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The impact of using exercises with assistive tools to increase the range of motion of the arms in rowers for 2000 meters

Ayad Abdul Latif Ali [1]

1 General Directorate of Karkh Education II

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Abstract

The study aimed to identify exercises using assistive tools to increase the range of motion for the arms of rowing players and to understand the impact of exercises with assistive tools on increasing the arm range of motion for rowing players. This was based on the observation that employing the arm's range of motion during the correct performance of rowing leads to increased shoulder joint movement. It was essential to follow this issue and observe its impact on the rowing range of motion and the improvement of numerical achievement. The researcher used the experimental method, and the study population consisted of (10) players, whereas the study sample was made up of (6) players who were selected deliberately. The researcher concluded that using assistive exercises led to an increase in the range of motion for the muscles and joints of the arms. The impact of assistive tools, including devices and instruments, contributed to increasing the effectiveness and efficiency of performance and enhancing physical adaptability in improving the range of motion, and this achieves one of the sustainable development goals of the United Nations in Iraq which is (Good Health). The researcher recommended emphasizing the use of assistive tools due to their role in developing the muscles' and joints' capability for motor performance and highlighting the use of imaging and analysis devices for detailed diagnostics.

Keywords | **Exercises, assistive tools, range of motion, rowing**

Introduction:

Over the past years, coaches have been utilizing a variety of exercises and training methods to develop comprehensive curricula that elevate athletes to a high technical level. This approach not only addresses the prominent issues hindering their progress but also aims to enhance athletic performance achievements. Furthermore, it establishes a crucial link between the requirements of the proposed curriculum and the manner of its implementation, ensuring the desired harmony between the coach, the curriculum, and the athlete. Therefore, it is observed that rowing coaches have made considerable efforts, yet the philosophy of training remains variable from one coach to another. By examining the latest advancements in modern sports science, it's clear that skillful performance and achievement are linked to the athlete's physical and functional efficiency. This is achieved through fluid movement integration in performance and utilizing various sports education sciences to enhance the desired skill. Relying on assistive tools can enhance the athlete's capability to achieve and determine the level of progress and improvement relative to international standards. Specialists strive to keep up with every new and innovative approach in this field. Therefore, the researcher agrees with Ali Daher's statement that "competition in rowing primarily relies on numerical levels, aiming to cover a specific distance in the shortest possible time. This reliance is based on meticulously studied details that specialists focus on significantly to overcome parts of seconds and minutes. It includes the physical, skillful, muscular, and comprehensive functional conditioning of the athlete" (1). Therefore, the

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importance of the research lies in the method of "utilizing the maximum range of motion of the arms in the paddle stroke, which, when performed according to correct mechanical indicators, helps in enhancing and developing the percentage of numerical achievement" (7). The purpose is to optimize the mechanics of performance and rely on the outcome of values without hindrances, considering that the body operates on a lever system and its connection with the mechanical aspects related to it. Through the researcher's observation, being one of the coaches of the Iraqi Rowing Federation, he noticed that utilizing the full range of motion of the arms during the correct execution of the rowing stroke leads to increased movement of the shoulder joint. It was essential to follow up on this issue and observe its impact on the range of motion in rowing and improving numerical achievement. The study aimed to: develop exercises using assistive devices to increase the range of motion of the arms in rowing athletes, as well as to understand the impact of exercises with assistive tools on increasing the range of motion of the arms in rowing athletes.

The method and tools:

The researcher employed the experimental method with a single equivalent group design, fitting the nature of the study. The researcher selected the study sample from the rowing team's player pool using a purposive method, choosing 6 players out of the total pool of 10 players. Two players were excluded due to their participation in international tournaments according to the federation's schedule, and two were used for the pilot study, representing 60% of the total population.

Devices, Tools, and Methods Used:

- Devices used: An HP computer and a SONY camera.
- Tools used: Four rubber ropes, two balance weights of 500 grams each, and one stationary rowing boat of the CONSEBT brand, made in Hungary.
- Methods used: A data recording form and the DART FISHE data analysis system.

