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The Effect of Assistive Training Devices on the Development of Physical Abilities and Their Relationship to Technical Skills in Futsal Players with Mild Intellectual Disabilities

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Abstract: *This study investigates the role of assistive training devices and exercises in improving selected physical abilities—namely speed, strength, flexibility, and coordination—among futsal players with mild intellectual disabilities. It further examines how these physical enhancements contribute to the development of core futsal skills, including passing, receiving, dribbling, and shooting. The research establishes the relationship between physical development and technical performance, providing a structured training framework that incorporates assistive tools as effective means of enhancing both athletic and functional outcomes. The findings highlight the importance of adaptive training interventions in promoting physical and skill-based progress, ultimately improving daily functional performance and fostering greater inclusion of individuals with mild intellectual disabilities in sports.*

Keywords: *Training, Physical, Abilities, Technical.*

Introduction

Football in general—and futsal in particular—represents an effective medium for developing mental, physical, technical, social, and psychological abilities across all segments of society. For individuals with mild intellectual disabilities, futsal holds additional significance, as it provides both therapeutic and developmental opportunities. However, this group faces distinctive challenges that necessitate the design of adapted training programs that align with their cognitive and physical capacities.

The integration of assistive tools and devices in training not only enhances the development of physical abilities but also provides psychological support, motivation, and progressive challenge. This creates a more engaging and effective training process.1 From a theoretical perspective, the present study enriches the scientific literature concerned with futsal training for players with mild intellectual disabilities by offering evidence-based insights into the effectiveness of assistive means in improving physical and technical performance. From a practical standpoint, the study provides coaches with concrete guidelines for designing training models that integrate assistive devices, thereby enhancing

training quality and accelerating improvements in physical and technical capabilities among this group of athletes.

Methodology

Despite the recognized importance of adaptive training, there remains a noticeable gap in research focusing on the use of assistive devices in futsal training for players with mild intellectual disabilities. Coaches often face difficulties in identifying the most effective training aids to foster both physical and skill development in this population. This lack of clarity not only hinders the design of effective training models but also affects the level of participation and progression of futsal athletes with mild intellectual disabilities.

Research Objectives

The study seeks to achieve the following objectives:

To design exercises incorporating assistive devices aimed at developing selected physical abilities in futsal players with mild intellectual disabilities.

To examine the effects of these assistive exercises on the enhancement of targeted physical abilities among the study participants.

To determine the relationship between the development of physical abilities and the improvement of specific futsal skills among players with mild intellectual disabilities.

Research Hypotheses

1. There are statistically significant differences in the development of the studied physical abilities among futsal players with mild intellectual disabilities after applying exercises that incorporate assistive devices.
2. There is a positive correlation between the improvement of selected physical abilities and the enhancement of specific futsal skills under investigation among the study participants.

Research Methodology

1. **Design and Approach:**
   The study adopts an experimental approach using a quasi-experimental one-group design with pre- and post-tests. The design measures changes in physical abilities and technical skills before and after the implementation of training with assistive devices.
2. **Population and Sample:**
   The research population comprised players of the national futsal team with mild intellectual disabilities. Using a comprehensive enumeration method, individuals aged 22–28 years during the year 2024 were selected. The participants were placed in one experimental group, underwent pre-testing, were exposed to the independent variable (assistive device-based training exercises), and were subsequently assessed through post-tests. The collected data were statistically processed.
3. **Methods of Data Collection:**
   - Personal interviews.

- Review of Arabic and international scientific sources and references.
- Standardized test and measurement forms for recording performance outcomes.

4. **Devices and Tools Used:**
   - Two **Seiko stopwatches**.
   - Futsal pitch (42 × 25 m).
   - Plastic rings (20).
   - Rubber belts (15).
   - Futsal balls (10).
   - Plastic markers (25).
   - Metric measuring tape, masking tape, and whistle.
5. **Physical Ability Tests**

   First: Physical Tests Under Consideration

   1. **Transition Speed Test**
      - **Test Name:** 30-Meter Sprint Test from a Moving Start.
      - **Purpose:** To measure transition speed when moving from an initial start.

