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Exercises Specific to Different Areas to Develop Endurance and Skill Performance in Handball for Under-17 Players

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Abstract
The development witnessed in the field of sports in general, and handball in particular, is the result of the efforts of specialists and researchers in how to develop the game and reach a stage where players deliver their best performance. Through this research, we designed exercises based on varying playing areas in terms of shape and size, utilizing different playing zones to develop — particularly — endurance in skill performance. We relied on a sample of young players, as they represent the cornerstone for game development. We also selected skill tests in both offensive and defensive aspects, focusing on performance endurance, since performance endurance is a crucial factor given the extended playing periods observed. Pre- and post-tests were conducted, results were analyzed, and the degree of player development was identified. These exercises proved to be very important for developing skill performance endurance. Based on the results, conclusions were drawn and recommendations were made that the use of these exercises is highly important. We also recommended applying them to develop the physical aspect so as to save time in team preparation and achieve economy of effort and time.

1. Introduction

1.1 Introduction and Research Significance

Handball training at the global level has recently witnessed remarkable development, receiving significant attention across its various fields. This has prompted those working in this field to constantly strive for better outcomes by finding effective solutions that influence results. In line with this development, there must be fixed, standardized training curricula built on scientific foundations that are compatible with the nature of competition and the age stage of players. World-class teams have reached high performance levels sustained over extended periods — throughout the entire match — without interruption or decline in performance. Therefore, this performance requires a great degree of endurance and high concentration during training sessions. This has led to the adoption of training systems consistent with the requirements of modern play: the exploitation of different playing areas using varied approaches, through which intensity is controlled. Such systems help blend physical, skill, psychological, and tactical aspects — they are comprehensive and all-encompassing training programs. In addition to being varied, they aim to eliminate routine from training and increase excitement and motivation, representing a novel addition to the training process.

The significance of this research lies in identifying how to harness exercises with different playing areas — by changing the shape and size of those areas — through the player's fluid motor performance and the same motor behavior during training and matches, in playing zones that resemble in-match performance. This is a new contribution to developing skill performance and addressing one of the important training aspects that may help supply coaches and those working in handball training.

1.2 Research Problem

Preparation and pre-season training for sports teams in Iraq tends to be very short. We know that ideal pre-season preparation requires sufficient time with both general and specific preparation phases. However, given the short preparation period at our clubs across all age groups, there must be a method or approach that enables the coach to prepare the team for competitions. Therefore, resorting to exercises that combine physical and skill preparation simultaneously — using the playing field divided into different shapes or zones, with intensity controlled by varying the area sizes — was the motivation for the researcher to design exercises using different areas of the field. These exercises address many problems faced by the team and players during play, and can help achieve the goal of reaching optimal performance and skill excellence. This approach is one of the important methods in the training process. The more valuable those exercises are and the closer they come to the reality and level of competition — through harmony between the art of motor performance and the physical capacity of players — the more effective and dynamic their impact will be. The research problem emerged in the form of the following question: Does the use of exercises specific to different areas contribute to the development of skill performance endurance in handball?

1.3 Research Objectives

- Designing exercises specific to different areas to develop skill performance endurance in handball.
- Identifying the effect of exercises specific to different areas on developing skill performance endurance in handball for players.
- Identifying the differences between post-tests of the experimental and control groups in specific physical capacities and skill performance in handball.

1.4 Research Hypotheses

- Exercises specific to different areas have a positive effect on developing skill performance endurance in handball.

• There are statistically significant differences in pre- and post-tests of both the experimental and control groups in some specific physical capacities and skill performance.
• There are statistically significant differences in post-tests of both the experimental and control groups in some specific physical capacities and skill performance in handball.

1.5 Research Scope

• Human Scope: Youth players of Al-Nasr Sports Club Handball Team.
• Time Scope: From 1/12/2025 to 1/3/2026.
• Spatial Scope: Al-Nasr Youth Forum Hall.

