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Establishing Normative Levels for an Arm and Shoulder Muscular Endurance Test in Forehand and Backhand Strokes among Wheelchair Tennis Players

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SPECIAL ISSUE ARTICLE

Establishing Normative Levels for an Arm and Shoulder Muscular Endurance Test in Forehand and Backhand Strokes among Wheelchair Tennis Players

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Abstract

Wheelchair tennis requires high physical effort becasue the players depend on arms and shoulders to move the wheelchair and perform the strikes continuously. Such effort needs muscular endurance to keep Performance level in the match. The muscles of the shoulder and elbow play a pivotal role in producing the force necessary for skill performance, which indicates the need for a standardized scientific test. Literature reveals a lack of a test to measure muscular endurance of wheelchair tennis players in particular; which is why the current study aimed at building a special test for muscular endurance of arms and shoulders with standardized levels for this category of players. The researcehrs used a survey-based descriptive methodology. The research population consisted of (45) Wheelchair tennis players under the age of 19 for the sports season (2024–2025). The concept of muscular endurance was analyzed, the test objective was identified, and it was constructed in its initial form, then it was applied to the research sample, leading to the final version of the test. After the statistical analysis, the results revealed that the highest percentage was at the (average) level (52.5%), followed by the (acceptable) level (30%), while the higher levels (good, very good) recorded low percentages. In light of these results, the study concluded that the designed test effectively measured its intended purpose. There is a concentration of average and acceptable levels compared to weaker performance at higher levels, which means a decrease in the repetitions achieved by the players. Therefore, the researchers recommended adopting the designed test as an objective scientific tool for assessing the muscular endurance of the arms and shoulders of wheelchair tennis players, and this achieves one of the sustainable development goals of the United Nations in Iraq which is (Quality Education).

Keywords: Muscular endurance, Arms and shoulders, Wheelchair tennis, Test construction and standardization

1. Introduction

Assessments and evaluation are among the most important scientific methods used to evaluate the level of players in various sports activities. They contribute to providing accurate data that helps coaches and researchers make sound scientific decisions concerning selection, and classification. Relying on objective and standardized measurement tools is the core of scientific judgment in athletic performance because the results vary due to subjective factors. Therefore, developing modern tests has become an ongoing scientific necessity due to the rapid development in the field of sports and the changing performance requirements in different games (McArdle et al., 2022).

McArdle et al. (2022) connects muscular endurance to basic physical abilities associated with efficient athletic performance. He elaborates that muscular endurance is the ability of muscles to sustain recurred contractions or to maintain force production over an extended period of time while resisting fatigue, which contributes to maintaining skill performance levels during activities that require continuous physical exertion. Furthermore, Suchomel et al. (2016) explains that enhancing muscular endurance contributes to the

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development of both muscular and nervous systems, helps to continue performing athletic movements and skills for longer periods of time without a noticeable decline, and enhances the ability to accurately replicate skill performances during athletic competitions. Wheelchair tennis is one of the sports that require high level of the physical ability because it depends on special physical, motor, and cognitive requirements, and needs continuous assessment of players' abilities due to the specific performance requirements associated with using a wheelchair.

Wheelchair tennis is an internationally recognized Paralympic sport, practiced by athletes with permanent physical disabilities that affect their ability to walk or move; therefore, players use special sports wheelchairs. This sport is officially regulated by the International Tennis Federation and is included in the Paralympic program. The classification of players in this system is based on the type of physical disability according to specific functional criteria for the upper and lower limbs (International Tennis Federation (ITF), 2023).

This sport is characterized by its high level of performance because the player needs to control the movement of the wheelchair while holding the racket and executing various shots accurately on the court with continuous muscular strength to achieve a balance between movement and precision in directing the ball, which makes the performance more complex than many other sports (Aziz, 2022).