Tests Used in the Research:

1. Physical tests, including the test to measure the range of motion, which involves flexion, extension, and abduction of the shoulder joint at the moment of performance (6).
2. Test to measure the muscular strength of the shoulder joint (6).

Post-Performance Measurement Variables:

1. The variable of the shoulder joint angle (enclosed between the hip joint and the shoulder joint and the line connecting the elbow joint to the shoulder joint) includes flexion, extension, and abduction.
2. The variable of the trunk tilt angle (enclosed between the hip joint to the shoulder joint with the horizontal line of the hip joint), which includes flexion at the end of the rowing stroke, extension at the beginning of the stroke, and abduction at the beginning of the vertical catch.

The Pilot Study:

The researcher, with the assistance of the research team, prepared and adjusted the cameras at a distance of 2 meters from the laboratory to observe and record the movement of the arms and shoulder joints. The distance was adjusted relative to the camera's frequency rate (25 frames per second) from the start of the movement to its end. The recorded performance was then transferred to an analysis program to adjust the variables, observe any difficulties, and identify them. The researcher conducted the pilot study on two players from the research community on July 10, 2023.

The Pret test:

The researcher conducted the Pret test with the assistance of the team on July 12, 2023, at 4:00 PM after setting up the camera positions and preparing the stationary test raft in the water, which was used for educational purposes and had

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the same measurements as the moving raft. The cameras were activated 30 seconds before the start of the experiment to avoid any interruptions or malfunctions. The performance time was one minute, and all participants underwent the experiment in the same manner. The variables were analyzed as follows:

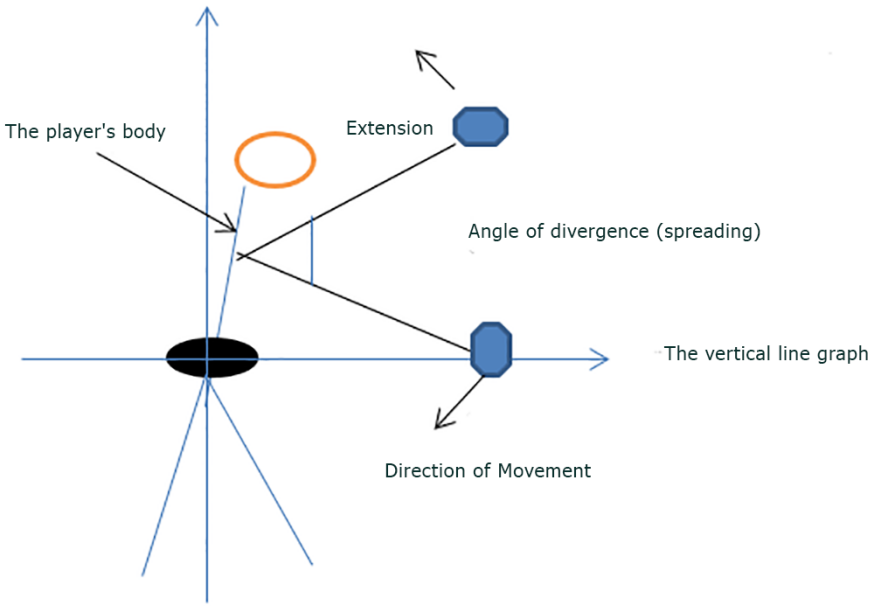
- Analysis of the arms' range of motion during the preparatory phase for the performance.
- Analysis of the arms' range of motion at the moment of initiating the performance.
- Analysis of the arms' range of motion after the performance and returning to the starting position.