2. Research Methodology and Field Procedures

2.1 Research Method

The choice of the appropriate method depends on the nature of the problem, as we try to select the best solutions. "The most distinguishing feature of precise scientific activity is the use of the experimental approach." The researcher used the experimental method with both a control group and an experimental group to solve the research problem.

2.2 Research Population and Sample

Determining the sample is one of the most important aspects of scientific research. The researcher intentionally defined the research population as the youth players of Al-Nasr Club, numbering 25 players. They were randomly and equally divided into two groups (experimental and control), with 10 players in each group. The remaining players were used in the pilot study.
The sample was intentionally selected for the following reasons:

• The sample members represent the population.
• The sample was consistently available.
• Ease of working with them and applying the exercises.
• Ability to supervise them.

2.2.1 Sample Homogeneity

To demonstrate the homogeneity of the research sample, variables of height, weight, training age, and pre-test offensive and defensive performance were measured for both groups, given their relevance to the study variables. This was done by calculating the skewness coefficient.

Table (1): Sample Homogeneity

No.	Variable	Unit	Mean	Std. Dev.	Median	Skewness
1	Height	cm	175.5	4.566	175.5	0.036
2	Body Mass	kg	69.72	4.062	68.5	0.902
3	Age	years	16.166	0.857	16	0.581
4	Training Age	years	5.833	0.907	6	0.552

2.2.2 Sample Equivalence

In order to determine the baseline measurements for both groups and attribute differences to the experimental factor, the two groups must be fully equivalent in all conditions. The researcher used the independent samples T-test on the pre-test results of both groups to control variables and ensure both groups start from the same baseline. Results showed random differences between the two groups, as shown in Table (2).

Table (2): Sample Equivalence (Pre-test)

No.	Variable	Unit	Control Mean	Control SD	Exp. Mean	Exp. SD	t	Sig	Significance
1	Long Pass Endurance	reps	4.3	0.82	4.1	0.73	0.203	0.57	Non-significant
2	Ball-Handling Endurance	sec	60.4	3.27	61.2	1.31	0.203	0.482	Non-significant
3	Varied Defensive Movements Endurance	sec	25.7	1.33	25.4	1.07	0.482	0.587	Non-significant

No.	Variable	Unit	Control Mean	Control SD	Exp. Mean	Exp. SD	t	Sig	Significance
4	Speed of Defensive Movements	sec	41.6	1.13	41.5	0.90	0.482	0.80	Non-significant

Table (2) shows that significance level values were higher than 0.05 for all research variables, meaning the differences between the two groups were non-significant, thus achieving equivalence between them.

2.3 Data Collection Methods, Tools, and Equipment

2.3.1 Data Collection Methods

- Arabic and foreign references and sources.
- Internet information network.
- Questionnaire.
- Testing and measurement.
- Observation.

2.3.2 Tools and Equipment Used

- A regulation handball court.
- 10 regulation size-3 handballs.
- 2 stopwatches.
- Measuring tape.
- Weight scale.
- Multi-size cones.
- 6 medicine balls of various weights.

3. Field Procedures

3.1 Test Identification

Test 1: Long Pass from 30 Meters for 45 Seconds

Purpose: To measure long pass performance endurance in handball.

Equipment: A handball court with a 4x4 m square drawn in any half of the court. The far side of the square parallel to the goal line is 10 m from the mid-line; the other two sides are 8 m from the side line. Regulation handballs, more than 15 ball boxes placed at the free-throw line, stopwatch, whistle.

Procedure: The player stands inside the square holding the ball. On the start signal, the player throws the ball toward the opposite goal, then moves to a box to pick up another ball and continues throwing for 45 seconds.

Scoring: The number of correct throws is recorded — those in which the ball enters the goal as a projectile, not rolling on the ground.

Test 2: Ball-Throwing Test

Purpose: To measure ball-handling performance endurance.