Tools and Equipment Used:

- Stopwatch.
- Three parallel lines marked on the ground.
  - The distance between the **first and second lines** = 10 meters.
  - The distance between the **second and third lines** = 30 meters.

Performance Specifications:

The participant stands behind the first line. Upon hearing the start signal, the participant begins running toward the second line (10 meters away). At the moment the runner crosses the **second line**, the timer is started. The time is stopped when the participant crosses the **third line**, located 30 meters beyond the second line.

Recording Method:

The time (in seconds) taken by the participant to cover the **30-meter distance** (from the second line to the third line) is recorded by the timekeeper and documented by the recorder.

Diagrammatic Representation:

The following figure illustrates the 30-meter sprint test from the starting position.

|------10 m------|----------30 m----------|

Test Start Line Acceleration Zone Measured Distance

Figure (1): 30-Meter Sprint Test from a Moving Start.

Meter Sprint Test from a Standing Start

- **Test Name:** 20-Meter Running Test from a Standing Start.

- **Purpose:** To measure translational (linear) velocity over a short distance.

Equipment Used:

- Running track (20 m × 2 m).
- Adhesive tape (to mark start and finish lines).
- Stopwatch.
- Whistle.
- Registration form for recording results.

Test Procedures:

A flat, straight running lane is prepared with a length of 20 meters and a width of 2 meters. Lines are marked at the start and finish using adhesive tape, each with a thickness of 5 cm.

Performance Description:

The participant stands in a stationary position directly behind the starting line. Upon hearing the start signal (given by a whistle), the participant runs at maximum speed to cover the 20-meter distance, crossing the finish line.

Test Conditions:

- The test is explained and demonstrated once before actual performance.
- If necessary, support staff may assist in guiding the participant during the test.
- Each participant is allowed **one attempt** only.

Test Administration:

- **Recorder:** Calls out the names of participants, signals the start of the test, and records results.
- **Monitor and Timer:** Ensures the correct execution of test procedures and measures the sprint time accurately.

Recording Method:

The total time taken (in seconds) by the participant to run from the starting line to the 20-meter finish line is recorded using the stopwatch.

Illustrative Note:

This test evaluates **linear sprint speed** from a stationary start and is commonly used in field-based assessments of speed and agility.

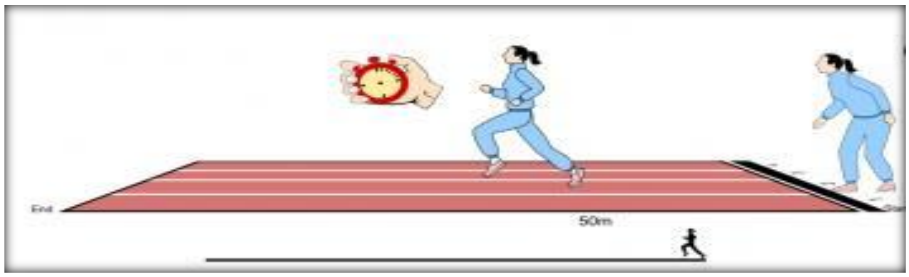

Figure (2): 20m running test from standing

Second: Skill Tests Under Consideration[2]

Futsal skill tests for players with mild intellectual disabilities are derived from the standardized protocols established by **Special Olympics International**. These tests are officially applied prior to regional and Olympic competitions to classify teams according to players' abilities and age categories.

Result and Discussion

Running (Dribbling) with the Ball for 15 Meters in One Minute

Purpose of the Test:

To assess the player's ability to dribble (run with) the ball over a 15-meter distance continuously for one minute, measuring both speed and ball control.

Equipment Used:

1. Five futsal balls.
2. Tape or chalk for marking lines.
3. Four cones.
4. Two stopwatches.

Performance Specifications:

The player starts at the designated starting line and dribbles the ball as quickly as possible within the marked lane toward the end zone. The running lane should be clearly marked with tape or chalk, and the end zone must be identified using cones and chalk.