Soylu et al. (2021) refer to the need of wheelchair tennis player to a high level of muscular endurance in arms and shoulders because he depends solely on them in moving the wheelchair and performing the backhand and beforehand strikes all around the match since the muscles of the arms and shoulders play a prominent role in producing the needed power to move in the field. Furthermore, the uniqueness of this sport requires scientific measurement tools to help coaches determine the level of muscular endurance in players and diagnose their strengths and weaknesses. Recent studies and interviews with specialists reveal the lack of a special test that measures the muscular endurance of the arms and shoulders of wheelchair tennis players. The importance of the current study comes from the need to construct and standardize a scientific test on muscular endurance of arms and shoulders that matches the physical and functional characteristics of wheelchair tennis players to be adopted by coaches for scientific evaluation and determination.

1.1. Justification of the study

1- Muscular endurance of arms and shoulders is the base of improving performance in wheelchair tennis.
2- There are no standardized tests to measure this endurance, especially for juniors, which weakens the accuracy of the assessment.
3- Objective tests help in classifying players and developing their training.
4- The development of the game requires modern measuring tools.
5- Standardized tests improve performance and validity of the assessment.
6- They support future scientific research.

1.2. Research problem

The muscular endurance of arms and shoulders represents one of the essential physical requirements that directly affects the skill level of wheelchair tennis players. This sport relies heavily on the strength and endurance of the upper limbs in wheelchair movement and performing various strikes. The lack of a specific test makes it difficult to accurately assess the true level of the players. Therefore; there is a need to construct a special test suitable for the performance of this category.

1.3. Research questions

1- Is the constructed test valid for measuring the muscular endurance of the arms and shoulders, capable of distinguishing between high and low-level players, and based on scientific principles?
2- What is the level of wheelchair tennis players in terms of arm and shoulder muscle endurance?

1.4. Purpose of the study

1- Design of a test to assess the muscular endurance of the arms and shoulders of wheelchair tennis players.
2- Set standards to asses the muscular endurance of the arms and shoulders of wheelchair tennis players.
3- Setting standard levels for testing the muscular endurance of the arms and shoulders for wheelchair tennis players

1.5. Study scope

Human Domain: under 19 years old tennis players in the sport season of 2024/2025.

Temporal Domain: 1/8/2025 to 1/12/2025.

Spatial Domain: tennis courts in Al-Sha'ab international Stadium.

1.6. Methodology and procedures

The researchers determined the research population to be 45 young wheelchair tennis players in the

(Open Division) category registered with the federation in 2024-2025 sports season. The pilot study sample, consisting of 5 players, was randomly selected. The construction and standardization sample consisted of 40 players who were randomly selected; thus, the entire population was covered 100%.

1.7. Field research procedures

After reviewing modern Arabic and foreign sources and references related to the research topic, and relying on the theoretical concept of muscular endurance of the arms and shoulders, the concept of the ability to be measured was analyzed, to be the reference framework for applying the practical test. The tests were designed based on the scientific principles of building sports measurement tools, taking into account the physical and motor characteristics of wheelchair tennis players under 19 years old.

1.8. Procedures for setting tests

1.8.1. Purpose of the test

One of the essential requirements for a successful test design is defining the purpose of the test. Therefore, the researchers defined the purpose as measuring the muscular endurance of the arms and shoulders.

Test design: The researchers reviewed Arabic and foreign sources (1-10) in the field of testing, measurement, and evaluation, and proceeded to design the test in its initial form, which included (title of the test name, objective of the test, tools, method of performance, and scoring) along with the test diagram.

Determining the validity of the test: The researchers designed a questionnaire based on the initial form of the test and presented it to a group of experts and specialists (Appendix 3) to consult them about the validity of the test. The results showed that the experts agreed on the test at a rate of 100%.

1.8.2. The pilot study

The researchers conducted the pilot study on Wednesday, August 6, 2025 to get reliable results and confirm the consistency of the scientific research procedures. The sample of the pilot study consisted of 5 players. The aim of this experiment was determining the dimensions, distances, appropriate time, and weight of the iron piece for testing, ensuring the safety of the tools, the efficiency of the assisting team, and ensuring the suitability of the number of test attempts.

Final test experience: The test was applied on the test construction sample to verify the scientific basis and the validity of the test in terms of difficulty and ease.

