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## The Impact of a High-Fitness Program on Developing Performance Endurance for Players of the Basketball Skills Challenge Competition

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### Abstract

The Basic Skills Challenge in basketball is one of the sports competitions introduced recently. It relies on the individual skills of the players and their speed of performance, along with high accuracy and concentration throughout performing those skills. Therefore, it requires special endurance to perform those skills efficiently and quickly. The importance of the study is highlighted through utilizing CrossFit exercises in developing performance endurance, which helps players continue performing various skills and their repetitions throughout the match. The researchers found that there is a decrease in performance endurance from time to time during the competition or in its final minutes. This puts the players in a challenging situation where they are required to perform high-level combined physical and skillful work in the face of decreased performance endurance. Therefore, the researchers prepared CrossFit exercises that provide an important incentive for continuity in performance and resistance to fatigue. They used the experimental method with pre and post-tests for both the experimental and control groups to suit the nature of the research. The research population was determined from the players of the Electrical Industries Sports Club for the 2023 sports season, totaling 14 players. The research sample was selected through a comprehensive enumeration method and divided into two groups: the experimental group and the control group, with each group consisting of 7 players. The CrossFit training program was applied for eight weeks, with three training sessions per week. The Statistical Package for the Social Sciences (SPSS) software was used to process the results. The researchers concluded that CrossFit exercises have a positive effect on developing performance endurance for the players in the Basic Skills Challenge basketball competition. and this achieves one of the sustainable development goals of the United Nations in Iraq which is (Good Health).

### Keywords

CrossFit exercises, performance endurance, Basic Skills Challenge in basketball

### Introduction:

The nature of the Basic Skills Challenge in basketball demands that players execute a series of skills with precision in shooting and high sensory-motor awareness while dribbling the ball around cones, maintaining balance, fluidity, and coordination during rapid performance over a period governed by the energy production systems utilized (the Lactic ATP-PC system) in each player's performance. Here, it is required of the players to have a high capacity to continue performing the sequential skills while maintaining the speed and accuracy of the

performance. The Basic Skills Challenge in basketball is a competition that requires its participants to have comprehensive preparation in all physical and skill-related aspects. It is a high-physical effort competition with significant physical demands, including the importance of maintaining a fast pace of play throughout the event. Here, it is up to the coaches to search for training methods that mirror the nature of the sports competition. The two researchers found that CrossFit exercises are among the modern training methods that have gained widespread popularity in recent times. This is due to the

nature of the exercises, which rely on competition between individuals or groups in their performance. Here, the role of training is to focus on exercises that involve high speed and the ability to sustain that speed for an extended period during play. Coaches and specialists aim to consistently achieve high and advanced levels through training based on organized and interconnected scientific principles. The study conducted by Mohsen and Maleh in 2020 highlighted the significance of training in elevating the players' levels, especially in a newly established competition. They emphasized that training is one of the most important means to help players reach higher levels. Furthermore, they stressed the importance of adopting beneficial and modern methods and techniques by the game's requirements and foundations to enhance technical, physical, and tactical performance, ultimately achieving athletic success that satisfies both the coach's and players' ambitions (1). Fatima emphasized in her study in 2008 that having a comprehensive view of the playing field in the Skills Challenge basketball competition is crucial. Players should possess this general perspective to increase the speed of play during competition and maintain that speed until the end of the competition at the same level. Therefore, specialists and experts strive to achieve advanced levels through training based on organized and interconnected scientific principles in training units (2). The research problem lies in the fact that CrossFit exercises represent a deliberate attempt to develop physical fitness in various areas, including respiratory and cardiovascular endurance, muscular endurance,

strength, flexibility, agility, speed, coordination, precision, as well as the ability to change direction, balance, and accuracy. Therefore, performance endurance is considered a composite capability comprising two traits: speed and endurance, both of which are important physical abilities. Players exert significant physical effort over a prolonged period to resist fatigue. The significance of the research lies in leveraging CrossFit exercises to enhance performance endurance, which helps players continue performing various skills and their repetitions throughout the competition via training and competition. Therefore, the study aimed to develop CrossFit exercises to improve the performance endurance of players in the basketball Basic Skills Challenge.

### **Method and Procedures:**

The researchers utilized the experimental method with a well-controlled design involving two equivalent groups (experimental and control groups). This method included pre-test and post-test assessments to address the research problem. The research population was defined as the players of the Electrical Industries Sports Club for the sports season of 2023, totaling 14 players. The research sample was selected using a comprehensive census method, and it was divided into two groups: the experimental group and the control group, each consisting of 7 players, with a normal distribution. Table (1) shows the value of the skewness coefficient, which is within  $\pm 1$ , indicating a symmetrical distribution of the population.