Equipment: Regulation balls, stopwatches.

Procedure: The player stands at the mid-line where 8 balls are placed. On the start signal, the player sprints, picks up a ball, dribbles toward the goal, and shoots with a jump. The same action is repeated with the remaining balls. The goalkeeper attempts to block all shots.

Scoring: Time is recorded from picking up the first ball to completing the last shot and returning to the starting line.

Test 3: Varied Defensive Movements for 45 Seconds

Purpose: To measure endurance in varied defensive movements — forward, backward, diagonal, and lateral.

Equipment: Court with four markers connected by lines (adhesive tape), measuring tape, stopwatch, whistle.

Procedure: The subject stands at point (A). On the start signal, they move to (B), then diagonally backward to (C), laterally to (A), forward to (B), diagonally backward to (D), then laterally to (A), completing one cycle. This continues for 45 seconds.

Scoring: 6 points per full cycle. If time ends before completing a cycle, partial points are added at one point per correct movement.

Test 4: Defensive Movements Forward and Backward

Purpose: To measure speed of lateral, diagonal forward, and diagonal backward defensive movements.

Equipment: Handball court, adhesive tape, measuring tape, stopwatch.

Procedure: Six markers are drawn on the 6-meter line at 3-meter intervals. The subject starts at marker 1 and, on a visual start signal, moves diagonally forward to marker 2, then diagonally backward to marker 3, continuing through all markers to 11, then returns to marker 1 using the same defensive movements.

Performance Conditions: (1) Movements must exactly replicate defensive movements in footwork during lateral, forward-diagonal, and backward-diagonal movements, as well as arm and hand positions. (2) Must touch each marker with the feet. (3) Any performance violating these conditions is not counted.

Scoring: The time taken to complete the distance going and returning.

3.2 Pilot Study

A pilot study was conducted to verify the soundness of the tools and equipment, and to ensure the proper functioning of the data analysis method, thereby avoiding errors in the main experiment. The pilot study allowed identification of all operational requirements and establishment of the scientific bases for the tests.

3.3 Main Experiment

Pre-test: The researcher conducted the pre-test on 1/12/2025.

Training Program Application: The researcher prepared specialized exercises within the main section of the training curriculum for the specific preparation phase, based on the pilot studies conducted, taking into account available resources and the general level of the research sample. The curriculum relied on scientific foundations of sports training and relevant scientific references, focusing on the comprehensive development of skill performance endurance in handball.

The training program was applied from 2/12/2025 to 5/2/2026 on the experimental group, under the direct supervision of the researcher assisted by the team coach. The experiment lasted 8 weeks with 3 training sessions per week (Saturday, Monday, Wednesday) within the main section of the curriculum. High-Intensity Interval Training (HIIT) was used to develop the physical and skill aspects. The researcher applied training load undulation (1:1 ratio).

Post-test: Conducted at the end of the training program.

3.4 Statistical Methods

The researcher used the SPSS statistical package for statistical processing, applying the following methods:

- Arithmetic mean
- Standard deviation
- Median
- Skewness coefficient
- T-test
- Percentage

4. Presentation, Analysis, and Discussion of Results

4.1 Pre- and Post-Test Results of the Control Group

Table (3): Control Group Pre- and Post-Test Results

Variable	Unit	Pre Mean	Pre SD	Post Mean	Post SD	t	Sig	Significance
Long Pass Endurance	reps	4.3	0.823	4.8	0.632	1.861	0.096	Non-significant
Ball-Handling Endurance	sec	60.4	3.272	58.5	1.957	3.243	0.010	Significant
Varied Def. Movements Endurance	sec	25.7	1.337	26.6	1.897	2.862	0.019	Significant
Speed of Defensive Movements	sec	41.68	1.131	39.828	1.112	7.462	0.000	Significant

Table (3) shows that in the Long Pass Endurance test, pre-test mean was 4.3 (SD=0.823) and post-test mean was 4.8 (SD=0.632). The t-value was 1.861 with Sig=0.096 (>0.05), indicating no significant difference between pre- and post-test.

