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The effect of plyometric exercises with a proposed device on the development of reaction speed and defensive movement in basketball players under the age of 18

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Abstract

The purpose of this study was the construction of plyometric exercises with a proposed device to improve the reaction speed and defensive motion in younger than 18 basketball players. Design The authors used experimental method in study and had equal control-experimental group (pretest-posttest). The sample of the study consisted young individuals in (Al-Nu'maniya Sports Club under 18 years). The pre and post-test results were compiled, analysed and discussed using the data processing techniques. The authors determined that the plyometric exercises in conjunction with the device in question improve reaction speed and defensive movements in subjects under 18 from volleyball players. They also suggested some things like use of the research's plyometric exercises, increase in the reaction speed and defensive movements for youth players. They also stressed the necessity of using recent training devices to improve physical fitness characteristics and defensive skills in young basketball players with age less than 18 years.

Keywords: plyometric exercises, reaction speed, defensive movement, basketball.

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Introduction

plyometric exercises have shown a significant impact on developing response speed and defensive movement for basketball players under 18 years of age. Research has shown that in-season rebound training within basketball practice can lead to improvements in explosive movements and jumping ability. In addition, it has been shown that combined balanced training with rebound exercises can enhance athletic performance, including accelerating response time in defensive movements during an opponent's attack.

This is what she emphasized by saying that rebound training programs, whether with or without adding additional load, can contribute

to developing the jumping ability of basketball players. This suggests a dose-response effect of rebound training on vertical jump performance. Furthermore, the use of the proposed device in rebounding exercises may provide additional benefits in enhancing explosive movements and defensive movement of basketball players.

The importance of incorporating rebound exercises with Fitlights into basketball training for players under the age of 18 is that they are not only limited to improving response speed and defensive movement, but can also contribute to overall athletic performance and injury prevention. This is what was emphasized by (Canlı U., 2020) that basketball coaches working, especially with young basketball players and teenagers in youth leagues, should apply muscle jumping exercises for the lower and upper extremities regularly throughout the playing season to obtain maximum strength. The point is that coaches design group exercise programs to further improve athletes according to variables such as strength and skill. It should also not be forgotten that sustainable muscle training programs appropriate to the level of development of athletes will help avoid injuries. By targeting explosive movements and agility through rebound training, young basketball players can enhance their abilities on the court and potentially reduce their risk of injury.

Although the effectiveness of rebound exercises in developing response speed and defensive movement is supported by research, potential debates may arise regarding the optimal training program and specific design of the proposed device. (Aff & Errete, 2015) stated that it is necessary to take into account individual differences in players' response to rebound training and the potential risks associated with high-impact exercises, especially for young athletes.

(Saeed, W., Abdulaa, A., & Sakran, 2023) mentions that special exercises similar to skill performance have an impact on developing skills, so it is necessary to make the devices similar to the skills and be similar to the playing conditions, and this is what the researchers did when making

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the device and determining Exercises that are similar to randomness and movement of the opponent during the attack.

One of the most relevant studies to this research was conducted by Mohameed & Alaany (2021), who were interested in examining methods for improving motor response speed among advanced basketball players, through specialized exercises using the modified (XTRA-MAN) device. The results verified that the exercises performed with the Modified Young apparatus were efficient.

In summary, rebound exercises in combination with the Fitlights device could effectively improve response speed and defensive movement of young basketball players. The research results support the potential benefits associated with inclusion of RT in basketball practice for increasing athletic performance and reducing injury. However, special training programs should also be considered into account and precautions should be taken to improve the impact of rebound exercise in young basketball players.

Methodology

The problem is the fundamentals of the guidelines used for choosing methods to reach findings by researchers. Al-Kazemi (2012) points out, phenomena can be explored from a methodological frame suited to the nature of the research problem. To this the researchers resorted to the experimental method, constituting two equivalent groups of subjects suitable for research problem.

Since "the selection of the sample is closely linked to the nature of the community from which it is taken and the nature of the research problem, because it is the model of the community in which the researcher conducts his work" (Al-Khafaji, 2014, p. 130). In the intentional method, the research sample was chosen by Al-Numaniyah Sports Club players to implement the experiment related to the subject of the study. The sample included (12) players. They were chosen because of the regularity of the players in training, the availability of the field, the proximity of the training center, and the ease of access to it by the researcher. Then the researcher divided the sample randomly by lottery into two groups: control (6) players and experimental (6) players. The percentage of the sample in relation to the research population was (20%).