**Table .1** illustrates the normal distribution of the research sample.

Variables	Measurement Units	Arithmetic Average	Median	Standard Deviation	Skewness Coefficient
Height	Meter	158.435	158.000	1.487	0.721
Weight	Kilogram	057.283	057.000	1.786	0.639
Age	Year	018.324	018.000	1.623	0.456

### **Devices, Tools, and Methods for Collecting Information:**

- Observation and experimentation, tests, and measurements. Arabic and foreign sources and references. Coloured tapes and stickers. Wooden benches. Cones (20 in total). Medical balls (7 in total), a Casio electronic stopwatch, official basketballs (14 in total), an official basketball court, barriers, weights of various sizes, a leather measuring tape (20 m), a personal laptop (HP brand), a device for measuring height and weight, and a digital camera (CANON brand, made in China) with a capability of 25 frames per second.

### **Tests used in the research:**

Firstly, the Shuttle Run Test (25 meters x 8 times from a high start), as in the study by Fikret (3).

### **Purpose of the test: Performance endurance**

#### **Procedures:**

1. Draw two parallel lines with a distance of 25 meters between them inside the basketball court.
2. The player assumes the high start position behind one of the parallel lines directly.
3. Give the starting signal to both players simultaneously to run at maximum speed towards the other parallel line, touch it with the foot, and then quickly turn around to return to the initial parallel line they started from.
4. The player continues to repeat this performance eight times, making the total distance covered 25 meters x 8, equaling 200 meters.

#### **Test instructions:**

1. The player should take the correct position (high start position directly behind the starting line).
2. The player must touch the defined parallel lines with their foot each time they reach them.
3. Continue without stopping during the performance upon the start signal until

touching the starting line again at the end of the second lap.

4. Speed is crucial in the performance.
5. The test is conducted with two players at the same time to ensure a competitive factor.
6. Each player has only one attempt.
7. The times recorded by the two players are announced to the rest of the players to ensure competitiveness.

**Scoring:** One point is awarded for each time the players run 25 meters.

The time taken by the player to cover the distance between the parallel lines back and forth (8 times) is calculated and recorded.

Secondly, the test for skill performance endurance, as in the study by Luay Sami (4).

**Purpose of the test:** To measure the ability to endure catching and high dribbling ending with accurate shooting.

#### **Procedures:**

1. A central point is determined under the basket, which is used to mark the main points.
2. Two points are identified: the first one is in front, 8.35 meters away from the central point, and the second is on the far-left side, 7.79 meters away from the central point, which in turn is 1 meter away from the sideline. These points represent the standing position of the tested player.
3. Place four barriers, each with a height of 2 meters, and a suspended barrier attached to each one with a length of 100 cm from the top and a width of 50 cm. Two barriers are positioned 75 cm away and directly facing the tested player, while the other two are positioned to the right and left of the central point within the area, at distances of 3.25 meters and 2.21 meters, respectively.
4. Position a marker 50 cm from the end of the free-throw line (on the left side of the central point) to delineate the entry of the tested player into the area from both sides (right and left).

5. Two points are determined, the first is frontal and 8.35 meters away from the central point, and the other is on the far-left side, 7.79 meters away, which is 1 meter away from the sideline. These points represent the positions of a team member who will pass the ball at each point.
6. The tested player stands on the first point (the frontal one) marked on the ground, and at the same time, two team members, each with a ball, stand at the specified points.
7. Two points are determined, the first is frontal and 8.35 meters away from the central point, and the other is on the far-left side, 7.79 meters away, which is 1 meter away from the sideline. These points represent the positions of a team member who will pass the ball at each point.
8. The tested player stands on the first point (the frontal one) marked on the ground, and at the same time, two team members, each with a ball, stand at the specified points.

#### **Test Conditions:**

1. Speed in performance, and assistance to the tested player (alerting) to perform the attempts from their specified spots. One team member standing to the left of the tested player will deliver 4 balls, and another 4 balls will be provided alternately by a second team member standing to the right of the tested player, under the performance description. Monitoring the correct steps and the correct arm for proper shooting is essential, and each player is allowed only two incorrect attempts.

#### **Grade Calculation:**

2. The time is calculated from when the tested player receives the ball until the end of the tenth attempt after the player releases the ball.
3. Divide the time by 60 seconds.
4. A point is awarded to the player for each successful jump shot.