The primary stopwatch runs for one minute to signal the duration of the test. The secondary stopwatch stops when the player, along with the ball, comes to a halt inside the end zone. If the player dribbles beyond the end zone, they must immediately return with the ball until the time period ends. A whistle is blown at the completion of one minute to indicate the end of the test.

Recording Method:

- The total time spent dribbling with the ball is converted into points using the standardized scoring scale (see Table 1).
- A penalty of **5 points** is deducted whenever the ball crosses the sidelines or if the player touches the ball with their hands.
- If the ball exits the lane, the referee immediately provides another ball, placing it at the midpoint of the lane opposite to where the ball exited, allowing the player to continue without interruption.

Illustrative Note:

This test evaluates a combination of **speed, control, and endurance** in ball dribbling, reflecting essential futsal performance requirements for athletes with mild intellectual disabilities.

Figure (2): 20-Meter Sprint Test from Standing Start.

Figure (3): Dribbling Test over 15 Meters for One Minute.

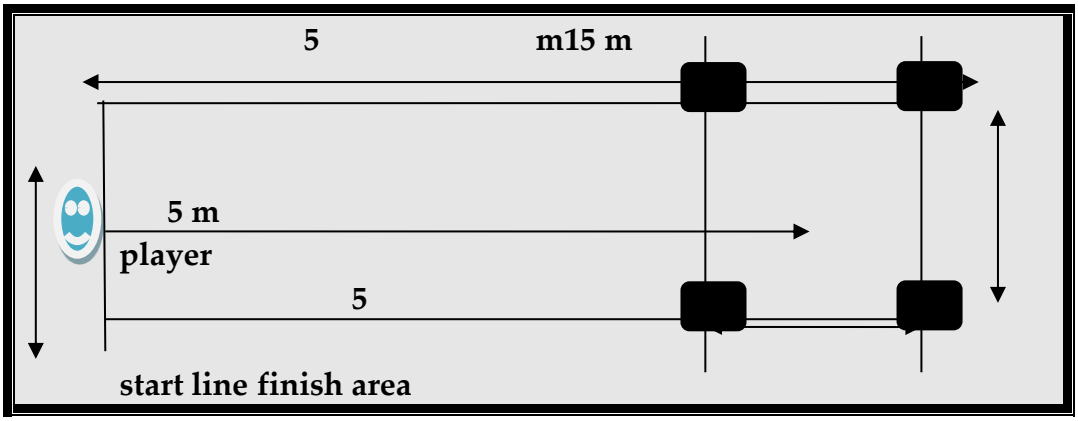

Figure (3): The setup of the **15-Meter Rolling (Dribbling) Test**, showing the running lane, starting line, end zone, and cone placements used during the test.

Table (1): Conversion of dribbling test performance time into points. The player's total time spent dribbling the ball within the one-minute test duration is converted into points according to the standardized scoring scale. Penalties are applied for technical errors (e.g., when the ball crosses the sidelines or the player touches the ball with the hand).

Table (1): Conversion of Running Time into Points

Running Time (sec)	Points Awarded	Running Time (sec)	Points Awarded	Running Time (sec)	Points Awarded	Running Time (sec)	Points Awarded
5 – 10	60	21 – 25	45	36 – 40	30	51 – 55	15
11 – 15	55	26 – 30	40	41 – 45	25	≥ 56	10
16 – 20	50	31 – 35	35	46 – 50	20	—	—

Receiving and Passing Test (5 m Reception – 10 m Passing)[3]

Purpose of the Test:

To assess the player's ability to receive the ball over a short distance (5 m) and then pass it accurately to a target zone (10 m), evaluating both reaction speed and technical precision.

Equipment Used:

- Two funnels forming a passing lane with a width of 5 meters.
- Two small goal areas (each 3 m wide), positioned 7 meters from the starting line.
- Cones and 1-meter flags to mark boundaries and goals.
- Four to eight futsal balls.
- A ball-return system to ensure continuous supply of balls to the coach.

