

# **The Effect of the Ballistic Training to Developing the Maximum**

**Muscular Power  
On The Performance Level  
Of The Flat Horizontal Strike  
(Sweep) In Junior**

## **Women Hockey Players**

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### **Abstract**

*This research aims to developing a program by using the ballistic training and determining its effect on the maximum muscular power of the two arms and the two legs for the U-18 hockey junior women and the performance level (punctuality – power – speed) of the flat horizontal strike (Sweep). Basic research sample (32) junior women who were divided into two groups, whereby one was experimental while the other one was controlling, and the number of each of them was (16) U-18 hockey junior women. Results: (1) The ballistic training program has a positive statistically significant effect at 0.05 level on the maximum muscular power of the two arms and the two legs and level of performance (punctuality – speed – power) of the flat horizontal strike for the U 18 hockey junior women. (2) The training program that is used with the controlling group has a positive statistically significant effect at 0.05 level on the maximum muscular power of two arms and two legs and the level of performance (punctuality – speed – power) of the flat horizontal strike of the U 18 hockey junior women.*

### **Key words**

## ***Ballistic Training – Maximum Muscular Power - Flat Horizontal Strike (Sweep).***

### **Introduction:**

The ballistic trainings are regarded from the most suitable trainings used in developing the maximum muscular power for they are distinctive from other trainings of developing the muscular power in that they combine in its natural performance between the two features of muscular power and speed together, besides the used medium resistors (Ali Fahmy Al-Bek, 2008).

The performance of the ballistic trainings depends on the theory of using a resistor that is appropriate with the power and speed of the elasticity of the muscles in order to achieve the goal of the training program in developing the maximum muscular power as a means to developing the mechanical effectiveness of the working muscles to reach a better level of the motor performance (Ali Fahmy Al-Bek, Emad El-Deen Abbas Abu Zaid, 2003).

The muscular power means the ability to repeatedly overcoming resistors by using a high dynamic speed as the muscular power is represented in the repetition with no waiting moment to gather the powers such as repeating the rapid continuing passing training (Emad El-Deen Abbas Abu Zaid, 2007).

As for the maximum muscular power, it is the maximum power the individual

can bring forth during performance for only one time at maximum possible speed, such as long passing and shooting at the goal in field hockey (Ali Fahmy Al-Bek, 2008). Reaching the high athletic levels for the field hockey woman player requires perfecting the basic motor skills in the hockey sport and recognizing the principles of each skill, and this clearly appears in the importance of the basic skills and how to perform them.

The skill of the flat horizontal strike (Sweep) is considered among the important skills in field hockey as the defense and mid players perform it, as well as the offensive in the rapid passing and shooting, due to its rapid performance and due to shortness of the back swinging of the stick, unlike hitting the ball by the flat face of the racket which requires the player to take the get ready position and positioning the left shoulder which takes long time and make it easy for the defender to intercept the ball, as the sweep skill has a great importance in deciding the results of games through shooting with it at the goal in several offensive situations (Claire M. & Verner, 2009).

Through the researcher's readings and viewing of scholarly studies on field hockey, she noticed there was no a scholarly study that dealt with the effect of the ballistic training on the maximum muscular power of the two arms and the two legs and the performance level of the flat horizontal shot (Sweep) for the junior women hockey players, in addition to the low level of the flat horizontal

strike (Sweep) for the U-18 junior women hockey at the Sharkia Hockey Region as to punctuality, speed, and power, whether during training or during games, which affects the low rate of shooting at the goal and the scoring of goals in games. The reason of this may be the lacking of the U-18 junior women players to the component of the maximum muscular power of the two arms and the two legs as one of the important physical components in field hockey, despite the existence of the training programs and the various training methods of preparing the hockey junior women. The researcher believes this is due to not using the ballistic training programs during the process of the special preparing of junior women field hockey players.

Therefore, the researcher thought to examine this problem through developing a program by using the ballistic training to improve the maximum muscular power of the two arms and the two legs and determining its impact on the performance level of the flat horizontal strike (Sweep) for the U-18 hockey junior women.

