

The Effect of Both (Ballistic and Plyometric) Methods of Exercises in Protecting from Knee Joint Injury in Terms of the Most Important Muscles Working on it for the Handball Center Player

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Abstract

The knee joint injury is very common for the handball center player, because of his position, which depends on the rotation on one of the legs to shoot on the goal with or without resistance from the opponent and jumping, and this requires giving appropriate exercises to strengthen the most important muscles working on this joint, which works to prevent injury in it through experimenting both (ballistic and plyometric) training methods, and the aim of the research is to identify the effect of both (ballistic and plyometric) methods in preventing knee joint injury according to the most important muscles working on the knee joint for the handball center player, and to identify the best methods in preventing Knee joint injury according to the most important muscles working on the knee joint for the research sample, and the researchers used the experimental approach with two experimental equal groups, The research community was determined which are the center players in Karbala governorate handball Clubs, in the youth age group (17-19) years, and they were randomly and evenly divided into two experimental groups as a sample for research As the first group used ballistic exercises, and the second group used plyometric exercises.

Key words: Knee joint, Injury, muscles working, Handball Center Player

Introduction

Sports training has become the optimal process for getting the athletes to levels that qualify them to compete in the championships and competitions through preparing them in various qualities ¹, including physical ones, which have a prominent role in developing other aspects, and through the integration with each other leads the skill or effectiveness to reach to a high level during competition ². This hasn't come in vain, but it has come through using modern and objective methods that were placed by specialists and researchers who have got all sections of modern science from various aspects through searching, study and accurate tests that they carry out to bring sports activity and activities to the level of Sophistication and progress ³. The development of the handball game in recent years has tended to the strong and fast play, thus it requires great skill and physical

work, and this leads to the pressure on the muscles and joints of the athlete's body and consequently to the occurrence of injury. which imposed us to think to find solutions for this state, depending on the muscular work and muscular balance's strength for the muscles that work for all joints, especially the muscles working on the knee joint, because of its importance in the performance of the handball player in general and the center player in particular, and what burden he bears during jumping, moving, and rotating with or without resistance, for protection from injury to this joint before it occurs ⁴. Therefore, modern training has turned to the use methods that help to produce fast strength that enables muscles to work with high efficiency without being injured, and these methods include ballistic and plyometric training, as they are from the best training methods and most suitable for the handball game, as its training is more appropriate and similar to the

performance of the modern handball player, especially for the center player. From this standpoint, the aim of this study is to protecting the most important muscles working on the knee joint of the center player through achieving progress in the efficiency of these muscles using ballistic and plyometric exercises.

Methodology

Research approach

The nature of the problem determines the approach used in the research to obtain accurate information and results and “the most important thing recognizes the accurate scientific activity is using the experimental method⁽¹⁾so that the researchers used the experimental design with two equal experimental groups that suit

the nature of the studied problem, and below the experimental design that was used in the research.

Research community and its sample

The researchers identified the research community for Center players of Karbala’s Governorate handball clubs, the youth age category 17-19 years, who are 14 players, and they were all chosen as a sample for research and in a comprehensive inventory method, and they were randomly and evenly divided into two experimental groups with a rate of 7 players for each group, as the first group used exercises using the ballistic method, and the second group used exercises using the plyometric method.

Table (1) shows the homogeneity of the research sample

Statistical parameters Variables	Measuring Unit	Arithmetic Mean	Standard Deviation	Mean	Torsional Coefficient
Length	Cm	171	7.12	171.5	-0,628
Weight	Kg	50.2	5.84	48.55	0,586
Training age	Month	21	3.58	22	0,758

Table (2) shows that the torsional coefficient of the variables (length, weight, and training age) is between ±1, which indicates the homogeneity of the research sample in these variables.

To control the research variables that influence the experiment and to start from one initiation point, the researchers sought to find equivalence for the two of the research groups for the pre-test results using T for independent samples, as shown in Table (2).

Table (2) shows the equivalence of the two research groups in the searched variables

Statistical parameters Variables	Measuring Unit	The experimental group (1)		The experimental group (2)		Calculated T value	indication level	Type of indication
		A	B	A	B			
Femoral straight muscle activity	MV× S	1405,27	26,93	1366,91	13,86	0,110	0,954	un significant

Cont...Table (2) shows the equivalence of the two research groups in the searched variables

Femoral posterior muscle activity	MV× S	2512,44	19,06	2493,20	10,08	1,903	0,268	un significant
Long fibula muscle activity	MV× S	1089,13	7,22	997,61	6,17	0,249	0,789	un significant
Twin muscle activity	MV× S	923,76	15,36	894,72	10,24	1,222	0,271	un significant

Freedom degree = 12 at the significance level (0.05)

Table (2) shows that the values of the indication levels were higher than the indication level 0.05 and for all research variables, at a freedom degree 12, and thus the differences are not significant between the two research groups, which achieves parity between them.