Performance Specifications:

- The duration of the test is **one minute**.
- The coach rolls the ball at a moderate pace toward the player.
- The player receives and controls the ball, then dribbles it through the passing area.
- At this point, the coach signals either **right or left** toward a designated goal.
- The player then passes the ball into the indicated goal area.
- Immediately after, the player returns to the starting position to receive the next ball.
- The process continues until the whistle is blown at the end of one minute.

Scoring:

- Each successful pass into the designated goal area = **10 points**.
- Incomplete or inaccurate passes are not awarded points.

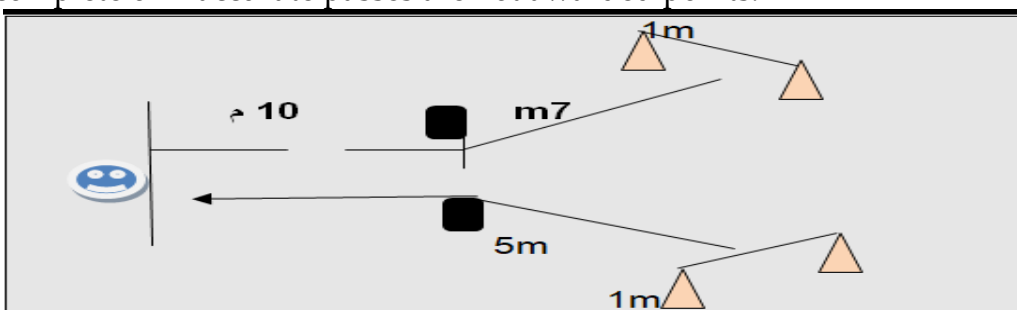

Figure (4): Setup of the Receiving (5 m) and Passing (10 m) Test.

Exploratory (Pilot) Experiment

An exploratory pilot experiment was conducted to ensure the validity and applicability of the physical and skill tests under investigation. The pilot included **two players** from the research sample and was carried out in the specialized indoor futsal hall at the Youth City Sports Talent Care Center, affiliated with the **Ministry of Sports and Youth in Baghdad**.

- The **first pilot session** was implemented on **Thursday, 1/4/2024**, covering both physical and skill tests.
- The **second pilot session** was conducted on **Saturday, 1/6/2024**, repeating the same tests to confirm reliability and consistency.

The pilot study confirmed that the sample was homogeneous in relation to the variables under investigation, as demonstrated in

Table (2), which presents the distribution and characteristics of the research sample.

Table (2): Sample Homogeneity in the Study Variables

T	Variable	Measurement Unit	Mean	Std. Deviation	Median	Skewness	Significance
1	30 m Sprint (from starting point)	Seconds	5.250	0.348	-0.449	-0.786	Homogeneous

2	20 m Sprint (standing start)	Seconds	5.458	0.241	-0.528	-0.583	Homogeneous
3	Ball Rolling (15 m / 1 min)	Points	396.0	30.984	42.0	-0.484	Homogeneous
4	Receiving and Passing (5–10 m)	Points	59.0	7.379	60.0	0.166	Homogeneous

Main Experiment

Mechanism for Implementing Exercises Using Assistive Devices

- The **duration of the special preparation phase** was set at **eight weeks**, with **three training units per week**.
- The duration of each training unit was **120 minutes**, of which the **main section** lasted approximately **90 minutes**.
- The **independent variable (exercises with assistive devices)** was applied for **25–35 minutes** per session, with an average of **30 minutes**. Over the entire training period, this amounted to: (25+35)÷2=30minutes×24sessions=720minutes(25 + 35) ÷ 2 = 30 minutes × 24 sessions = 720 minutes(25+35)÷2=30minutes×24sessions=720minutes
- Weekly training loads were organized into **wave-like fluctuations (1–2)** to ensure progressive adaptation.
- The number of assistive exercises per unit ranged between **3–4 exercises**.
- The training method adopted was **high-intensity interval training (70–90%)**, tailored to the capabilities of players with mild intellectual disabilities.
- The regulation of training load components (intensity, volume, rest) was based on standardized equations for heart rate and exercise difficulty:[4]