5. The player receives zero points for each unsuccessful jump shot or incorrect performance.
6. Sum up the points for accuracy from successful attempts.
7. Total Grade (Final): Divide the accuracy result by the time.

#### **The Pilot Study:**

Two pilot studies were conducted, one of them for the specific endurance test on Monday, 6/2/2023, at 10:00 AM, with the exploratory research sample consisting of 2 players. This was to identify any obstacles the researchers might face when implementing the experiment and to select the appropriate location and time for its application, as well as to assess the efficiency of the used tools and their setup method. The second pilot study for the tests was conducted on Thursday, 9/2/2023, at 10:00 AM with the exploratory research sample, aiming to identify any potential obstacles that might arise during the implementation of the tests and to address them. The exploratory sample was obtained from the research population, which consisted of players from the Industrial Sports Club.

#### **The Main Experiment included:**

**Firstly, the pre-test:** The pre-test was conducted on both the experimental and control research samples on Wednesday, 15/2/2023, at 10:00 AM in the hall of the Electrical Industries Club in Baghdad. This was after a warm-up session for the members of both research samples and all temporal and spatial conditions were standardized to align them with the subsequent post-tests. After randomly distributing the research sample, equivalence was ensured between the experimental and control groups in the pre-test, as indicated in Table (2), which shows the equivalence and homogeneity of the research samples.

**Table .2** It illustrates the equivalence of the two groups in the T-test and their homogeneity through Levene's coefficient in the pre-test for performance endurance.

Tests	Measurement Units	Experimental Group		Control Group		Levene's Test	Sig (2-tailed)	T-Test	Sig (2-tailed)	Significance Level	Significance of Differences
		Mean	Std. D	Mean	Std. D						
25m x 8 Test Skill	Second	45.02	0.37	45.18	0.39	0.02	0.878	0.758	0.462	0.05	Random
Performance Endurance	Degree	4.670	0.14	04.70	0.08	2.95	0.112	0.444	0.665	0.05	Random

**Secondly: The implementation of CrossFit Exercises**

CrossFit exercises were prepared and implemented for two months, totaling 8 weeks, with 3 sessions per week (Sunday, Tuesday, Thursday) for each week. Each training session lasted for 90 minutes. CrossFit exercises were executed for 10 minutes as part of the physical preparation in the main section of the training unit, following the skill preparation. They consisted of 4-5 stations in each training unit. These stations were executed continuously without pause, except for the transition time between stations. The stations were then repeated between 6-8 times. The control group participated in the same components of the training unit, except for the physical section, which lasted 10 minutes during which they performed traditional specific strength exercises using weights. The training program commenced on 16/2/2023 and continued until 11/4/2023.

**Thirdly, the post-tests:**

After completing the main experiment, the post-tests were conducted on both the experimental and control research samples on Wednesday, 12/4/2023, at 10:00 AM after a warm-up session for the members of both research samples. All temporal and spatial conditions were standardized to align them with the pre-tests.

**Statistical Methods:**

The results were statistically processed using the SPSS system and utilizing the following formulas: mean, standard deviation, simple skewness coefficient, percentage ratio formula, Levene's test for homogeneity, independent samples T-test, and paired samples T-test.

**Results:**

**Table .3** It displays the statistical characteristics between the pre-test and the post-test for the experimental group.

Tests		Mean	Std. D	The mean difference between the means	Its Standard Deviation	Samples Test	Sig (2-tailed)	Significance Level	Significance of Differences
25m x 8 Test	Pre-test	45.02	0.37	2.84	0.69	10.9	0.000	0.05	Significant
	Post-test	42.18	0.68						
Skill Performance Endurance	Pre-test	4.67	0.14	2.87	0.28	27	0.000	0.05	Significant
	Post-test	7.54	0.17						

Table .4 shows the statistical characteristics between the pre-test and the post-test for the control group.

Tests	Mean	Std. D	The mean difference between the means	Its Standard Deviation	Samples Test	Sig (2-tailed)	Significance Level	Significance of Differences	
25m x 8 Test	Pre-test	45.18	0.39	2.01	0.56	9.4	0.000	0.05	Significant
	Post-test	43.17	0.28						
Skill Performance Endurance	Pre-test	4.7	0.08	1.57	0.16	21.4	0.000	0.05	Significant
	Post-test	6.27	0.21						

Table .5 displays the statistical characteristics between the two research groups in the post-test for performance endurance.