Means, tools and devices used in the research

Means of collecting information

- Objective tests and measures.
- Observation

Determine the most important muscles that work on the knee joint

After referring to the scientific sources, the most important muscles that work on the knee joint were identified as they are: (the femoral rectus muscle, posterior femoral muscle, long fibula muscle, twin muscle).

Determine the tests for the search variables

After referring to scientific sources, the researchers chose the electrical activity test of the muscle to serve the studied variables.

Description of the tests

EMG device test

Test name: Measurement of the electrical activity of muscles using an EMG device.

The purpose of the test: To measure the activity of the most important muscles that work on the knee joint

Exploratory experience

The researchers have made an exploratory experiment on Sunday/ 11/23/2018) on a group of 4 player sample, to benefit from the following:

- 1- Testing the validity of the tools and devices used in the tests.
- 2- Knowing the efficiency of the staff and train them on tests.
- 3- The validity and relevance of the exercises for the level of the research sample.
- 4- Calculating the performance time for each exercise.
- 5- Calculating the maximum stresses of the exercises used in the research.
- 6- Determine the appropriate rest time between repeats and groups.

Preordained test

The preordained test was done on the research sample on (Tuesday/ 1/12/2019), at the martyr Al-Hakeem closed Hall Stadium in Karbala Governorate.

Main experience:

After finishing the preordained tests, the researchers

will include the exercises that he prepared on the (Alfartmix) and (electrical stimulation) devices within the training program for the research sample at the beginning of the main section of the training unit, then the main part will be completed together with the same trainer exercises, and will be as follows:

1- The date of starting the exercises was Saturday , 5/12/2018.

2- The exercises were applied in the special preparation stage.

3- The trial period reached 8 weeks divided into 24 training units, with an average of three units per week.

4- A special coach has been identified for each group, to be given the special exercises prescribed for them at the beginning of the main part and on the stadiums of the closed hall Al-Hakim Sports Hall and the youth center on Saturdays, Mondays, and Thursdays and at the same time, and after completing the special exercises they are combined again to complete the training unit for them under the guidance of their coach.

5- The researchers determined the intensity of the exercises between (85-100%).

6- The training extent of the exercises reached (25-40) minutes from the extent of the training unit.

7- The researchers used the high-intensity periodical training method.

8- The end date of the experiment was (Thursday1/31/2019).

Post-Test:

The post-test on the research sample was done on (Sunday 3/2/2019), at the Al-Hakim closed hall in Karbala, Considering the same conditions and circumstances in the pre-test.

2-5 Statistical Methods:

The researchers used the SPSS statistical bag, using the following statistical means: Arithmetic mean, the standard deviation, (T) for the corresponding and independent samples, the Pearson correlation coefficient, the torsional coefficient, the median, the Ca2 test.

Discussing the results

The results were presented, analyzed and discussed in this chapter, which was obtained from the research sample, after the data were statistically processed and presented in the form of explanatory tables that facilitate the observation of differences and comparison between the test results of the two research groups, and then discussed to achieve the goals of the research and test its hypotheses. To test the second hypothesis, the researchers used (T) test for the corresponding samples to extract the significance of the differences between the tests results in the preordained and post measurements of the two research groups, as shown in tables (3) and (4).

Table (3) shows the arithmetic mean, standard deviations, calculated (t) value, the level and type of significance for the first experimental group in the preordained and post-tests.

Tests	preordained		Post		Calculated T value	Significant level	Significant type
	A	B	A	B			
Femoral straight muscle activity	1405,27	26,93	2082,56	47,63	51,813	0,00	Significant
Femoral posterior muscle activity	2512,44	19,06	3579,77	28,91	128,930	0,00	Significant
Long fibula muscle activity	1089,13	7,22	2009,23	47,43	79,091	0,00	Significant
Twin muscle activity	923,76	15,36	1547,59	39,81	66,702	0,00	Significant

At the significance level (0.05) and the degree of freedom 6.

Table (3) shows the statistical indicators for the tests' results in the preordained and post-measurement of the research variables that were subjected to the members of the first experimental group.

