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The impact of game simulation drills on blocking and various defensive movements for handball players (15–18 years old)

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Abstract:

The importance of studying the effect of playing simulation exercises in the chest wall and the various defensive moves of handball players (15-18 years old), in an effort to find out the effectiveness of this type of exercise in the development of comprehensive defensive performance, and achieving integration between the skill side and the plans of the juniors, to build a scientific training base that contributes to the preparation of players capable of defensive performance with high efficiency in the later stages, the research problem was summarized by the following question: Does the use of playing simulation exercises contribute to the development of the level of defensive performance, especially in the chest wall and defensive moves the variety of defensive abilities of handball players of the category (15-18 years old) compared to traditional training methods ،The objectives of the research were to prepare play simulation exercises to develop the chest wall and various defensive moves for handball players (15-18) years, and to identify the results of play simulation exercises in the development of the chest wall and various defensive moves for handball players (15-18) years. The researchers used the experimental method with two experimental and control groups to fit the research problem, the research community consisted of the players of the Maysan handball education team for the academic year 2023-2024, numbering 16 players, the players were divided in a random way into two experimental and control groups with (6) players for each group, players were excluded for the exploratory experiment and other players being goalkeepers, homogenization was carried out between the two groups for variables (height, weight, chronological age, training age), appropriate devices and tools were used, as well as appropriate tests and measurements for the studied variables the statistical bag (SPSS) was used.26) to process the results were analyzed And to discuss the results according to modern scientific sources to reach conclusions from them (there is a clear superiority of the dimensional

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tests of the experimental and control groups over the tribal tests in the research variables, and there is a superiority of the dimensional tests of the experimental group at the expense of the dimensional tests of the experimental group in the research variables) as for the recommendations, including (the inclusion of simulation exercises of playing regularly within the curricula of handball training in general, especially the age groups, and the design of exercises so that they are with real positions of play and include changing directions quickly, correct positioning, interaction with the ball and colleagues).

Keywords: game simulation drills, blocking, defensive movements, handball

1. Research Identification

1.1 Introduction and Significance of the Study

Handball is considered one of the fast-paced team sports characterized by a wide variety of competitive situations and an overlap between offensive and defensive roles. This requires players to possess a high level of physical, technical, and tactical abilities, particularly in defensive aspects, which represent one of the most important factors in achieving superiority in matches. The "structure of defence" is considered the backbone of shutting opponents' attacks down and not allowing scoring chances, and this in turn benefits team results at various age levels.

The defensive shielding and the diverse defensive movements play a key role in the handball defense system. Good blocking leads to a decreased shot angle and opponent disturbance, whereas varied defensive movements help to cover gaps, support team matesand quickly switch from defense to offense. To accomplish this sort of performance demands that the players exhibit a high level of teamwork with each other by requiring large-scale coordination and the skill to make snap decisions under shifting game situations.

Innovations in training theory have also seen a relatively new type of game simulation exercise develop, known as game-based training with an objective of making match-related training situations more realistic than the traditional approaches. This is done by simulating real competitive conditions with respect to the speed of play, pressure and diversity of movement options. These exercises help to combine physical, technical and tactical skills in a single frame and enable players to train motor and tactical responses accordingly to those which the game requires.

All who play sport need this type of training, and is even more important for youngsters 15-18 as this represents a key period in the development of long term technical and tactical foundations when players move from general to specific performance. Nevertheless, field observations show that many training programs for youth players include isolated exercises,

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which may not be sufficiently representative of the complex defensive actions performed during matches.

It has been demonstrated in several studies that such exercises [i.e. those imitating match play] are very efficient in addressing players' technical and tactical skill, as they enhance the physical and psychological component of the game connected with hard situations and to bridge the theory part of teaching with its practical implication (Salim, 2019, p. 122). Horton (2021, p. 85) further stressed that the practice of drills simulating real game-playing scenarios contributes to developing speed of motor response as well as fast decision making and building coordination among team members when handling alterations in defensive situations.

The current research is important as it investigates the impact of game-based simulation exercises on defensive block and diversified movements in defense among 15- to 18-year-old handball players; in order to determine effectiveness of this sort of training for developing general defensive performance and integration between technical and tactical aspects with youth athletes. This ultimately contributes to building a scientific training base that helps prepare players capable of high-level defensive performance in later stages.