Table 1. *shows the research population, sample, and percentage*

	Club name	Number of Players
1	Al Numaniyah Club	12
2	Al-Kout Club	12

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3	Al-Ahrar Club	12
4	Al-Mowfaqia Club	12
5	District Club	12
	Total	60
	Percentage	% 20

The researcher also standardized the research variables of age, training age, height and b ody mass and resorted to accurate statistical methods as may be observed over Table (2).

Table 2. *It shows the homogeneity of the sample in variables (age, training age, height, body mass)*

variables	measruing unit	Arithmetic mean	deviation Standard	Torsion coefficient
height	cm	180.13	1.26	0.194
Mass(weight)	kg	70.56	1.46	0.153
Chronological age	year	17.06	0.85	0.13
Training age	year	2.75	0.78	0.49

Devices and tools

- 6 legal basketballs.
- Basket goals.
- 2 Japanese-made electronic stopwatch.
- Japanese-made electronic medical scale.
- Measuring tape.
- Japanese-made Sony manual camera.
- A Chinese-made HP laptop computer.
- Fox type whistle.
- Signs, 50 cm high, 10 in number.
- Balance ball (1).
- 4 plastic columns, 1.50 m high.
- Various rubber ropes.
- Designed device (Fitlights)

fitlights device

The idea of modifying the device was discussed by the researcher, supervisor, and engineer, as they were based on previous devices that had been used in games and events. As a result, the researcher developed a clear picture of the nature of the device he wished to modify,

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and the idea was built on scientific and economic foundations, taking into account the availability of an appropriate sample. This idea was initially tested using a computer program and theoretically.

The device was designed by the researcher as an educational and training device that aims to develop the speed of motor response and all the skills that need to make a quick decision in movement. This is what the researcher noticed in most players, which is the lack of making a quick decision during the match, such as in offensive or defensive actions, using audio-visual stimuli in the game. A variety of sports games and events, including basketball. The device can be used by all athletic levels, and is also suitable for open skills that require quick motor response in an open environment. The device helps the player to anticipate and predict quickly before the stimulus appears, which contributes to the development of his mental abilities and thus enhances the speed of motor response.

• How the fitlights device works

The main program for the device's operation was designed to operate at different times, and special exercises were prepared using rubber ropes compatible with the device's operation on the field, with the aim of developing the speed of motor response and defensive movement chosen by the researcher in coordination with the supervisor. Discs are distributed on the field according to specific exercises, and the player moves to the effect that is on and touches it before it turns off.

Tests used

- Motor response speed test (Nelson) to multiple directions: (Ibrahim and Bariqa, 1995, p. 198)
- The aim of the test: to measure the motor response time according to the choice of the stimulus in four directions.
- **Tools**: flat space free of obstacles, stopwatch, measuring tape, masking tape.
- Procedures: The test area is planned as in Figure (3), and the distance between point (x) and the four lines is 6.40 m.
- **Test description**
    - The tester stands at point (x) and focuses his gaze on the raised hand of the referee who stands at point (a).
    - The referee gives the signal (Get ready) to the tester.
    - The referee holds the stopwatch in one hand and raises it high, then quickly moves his arm either to the right, left, forward, or backward, and at the same time starts the watch.

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- The tester responds to the referee's signal and tries to cover the distance as quickly as possible in the specified direction. When he reaches the finish line, the referee stops the stopwatch.
- The tester is given (8) attempts divided into four directions, between one attempt and the next (20 seconds).
    - Attempts are determined randomly and by drawing papers.

- **the conditions**
    - The tester does not know that he is required to have eight attempts distributed equally in the four directions.
    - The referee must practice the start signal, give the arm signal, and run the clock at the same time.
    - The test begins with giving a signal (I am getting ready... I am starting) and the time period between the two words ranges from (1.5-2) seconds.
- **Register**
    - Calculates the time for each attempt.
- The lab score is the average of the eight attempts.