Scientific Basis of the Test: The researchers relied on content validity to verify the test's validity by presenting a questionnaire to survey experts and specialists about the test's suitability for measuring what it was designed to measure. The percentage of the agreement was 100%, thus, the researchers verified the validity of the test. To verify the reliability of the test, the researchers found the reliability coefficient by the test-retest method. The test was reapplied three days after the first application (9/8/2025). The simple correlation coefficient between the results of the two applications was 0.894, which indicates that the test has a high reliability.

Objectivity: The researchers used the scores of two coaches during the test-retest and used the simple correlation coefficient between the two scores, which was 0.924. This indicates that the test has a high objectivity. Then the researchers applied the test on the construction group (40 players) on (25-8 to 30-8-2025) at 5 pm. The support team, whose names are listed in Appendix 4, explained the test and how to apply it to implement it. The test was supervised by the researchers. Then the data was prepared and entered into pre-designed forms for the statistical analysis to know the discriminatory power and difficulty/ease levels.

The discriminatory power of the test: The researchers organized the row scores ascendingly. A total of 50% of the high scores and 50% of the lower scores were selected from the construction group. The researchers used (t) test for the equal number independent samples. After statistically processing the data, it was found that the test has discriminatory power. As shown in Table 1, there are significant differences between the upper and lower groups.

Difficulty and ease level: The appropriate test is characterized by a suitable level of difficulty for the test-takers. The researchers verified the level of difficulty of the test by finding the chi-square value for the data of the construction sample. The calculated chi-square value was 14.581, below the significance level of 0.000, which is less than 0.05. Thus, the degree of difficulty of the test was appropriate for the sample.

The test in its final form: After verifying the scientific basis and the extent of the test's ability to distinguish between higher and lower levels, and the suitability of the test for the research sample in terms of difficulty and ease, the researchers arrived at the final version of the test:

- **Test title**: Muscular Endurance Test for the arms and shoulders of wheelchair tennis players.
- **Purpose of the test**: To measure the muscular endurance of the arms and shoulders of wheelchair tennis players.

Table 1. Shows the discriminatory power between the upper and lower groups of the construction sample.

	Upper group		Lower group				
Test	M	SD	M	SD	Calculated (t) value	sig	Statistical Significance
Arm and shoulder muscular endurance test	8,68	1,956	3,34	1,815	8,725	0,000	Significant

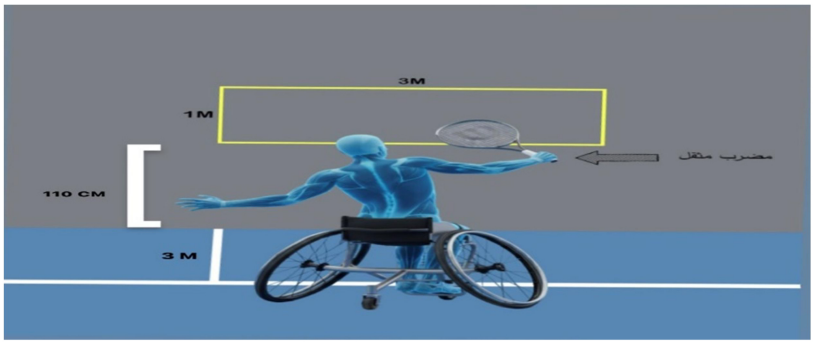

Fig. 1. Shows the muscular endurance test for the arms and shoulders of wheelchair tennis players.

- **Tools**: Legal wheelchairs, smooth wall, tennis rackets, tennis balls, 100g iron piece, colored adhesive tape, stopwatch (Fig. 1).
- **Performance**: The tester is positioned on the starting line and continuously performs the forehand and backhand strikes on the designated area on the wall using the weighted bat, with the wheel of the chair touching the starting line, which is 3 m away from the wall. The player continues, and if the ball rebounds to the right of the player, he hits it with a forehand strike. If the ball rebounds to the left of the player, he hits it with a backhand strike. The player continues to perform the forehand and backhand strikes according to the area of the ball's rebound from the wall until the effort is exhausted.
- **Scoring**: Performance time is calculated in minutes from the first touch of the bat to the ball until the player stops hitting the ball.
- **Notes**: If the player fails to control the ball, the examiner will immediately give them another ball to continue the attempt.
- **Standardizing the test**: The test was conducted on a standardization sample of 40 wheelchair tennis players from 24/11/2025 to 26/11/2025 on the tennis courts at Al Sha'ab International Stadium at 4:00 PM. The researchers took into account the preparation of the players in terms of warming up and providing the necessary supplies such as juice and water. The test was conducted with the help of the support team Appendix 4. After completion, the data were entered into registration forms and prepared for statistical processing.

