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## The Effect of Coordination Exercises for Tendon Pulling and Anchoring Movement on the Accuracy of Shooting Types among Archery Players

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### Abstract

The importance of this research lies in improving the level of eye-hand coordination, particularly during the crucial stages of pulling and anchoring before shooting, in order to enhance accuracy and subsequently achieve the proper shot toward the target. In this way, we have assisted coaches in guiding athletes toward better performance in achieving sports accomplishments and attaining the required points. The research problem lies in the fact that coordination is one of the essential and fundamental motor abilities for various sports, which contributes to enhancing accuracy. This particular game relies on shooting accuracy after the stages of pulling and anchoring before shooting. Therefore, it requires coordination between eye movements in target identification and the act of shooting. The greater the coordination, the easier it becomes to score points. The main objective of the research was to examine the impact of coordination exercises for string pulling and anchoring movements on the accuracy of different shooting techniques among archers. Based on the findings, it was concluded that coordination exercises during string pulling and anchoring movements are essential and fundamental for enhancing performance, particularly in improving the accuracy of various shooting techniques in archery. It was recommended to adopt coordination exercises during string pulling and anchoring movements, as they are essential and fundamental for improving performance, particularly the accuracy of various shooting techniques among archery players. and this achieves one of the sustainable development goals of the United Nations in Iraq which is (Quality Education).

### Keywords

Coordination exercises, anchoring movement, archery

### Introduction:

Societies progress and develop to the highest levels as a result of their focus on everything that contributes to human happiness and prosperity, particularly in the scientific, educational, and even physical domains. These areas represent key aspirations for individuals to achieve in their daily and future lives. From a sporting perspective, which is one of the areas that garners significant attention from individuals due to its ability to fulfill various desires, both moral and health-related, sport is considered a primary and

essential goal. As a result, most societies focus on the sporting aspect and provide everything necessary for individuals to engage in sports, whether it be facilities, equipment, or appropriate training for various sports.

From the perspective of sports training, it is a crucial science in shaping athletes and fulfilling their ambitions to reach the highest levels in various sports. It provides the correct exercises and advanced training, tailored specifically to the requirements of each sport in terms of physical, skill-based, and tactical aspects.

Archery, like other sports, has its practitioners and enthusiasts, as it instills character and confidence in its participants by enabling them to achieve their goals, as well as providing the joy of accomplishment. Thus, like all other sports, it requires both physical and skill-based aspects to achieve points.

Coordination exercises are considered crucial and fundamental for archers, particularly in terms of eye-hand coordination, to achieve proper performance with high accuracy. According to Mohammed Hassan Alawi, coordination exercises "represent stability and focus in the precise coordination between the eye and hand, a type of motor performance related to neuromuscular coordination. This coordination is essential for motor skills that require control, precision, and synchronization. These motor skills often demand eye-hand coordination, as the motor actions in archery require extreme accuracy in shooting or aiming at the target". (2)

In archery, there are multiple motor skills, each requiring focus and precision in execution. Among these movements are the critical and fundamental actions of drawing the bow and anchoring, which must be performed before aiming. These movements require coordination for proper execution. According to Adel Abdel Basir, "Each set of exercises should be designed to provide an effective impact. The greater the coordination between the muscles involved in performance, on the one hand, and between the muscles executing the movement and the opposing muscles, on the other hand, the greater the power generated, leading to the development of all abilities specific to the type of activity and practiced sport" (12).

Thus, the importance of this research lies in enhancing the level of eye-hand coordination, particularly during the critical stages of drawing the bow and anchoring before aiming, in order to improve accuracy and ensure proper targeting. In this way, we have aided coaches in developing archery players to perform better, achieve

sporting accomplishments, and score the required points. The research problem focuses on coordination, which is one of the essential motor abilities for various sports, contributing to improved accuracy. Archery is a sport that relies heavily on accuracy in aiming, following the processes of drawing the bow and anchoring before shooting. This requires coordination between eye movements in target identification and the act of shooting. The greater the coordination, the easier it becomes to score points.

According to the researcher's perspective, being a specialist in training and archery and having reviewed key sources on the game's requirements, it was found that coordination is a crucial and fundamental motor ability in aiming. Therefore, any weakness or inconsistency in coordination affects accuracy. This prompted the researcher to investigate this issue by enhancing coordination levels to improve the shooting accuracy of archery players and elevate their performance beyond the required standard.

#### **The research aims to:**

- Investigate the effect of coordination exercises for tendon drawing and anchoring movement on the accuracy of different shooting types among archery players.

#### **Research Hypothesis:**

- There is a positive effect of coordination exercises for bowstring draw and precision anchoring movement in various shooting types.
1. Human: Archers from the Amanat Baghdad Sports Club
  2. Spatial: The stadium of Amanat Baghdad Sports Club - Al-Zawraa Park Gardens
  3. Temporal: From 14/01/2024, to 26/03/2024.