In the Ball-Handling Endurance test, pre-test mean was 60.4 (SD=3.272) and post-test mean was 58.5 (SD=1.957). The t-value was 3.243 with Sig=0.010 (<0.05), indicating a significant difference between pre- and post-test.

In the Varied Defensive Movements Endurance test, pre-test mean was 25.7 (SD=1.337) and post-test mean was 26.6 (SD=1.897). The t-value was 2.862 with Sig=0.019 (<0.05), indicating a significant difference.

In the Speed of Defensive Movements test, pre-test mean was 41.68 (SD=1.131) and post-test mean was 39.828 (SD=1.112). The t-value was 7.462 with Sig=0.000 (<0.05), indicating a significant difference.

4.2 Pre- and Post-Test Results of the Experimental Group

Table (4): Experimental Group Pre- and Post-Test Results

No.	Variable	Unit	Pre Mean	Pre SD	Post Mean	Post SD	t	Sig	Significance
1	Long Pass Endurance	reps	4.1	0.737	7.3	0.948	12.829	0.000	Significant
2	Ball-Handling Endurance	sec	61.2	1.316	54.6	1.897	16.500	0.000	Significant
3	Varied Def. Movements Endurance	sec	25.4	1.0749	29.2	1.135	13.077	0.000	Significant
4	Speed of Defensive Movements	sec	41.562	0.904	36.56	1.129	9.777	0.000	Significant

Table (4) shows that in the Long Pass Endurance test, pre-test mean was 4.1 (SD=0.737) and post-test mean was 7.3 (SD=0.948). The t-value was 12.829 with Sig=0.000 (<0.05), indicating significant differences in favor of the post-test.
In the Ball-Handling Endurance test, pre-test mean was 61.2 (SD=1.316) and post-test mean was 54.6 (SD=1.897). The t-value was 16.500 with Sig=0.000 (<0.05), indicating significant differences in favor of the post-test.
In the Varied Defensive Movements Endurance test, pre-test mean was 25.4 (SD=1.074) and post-test mean was 29.2 (SD=1.135). The t-value was 13.077 with Sig=0.000 (<0.05), indicating significant differences in favor of the post-test.
In the Speed of Defensive Movements test, pre-test mean was 41.562 (SD=0.904) and post-test mean was 36.56 (SD=1.129). The t-value was 9.777 with Sig=0.000 (<0.05), indicating significant differences in favor of the post-test.

4.3 Comparison of Post-Test Results: Control vs. Experimental Groups

Table (5): Post-Test Comparison Between Control and Experimental Groups

No.	Variable	Unit	Control Mean	Control SD	Exp. Mean	Exp. SD	t	Sig	Significance
1	Long Pass Endurance	reps	4.8	0.632	7.3	0.948	2.908	0.009	Significant
2	Ball-Handling Endurance	sec	58.5	1.957	54.6	1.897	2.908	0.014	Significant
3	Varied Def. Movements Endurance	sec	26.6	1.897	29.2	1.135	-3.754	0.001	Significant
4	Speed of Defensive Movements	sec	39.828	1.112	36.56	1.129	-3.754	0.002	Significant

Table (5) shows that in the Long Pass Endurance test, control group post-test mean was 4.8 (SD=0.632) versus experimental group post-test mean of 7.3 (SD=0.948). The t-value was 2.908 with Sig=0.009 (<0.05), indicating significant differences in favor of the experimental group.
In the Ball-Handling Endurance test, control group mean was 58.5 (SD=1.957) versus experimental group mean of 54.6 (SD=1.897). The t-value was 2.908 with Sig=0.014 (<0.05), in favor of the experimental group.
In the Varied Defensive Movements Endurance test, control group mean was 26.6 (SD=1.897) versus experimental group mean of 29.2 (SD=1.135). The t-value was 3.754 with Sig=0.001 (<0.05), in favor of the experimental group.
In the Speed of Defensive Movements test, control group mean was 39.828 (SD=1.112) versus experimental group mean of 36.56 (SD=1.129). The t-value was 3.754 with Sig=0.002 (<0.05), in favor of the experimental group.