1.2 Research Problem

Defensive movements in handball are among the most important technical aspects contributing to achieving tactical superiority during matches, as organized defensive performance represents a key factor in thwarting attacks and reducing pressure on the goalkeeper. Although coaches often place considerable emphasis on offensive aspects during training sessions, the defensive aspect—particularly defensive blocking and diversified defensive movements—often does not receive sufficient focus and development. This leads to a decline in the effectiveness of the team's collective defense.

Based on field experience and observation of youth handball training programs in several clubs, most training units lack the use of exercises that simulate real playing situations. Defensive exercises are often performed in a traditional manner, detached from the realistic situations encountered by players during matches. This traditional training approach makes it difficult for players to make appropriate decisions and to time positioning or jumping accurately when forming defensive blocks or transitioning between individual and collective defense according to the flow of play. Accordingly, the research problem is formulated in the following question:

Does the use of game-based simulation exercises contribute to improving the level of defensive performance—particularly defensive blocking and diversified defensive movements—among handball players aged 15–18 years compared with traditional training methods?

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Answering this question represents a scientific attempt to address one of the shortcomings in defensive training for youth handball players and to present a more realistic training approach that contributes to improving defensive abilities and enhancing tactical performance effectiveness during matches.

1.3 Research Objectives

1. To design game-based simulation exercises aimed at developing defensive blocking and diversified defensive movements among handball players aged 15–18 years.
2. To identify the effect of game-based simulation exercises on the development of defensive blocking and diversified defensive movements among handball players aged 15–18 years.

1.4 Research Hypotheses

1. There are statistically significant differences between the pre-test and post-test results of both the control and experimental groups in favor of the post-tests.
2. There are statistically significant differences in the post-test results between the experimental and control groups in favor of the experimental group.

1.5 Research Scope

1.5.1 Human Scope: Players of the Maysan Directorate of Education handball team.
1.5.2 Temporal Scope: From 11/1/2024 to 16/3/2024.
1.5.3 Spatial Scope: Martyr Saad Khalaf Sweif Hall.

2. Research Methodology and Field Procedures

2.1 Research Methodology

The methodology is defined as "the path followed by the researcher to achieve the research objectives based on a set of rules and principles, the most important of which is understanding the nature of the problem under study, which imposes the selection of an appropriate methodology to reveal the truth in question" (Allawi & Rateb, 1999, p. 232). Accordingly, the experimental method with two equivalent groups (experimental and control) was employed, as it is suitable for addressing the research problem.

2.2 Research Population and Sample

The research population was intentionally selected and consisted of players of the Maysan Directorate of Education handball team for the academic year 2023–2024, totaling 16 players. The research sample was selected by lottery, comprising 12 players. These players were divided into

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two groups: an experimental group and a control group, with 6 players in each group. Two players were excluded for the pilot study, and two others were excluded because they were goalkeepers. Table (1) presents the details of the sample. Homogeneity between the two groups was established for the variables of height, weight, chronological age, and training age, as shown in Table (2).

Table (1): Research Population and Sample

Sample Category	Number	Percentage
Main sample	12	75%
Pilot study sample	2	12.5%
Excluded players (goalkeepers)	2	12.5%
Total	**16**	**100%**

Table (2): Homogeneity of the Research Sample

Variables	Unit of Measurement	Mean	Median	Standard Deviation	Skewness Coefficient
Height	cm	174.1	174	2.64	0.31
Weight	kg	67.6	68	4.83	0.25
Chronological age	years	17.1	17	0.87	0.22
Training age	years	3.8	4	0.63	0.13

2.3 Means, Devices, and Tools Used

- Interview, observation, questionnaire, and testing
- Result recording forms
- Laptop computer (DELL)
- Laser printer (Canon 2900)
- Stopwatch (1), SONY
- Whistle
- Measuring tape
- Adhesive marking tape (5 cm width)

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- Handball court
- Handballs (5)
- Two uprights with a height of 2.60 m
- A rope 50 cm in length with a handball attached

2.4 Field Research Procedures

2.4.1 Tests Used

First: Two-Direction Defensive Blocking Test (Jirjis, 2004, p. 158)