#### **Definition of Terms:**

- **Neuromuscular Coordination:** According to Kamal Darwish, "it is the ability to

- coordinate the movements of different body parts when performing comprehensive movements" (6).
- **Drawing Phase:** The archer pulls the string in a straight, horizontal line parallel to the arm holding the bow grip until it reaches the anchoring point beneath the chin. To achieve this, the upper back muscles must work to bring the shoulder blades closer together, while the non-working muscles should remain relaxed. During this phase, grip strength is crucial, as the drawing process relies on it.
  - **Anchoring Phase (Fixation Phase):** According to Daham Abdullah, this is "a crucial phase in shooting because it provides deliberate focus and prepares the body's systems for accurate shooting. During this phase, the string must touch the nose, and the index finger should touch the chin, with the mouth closed and teeth clenched. Breath should be held, as any movement can alter the anchoring point in each shot, which in turn affects the shooting accuracy. The strength of the arm is particularly important in this phase, as any fatigue or shaking of the arm holding the bow during anchoring can negatively impact shooting accuracy" (5).

**Kareem Hamad Kadhem's Study:** "The Effect of Special Exercises for the Pulling Hand Fingers on the Development of Performance and Shooting Accuracy in Junior Archery Players" (4).

**Study Discussion:** This study emphasizes the importance of improving shooting accuracy through proper training, whether through coordination or by enhancing strength. Both are essential and fundamental for advancing archery players.

**Methodology and Procedures:**

The researcher used the experimental method with an equivalent group design, which helps address the research problem. The research sample consists of 20 archery players from the Amanat Baghdad Sports Club, selected intentionally from the target population. Additionally, the sample was chosen deliberately from the starting lineup of players, totaling 10 athletes, representing 50% of the original population. The players were randomly divided into two groups: a control group and an experimental group, with 5 players in each group. The variables were managed as shown in Table (1).

**Previous Studies:**

**Table .1 Illustrates the means, standard deviations, variance, and differences in the research variables.**

Tests	Control group			Experimental group			Calculate d (t) value	Significance level
	Mean	Standard deviation	Variance	Mean	Standard deviation	Variance		
Weight / kg	75.47	0.956	1.266	75.53	0.966	1.278	0.088	Not-significant
Height / cm	176.84	1.854	1.048	176.68	1.795	1.015	0.124	Not-significant
Hand-eye coordination / degree	11.745	0.532	4.529	11.823	0.654	5.531	0.185	Not-significant
Visual shooting accuracy / degree	2.178	0.347	15.932	2.188	0.452	20.658	0.035	Not-significant

Visual focus accuracy / degree	2.524	0.335	13.272	2.624	0.475	18.102	0.344	Not-significant
Performance shooting accuracy / point	676.88	2.874	0.724	676.91	2.669	0.394	0.015	Not-significant

Calculated (t) value = 2.306

### The researcher used

- **Arabic and foreign references.**
- Scientific observation.
- Used tests.
- Stopwatch.
- Measuring tape.
- Medical scale.
- Archery equipment: (6 arrows, a target board, a stand, and paper targets).
- 20 tennis balls.
- Smooth wall.

### Field Research Procedures:

#### Identifying Research Variables:

Based on the researcher's field and training experience, it was determined that these variables are essential for archery players. Therefore, they were selected, and measurements were conducted accordingly:

1. Hand-eye coordination
2. Visual shooting accuracy
3. Visual focus accuracy
4. Accuracy of different shooting types.

#### Research Variable Tests:

##### Coordination Test: Ahmed Uraibi Ouda (17)

This test uses two tennis balls and is conducted in four sets, with each set consisting of (5) balls. The total score is (20) points.

##### Visual Shooting Accuracy Test: Afrah Abdul Qadir (13)

- **Objective of the test:** To measure the player's ability to accurately hit the target.
- **Performance method:** The player stands 10 meters away from the target and shoots two

arrows within one minute, aiming at the center of the target and focusing on the (9-10-X) zones only.

- **Scoring:** One point is awarded if the arrow hits the (9) zone, two points if it hits the (10) zone, and three points if it hits the (X) zone. No points are awarded if the arrow lands outside the designated target zones. The maximum score achievable is 6 points, and the minimum is 0.

##### Visual Focus Accuracy Test: Afrah Abdul Qadir (13)

- **Objective of the test:** To measure the player's visual focus ability.
- **Performance method:** The player stands 10 meters away from the target (a visual abilities measurement board) and shoots six arrows within three minutes. The coach specifies a particular shape to aim at (e.g., a smiling face), regardless of the colour.
- **Scoring:** One point is awarded for each arrow that hits the designated shape, and zero points if the arrow misses the shape. The maximum possible score is 6 points, and the minimum is 0.