Statistical analysis: The researchers used the statistical package for statistical analysis.

1- **Results**: The mean, standard deviation, median, and skewness coefficient are shown for the muscular endurance test of the arms and shoulders of wheelchair tennis players. The descriptive statistics are presented in Table 2.

1.9. Building standardized test levels

The researchers converted raw scores to standardized test scores using a sequential method and employed a method of drawing standardized levels according to normal distributions, utilizing the normal distribution curve (gauss) to determine these levels. Converting raw scores to standardized scores is a statistical method used in interpreting test results. These scores help determine an individual's score relative to the group average and interpret it according to the normal distribution of scores, as noted by Cohen et al. (2021). The corresponding raw and standard scores are presented in Table 3.

In order for the researchers to be able to interpret the test results that the research sample underwent and convert them into objective values with statistical significance, they derived the ideal standard levels, which they determined by dividing the range into 6

Table 2. Shows that the value of the skewness coefficient did not exceed ±1, which confirms the normal distribution of the data of the research sample.

Variables	Unit of Measurement	Mean	Median	Standard deviation	Skewness
Arm and shoulder muscular endurance test	Minute	7.74	8.00	1.548	–0.503

Table 3. Shows the raw scores corresponding to the standard scores for the muscular strength endurance test of the arms and shoulders of wheelchair tennis players.

Standard score	Raw score	Standard score	Raw score	Standard score	Raw score	Standard score	Raw score	Standard score	Raw score	Standard score	Raw score
80	12,360	69	10,666	58	8,972	47	7,278	36	5,584	25	3,890
79	12,206	68	10,512	57	8,818	46	7,124	35	5,43	24	3,736
78	12,052	67	10,358	56	8,664	45	6,97	34	5,276	23	3,582
77	11,898	66	10,204	55	8,510	44	6,816	33	5,122	22	3,428
76	11,744	65	10,050	54	8,356	43	6,662	32	4,968	21	3,274
75	11,59	64	9,896	53	8,202	42	6,508	31	4,814	20	3,120
74	11,436	63	9,742	52	8,048	41	6,354	30	4,660		
73	11,282	62	9,588	51	7,894	40	6,20	29	4,506		
72	11,128	61	9,434	50	7,74	39	6,046	28	4,352		
71	10,974	60	9,28	49	7,586	38	5,892	27	4,198		
70	10,820	59	9,126	48	7,432	37	5,738	26	4,044		

Table 4. Shows the raw scores, their ranges, and their corresponding percentages for the normative levels of the test.

	Normative levels, their ranges, and their percentages											
	Very good		Good		Average		Acceptable		Weak		Very weak	
	71-80 2.145%		61-70 13.585%		60-51 34.135%		50-41 34.135%		40-31 13.585%		21-30 2.145%	
	Raw scores, their ranges, and their percentages											
Arm and shoulder muscular endurance test	12.360-10.974		10.82-9.434		9.28-7.894		7.74-6.354		6,20-4,814		4.660-3.274	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
	3	7.5%	4	10%	21	52,5%	12	30%	0	0	0	0

levels along the base of the curve, and each level has one standard deviation, which are respectively (very weak, weak, acceptable, average, good, very good).