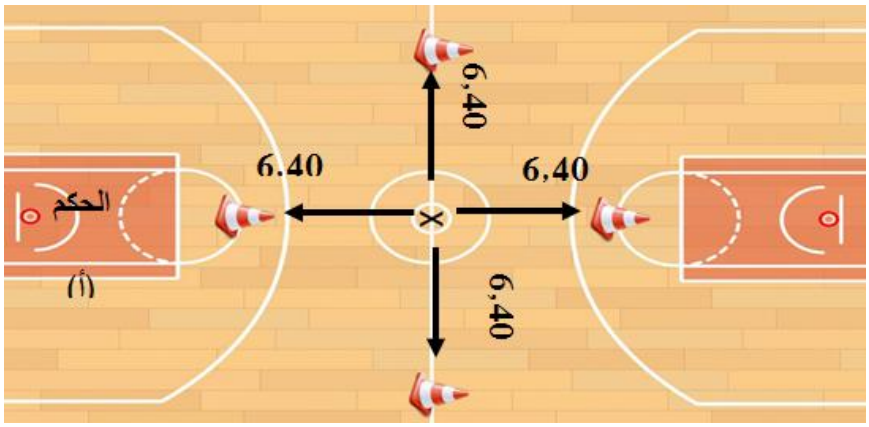

Figure 3. *Nelson's motor response speed test shows multiple directions*

- (Defensive Move) Test: (Hussein, 2012, page 82)

Purpose of the test: to measure the speed of the defensive player's movement performance.

Tools used: adhesive tape, leather measuring tape (20 m), markers (4), electronic stopwatch, whistle, or pen, and pens for recording.

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Test procedures (see Figure 4).

Four signs distributed as follows:

Sign No. (1) lies in the middle of the throat on earth. Signs (3) &(4) are placed 90 cm from the sideline and 8.325 m above the baseline. Sign No. (2) is placed in the middle of central circle as shown in the figure.

Performance description

The defender takes up position behind Marker No. (1). At the sound of the starting signal by whistle, player runs up to second mark or Marker No. (2) and touches with right arm. The player makes his way down to Marker No. (3) and goes through the same routine by touching the mark with the right arm. The player then performs a quarter rotation towards the middle returning to the first marker, and does the sequence again on their left side.

Test conditions

- Execute test steps quickly.

- Bend the knees when performing the defensive player's movement, while raising the arms to no less than 90 degrees between the upper arm and the torso.

-Just one try.

Test administration: Timer: giving start and end signals via the whistle with timing.

Recorder: Calls the rolls and notes the performance while recording the testing time.

Calculating the score: The player records the time he takes to perform the test in its six steps, based on the start and end whistle.

Send feedback

Side panels

History

Saved

Contribute

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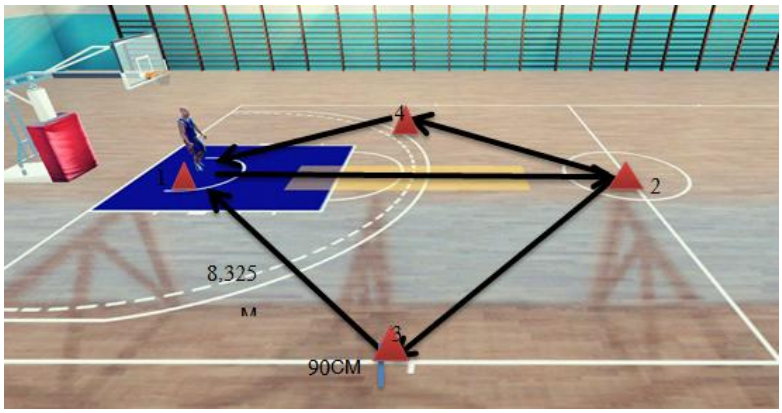

Figure 4. *shows the defensive move test*

Main experience

After the researcher completed the pre-tests for the two groups, he began implementing the vocabulary of the main section that had been prepared by the researcher, preparing rebound exercises using the fitlights device and rubber ropes and the extent of their effect on the speed of motor response and defensive movement for basketball players under (18) years of age, and using them. With the experimental group of (6) players in order to develop their defensive performance. The control group will use the normal curriculum prepared by the trainer.