- **Purpose of the test:**
  To measure the defensive blocking skill.
- **Equipment used:**
  Two uprights fixed to the ground with a height of 2.60 m. From each upright, a rope 50 cm in length is suspended with a ball attached. The height of the ball from the ground is 2.10 m, positioned in the 9 m area.
- **Performance method:**
  The participant stands on the 6 m line and moves forward with a slight incline toward the 9 m line, such that the distance between the player and the suspended ball is 3 m. The distance between the two balls is also 3 m. The player's movement path forms an equilateral triangle, with each side measuring 3 m. The participant jumps vertically to touch the ball with both hands, then moves backward to the 6 m line. This performance is repeated continuously for 30 seconds, as illustrated in Figure (1).
- **Scoring:**
  One point is awarded for each correct attempt in which the ball is touched with both hands.

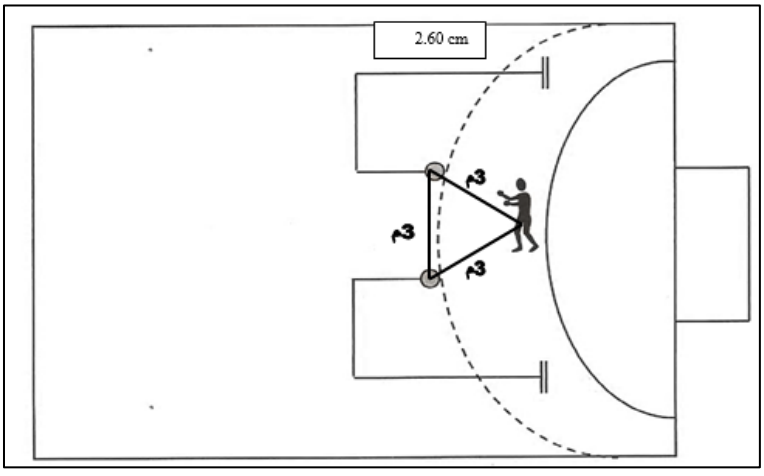

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Figure (1): Defensive Blocking Test

Second: Defensive Movements Test (Mutab, 2004, p. 139)

- **Purpose of the test:**
  To measure the defensive movement skill.
- **Equipment:**
  A flat surface and adhesive tape only, used to mark the shape as illustrated in Figure (2) on the playing court.
- **Performance specifications:**
  Movement is performed along a triangular shape with a total side length of 4.5 m, such that each side measures 1.5 m. Each side represents the distance between two points. At the beginning, the player moves from A to B with a defensive facing action. Next, the player runs from (B) to (C), running backwards on a small incline. Then the player travels from (C) to point (A) and we are introduced to the lateral movement.
  The same performance is then repeated by moving from point (A) to point (B) to point (D), and then back to point (A). The player continues repeating this sequence for the required duration of 30 seconds.
- **Scoring:**
  One point is awarded for each point (A, B, C, D) reached by the player within the 30-second test duration.

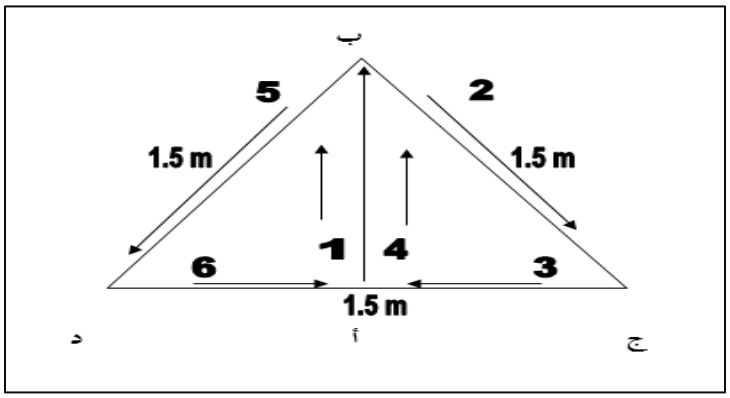

Figure (2): Defensive Movements Test

2.4.2 Pilot Study

In order to identify the positive and negative aspects that may arise in the future, avoid them, and develop, omit, or modify certain procedures (Tuʿaymah, Niʿmah, & Al-Muʾmin, 2024, p. 726), the researchers conducted a pilot study on Thursday, 11/1/2024. The pilot study was carried out

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on a sample of secondary-school handball players from the Maysan Directorate of Education team, consisting of players drawn from the research population but excluded from the main sample. The objectives of the pilot study were to:

1. Identify the timing and equipment related to the tests.
2. Identify potential obstacles that might occur during the main experiment.
3. Ensure the adequacy of the assisting research staff before implementation.