The Main Experiment:

Based on references, studies, and relevant field experience, an auxiliary program was prepared in addition to the players' training as devised by their coach for conditioning and strengthening the shoulder muscles, increasing their stretchability, and controlling the paddle when increasing the arms' range of motion. The auxiliary program included three weekly units on Saturdays, Mondays, and Wednesdays, integrated into the training regimen, with each session lasting between 20 to 30 minutes, in agreement with the coach, totalling 24 units over 30 days. The program encompassed:

1. Using a set of elastic bands for rehabilitation and increasing the range of motion of the shoulder joint, thereby affecting the range and width of the arms when opened. The elastic bands are attached to the sides of a flat bench with a sliding seat. The player uses the sliding seat, holding the bands fixed on the sides, to perform the skill back and forth with repetitions ranging from 2 minutes to 5 minutes progressively (2-3-4-5) using the principle of gradual increase in time and speed. The performance with the bands represents a simulated paddle stroke, and the increase in speed is according to the number of strokes per minute until the end of the training unit's duration.
2. Using dumbbells weighing 500 grams, perform rowing movements while standing, extending the arms forward and sideways using the dumbbells to the maximum possible extent, with repetitions ranging from 10 to 15 per minute and a set of repetitions between 6 to 8, with a rest period of 2 minutes between them.

As shown in Figure (1) below



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Post-tests
The post-tests were conducted under the same conditions as the pre-tests on August 16, 2023, adhering to the same performance conditions, filming protocols, data analysis, and recording requirements.

Statistical Methods:
The researcher used the SPSS statistical software to obtain the data results.

- Percentage
- Arithmetic mean
- Standard Deviation
- T-test for single-sample groups

Results:
The study presented the results of the physical variables (flexion at the end of the stroke, extended extension, and abduction at the beginning of the stroke) and muscular strength.

Table .1 displays the values of the physical variables in both the pre-test and post-test, as well as the differences between them.

The variables	Unit of Measurement	Pre-test - Arithmetic Mean	Standard Deviation	Post-test - Arithmetic Mean	Standard Deviation	Differences	T-value	Significance
Muscular Strength	kg	4‹8	1‹56	5‹1	1‹58	0.3	3.45	Significant
Flexion at the End of the Stroke	Degree	113‹3	2‹93	111	2‹85	2.3	2.68	Significant
Divergent Extension	Degree	131‹1	3‹14	133	3‹22	2.1	3.47	Significant
Abduction at the Beginning of the Stroke	Degree	144‹7	4‹85	146‹1	4‹90	2.5	5.69	Significant

At a degree of freedom (5) and a significance level of (0.05)
Analysis and discussion of the shoulder joint angle before and after performance for both pre-test and post-test.

Table .2 shows the values of the shoulder joint angle variables before and after performance in both the pre-test and post-test and the differences between them.

The variables	Unit of Measurement	Pre-test - Arithmetic Mean	Standard Deviation	Post-test - Arithmetic Mean	Standard Deviation	Differences	T-value	Significance
Shoulder joint angle before a performance	Degree	138	4‹12	137‹2	4‹08	1.2	7.62	Significant
Shoulder joint angle after performance	Degree	183	9‹38	185	9‹67	-2	5.14	Significant

At a degree of freedom (5) and a significance level of (0.05)

Discussion:
Through the data presented in Table (1), we observe significant statistical differences between the pre-test and post-test, where the values were greater than their critical value of (6). This indicates that the impact of the auxiliary exercises led to an improvement in the physical range of motion for the research sample. The

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implementation of repetitions with the help of exercises contributed to the development of flexibility in the shoulder joint ligaments, relying on the players' experience with performance, balance on the boat, and complete control over the movement. The researcher noted the following based on the division of the variables:

1- Muscle Strength: It has progressively developed despite the short period for utilizing auxiliary exercises, which were applied scientifically and proved their effectiveness in increasing the strength of the muscles surrounding the shoulder joint. This is due to the increased ability of the muscles to contract more rapidly during repetitive motion, leading to improved coordination between the movements of the arms and the trunk. This aligns with the notion that "muscle strength leads to the continuity in performing physical activity and the athlete's ability to perform a specific load over some time" (8).