Results

Table 3. *It shows the mean, deviation, difference of means, deviation difference, standard error of the differences, the calculated T value, and the significance value of the pre- and post-tests for the post-tests of motor response speed and defensive movement for the experimental research group*

variables	Test	s^-	± A	F^-	± A F	Value T	Indicative value	Development rate
Speed of motor response	Tribal	2.590	0.174	0.608	0.209	7.119	0.001	23.51
	Post	1.981	0.066					
Defensive move	Tribal	21.738	0.960	3.658	0.838	10.693	0.000	16.82
	Post	18.080	0.647					

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Table 4. *It shows the mean, deviation, difference of means, deviation difference, standard error of the differences, the calculated T value, and the significance value of the pre- and post-tests for the tests of speed of motor response and defensive movement for the control research group.*

variables	Test	s^-	± A	F^-	± A F	Value T	Indicative value	Development rate
Speed of motor response	Tribal	2.568	0.206	0.023	0.217	0.263	0.803	2.89
	Post	2.545	0.091					
Defensive move	Tribal	22.531	1.329	0.633	1.772	0.875	0.421	2.80
	Post	21.898	1.145					

Table 5. *It shows the arithmetic means, standard deviations, the calculated (T) value, and the result of the differences between the experimental and control groups in the speed of motor response and defensive movement*

variables	measruing unit	Experimental group		Control group		T value	Error level	indication
		s^-	±A	s^-	± A			
Speed of motor response	second	1.981	0.066	2.545	0.091	-12.232	0.000	D
Defensive move	second	18.08	0.647	21.898	1.145	-7.108	0.000	D

Discussion

All differences between pre and post obtained from the results in tables 1-2 were found to be different for both testing groups (experimental and control) relatively the speed of motor response and defense movement. Moreover, between post-tests of the groups also have differences, in which experimental groups gain a better outcome. The researchers say the experimental group's superior performance can be attributed to their practice in speed of movement response and defensive reaction training through rebound exercises (by using training devices and implements with progressive increase from easiness to difficulty as per the successive units of trainings). This tactical decision was taken to increase the construct validity of this research.

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The increasing of the motor response speed this way has proved to be very successful over relatively prolonged periods, for a certain type of training – the improvement of the skill involved in defense movement style was missing from his teaching method. "the motor skills are so important because they actually are providing the skill and movement of the nature and demands of the performance" (Singer 1997, p. 221). In addition, the program has been comprehensive in contents of its training programme; well-timed session periods; matched with specific Football methodologies and exercise progressions have promoted Players' physical, skill- and tactical development. ing (specific for the sample skill level and duration time).This based on Abass, Karrar and Abd Alsatar(2023) study.

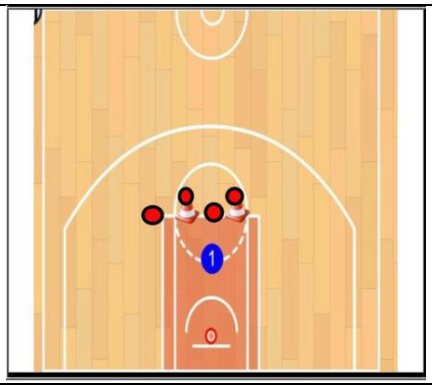
Special exercises using training tools and accessories, such as ball throwing games or a neurobixball have been successful in improving physical skills related to gaming. Confirming this, Mohammed & Ali (2020), Mohameed & Alaany (2021), Santos & Janeira (2012) and Domeika et al. (2020) have validated that the use of specific exercises with equipment and instruments can exercise a positive influence on the acquisition of physical abilities and skillexecution.

Conclusions

According to the results obtained from this sample group, it was concluded that rebound training on rubber ropes together with Fitlights system application, which were applied to the members of the control group, were effective and meaningful in developing speed of motor response and speed of defensive movement for young basketball players.

Appendices

Appendix (1)
Exercises used in the research

	**(1) practice** **One player performs the exercise. Two visual effects are distributed on the ground and two are distributed on the signs, as shown in the figure. Each effect is 50 cm away from the other. The player stands facing the effect, and from the movement, the player touches the effect on the person with his hand and touches the effect on the ground with his foot. Using a time of 1 .second, the player stands on a balance ball**