2.4.3 Pre-Tests

The researchers, together with the assisting research staff, conducted the pre-tests for both the experimental and control groups on Wednesday, 17/1/2024, at Martyr Saad Khalaf Sweif Hall at 3:00 p.m. Group equivalence was established based on the results of these tests, as shown in Table (3).

Table (3): Equivalence of the Two Research Groups

Tests	Unit of Measurement	Experimental Group (Mean)	SD	Control Group (Mean)	SD	t-test	Sig.	Significance
Defensive blocking	Score	4.16	0.75	4.33	0.81	0.36	0.72	Not significant
Defensive movements	Score	14.33	1.03	14.66	0.81	0.62	0.70	Not significant

Not significant at a significance level of (0.05) and with (10) degrees of freedom.

2.4.4 Main Experiment

The main experiment was implemented on the players of the experimental group after completing the pre-tests and confirming the homogeneity of the two groups in the variables under investigation. The experiment aged for 8 weeks with three training sessions per week on Saturday, Monday and Wednesday (from Saturday 20/1/2024 to Wednesday 13/4/2024). Game-based simulations were nested within the body of the training unit to last 45–55 minutes each.

All the exercises were performed in the indoor Martyr Saad Khalaf Sweif Hall (directly supervised by researchers) and included progressive overload-principle and exercise variation.

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The total number of training sessions was 24 (three times a week for 8 weeks). All training units were planned by following the principle of progressive load increase and progression as gradually advancing to maximal attainable effort as possible.

The significant portion of each training unit was aimed to promote an enhanced defensive performance of the players with progressive intensity (from 70% up to 100% from personal level demanded), according to the principle of overload. During the first 2 weeks (Weeks 1–2), intensity was moderate (70–75%) to neuromuscular preparation and device performance pattern familiarization, as well as appropriate rest intervals between exercise sets. In weeks 3–5, the intensity was increased to 80–90%, with a relative reduction of training volume and an increased focus on performance quality under near-maximal exertion demands. In the last phase (Weeks 6–8), one weekly session was dedicated to maximal effort (100%) for working on maximum capacity combined with longer rest, so that athletes will be able to last longer under pressure.

It was distributed based on a weekly training workload between three days of training: the one that took place on Saturday at moderate intensity (70–85%), the second one on Monday at maximal effort (100%) or high intensity (85–95%), and the last one performed in Wednesday, which was addressed at moderate to high intensity weaving together technical-tactical aspects and player application. During the intervention of main period, the volume and intensity of training load were strictly controlled and the players' physical status was monitored. Combining the golden rule of defense conduct in quality over quantity was a common interest to warrant players' safety and maximize training performances.

2.4.5 Post-Tests

The post tests were conducted on Saturday 16/3/2024, after implementation of the training program which included 24 training unit over 8 weeks at Martyr Saad Khalaf Sweif hall. Great care was taken to maintain similar testing conditions as the pre-tests in terms of location, apparatus and assisting staff so that we could ensure that results were valid and reliable.

2.5 Statistical Methods

The Statistical Package for the Social Sciences (SPSS, version 26) was applied to compute statistical indices including means, standard deviations, medians, skewness coefficient as well as the results of independent-samples t-test, one-sample ttest and non-parameter mean differences along with their standard errors (SEs), degrees of freedom (df) and significance levels.

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3. Presentation, Analysis, and Discussion of the Results

3.1 Presentation of the Pre-Test and Post-Test Results of the Experimental Group

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

Tests	Unit of Measurement	Pre-Test (Mean)	SD	Post-Test (Mean)	SD	Mean Difference	Standard Error	t-test	Sig.	Significance
Defensive blocking	Score	4.16	0.75	8.83	1.16	4.66	0.61	7.59	0.001	Sig
Defensive movements	Score	14.33	1.03	17.92	1.22	3.95	0.60	6.93	0.001	Sig

Significant at a significance level of (0.05) and with (5) degrees of freedom.