### Research Objectives:

This research aims to developing a program by using the ballistic training and determining its effect on the following:

1. The maximum muscular power of the two arms and the two legs for the U-18 hockey junior women.
2. The performance level (punctuality – power – speed) of the flat horizontal strike (Sweep)

### Research Hypotheses:

1. There are statistically significant differences between the averages of the two dimensional measurements of the two groups the experimental and the controlling in the maximum muscular power of the two arms and the two legs in favor of the experimental group.
2. There are statistically significant differences between the averages of the two dimensional measurements of the two groups the experimental and the controlling in the performance level (punctuality – power – speed) of the flat horizontal strike in favor of the experimental group.

### Research Procedures:

The researcher utilized the experimental method for its appropriateness to the current study.

### Research Sample:

The researcher has chosen the research sample individuals by the deliberate way from among the U-18 hockey junior women who are enrolled with the Sharkia Sports Club and Al-Sayadin Sports Club during the sports season 2011/2012, and who are registered with the Egyptian Hockey Federation, whereby the total size of the sample before performing the basic experiment was (42) junior women, where a number of (10) junior women were

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excluded and these are the participants in the exploratory study. Thus the size of the basic research sample became (32) junior women who were divided into two groups, whereby one was experimental while the other one was controlling, and the number of each of them was (16) U-18 hockey junior women.

The researcher made the parity between the research two groups in the previous variables in which harmony was made. This measurement is considered as the pre measurement of the two groups: the experimental and the controlling. The two tables (1) and (2) show this:

**Table (1):**

*The Significance of the Differences between the Two Groups: the Experimental and the Controlling In the Researched Growth Rates N=16*

Variables	Unit	Experimental group		Control group		t-stat
		Mean	Variance	Mean	Variance	
Age	Years	16.55	0.59	16.70	0.62	0.68
height	Cm	162.00	4.91	162.95	5.27	0.51
Weight	Kg	59.25	3.73	60.00	4.01	0.53
Training age	Years	3.60	0.61	3.70	0.69	0.42

\* Significantly different at  $p < .05 = 2.042$

It is clear from Table (1) that there are no statistically significant differences at level of 0.05 between the two groups: the experimental and the controlling in the growth rates, which indicates the parity of the study two groups in these variables.

**Table (2):**

*The Significance of the Differences between the Two Groups: the Experimental and the Controlling in the Researched physical and skilful variables*

Variables	Unit	Experimental group		Control group		t-stat
		Mean	Variance	Mean	Variance	
throwing a weight of 900 gm to the maximum distance	Meter	9.20	0.77	9.35	0.82	0.52
wide jump from stationary	Meter	1.55	0.15	1.60	0.20	0.77
punctuality of the flat horizontal strike	Num.	2.00	0.95	2.16	0.66	0.54
strength of the flat horizontal strike	Meter	2.90	1.03	3.25	1.12	0.86
speed of the flat horizontal strike	Second	77.62	4.57	76.84	4.03	0.46

\* Significantly different at  $p < .05 = 2.042$

It is clear from Table (1) that there are no statistically significant differences at level of 0.05 between the two groups: the experimental and the controlling in the researched physical and skilful variables, which indicates the parity of the study two groups in these variables.

## Tools of Collecting Data:

### *First: The Tests of the Researched Muscular Power:*

- 1-The test of throwing a weight of 900 gm to the maximum distance
- 2-The test of wide jump from stationary.

### *Second: The Tests of the Researched Skills:*

- 1-The test of the punctuality of the flat horizontal strike
- 2-The test of the strength of the flat horizontal strike
- 3-The test of the speed of the flat horizontal strike

### *Third: The Suggested Ballistic Training Program:*

The Bases of Setting the Program:

- 1-The suitability of the selected exercises in the training unit to the abilities of the members of the research sample.
- 2- Paying attention to performing the trainings elongation and flexibility in the beginning of the training unit.
- 3-The consideration of the principle of the integration of trainings (the two arms – the trunk – the two legs) in order to achieve the maximum possible benefit.
- 4-The researcher used the method of periodic training in its two incisions: low and high intensity, during the suggested training program.

5-The consideration of the principle of gradualism from what is easy to what is difficult in performing the ballistic trainings inside the training units and throughout the training program.

6- Allowing a positive break interval between each and other group, its duration ranges between (2 minutes – 3 minutes).