Partial Intensity Percentage=Heart Rate per ExerciseMaximum Heart Rate×100\text{Partial Intensity Percentage} = \frac{\text{Heart Rate per Exercise}}{\text{Maximum Heart Rate}} \times100Partial Intensity Percentage=Maximum Heart RateHeart Rate per Exercise ×100

Average Pulse per Exercise=Partial Intensity Percentage×Maximum Pulse100\text{Average Pulse per Exercise} = \frac{\text{Partial Intensity Percentage} \times \text{Maximum Pulse}}{100}Average Pulse per Exercise=100Partial Intensity Percentage×Maximum Pulse

Difficulty Ratio of Training Unit (%)=Σ (Partial Intensity × Exercise Volume)Total Exercise Volume\text{Difficulty Ratio of Training Unit (\%)} = \frac{\text{Σ (Partial Intensity × Exercise Volume)}}{\text{Total Exercise Volume}}Difficulty Ratio of Training Unit (%)=Total Exercise VolumeΣ (Partial Intensity × Exercise Volume)

Field Research Procedures

After defining the research variables and conditions, the researcher determined the timeline for pre-tests, application of the training program (independent variable), and post-tests.

Pre-tests

- Before the start of testing, the researcher provided a clear explanation and demonstration to ensure participants' understanding.
- Pre-tests were conducted on a sample of **10 futsal players with mild intellectual disabilities** (experimental group).
- The **physical pre-tests** were conducted in the indoor futsal hall affiliated with the Ministry of Youth:
  - **Monday, 1/8/2024, at 9:00 AM** – Physical ability tests.
  - **Tuesday, 1/9/2024** – Skill-based tests.

Implementation of Training with Assistive Devices

- The training program was applied across **24 training units**, starting from **Saturday, January 13, 2024**, and concluding on **Thursday, March 7, 2024**.
- Exercises with assistive devices were introduced in the **main section of each training session** for 25–35 minutes, averaging 30 minutes.
- Total exposure time to the independent variable = **720 minutes**.
- Training units followed the principle of **gradual progression (from simple to complex)** while considering the physical and cognitive abilities of players with mild intellectual disabilities.
- Training load was scientifically standardized to match the participants' capacities, ensuring safety and effectiveness.

Post-tests

- Post-tests were administered following the completion of the 24 training units, in the same conditions (time, place, and procedures) as the pre-tests:
  - **Sunday, 3/10/2024, at 9:00 AM** – Skill tests.
  - **Monday, 3/11/2024** – Physical ability tests.

This ensured comparability of pre- and post-test data.

Presentation and Discussion of Results

First: Discussion of 30-Meter Sprint Test (from Starting Position)

Table (3) presents the results of the pre- and post-tests for the **30 m sprint test**, highlighting the statistically significant differences observed after applying the training program with assistive devices.

Test	Measurement Unit	Pre-test Mean ± SD	Post-test Mean ± SD	*t* Calculated Value	Sig. Value	Significance

30 m Sprint (from start)	Seconds	6.250 ± 0.348	5.305 ± 0.424	6.32	0.000	Significant

Interpretation of Table (3):

- The results indicate a **statistically significant improvement (p < 0.05)** in sprint performance over 30 meters after the application of assistive device-based exercises.
- The **mean time decreased** from **6.25 sec** in the pre-test to **5.31 sec** in the post-test, confirming that the training program had a positive effect on the players' transition speed.
- The calculated *t* value (**6.32**) with a significance level of **0.000** strongly supports the effectiveness of the intervention.

Discussion of Table (3): 30-Meter Sprint from a High Start

The results of Table (3) indicate that there are statistically significant differences in favor of the post-test in the 30-meter sprint test from a high start. This outcome is consistent with the demands of futsal as a game that requires the player to perform numerous fast and variable movements throughout the competition. Most of these movements are sudden and executed at high speed in response to the requirements of the match, such as competing to gain ball possession from the opponent, rapid changes of direction, and frequent switching of playing positions between defense and attack. In addition, the constant change of ball location within the futsal court requires the player to improve performance efficiency across all playing zones .[5]