##### Performance Test: Majid Mohi Abdul Al-Adhim (11)

This is the official test used in competitions, where the player shoots 72 arrows, divided into two groups. Each group consists of 6 rounds, and in each round, 6 arrows are shot. The total possible score is 720 points.

#### Pilot Study:

The pilot study was conducted on 14/1/2024 with the experimental sample by applying some exercises using the station method. The purpose was to evaluate the exercises and determine their suitability for the research sample, as well as to identify the components of the training load in terms of intensity, volume, and rest.

**Scientific Foundations:**

Standardized tests with scientific foundations of validity, reliability, and objectivity were utilized. These tests are appropriate for measuring the sample.

**Main Experiment:**

**Pre-tests:** Conducted on 28/1/2024.

**Training used:** Coordination exercises were applied, focusing on improving motor and skill-related aspects such as tendon drawing and anchoring (stability) to enhance coordination. This, in turn, helps improve accuracy in its

various forms. These exercises were performed during the main part of the training session for the experimental group, under the supervision of the coach. The exercises were conducted during the preparation period, with intensity levels ranging between 70% and 80%. The volume of exercises was determined by the level of load used, with rest periods between repetitions and sets. The researcher relied on heart rate as an indicator, which ranged between 120-130 bpm (beats per minute) during repetitions, with increased rest periods at times, especially when the intensity was between 90% - 100%, where the heart rate reached 130-140 bpm. The exercises were applied over two months, with three training sessions per week, from 29/1/2024 to 25/3/2024.

**Post-tests:** Conducted on 26/3/2024.

**Statistical analysis:** The SPSS system was used for data analysis.

**Results:**

**Table .2** It shows the means, standard deviations, and t-values for the research variables in the control group.

Tests	Statistical Variables				Significance level
	Pre-test Mean	Post-test Mean	Standard Error	Calculated t-value	
Hand-eye coordination / degree	11.745	13.87	0.754	2.818	Significant
Visual shooting accuracy / degree	2.178	3.952	0.564	3.145	Significant
Visual focus accuracy / degree	2.524	3.985	0.477	3.062	Significant
Performance shooting accuracy / point	676.88	679.12	0.712	3.146	Significant

Tabulated t-value = 2.776

**Table .3** It shows the means, standard deviations, and t-values for the research variables in the experimental group.

Tests	Statistical Variables				Significance level
	Pre-test Mean	Post-test Mean	Standard Error	Calculated t-value	
Hand-eye coordination / degree	11.823	15.784	0.964	4.108	Significant
Visual shooting accuracy / degree	2.188	5.124	0.778	3.773	Significant
Visual focus accuracy / degree	2.624	5.332	0.791	3.423	Significant
Performance shooting accuracy / point	676.91	682.41	1.441	3.816	Significant

Tabulated t-value = 2.776



**Table .4** It shows the values of the post-test mean differences between the two groups in the research variables.

Tests	Control group		Experimental group		Calculated t-value	Significance level
	Post-test Mean	Standard Deviation	Post-test Mean	Standard Deviation		
Hand-eye coordination / degree	13.87	0.654	15.784	0.712	3.962	Significant
Visual shooting accuracy / degree	3.952	0.671	5.124	0.634	2.542	Significant
Visual focus accuracy / degree	3.985	0.634	5.332	0.782	2.677	Significant
Performance shooting accuracy / point	679.12	0.965	682.41	0.922	4.932	Significant

Tabulated t-value = 2.306

Through the statistical analysis of Tables (2) and (3), comparing the pre- and post-tests in hand-eye coordination and certain types of archery shooting, it was found that both groups showed improvement. This indicates that the exercises used for both groups successfully achieved the training objectives. As Marwan emphasized, "the goal of training is to bring the athlete to the highest level of achievement in their respective sport" (14).

As Mawahib pointed out, "training based on the principles and foundations of sports training, and what this training requires in terms of setting clear objectives" (10).

Meanwhile, Hamad Abdullah states, "Providing regular exercises in a correct manner enhances and strengthens the muscle groups involved in performance, which the athlete develops during training" (15).

Additionally, Qasim Hassan Hussein and Abd Ali Nasif note that "athletes improve during training after sufficient repetition of exercises with an appropriate load" (3).

By observing **Table (4)**, which shows the superiority of the experimental group over the control group in hand-eye coordination and shooting accuracy, it is evident that the specific coordination exercises used played a significant role in enhancing development and progress,

according to the unique requirements of the sport. This aligns with what Muhammed Redha stated: "The conditions of sports training depend on the level of development of its components, as the level of achievement rises according to the demands of the competition" (7).