Tests	Measurement Units	Experimental Group		Control Group		T- Test	Sig (2-tailed)	Significance Level	Significance of Differences
		Mean	Std. D	Mean	Std. D				
25m x 8 Test	Second	42.18	.680	43.17	.280	3.49	0.004	0.05	Significant
Skill Performance Endurance	Degree	7.54	0.17	6.27	0.21	13.5	0.000	0.05	Significant

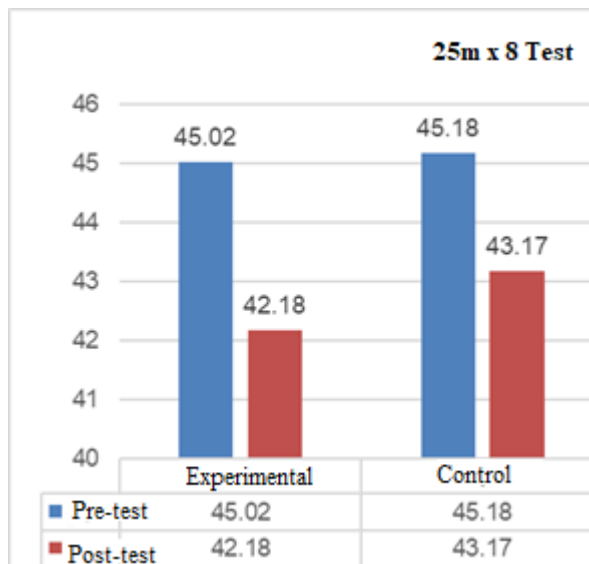
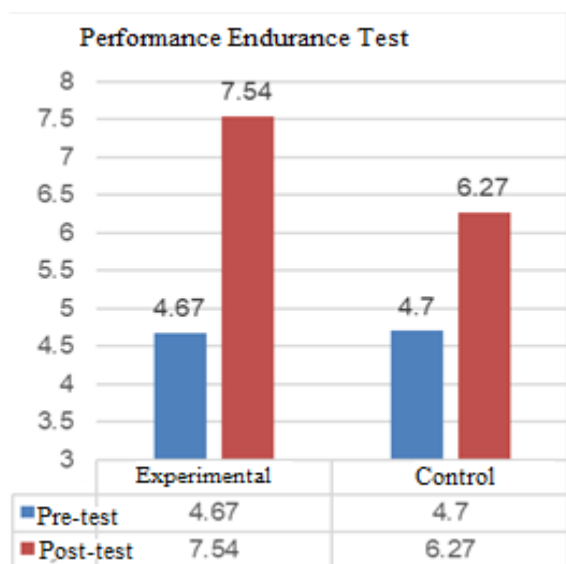


Figure 1 illustrates the differences in the mean values for the two research groups between the pre-tests and post-tests.

### **Discussion:**

Tables 2, 3, 4, 5, and Figure 1 indicate that the experimental group, which utilized CrossFit exercises, improved in performance endurance better than the control group. This is attributed to the features of CrossFit exercises, including the use of resistance in repeated stations without rest periods, and for 10 minutes in each training unit, which aided in the development of performance endurance. This is confirmed by Tenenbaum et al. in state that training with intensity and repetitions in weightlifting exercises will help develop both endurance and speed (5). Therefore, coaches and specialists aim to always reach high and advanced levels through training based on organized and interconnected scientific principles (6). CrossFit exercises are considered a new training system that mixes elements of physical fitness and incorporates weightlifting, power training, and gymnastics together. It is effective in achieving challenge and accomplishment variables (7). Therefore, specialists aim to reach higher and advanced levels through training based on organized and interconnected scientific principles in training units (8).

The study by Fatima et al. highlighted that specialized exercises can develop physical, motor, cognitive, and skill aspects (9). Additionally, these exercises contribute to improving skill performance endurance, as fatigue and competitive pressure can lead players to lose focus, resulting in a loss of accuracy in skill execution due to exertion (10). It emphasizes that effective training preparation is essential for good team performance in basketball, given its demanding and physically intense nature, requiring players to excel in skill and physical fitness (11).

Many teams possess good skills but cannot win due to their players losing physical fitness in the last quarter of the game. Other teams lack precision in skill and strategic preparation, primarily due to incomplete physical conditioning, which affects offensive basketball skills. CrossFit exercises work on developing