The results showed that the values of the arithmetic mean for all the research variables were higher in the

post-test than the preordained test, and a significant difference occurred between the two tests for the post-test, since the bigger the Arithmetic mean, the better the level, and this is what the levels of significance indicated as they were less than the level of (0.05) significance, which indicates significant differences between the two tests.

Table (4) shows the arithmetic mean, standard deviations, calculated (t) value, level, and type of significance for the second experimental research group in preordained and post-test.

Tests	preordained		Post		Calculated T value	Significant level	Significant type
	A	B	A	B			
Femoral straight muscle activity	1366,91	13,86	1812,41	39,87	74,621	0,00	Significant
Femoral posterior muscle activity	2493,20	10,08	3111,32	24,43	110,135	0,00	significant
Long fibula muscle activity	997,61	6,17	1693,58	40,02	151,638	0,00	significant
Twin muscle activity	894,72	10,24	1332,73	35,99	54,865	0,00	significant

At the significance level (0.05) and the degree of freedom 6.

Table (4) shows the statistical indicators of the tests' results in the preordained and post-measurement of the research variables for the second experimental group sample.

As the results showed that the values of the arithmetic mean for all the research variables were higher in the post-test than the preordained -test, and a significant difference occurred between the two tests for post-test, since the greater the arithmetic mean, the better the level, and this is what the significance levels indicated as the least significance level was (0.05), which indicates that there were significant differences between the two tests, and this is consistent with what was stated in the second hypothesis of the research.

The researchers attribute the reason for the development that occurred on the two experimental groups members to the regularity in the training process and the work according to the lengthening and shortening cycle, so evolution will certainly occur for the members of the two training groups.

As the organized sports training leads to an increase in the efficiency of the functional systems, especially the nervous and muscular systems, and this appears directly in the muscles' ability to produce strength while increasing the speed of the muscular contraction for decision-making, and all this is in the service of skill performance.

In addition to the codified repetition process in the training process, which had a clear role in the development process.

Table (5) shows the arithmetic mean, the standard deviations, calculated (t) value, the level, and type of significance between the results of measuring post-tests for the two research experimental groups.

Test	measuring unit	1st experimental group		2nd experimental group		Calculated T value	Significant level	Significant differences
		-A	B	-A	-B			
Femoral straight muscle activity	MV× S	2082,56	47,63	1812,41	39,87	31,143	0,00	significant
Femoral posterior muscle activity	MV× S	3579,77	28,91	3111,32	24,43	80,682	0,00	significant
Long fibula muscle activity	MV× S	2009,23	47,43	1693,58	40,02	43,838	0,00	significant
Twin muscle activity	MV× S	1547,59	39,81	1332,73	35,99	14,674	0,00	significant

At the significance level (0.05) and the degree of freedom (12)

Table (5) shows the arithmetic mean, the standard deviations and the significance of the differences between the post-tests' results for the two experimental groups, and through reviewing the results of the tests that were reached, it becomes clear to us that there are significant differences between the measurement of the post-tests of the two groups in all the variables, and in the interest of the first experimental group that used ballistic exercises as the values of the significance level were less than the error level (0.05) and this is consistent with what was stated in the third hypothesis of the research.

Discuss the results of measuring the post-tests for the two research groups

The researchers attributed the reason for the development and the advantage of the first group upon the second group to the fact that the ballistic exercises which were chosen had a positive impact on developing strength and the rapid ability of the muscles that work

on the knee joint^{6,7}, which positively affects the work of the knee joint and protecting it from injury. And this muscle strength and flexibility are more conservative on the knee joint from injury and lacerations, as it is important to have the right balance between strength and flexibility between the different muscle groups working on the knee joint, especially the thigh muscles that control the knee and are more able to withstand muscle pressure⁸⁻¹⁰.

Conclusions

The exercises used in the ballistic method have a clear positive effect in developing the activity of the most important muscles working on the knee joint of the handball center player. The exercises used in the plyometric method have a positive effect on developing the activity of the most important muscles working on the knee joint of the handball center player. Exercises of both (ballistic, plyometric) methods work to protect the knee joint from injury to the handball center player, but the preference was for ballistic exercises method according to the greater development achieved by the

activity of the most important muscles working on this joint.

Financial Disclosure: There is no financial disclosure.

Conflict of Interest: None to declare.

Ethical Clearance: All experimental protocols were approved under the Kerbala University and all experiments were carried out in accordance with approved guidelines.

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