2. Results discussion

Table 4 shows that there is a difference in the percentages of the standard levels achieved by the research sample in the tests compared to what is prescribed for them in the normal distribution. In the muscular strength endurance test for the arms and shoulders, the research sample achieved a percentage of (7.5%) at the very good level, while the percentage reached (10%) at the good level. The sample achieved the highest percentage (52.5%) at the average level, followed by a percentage of (30%) at the acceptable level. The sample did not achieve any percentage at the very weak and weak levels. Thus, the highest percentages achieved by the research sample were at the average and acceptable levels. In light of the presented results, we note that the research sample's test scores were limited to the levels of (average, acceptable). Based on this, it appears that the level of the sample members is considered good. However; in order to reach the higher levels and be able to win in international competitions, we find that the players are below the level of keeping up with the competitors, which necessitates that coaches pay attention to continuous training and regulate training intensity in a manner that suits this physical ability because it is one of the most important physical abilities that wheelchair tennis players need and has a positive effect on skill performance. Nevertheless, improving skill performance in sports activities is closely linked to developing all physical abilities. González-Devesa et al. (2026) explained that developing physical fitness components such as strength, speed, agility, and balance leads to improved athletic performance and helps in executing athletic skills with greater accuracy and efficiency in competitions. In addition, Cao et al. (2024) emphasizes that regular physical training helps improve the physical and skill performance of athletes, because physical abilities represent the cornerstone upon which the athlete relies to execute athletic skills with high efficiency.

The researchers attribute the distribution of the research sample across the achieved levels to a lack of attention to continuous practice. They found that some members of the research sample were absent from certain training sessions, which negatively impacted their test performance. This is confirmed by the fact that repetition and continuous training leads to an improvement in the level of physical abilities. Joyce and Lewindon (2021) indicated that "continuity in training is one of the basic factors for developing the physical abilities of athletes, and that physiological and physical adaptations occur as a result of the

regular repetition of training loads, and that interruption and random training leads to a decrease in the level of physical fitness and a decline in the level of motor and skill performance in players".

The researchers attribute the achievement of the above levels by the research sample to the lack of standardized training programs based on scientific principles and foundations. Organized and scientifically based training programs contribute to developing the physical and technical abilities of players and improving their athletic performance. Training programs that take into account the gradual increase in load, repetition, and recovery contribute to creating functional and physical adaptations in the body's systems, leading to raising the level of athletic achievement and improving the physiological response to training loads. Recent studies have confirmed that organizing training loads according to scientific principles leads to improved muscular endurance, strength, and speed, and positively affects the skill performance of athletes in various sports, including games that rely heavily on the muscles involved in performance. The failure of players to reach advanced levels of muscular endurance is attributed to the poor regulation of training units in accordance with the characteristics of the age group, as well as the lack of variety in exercises and the failure to organize repetitions appropriately because "Neglecting to organize training sessions according to scientific principles, and failing to consider regulating loads and gradually increasing training intensity, leads to a weakness in the development of physical abilities. Conversely, adhering to these principles contributes to improving the level of physical abilities and enhancing the efficiency of athletic performance among players." (Andrioti et al., 2023).

3. Conclusion

1- The designed test was suitable for measuring what it was designed to measure.
2- The designed test distinguished between the upper and lower levels of the sample and had an appropriate level of difficulty.
3- A standardized scoring table was constructed sequentially for the research sample's scores in the arm and shoulder muscular endurance test for wheelchair tennis players.
4- The percentages achieved by the research sample across all levels showed a clear discrepancy with the ideal percentages on the normal curve.
5- The standard levels (average - acceptable) achieved the highest percentages, while there was a decline in the standard levels (good - very good) due to their low number of frequencies. Concerning weak and very weak levels, they did not achieve any frequency.

4. Recommendations

1- Adopt the test, which was designed and developed for wheelchair tennis players, as an objective scientific method for assessing the muscular endurance of the arms and shoulders of wheelchair tennis players.
2- Adopt the standards and levels of the current study to evaluate the level of players in enduring the muscular strength of the arms and shoulders on a periodic basis in order to monitor the development of the players.
3- Adopt the criteria and standards of the current study when selecting eligible players.
4- Use of this test when developing training programs and standardizing training loads for wheelchair tennis players' muscular endurance.
5- Conduct studies and research on wheelchair tennis and other physical abilities.

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 the Scientific Committee of the College of Physical Education and Sports Sciences for Women, University of Baghdad, Iraq, on (2025/10/28).

Author's contributions

All contributions to this study were carried out by the researchers. **Taif Hasan Mandeel** conducted the study procedures, collected and organized the data, participated in the implementation of the experimental program, and contributed to drafting the manuscript. **Prof. Dr. Warda Ali Abbas** developed the research idea, designed the study, supervised the research procedures, interpreted the results, and reviewed and finalized the manuscript.