7-The consideration of the principle of variety in performing the trainings within the training unit so that the junior woman does not feel bored.

8-The gradualism in increasing the training weights and the appropriate progress with it.

9- Giving relaxing trainings in the final part of the daily training unit with the objective of restoring the body to the natural state.

## The Content of the Training Program:

### *The Intensity of the Load:*

The load intensity used in the ballistic training ranges between 30%:50% which is represented in the weight trainings –the maximum weight that can be raised for one time- so that the weight may not be a burden on the body and affects negatively on the speed of the muscular contraction which causes injury.

As for the free weights (the medical balls – the shot with the handle), the intensity of the load can be determined through the weight of the tool itself as the weights of the medical balls range

between (2 -5) kilo grams, and the weights of the shot with the handle range between (4 -7) kilo grams.

***The Size of the Load (Repetition – Groups):***

The suitable size of the ballistic trainings by using the weights trainings ranges between (10 -12) repetitions in the one group, that the groups range between (3 - 5) groups, and the rest periods from (2 – 3) min between the groups.

As for the size of the load for the ballistic trainings with the free weights, it ranges between (10:15) repetitions, the groups between (2:3) groups, and the rest periods from (2-3) min between the groups.

**Training Program:**

The researcher determined the period to apply the suggested program of the

ballistic training by (10) weeks at rate of (3) times per week, the time of the daily training unit (70) minutes divided into the warm up part (15) minutes, the main part (50) minutes, and the closing (5) minutes, in addition to (20) minutes skillful trainings in the beginning of the main part of the daily training unit.

Pre measurements have been made in the period from 9/8/2011 until 11/8/2011 for the two groups of the study in the researched physical and skillful variables, While training program has been applied on the members of the experimental group, in the period from 12/8/2011 to 20/10/2011 for period of (10) weeks at the rate of three training units per week, and post measurements have been made for the members of the two groups: experimental and controlling in the same order and terms of the prior measurements, in the period from 22/10/2011 until 24/10/2011.

***Table (3):***

***The Significance of the Differences between the Two Post Measurements for the Two Groups, the Experimental and the Controlling in the Researched Physical and Skillful Variables***

Variables	Unit	Experimental group		Control group		t-stat
		Mean	Variance	Mean	Variance	
throwing a weight of 900 gm to the maximum distance	Meter	13.95	0.85	12.50	0.77	4.86*
wide jump from stationary	Meter	1.80	0.05	1.70	0.10	3.40*
punctuality of the flat horizontal strike	Num.	3.44	1.02	2.63	1.00	2.16*
strength of the flat horizontal strike	Meter	5.00	0.60	4.16	0.67	2.46*
speed of the flat horizontal strike	Second	63.79	4.16	70.23	4.25	4.18*

\* Significantly different at  $p < .05 = 2.0422$

Table (3) shows the existence of statistically significant differences at 0.05 level between the two post measurements of the two groups: the experimental and the controlling in the researched physical and skillful variables in favor of the experimental group.

**Table (4):**

*The Ratios of the Improvement of the Post Measurement than the Pre for the Two Groups, the Experimental and the Controlling in the Researched Physical and Skillful Variables.*

Variables	Experimental group (N=16)			Control group (N=16)		
	Pre	Post	Rate of Improvement	Pre	Post	Rate of Improvement
<i>throwing a weight of 900 gm to the maximum distance</i>	9.20	13.95	51.63%	9.35	12.50	33.69%
<i>wide jump from stationary</i>	1.55	1.80	16.13%	1.60	1.70	6.25%
<i>punctuality of the flat horizontal strike</i>	2.00	3.44	72.00%	2.16	2.63	20.09%
<i>strength of the flat horizontal strike</i>	2.90	5.00	72.41%	3.25	4.16	28.00%
<i>speed of the flat horizontal strike</i>	77.62	63.79	21.68%	76.84	70.23	6.41%

It becomes clear from Table (4) the existence of improvement ratios in the post measurement than the pre for the two groups: the experimental and the controlling, in the researched physical and skillful variables in favor of the experimental group.

### Discussing the Results:

The results of Table (3) show the existence of statistically significant differences at 0.05 level between the two post measurements of the two groups: the experimental and the controlling in the maximum muscular power of the two arms and the two legs in favor of the experimental group.