Based on Table (4), the results indicate that there are statistically significant differences between the pre-test and post-test of the experimental group in favor of the post-test in the defensive blocking test. The mean score of the pre-test was 4.16 points with a standard deviation of 0.75, whereas the mean score of the post-test reached 8.83 points with a standard deviation of 1.16. The mean difference between the two tests was 4.66 points, and the standard error was 0.61. Statistical analysis using the t-test revealed that the calculated t value was 7.59, which is statistically significant, as the significance level (0.001) is lower than the adopted significance level (0.05) with 5 degrees of freedom. This indicates that the differences were statistically significant in favor of the post-test for the experimental group.

Regarding the defensive movements test, the results indicate statistically significant differences between the pre-test and post-test of the experimental group in favor of the post-test. The mean score of the pre-test was 14.33 points with a standard deviation of 1.03, while the mean score of the post-test reached 17.92 points with a standard deviation of 1.22. The mean difference between the two tests was 3.95 points, and the standard error was 0.60. Statistical analysis using the t-test showed that the calculated t value was 6.93, which is statistically significant, as the significance level (0.001) is lower than the adopted level of significance (0.05) with 5 degrees of freedom. This indicates that the differences were statistically significant in favor of the post-test for the experimental group.

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3.2 Presentation of the Pre-Test and Post-Test Results of the Control Group

Table (5): Pre-Test and Post-Test Results of the Control Group

Tests	Unit of Measurement	Pre-Test (Mean)	SD	Post-Test (Mean)	SD	Mean Difference	Standard Error	t-test	Sig.	Significance
Defensive blocking	Score	4.33	0.81	6.50	0.54	2.16	0.40	5.39	0.003	Significant
Defensive movements	Score	14.66	0.81	16.33	1.21	1.66	0.49	3.37	0.020	Significant

Significant at a significance level of (0.05) with (5) degrees of freedom.

Based on Table (5), the results indicate statistically significant differences between the pre-test and post-test of the control group in favor of the post-test in the defensive blocking test. The mean score of the pre-test was **4.33** points with a standard deviation of **0.81**, while the post-test mean reached **6.50** points with a standard deviation of **0.54**. The mean difference between the two tests was **2.16** points, and the standard error was **0.40**. Statistical analysis using the *t*-test revealed a calculated *t* value of **5.39**, which is statistically significant, as the significance level (**0.003**) is lower than (**0.05**) with **5 degrees of freedom**. This indicates that the differences were significant in favor of the post-test for the control group.

In the defensive movements test, the results also show statistically significant differences between the pre-test and post-test of the control group in favor of the post-test. The pre-test mean was 14.66 points with a standard deviation of 0.81, whereas the post-test mean reached 16.33 points with a standard deviation of 1.21. The mean difference between the two tests was 1.66 points, and the standard error was 0.49. Statistical treatment using the t-test showed a calculated t value of 3.37, which is statistically significant, as the significance level (0.020) is lower than (0.05) with 5 degrees of freedom. This confirms that the differences were statistically significant in favor of the post-test for the control group.

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3.3 Presentation of the Post-Test Results of the Experimental and Control Groups

Table (6): Post-Test Results of the Experimental and Control Groups

Tests	Unit of Measurement	Experimental Group (Mean)	SD	Control Group (Mean)	SD	t-test	Sig.	Significance
Defensive blocking	Score	8.83	1.16	6.50	0.54	4.42	0.001	Significant
Defensive movements	Score	17.92	1.22	16.33	1.21	3.31	0.008	Significant

Significant at a significance level of (0.05) with (10) degrees of freedom.

Based on Table (6), the results indicate statistically significant differences between the post-test results of the experimental and control groups in favor of the experimental group in the defensive blocking test. The average of the post-test for the experimental group was 8.83 (SD = 1.16) and the control group had an average score of 6.50 (SD=0.54). The t-test statistics calculated (t=4.42) are significant, as the significance level of 0.001 is less than the accepted value of 0.05 with df of 10. This means that there were statistically significant differences between the two groups.

In the defensive movements test, there were also statistically significant differences between post-test scores of the experimental and control group in favor of the experimental group. The experimental group mean score was 17.92 points, standard deviation 1.22 and in the control group 16.33 points with a standard deviation of 1.21. Statistical analysis using t test resulted in a computed t value of 3.31, which is statistically significant, as the significance (0.008) was less than the level of significance (0.05) with 10 degree of freedom. This validates that the differences were not a matter of chance in favor of the experimental group.