The study also benefited from the assistance of a number of experts: **Prof. Dr. Warda Ali Abbas** (Statistics), **Prof. Mohammed Ahmed Abdullah and Prof. Dr. Shareef Salih** (Revision), and **Asst. Prof. Dr. Fatimah Mohammed Al-Asadi** (Translation), Directorate of Scholarships and Cultural Relations, Ministry of Higher Education and Scientific Research.

Facilitating the task

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Funding statement

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Data availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Appendices

Appendix (1) Test Validity Assessment Form

University of Baghdad
College of Physical Education for Women
Mr/Mrs. . .. .
Greetings:

The study entitled (Construction and Standardization of a Muscle Endurance Test for Arms and Shoulders of Open Category Wheelchair Tennis Players), needs to determine the validity and suitability of the test for wheelchair tennis players under 19 years old. We attach the test in its initial form, and since you have scientific expertise in the field, we ask you to give your opinion on the validity of the test and provide comments in case of any modification. We appreciate your input.

The researchers
Prof. Dr. Warda Ali Abbas Taif Hasan Mandeel
Degree and title:
General and specific specialization:
Date of obtaining the academic title:
Official workplace:
Date:
Signature:

Appendix (2) Test model

- **Test title**: Muscular Endurance Test for the arms and shoulders of wheelchair tennis players.
- **Purpose of the test**: To measure the muscular endurance of the arms and shoulders of wheelchair tennis players.
- **Tools**: Legal wheelchairs, smooth wall, tennis rackets, tennis balls, 100g iron piece, colored adhesive tape, stopwatch (Figure 1, Appendix 2).
- **Performance**: The tester is positioned on the starting line and continuously performs the forehand and backhand strikes on the designated area on the wall using the weighted bat, with the wheel of the chair touching the starting line, which is 5 m away from the wall. The player continues, and if the ball rebounds to the right of the player, he hits it with a forehand strike. If the ball rebounds to the left of the player, he hits it with a backhand strike. The player continues to perform the forehand and backhand strikes according to the area of the ball's rebound from the wall until the effort is exhausted, as is shown in Figure 1.
- **Scoring**: Performance time is calculated in minutes from the first touch of the bat to the ball until the player stops hitting the ball.
- **Notes**: If the player fails to control the ball, the examiner will immediately give them another ball to continue the attempt.

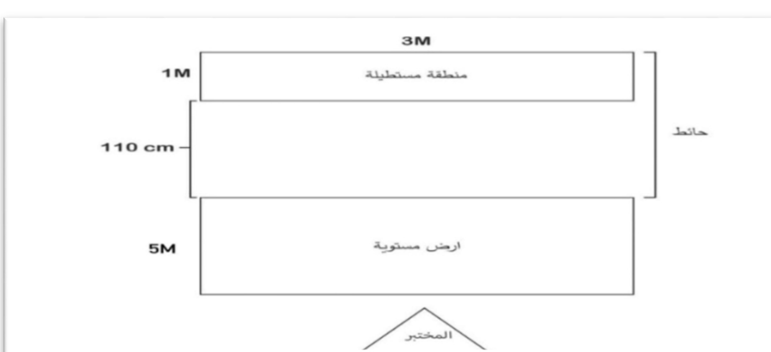

Figure 1. Muscular endurance test for the arms and shoulders of wheelchair tennis players.

Appendix (3)

Names of the experts and specialists who were presented with the test.