The researcher attributes this improvement to the integration of assistive training devices within the training units prepared. These exercises provided variation in developing the studied physical abilities depending on their planned intensity and duration. Indeed, **diversity in athletic performance is considered one of the essential factors for achieving balance in physical integration and increasing athletes' motivation to train**.[6]

Furthermore, the enhancement of sprinting speed ability is largely dependent on repeated performance of effort. In this regard, **athletes with intellectual disabilities require continuous performance repetition to assimilate and retain multiple skills** .[7] The findings also highlight the importance of adopting training based on scientific principles, which directly contributes to the improvement of speed variables across different forms during the stages of special physical preparation. This is positively reflected in the development of motor response speed among the studied sample, as **training at different speed intensities is an effective method to enhance reaction time and motor responsiveness**.[8]

Table (4): Results of the pre- and post-tests of the 20m sprint from a standing start

Test	Measurement	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	Calculated t-value	Sig. value	Significance

20m sprint from standing	Seconds	5.4579 ± 0.24061	4.4607 ± 0.26909	4.34	0.000	Significant

Discussion of Table (4): 20-Meter Sprint from a Standing Start

The results of Table (4) reveal statistically significant differences in favor of the post-test for the 20-meter sprint from a standing start. This improvement can be attributed to the positive effect of the applied training program using assistive devices, which contributed to the enhancement of transitional speed. It is well established that when the speed characteristic of any specialized athletic performance improves, the specific types of speed upon which such performance relies must also develop in parallel ( ).

The observed improvement in the post-test reflects the careful planning of training components aimed at speed development. The principle of continuous repetition of activity was effectively employed, which is particularly crucial for individuals with intellectual disabilities, as **they require frequent and consistent repetition to acquire and consolidate multiple skills and abilities** ( ).

Moreover, the improvements recorded in this test not only demonstrate an increase in the players' speed capacity, but also highlight the development of neuromuscular efficiency. Enhanced speed performance is strongly linked to the ability of the neuromuscular system to function with precision and efficiency, ensuring smooth coordination between different body parts during movement. In this context, **coordination is considered one of the complex and fundamental abilities that directly relate to speed on the one hand, and the integrity of both the nervous and muscular systems on the other hand**.

Thus, the results confirm that the training approach, which combined structured repetition and scientifically designed assistive exercises, significantly contributed to the improvement of transitional speed in futsal players with mild intellectual disabilities.

Table (5): Results of the pre- and post-tests of the rolling skill test

Test	Measurement	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	Calculated t-value	Sig. value	Significance
Rolling	Points	21.1271 ± 2.70763	16.0393 ± 2.83910	7.21	0.000	Significant

Third: Discussion of the Rolling Test

The results presented in Table (5) indicate that there are statistically significant differences between the pre- and post-tests in the **ball rolling skill test** in favor of the post-test. These findings align with the nature of the skill tests adopted by the International and Regional Special Olympics Federation, which are based on gaining points within a specific time frame during performance. All players in the research sample demonstrated a higher number of points in the post-test, reflecting the effectiveness of the training program and its reliance on assistive tools such as elastic bands and floor rings.

These tools enhanced both the **intensity** and **concentration** required during performance, which in turn acted as developmental stimuli by increasing the mental and physical focus necessary to repeat the exercises successfully. This aligns with the principle that **training programs for individuals with intellectual disabilities prioritize exercise volume (repetition) over intensity**, due to the limitations in their cognitive capacities. Unlike training for non-disabled individuals, where intensity plays a central role, training for those with intellectual disabilities must emphasize volume to ensure neuromuscular coordination and skill consolidation.

As Yarab Khen emphasized, *"whenever movement is repeated, it leaves an effect in the central nervous system, such that the passage of the response becomes easier with repetition and clearer understanding"* .[9] This confirms that the method employed—focusing on gradual, repetitive, and varied performance—ensures the development of skill performance through assistive exercises, as reflected in the significant statistical improvements recorded in the post-test.