2- End-of-Stroke Angle (Flexion): Relying on the flexibility of the joint connecting the forearm and the hand, as the rowing motion depends on the speed and flexibility of the joint in rotating the oar to lift the oar blade out of the water after the end of the stroke to start the reverse recovery phase for a new stroke. This depends on the increased ability of the working muscles, the flexibility and strength of the ligaments, and the joints' ability to move quickly in all directions. It is mentioned that "the effects of the endurance capacity of muscles and joints, in conjunction with the resistance training present and exerted from the conditions of a 2000m ROWING race, are considered as a measure of effort" (5).

3- Divergent Extension: This occurs after spreading and rotating the oar to initiate a new rowing movement, and the improvement in the extension ratio with the arms straightening forward is attributed by the researcher to the forearm muscles' strength using the weight and the players' skill in balancing between the body movement on the boat and the arm movement holding and carrying the oar. This helped in preparation and improving the range of motion for straightening the arms and the strength of the shoulder muscles after using the assistive weights. It is mentioned that "Endurance and strength training improves the athlete's ability to excel and enhance performance through speed and overcoming resistances" (4).

4- The angle at the beginning of the stroke (abduction) is determined by the straightness of the arms and the strength of the shoulder muscles. This angle is represented by the outward divergence of the wrist joint holding the paddle, aiding in extending the range of motion for initiating the stroke. This utilizes the length of the holding arm, body balance, and movement coordination, relying on the angle's base represented by the trunk and the dynamic balance of the movement. According to Abdul Latif (2014), "every comprehensive result of anybody part's effect during training stages produces a good training interaction and greater training potential with the use of assisting organizational means" (2).

The data and the presentation of Table (2) show statistically significant differences between the pre-test and post-test, with values exceeding the table value of 4.12. This indicates that the mechanical range of motion through the shoulder joint has changed due to the performance exercises. The adaptation of the joint at the beginning and end of the rowing stroke, along with an increase in joint flexibility, and the strength factor of the surrounding muscles and supporting ligaments, enhanced their ability to elongate and contract. The exercises were suitable as an auxiliary condition. According to Abbas (2008), the joint's ability to operate at its maximum range is due to the muscles acting on it, or it's the wide range of motion of the limbs under the influence of the muscle groups involved in the performance (9). This aligns with the opinions of some researchers and experts, who suggest that the relative improvement in the correct

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mechanical ranges using auxiliary tools and devices is evident through the training units and progressively through the exercises conducted on the athlete. Within the circuits or stations within the training methodology, comparisons can be made with previous tests, hence a significant impact on the numerical level is observed. The researcher attributes this improvement to intensive training through scientifically regulated training units, specifically tailored to exercise-based training. Given the nature of the activity, which will lead to the development and increase of the range of motion and the ability to maintain endurance while using the correct angles even in the presence of fatigue, this is reflected in the training units implemented by the researcher.

Conclusions:

- The use of auxiliary exercises led to an increase in the range of motion for the muscles and joints of the arms.
- The impact of auxiliary tools, such as devices and equipment, increased in the proportion and effectiveness of performance and enhanced physical capability in improving range of motion.

Recommendation:

- Emphasizing the use of auxiliary tools due to their role in developing muscle and joint flexibility for motor performance.
- Emphasizing the use of imaging and analysis devices for diagnosing specific details.
- Emphasizing the connection between auxiliary exercises and training methods with technical performance to achieve and develop results.

Author's declaration:

Conflicts of interest: None

We confirm that all tables and figures in this article are ours and written by the researchers themselves.