No.	Full name	Specialization	College
1	Lect. Dr. Bahaa El-Din Ali Rahim	Racket games training	College of Physical Education/ University of Baghdad
2	Prof. Dr. Ahmed Ismail	Track and field/ persons with disabilities	College of Physical Education/ University of Baghdad
3	Lect. Dr. Muath Essam Tawfiq	Training science / Racket games	College of Physical Education/ University of Baghdad
4	Prof. Dr. Abbas Ali Adhab	Measurement and evaluation	College of Physical Education/ University of Baghdad
5	Prof. Dr. Iman Abdul Amir	Track and field/ persons with disabilities	College of Physical Education/ University of Baghdad
6	Prof. Dr. Mohamed Hassan Helil	Motor learning / Racket games	College of Physical Education/ University of Baghdad
7	Prof. Dr. Zahra Shehab Ahmed	Assessments and Measurements / Racket Games	College of Physical Education/ University of Baghdad
8	Prof. Dr. Nada Nabhan Ismail	Assessments and Measurements / Racket Games	College of Physical Education/ University of Baghdad
9	Prof. Dr. Luma Samir Hammoudi	Motor Learning / Volleyball	College of Physical Education/ University of Baghdad
10	Prof. Dr. Abeer Hatem Dakhel	Training physiology / Racket games	College of Physical Education/ University of Baghdad

Appendix (4)

Names of the supporting team members.

No.	Name	Academic title	Specialization	Place of work
1	Eman Abdul Jabbar	Master's Student	/	College of Physical Education for Women/ University of Baghdad
2	Shahad Khaled Khalaf Hikmat	Master's Student	Tennis coach	College of Physical Education for Women/ University of Baghdad
3	Mahmoud Baqer Mahmoud	Employee	Law	Employee

تحديد مستويات معيارية لاختبار تحمل القوه العضلية للذراعين والاكتاف للضربتين الأمامية والخلفية للاعبي تنس الكراسي المتحركة

طيف حسن منديل،وردة علي عباس

كلية التربية البدنية وعلوم الرياضة للبنات، جامعة بغداد

ملخص البحث

تُعد رياضة تنس الكراسي من الأنشطة التي تتطلب مستوى عالياً من الجهد البدني، إذ يعتمد اللاعب على الذراعين والاكتاف في تحريك الكرسي وأداء الضربات باستمرارية، مما يستدعي امتلاك قدرة تحمّل القوة العضلية للحفاظ على مستوى الأداء في المباراة. تؤدي عضلات الكتف والمرفق دوراً محورياً في إنتاج القوة اللازمة للأداء المهاري، ومن هنا تبرز الحاجة إلى اختبار علمي مقنن، وتشير المراجع إلى عدم توافر اختبار يقيس تحمّل القوة العضلية لدى لاعبي تنس الكراسي بصورة خاصة. لذلك هدفت هذه الدراسة إلى بناء اختبار خاص لتحمّل القوة العضلية للذراعين والاكتاف، ووضع درجات ومستويات معيارية خاصة لهذه الفئة. اعتمدت الباحثتان المنهج الوصفي بأسلوبه المسحي، وتكوّن مجتمع البحث من لاعبي تنس الكراسي دون سن التاسعة عشرة للموسم الرياضي (2024–2025)، والبالغ عددهم (45) لاعباً. كما تم تحليل مفهوم تحمّل القوة العضلية، وتحديد هدف الاختبار، وصياغته بصورته الأولية، ثم تطبيقه على عينة البحث، وصولاً إلى الصيغة النهائية للاختبار. وبعد إجراء المعالجات الإحصائية، أظهرت النتائج أن أعلى نسبة تحققت في المستوى (متوسط) بنسبة (52.5%)، يليه المستوى (مقبول) بنسبة (30%)، في حين سجلت المستويات الأعلى (جيد، جيد جداً) بنسب منخفضة. وفي ضوء هذه النتائج، توصلت الدراسة إلى أن الاختبار المصمم يتمتع بقدرة جيدة على قياس ما وُضع من أجله، وأن هناك تركزاً في المستويات المتوسطة والمقبولة مقابل ضعف في المستويات العليا، وهو ما يعكس انخفاض عدد التكرارات المحققة لدى اللاعبين. وبناءً على ذلك، أوصت الباحثتان باعتماد الاختبار المصمم كأداة علمية موضوعية لتقييم تحمّل القوة العضلية للذراعين والاكتاف لدى لاعبي تنس الكراسي. وهذا يحقق أحد أهداف التنمية المستدامة للأمم المتحدة في العراق وهو (التعليم الجيد).

الكلمات المفتاحية: تحمل القوة العضلية، الذراعين والأكتاف، تنس الكراسي المتحركة، بناء وتقنين الاختبارات