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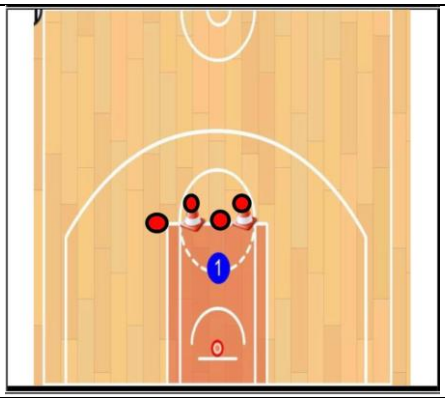
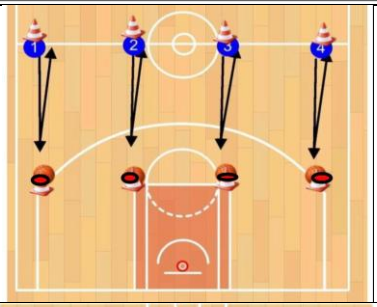
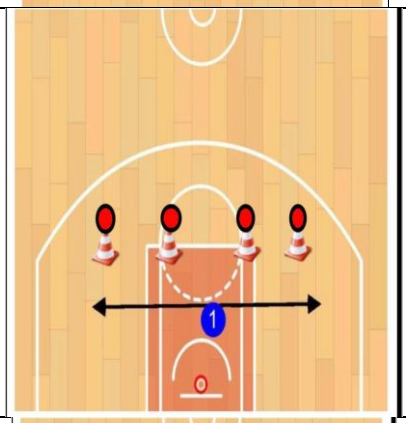
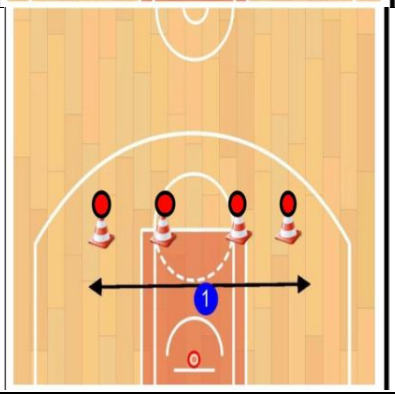
	**(2) practice** **The same exercise as the previous one, but without the balance ball. The player wears the rubber rope that connects the feet. The player is at a distance of 2 meters from the device and quickly launches towards the .effect that lights up**
	**(3) practice** **4players stand facing the signs that carry the visual effects, and each of them wears the elastic cord that connects the feet. The player is 4 meters away from the device and quickly runs towards the effect that lights up. The 0.5 second system is used in this exercise.**
	**(4) practice** **One player performs the exercise, and 4 effects are placed in a straight line** **The distance between the effects is 1.5 metres. The player performs the exercise by starting, assisting and covering in defense, and turning off the light coming from the effect without knowing which effect will light up, according to the time allotted for the exercise while wearing a rubber rope jacket. The 2-second program is used in this exercise.**
	**(5) practice** **The same exercise as the previous one, but using the 1-second system.**
	(6) practice

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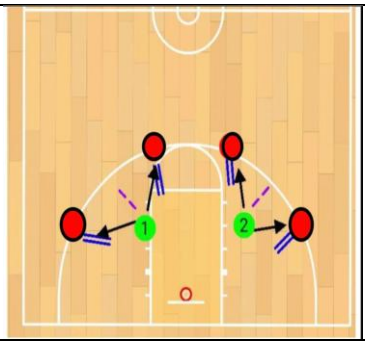		The exercise is carried out by 2 players, and 2 effects are placed on the three-point arc and as shown in the figure. The player moves quickly towards the effect that lights up and returns to the starting point, according to the time allotted for the exercise.

Appendix (2)

.(1) : Training unit number				Week and month: first_first		
minutes34.92Exercise time:				Day and Date 11/1/2023		
Location: Martyr Muhammad Naji Al-Numani Hall						
Exercise number	intensity	Exercise number	intensity	Exercise number	intensity	Exercise number
1	%85	4	2	m 2-1	m 3_2	m5.82
2	%85	4	2	m 2-1	m 3_2	m5.82
3	%85	4	2	m 2-1	m 3_2	m5.82
4	%85	4	2	m 2-1	m 3_2	m5.82
5	%85	4	2	m 2-1	m 3_2	m5.82
6	%85	4	2	m 2-1	m 3_2	m5.82

.(1) : Training unit number				Week and month: first_first		
minutes34.9Exercise time:				Day and Date 11/1/2023		
Location: Martyr Muhammad Naji Al-Numani Hall						
Exercise number	intensity	Duplicates	groups	Comfort between groups	Rest between exercises	Total performance time
1	%85	4	2	m 2-1	m 3_2	m5.82
2	%85	4	2	m 2-1	m 3_2	m5.82
3	%85	4	2	m 2-1	m 3_2	m5.82
4	%85	4	2	m 2-1	m 3_2	m5.82
5	%85	4	2	m 2-1	m 3_2	m5.82
6	%85	4	2	m 2-1	m 3_2	m5.82

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