Ethical-Clearance: this manuscript approved by local ethical committee of physical education and sport sciences college for women on (January /2024)

Author's contributions:

All contributions of this study were done by the researchers (A.A.) who get the main idea and work on writing and concluding also with number of experts, Ayad Abdullatif (General Education Directorate of Al-Karkh II) in Statistics, Oliver Stoll in revision, Inaam Ghalib in translating, Maurizio Bertollo in proofreading

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Appendices

Appendix (1) A sample of weekly training units

Unit and Day	Exercises Used	Exercise Repetition	Rest between Reps	Rest between Sets	Intensity	Total Time	Pulse
Saturday	Using auxiliary tools (ropes) for 30 minutes minutes recovery + 15-10 Swedish exercises				%60	65 m	p140
Sunday	Warm-up for 10 minutes Technical rowing for 45 minutes minutes of Swedish 10 exercises				%50	65 m	130-140 p
Monday	Warm-up for 10 minutes Fartlek for 25 minutes Various exercises using auxiliary tools to strengthen shoulder muscles for 15 minutes minutes recovery 10	-40 p20				60 m	
Tuesday	Warm-up for 10 minutes Endurance rowing for 60 minutes minutes recovery 10				%60	80 m	150-145 p
Wednesday	Warm-up for 10 minutes Exercises using auxiliary tools (ropes) 10-15 minutes recovery				%60	85 m	p145

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Thursday	Warm-up for 10 minutes Technical rowing for 65 minutes minutes recovery 10				%70	85 m	130-140 p

Appendix(2)
Names of the Experts

Name	Academic Achievement
1- Asst. Prof. Dr. Ali Abdul Latif Ali	Ph.D. in Physical Education and Sports Science
2- Asst. Prof. Dr. Haider Majid Sadoun	Youth Kayak National Team Coach
3- Majeed Saleh Abdul Raheem	Ph.D. in Physical Education and Sports Science / Former player / Specialization in Sports Physiology
4- Hamza Hussein Mohammed	Bachelor of Physical Education and Sports Science, President of the Iraqi Rowing and Canoe Federation
5- Lect. Dr. Abdul Rahman Ahmed Saeed	Bachelor of Physical Education and Sports Science, National Team Rowing Coach
6- Mohammed Hatem Kareem	Ph.D. in Physical Education and Sports Science / Al-Mustansiriya University

تأثير استخدام تمرينات بوسائل مساعدة لزيادة المدى الحركي للذراعين لدى لاعبي التجديف 2000متر

اياد عبد اللطيف علي
المديرية العامة لتربية الكرخ الثانية

مستخلص البحث

هدفت الدراسة التعرف إلى اعداد تمرينات باستخدام وسائل مساعدة لزيادة المدى الحركي للذراعين لدى لاعبي التجديف والتعرف على تأثير التمرينات بوسائل مساعدة على زيادة المدى الحركي للذراعين لدى لاعبي التجديف،بالاستناد الى الملاحظة التي تم ان توظيف المدى الحركي للذراعين عند لاعب التجديف اثناء اداء الجدفة بالشكل الصحيح يؤدي الى زيادة حركة مفصل الكتف وكان لابد من تتبع هذه الاشكالية وملاحظة تاثيرها على المدى الحركي للجدفة وتحسين الانجاز الرقمي واستخدم الباحث المنهج التجريبي، وتكون مجتمع الدراسة من (10) لاعبين، حيث تكونت عينة الدراسة من (6) لاعبين وتم اختيارهم بالطريقة العمدية، واستنتج الباحث ان استخدام التمرينات المساعدة ادى الى زيادة المدى الحركي لعضلات ومفاصل الذراعين وان تأثير الوسائل المساعدة من اجهزة وادوات ادت الى زيادة نسبة وفاعلية الاداء وارتفاع القابلية البدنية في تحسين مدى الحركة، وهذا ما يحقق احد اهداف التنمية المستدامة للامم المتحدة في العراق (الصحة الجيدة). واوصى الباحث الى التأكيد على استخدام الوسائل المساعدة لما لها من دور في تطوير قابلية العضلات والمفاصل على الاداء الحركي فضلا عن التأكيد على استخدام اجهزة التصوير والتحليل لتشخيص جزئيات.

الكلمات المفتاحية | **تمرينات ، وسائل مساعدة ، المدى الحركي ، التجديف**