skill performance endurance by maintaining performance levels throughout the test duration, playing a key role in engaging multiple muscle groups (12). Motor enrichment and the diversity of exercises provide motor experience and a significant ability to identify precise motor pathways within the central nervous system, thereby understanding and perceiving the complex coordination required for the motor task, and sustaining longer periods without feeling fatigued (13). This positively reflects on the sensory-perceptual capacity in performance and the execution of new motor tasks in the best way and in the shortest time (14). The implementation of CrossFit exercises in training has recently begun to rely on the use of various training tools according to technology and modern techniques, with a blend of executing exercises at high speed. This approach provides motivation and incentive during training and easily and simply defines the desired goal for both the coach and the player (15). Training sessions with pre-defined goals to develop specific endurance, speed, and accuracy of motor skills provide the coach with sufficient information about the player's capabilities and potential, allowing for the analysis and diagnosis of errors in skill and physical performance, and the possibility for the coach to correct those errors (16). Here, the researchers attribute modern training methods, based on the blend and interaction of speed within a single performance with high awareness and within periods that match the nature of the skill performance, contribute to increasing the athlete's response due to the direct impact of sensory and moral stimuli.

### **Conclusions:**

1. CrossFit exercises achieved the intended purpose and led to a significant improvement in performance endurance among the experimental group compared to the control group.
2. The nature of CrossFit exercises aligns with the nature of performance in the Skills Challenge basketball competition and

effectively contributed to the development of performance endurance among the experimental group compared to the control group.

3. Working on developing training sessions with goals that align with the nature of the sporting event and choosing the appropriate energy system active in that event helps achieve the desired objectives in sports training.

### **Recommendations:**

1. It is crucial to develop new exercises and training methods that are suitable for the Basic Skills Challenge in basketball.
2. Conduct further studies and research on samples of players from the Basic Skills Challenge, as it is a newly popular event.
3. Emphasize and focus on CrossFit exercises due to their impact on enhancing the performance endurance of basketball players.

### **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 (H.F. and F.A.) who get the main idea and work on writing and concluding also with number of experts, Warda Ali Abbas (Physical Education and Sport Sciences College for Women/ University of Baghdad) in Statistics, Ali Makki in revision, Nour Riadh in translating, Huda Shihab in proofreading

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## تأثير برنامج عالي اللياقة في تطوير تحمل الأداء للاعبات مسابقة تحدي المهارات في كرة السلة

هدير فلاح عبد الصاحب 1 ، فاطمة عبد مالح 2 ، نوزت ديمرجي 3

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مسابقة تحدي المهارات الأساسية في كرة السلة من المسابقات الرياضية التي تم استحداثها في الآونة الأخيرة ، وتعتمد في طريقة لعبها على المهارات الفردية للاعبات وسرعة اداءهم مع الدقة والتركيز العالي طول مدة الأداء لتلك المهارات, لذا يتطلب ذلك تحمل خاص لأداء تلك المهارات بكفاءة وسرعة عالية , وتتجلى أهمية الدراسة من خلال استثمار تمارينات (الكروس فت) في تطوير تحمل الاداء الذي يساعد اللاعبات على الاستمرار في أداء المهارات وتكرارها المتنوعة طول مدة المباراة, حيث وجدت الباحثتان انخفاض مستوى تحمل الاداء بين حين وآخر في أثناء المسابقة أو في دقائقها الأخيرة ، إذ يصبح اللاعبات في وضع صعب ويتطلب منهن أداء عمل بدني ومهاري مشترك عالي أمام انخفاض مستوى تحمل الاداء , لذا اعدت الباحثتان تمارينات الكروس فت التي توفر حافزاً مهماً للاستمرارية في الأداء ومقاومة للتعب, واستخدم المنهج التجريبي بالاختبار القبلي والبعدي للمجموعتين التجريبية والضابطة لملائمته طبيعة البحث, وتم تحديد مجتمع البحث من لاعبات نادي الصناعات الكهربائية الرياضي للموسم الرياضي 2023, والبالغ عددهن (14 لاعبة), إذ تم اختيار عينة البحث بأسلوب الحصر الشامل وقسمت العينة الى مجموعتين التجريبية والمجموعة الضابطة وبواقع ( 7 لاعبات) لكل مجموعة وتم تطبيق اعداد تمارينات الكروس فت ولمدة ثمانية أسابيع وبواقع ثلاث وحدات تدريبية في الأسبوع الواحد واستعملت برنامج الحزمة الاحصائية للعلوم الاجتماعية SPSS لمعالجة النتائج وتوصل الباحثتان إلى ان تمارينات الكروس فت لها اثر ايجابي في تطوير تحمل الاداء للاعبات مسابقة تحدي المهارات الاساسية بكرة السلة, وهذا ما يحقق احد اهداف التنمية المستدامة للامم المتحدة في العراق (الصحة الجيدة).

تمارينات الكروس فت ، تحمل الأداء ، مسابقة تحدي المهارات في كرة السلة

الكلمات المفتاحية