The researcher attributes the improvement in the maximum muscular power of the two arms and the two legs for the members of the experimental group to the effectiveness the component of the ballistic training program which included a group of weights trainings for the two arms, trunk, and the two legs to establish the muscular power (The first stage of the suggested training program), and in the

second stage the preparation period, the weights trainings were executed by high intensities to make sure of improving the muscular power for the junior woman, then the starting in the third stage implementing the ballistic trainings, where it was taken into account the rationing of the training loads to be appropriate with the nature of the research sample, and the graduation with the trainings from the easy to the difficult, which had a positive impact on the researched physical variables.

This result is consistent with what (George, 2002) indicated that the ballistic training is considered from among the best trainings to develop the muscular power of the athletes, whereby most of the trainings are performed in an explosive way as the contraction by shortening is transformed into contraction by lengthening in the shortest possible time.

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By viewing the results of Table (4), it becomes clear that there exist improvement ratios in the post measurement than the prior measurement for the two groups: the experimental and the controlling in the maximum muscular power of the two arms and the two legs in favor of the experimental group.

This result is consistent with what (Fleck & Kramer, 2004) indicated that it could be benefited from the ballistic training for it is from among its principle is the emancipation from heaviness, and this forces the muscular fibers to rapid contraction to produce maximum power in shortest possible time, and this effectively affects the maximum muscular power of the two arms and two legs for athletes.

Also, the results of Table (3) showed there are statistically significant differences at 0.05 level between the two post measurements for the two groups: the experimental and the controlling in the performance level (punctuality – speed – power) of the flat horizontal strike in favor of the experimental group.

The researcher attributes this significant improvement in the level of performance (punctuality – speed – power) of the flat horizontal strike for the members of the experimental group to the effectiveness of the content of the ballistic training program as its exercises combine between power and speed, besides its exercises are closer to the nature of the requirements of the skill performance of the flat horizontal strike, and this result is consistent with what (Komi Beter, 1997) indicated that the

ballistic training increases the speed of the motor performance through the similarity of the nature of the performance of the ballistic trainings in that it simulates the athletic move in accordance with its time and architectural path, i.e. the gained power from this kind of training leads to the increase of the ability of the muscles to contract at a faster rate, and this speed represents great importance because it achieves a great deal of training outcome in the athletic skills that depend on the throwing movements such as the rapid, powerful shooting in field hockey.

Observing the results of Table (4) it becomes clear that there are improvement ratios in the post measurement than the pre measurement for the two groups: the experimental and the controlling in the level of performance (punctuality – speed – power) of the flat horizontal strike in favor of the experimental group.

This result agrees with what both of (Michael Stone, 1998) and (Edmund Burke, 2001) indicated that the ballistic training leads to increasing the speed as a result of using light weights, also the training includes speeding up with the weight or the object in an explosive way in a speed that is appropriate with the nature of the skillful performance in field hockey.

Also, the ballistic training leads to the rapid adjustment of the muscular nervous system with the nature of performance of the throwing skills unlike the training with the traditional weights with high loads and slow speeds.

## **Conclusion**

- 1- The ballistic training program has a positive statistically significant effect at 0.05 level on the maximum muscular power of the two arms and the two legs for the U 18 hockey junior women.*
- 2- The ballistic training program has a positive statistically significant effect at 0.05 level on the level of performance (punctuality – speed – power) of the flat horizontal strike of the U 18 hockey junior women.*
- 3- The training program that is used with the controlling group has a positive statistically significant effect at 0.05 level on the maximum muscular power of the two arms and the two legs and the level of performance (punctuality – speed – power) of the flat horizontal strike of the U 18 hockey junior women.*

## **Recommendations**

- 1- Using the ballistic training program to developing the maximum muscular power of the two arms and the two legs for what it has of positive effect on the level of performance (punctuality – speed – power) of the flat horizontal strike of the U 18 hockey junior women.*
- 2- Having guidance in the components of the suggested ballistic training program in building up similar training programs that develop the maximum muscular power which serves the skillful aspect for the U 18 hockey junior women.*
- 3- The Egyptian Hockey Federation is to include the ballistic training method as one of the innovated training methods in training hockey junior women among the educational sessions for the field hockey trainers.*

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