The researcher attributes the improvement to the **training mechanism that preferred increasing volume over intensity**, which is better suited to the abilities of athletes with intellectual disabilities. This approach supports neuromuscular responses that enable progress in both physical and skill domains. Furthermore, gradual progression from simple to more complex exercises fostered consistency and consolidation of skills, consistent with Moston's assertion that *"the fundamental principle in motor skill learning is the importance of the number and diversity of practice attempts"*.[10]

Repetition thus plays a pivotal role in enhancing performance through its cumulative effect on the central nervous system, particularly in athletes with intellectual disabilities who often struggle with cognitive retention. As Omar Abdel Rahim stated, *"there is no advantage in retaining a clear image in this group"* ,[11] underscoring the necessity of multiple repetitions for skill acquisition.

Finally, the researcher notes that repeating the rolling skill across different positions and forms within the futsal field enhanced motor coordination, speed, and accuracy of subsequent movements. This repetitive approach consolidated the rolling skill and facilitated its development, in line with the unique needs of players with intellectual disabilities.

Table (6): Results of the pre- and post-tests of the receiving and handling skill test

Test	Measurement	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	Calculated t-value	Sig. value	Significance
Receiving and handling	Degree	12.7857 ± 1.80506	16.0714 ± 1.38477	5.45	0.000	Significant

Fourth: Discussion of the Receiving and Handling Test

The results presented in Table (6) show statistically significant differences between the pre- and post-tests in the **receiving and handling skill test**, in favor of the post-test. This

indicates that the training program had a direct impact on improving the ability of participants to control the ball and perform accurate passes under different conditions.

The researcher attributes this improvement to adopting the simplest forms of training for this skill, such as **receiving the ball and passing it with the sole of the foot from different distances**, which represents the foundation of learning more advanced forms of the skill. As Muhammad Raafat highlighted, *"one of the important basics for the player is his ability to put the ball under his complete control in different playing situations"*.[12]

Training players with mild intellectual disabilities in simplified forms of the skill helped them achieve mastery at acceptable levels. This reflects the golden rule of football, which emphasizes: *"Always try to make your colleague look the best on the field, by passing easy balls to him"*.13

It is often said that **football is a game of passing**, as passing remains the cornerstone of all tactical systems. Regardless of different schools of thought in football strategy, the decisive factor remains passing, since nearly 80% of solutions in real match conditions come through a pass.[14] This is supported by Mufti Ibrahim, who confirmed: *"Perhaps nothing destroys a team's play more than poor, inept passes, and nothing will build confidence among the team members as much as good passes between the players"*.[15]

The training curriculum, which relied on scientific methods in developing handling exercises, clearly contributed to improving both the **physical** and **technical aspects** of the participants. The diversity of training forms increased motivation, attention, and coordination, making them the cornerstone for enhancing the level of skill performance in futsal players with mild intellectual disabilities.

Conclusion

Based on the presentation, analysis, and discussion of results, the researcher reached the following conclusions:

1. Exercises using assistive devices (rings and rubber ropes) had a positive impact on improving selected physical abilities in futsal among individuals with mild intellectual disabilities.
2. Improvement in physical abilities through these exercises was directly and significantly related to the development of futsal skills in the sample.
3. Taking into account the special needs of people with intellectual disabilities by gradually increasing training load—focusing on **volume** rather than intensity—significantly influenced the development of both physical and skill performance.
4. The training program, standardized in terms of **intensity, volume, and rest**, was effective in enhancing physical abilities, which directly reflected on the improvement of skill performance.

Recommendations

From the conclusions, the researcher recommends the following:

1. Adopting assistive-device-based exercises in training curricula for futsal teams within the Iraqi Special Olympics, to enhance their physical and skill capabilities, thereby supporting achievements and championships.

2. Extending the use of assistive-device exercises to all sports activities for people with disabilities, as they foster competition, excitement, and motivation, enhancing training performance and outcomes.
3. Applying a gradual training approach with emphasis on volume over intensity when training individuals with disabilities, ensuring suitability with their mental and physical abilities.
4. Conducting further research on the impact of assistive devices in sports for all disability categories, in order to support this segment of society in achieving health, recreation, and competitive excellence.

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