These results also highlight the role of coordination in archery, particularly in the execution of drawing and anchoring (stability) before shooting. Coordination exercises, as viewed by Muhammed Saad Mahmoud, "are effective movements that rely on the organized and coordinated work between the muscular and nervous systems. The better the coordination between the two systems, the more harmonious the movement becomes." Muhammed Saad also noted that "the individual's sense of ability enhances their capacity for good performance" (8). Coordination also had a significant impact on improving shooting accuracy in its various forms, including visual accuracy. According to both Abu Alaa Ahmed and Ahmed Nasr El-Din, "Visual accuracy and shooting accuracy are interrelated, each complementing the other. As visual accuracy improves, shooting accuracy increases, which ultimately leads to distinguishing good performance from poor performance, and achieving higher results" (1). Meanwhile, Saleh Shafi states, "Achievement depends on accuracy,

and an increase in accuracy means an increase in points, which is why it ranks first in terms of contribution to the results of archery players" (9). Accordingly, Alaa believes that "each player must train according to the required speed, based on the type, intensity, and frequency of the exercise" (16).

### **Conclusions:**

Based on the discussion of the results, the researcher reached the following key conclusions:

1. Coordination exercises during tendon drawing and the anchoring movement are essential and fundamental for improving performance, particularly the accuracy of various shooting types in archery players.
2. The basic skills involved in tendon drawing and anchoring (stability) require coordination before shooting to achieve optimal results. This explains the success of coordination exercises in enhancing accuracy levels.

### **The researcher recommended:**

1. Adopting coordination exercises during tendon drawing and anchoring movements, as they are essential and fundamental for improving performance, particularly the accuracy of various shooting types in archery players.
2. Emphasizing the training of basic skills during tendon drawing and anchoring (stability) by incorporating coordination exercises before shooting to achieve better results. This is the reason for the success of coordination exercises in enhancing accuracy levels.

### **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 (August /2024)

### **Author's contributions:**

All contributions of this study were done by the researcher (F.A.) who get the main idea and work on writing and concluding also with number of experts, the researcher in Statistics, Huda Shihab in revision, Inaam Ghalib in translating, Urska Dobersek in proofreading

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### Appendix (1) Sample of the Units

**Week: 1**  
**Training Unit (1)**

**Intensity: 70%**  
**Total Exercise Time: 40-43 minutes**

Section	Time (Minutes)	Exercises	Volume	Rest	
				Between Sets	Between Repetitions
Main	3.33	1- Throw tennis balls at circles marked on the wall with the right hand and then the left hand.	3×10	Heart rate recovery (120-130 bpm)	Heart rate recovery (120-110 bpm)
	1.43	2. Rotate the arm from the front shoulder and the other throws on colored circles on the wall.	3×10		
		3. Shoot arrows at a target from a distance of 3 meters from the target board.			



	3.32	4. Shoot arrows at various distances, then transition to throwing tennis balls at the same target.	3×10		
	3.5		3×10		

### تأثير تمارين توافقية لسحب الوتر وحركة الارساء بدقة انواع التصويب لدى لاعبي القوس والسهم

فرح علاء جعفر

جامعة بغداد / كلية التربية البدنية و علوم الرياضة للبنات – العراق

جاءت اهمية البحث للارتقاء بالمستوى التوافق بين العين واليد وخاصة في مرحلتي السحب والارساء المهمة قبل التصويب لغرض زيادة الدقة ومن ثم التصويب المناسب نحو الهدف وبهذا قد ساعدنا المدرب علي بناء اللاعبين نحو الافضل في تحقيق الانجازات الرياضية وتحقيق النقاط المطلوبة. وكانت مشكلة البحث بان التوافق من القدرات الحركية المهمة والاساسية لمختلف الالعب الرياضية والتي تساعد في رفع الدقة ، ولهذا فان هذه اللعبة تعتمد على الدقة في التصويب بعد عملية السحب والارساء قبل التصويب وهنا يتطلب التوافق في حركات العين في تحديد الهدف وبين التصويب وكلما زاد التوافق زاد الحصول على النقاط بسهولة. وكان اهم اهداف البحث التعرف على تأثير تمارين توافقية لسحب الوتر وحركة الارساء بدقة انواع التصويب لدى لاعبي القوس والسهم.وعليه تم الاستنتاج تمارين توافقية اثناء سحب الوتر وحركة الارساء مهمة واساسية لرفع المستوى وخاصة دقة انواع التصويب لدى لاعبي القوس والسهم. وتم التوصية اعتماد تمارين توافقية اثناء سحب الوتر وحركة الارساء لأنها مهمة واساسية لرفع المستوى وخاصة دقة انواع التصويب لدى لاعبي القوس والسهم وهذا ما يحقق احد اهداف التنمية المستدامة للامم المتحدة في العراق (التعليم الجيد).

مستخلص البحث

تمارين توافقية ، حركة الارساء، القوس والسهم

الكلمات المفتاحية