4.3.1 DISCUSSION OF POST-TEST RESULTS

Through Table (5) and the test result values obtained, there was a clear development in the post-test results of the experimental group that underwent the program designed by the researcher. The researcher attributes this development to the nature of the designed exercises in terms of objective, delivery method, and the tools used, as well as the curriculum adopted by the researcher, in addition to the principle of organizing these exercises and applying them within training sessions. Training on the targeted skill can be organized in a manner consistent with the desired goal and the principle of gradual progression from easy to difficult, and from simple to complex. "The principle of gradual progression coordinates and systematically links exercises used in a training session with the gradual increase in their intensity and volume based on the player's level in training." The exercises also adopted a method similar to game conditions and match variables: "Increasing the number of repetitions and performing exercises with a movement path similar to the movement path of the skill, working to develop both the physical and skill aspects over time."

Regarding the Long Pass Endurance test, results showed clear development. Using these exercises helped obtain positive results in this important skill; successful passing is considered a successful offensive operation. For a player to reach an advanced level that assists the team, diversity in exercises used is necessary — most exercises develop several skills simultaneously — but exercises should be standardized with clearly defined objectives, continuously reviewed. Long pass performance endurance helps develop several other skills and improves the player's offensive performance.

In the Ball-Handling Endurance test, clear player development is evident, attributed to the type of exercises used and their execution method. This was achieved by setting training according to a scientific approach considering the nature of exercises, their application method, and reaching the goal of developing ball-handling endurance in a manner closer to in-game performance.

In the Varied Defensive Movements Endurance test, the researcher worked through the designed exercises to develop defensive performance, given its importance in handball. Many coaches prioritize defense and place it at the beginning of preparation, as it significantly affects player development. As noted by Al-Khayyat and Qassim (1988): "Especially when considering the final outcome — a defensive error means a goal scored by the opposing team, while an offensive error means losing the ball." Through the exercises, the researcher worked to develop defensive movements: "Defenders' movements are usually forward, backward, or lateral, and all these movements do not occur separately but in an intertwined manner depending on the attackers' positions, which relates to individual or collective offensive duties by the opposing team." Therefore, using exercises similar to game performance helps develop players, requiring the learner to apply different forms of skill execution in various situations. "Practicing the skill in situations similar or close to actual game situations during competition, interspersed with instructions and directed exercises for performing and mastering the skill — including explanation — helps develop performance and reach the goal in the shortest time."

In the Speed of Defensive Movements test, clear development in the experimental group's post-tests was evident. The researcher attributes this to the exercises used and their execution method, focusing on developing performance endurance in the defensive aspect. Defensive skills in handball carry great weight in the game, equivalent in importance to offensive skills: "A team that masters defense can attack steadily and quickly without giving the opposing team the opportunity to quickly reorganize its ranks." Therefore, emphasis was placed on the defensive aspect, and exercises similar to game performance were designed so players would have greater readiness, better experience, and achieve positive results in matches.

5. Conclusions and Recommendations

5.1 Conclusions

Based on the presentation, analysis, and discussion of results, the following conclusions were drawn:

- Exercises specific to different areas have a positive effect on developing skill performance endurance in handball.
- The degree of development in skill performance endurance in the research group that used these exercises was better compared to the control group.

5.2 Recommendations

In light of the conclusions, the researcher recommends:

- Using exercises specific to different areas in training age groups, particularly for developing the skill aspect.
- Experimenting with exercises specific to different areas on physical performance and examining the results.

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