations and giving basketball teams the assistance they need to enhance their training and recovery procedures.
3. investigating the efficacy of strength training and other physical skills in an aquatic setting for basketball and other team and individual sports.

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