3.4 Discussion of Results

Based on the results presented in Tables (3), (4), and (5), a clear superiority of the post-test results for the experimental group is evident, along with a marked improvement of the experimental group compared with the control group. This finding indicates that game-based simulation exercises were effective in developing defensive blocking performance, as they reflect the real demands of game situations and encourage players to perform with greater accuracy, speed, and responsiveness consistent with actual competitive conditions.

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This advantage can be due to the game-based simulation exercises used in the experimental group of this study for these were elaborated so that they could reproduce training moments as close as possible to real match conditions. Through this, players could then confront defensive conditions corresponded for game play so as to better enable them to perceive the trajectory of the ball and take proper positioning for an effective block in their defense. Furthermore, those exercises were based on an intricate context that involved cooperation between two or more players, which coherently resulted in better collective defensive behavior. Excised neuromuscular interaction efficiency and reaction speed, as elements of successful defensive blocking.

The observed improvement can also be explained by the fact that situational, game-simulated exercises increase players' defensive awareness and enhance their level of mental concentration during performance. In addition, such exercises strengthen the relationship between kinesthetic perception and the temporal timing of defensive movement, leading to more precise and efficient performance in stopping attacks. The competitive and enjoyable nature of these exercises further increased players' motivation, which was positively reflected in their technical performance. These findings are consistent with the views of Mohamed Hassan Allawi (2014), who emphasized that the use of training situations simulating real play contributes to improving skill performance through the integration of physical and mental aspects (Allawi, 2014, p. 233).

Similarly, Abdel Hamid Sharaf (2018) indicated that situational training develops defensive abilities through repetition under conditions similar to competition (Sharaf, 2018, p. 112). Defensive blocking, in particular, is a defensive skill that requires rapid decision-making and correct positioning, and it can be effectively developed through exercises that incorporate real playing situations (Al-Sibaei, 2017, p. 145). Qasim Hassan (2019, p. 98) also noted that training based on simulation contributes to enhancing nervous system efficiency and increasing neuromuscular coordination in collective defensive situations (Hussein, 2019, p. 98).

With regard to the results of the defensive movements tests, the experimental group also demonstrated superiority over the control group. This can be explained by the fact that game-based simulation exercises focused on developing diversified defensive movements through multiple defensive situations requiring rapid changes of direction, correct positioning, and continuous interaction with the ball and teammates. This approach enhanced players' ability to make quick and effective defensive decisions during matches.

In addition, the superiority and development trend can be the result of game-based simulation exercise used to enhance diversified defensive movements, which allowed players with more accurate, faster and responsive performance under competitive match situations as well as facilitate group synchronization in defense. The remarkable enhancement of performance in the experimental team is also owing to that these drills did not concern only with physical content, but also combined skills intelligence and tactics. This enabled players to adjust their defensive positioning on the fly, in response to changes in play surrounding them. Furthermore, the

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competition between players in those conditions and constraints improved concentration and motivation during practice. This contrasts with Mustafa (2015) who claimed that situational drills enhance defensive performance comparable to game-like situations, where athletes are reproducing match pressure scenarios.

4. Conclusions and Recommendations

4.1 Conclusions

1. The post-test results of both the experimental and control groups showed clear superiority over the pre-test results in the research variables.
2. The post-test results of the experimental group were superior to those of the control group in the research variables.
3. Game-based simulation exercises were effective in developing defensive blocking and defensive movements in the experimental group.
4. Game-based simulation exercises contribute to linking physical performance with cognitive abilities, thereby increasing players' defensive awareness and speed of decision-making.
5. Game-based simulation exercises enhance neuromuscular coordination and collective cohesion during play.

4.2 Recommendations

1. Game-based simulation exercises should be regularly incorporated into handball training curricula in general, particularly for youth age categories.
2. Training exercises should be designed to reflect real game situations and include rapid changes of direction, correct positioning, and interaction with the ball and teammates.
3. Competition and challenge should be incorporated within training units to motivate players and increase their level of motivation.
4. Performance should be periodically monitored using standardized tests to identify strengths and weaknesses in order to adjust training programs accordingly.
5. Similar studies are recommended to be conducted on other samples.

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