

Improving the muscular imbalance of penalty corner players of hockey

***Prof. Ph. D. / Mohammed Talaat Abu Elmaatei**

****Prof. Ph. D./ Ahmed Amin Ahmed Elshafei**

Research Introduction & Problem:

Hockey sport is distinguished by the diversity of its tactical performance and the duties inside the team which are based on the well physical preparation; the team which has a number of good players who enjoy distinguished physical performance and tactical flexibility to execute these duties is the best team to achieve victory. The penalty corner players are of these players; as they depend on distinctive technical performance especially the speedy power. Through reviewing the scientific references and meeting the experts, the two researchers found that the muscular strength is closely linked to the muscular balance.

While the first researcher was training the hockey 1st class team and the juniors team under (18) years

in Zamalek Club, season (2014/2015), he made physical tests of penalty corner players in both teams, these tests included: the muscular power (weights), because the two researchers are convinced of the importance of the muscular power and the ability of penalty corner players. Also, these tests are considered a corner stone in selecting the best players to execute the penalty corner regarding its importance in scoring goals.

These tests resulted in discovering that there is a muscular imbalance in the players who perform the penalty corner; what helped to identify this problem was the first researcher's observation of the upper limb swelling in the penalty corner players more than their lower limb, by asking the players; it turns out that they were exercising using weights believing that

* Professor of Racket Games and Dean of the Faculty of Physical Education, Sadat City University

** Assistant Professor, Department of Teaching Methods, Training and Practical Education, Faculty of Physical Education, Sadat City University, Egypt.

strengthening arms improves the power of shooting the ball and consequently improves the penalty corner performance which urged the researcher to submit them to muscular imbalance tests (Pre-measurements) in order to check the validity of this observation.

Hockey sport in general and penalty corner in particular depend on the coordination and balance of the body during skill performance specially (flick and shooting) skills because they depend on the total power resulting from the body (lower limb passing through the trunk to the upper limb) during performing these skills. The existence of imbalance in the power between the lower and upper limbs of the body affects the power and accuracy of skill performance; consequently, it results in losing a lot of power which if well used and gathered may result in better production of power towards the specialized athletic activity, and again affects these skills regarding (power and speed) and hence lead to better results of ball power and accuracy.

The two researchers contented with improving the muscular balance between the upper and lower limbs, as this suits the motor path of the players when playing the penalty corner either in (flick or shooting) skills, because the motor path starts from (the lower limb passing through the trunk to the upper limb), so the two skills are the most important and the most used in penalty corner. Since the penalty corner mainly depends on power and ability, the two researchers designed a weights program for penalty corner players in order to improve their muscular imbalance, and also to recognize the effect of improving the muscular balance on the skill level, body structure, strength and body weight center.

Research Aim:

This research aims to design a program using weights to improve the muscular imbalance of penalty corner players in order to recognize:

- 1- The program's effect in improving the muscular imbalance between the upper and lower limbs' muscles of penalty corner players.
- 2- The program's effect on the skill performance level of

penalty corner players concerning (the accuracy, strength and speed of flick skill, the accuracy, strength and speed of shooting skill).

Research Term:

1- Muscular Imbalance:

Is identified as : when “muscles group is relatively stronger around certain joint more than the muscles group opposed to it around the same joint. (2:1)

Research Procedures:

First: Research Method:

The two researchers used the experimental method for one group by designing before & after measurements,

and 2 follow-up measurements as this suits the nature of this study.

Second: Research Society & Sample:

The two researchers selected the research sample deliberately from penalty corner players in the 1st class team and juniors under (18) years team in Zamalek Club, season (2015 /2016), they are (4) players; (2) players from the 1st class team and (2) from the juniors under (18) years. Table (1) shows the description of research sample in the variables of age, height, weight and training age.

**Table (1)
Description of research sample in the variables of age, height, weight and training age**

Variables	Measurement unit	1st player	2nd players	3rd player	4th players
Time age	Year	23	18	25	17
Height	Cm	170	168	172	175
Weight	Kg	85	73	99	69
Training age	Year	13	7	16	9

The previous table shows the description of penalty corner players in the variables of time age, height, weight and training age.

Third: Data Gathering Tools:

The two researchers used the following tools in

gathering the data related to the research which are:

1- References & Researches related to the research:

The two researchers reviewed some scientific references and researches related to the study such as (2), (3), (4), (5), and (6).

2- Personal Interviews:

The two researchers made a number of interviews with experts in the field of training muscle power and hockey sport.

3- Used Tests:

a- Tests measuring muscular imbalance:

- Bench Press.
- Squat (enclose. 1).

b- Tests measuring skill level:

- Flick accuracy.
- Flick speed.
- Flick ability.
- Shooting accuracy.
- Shooting speed.
- Shooting ability. (enclose 2)

4- Fourth: Validity & Reliability of Used Tests:

Regarding validity & reliability of used tests in the research for both tests (muscular imbalance and skill tests), the two researchers contended with the experts' opinions, and also applying these tests in similar researches and studies and on similar samples such as (2), (3), (4), (5), (6), (7), (8).

5- Fifth: Research Measurements:

a- Pilot study:

The two researchers made a pilot study on the research sample to check the research problem in the variables of (muscular imbalance) on 9/8/2015.

b- Before Measurement:

The before measurement was applied on the research sample on 23/8/2015 in weights hall in Zamalek Club by measuring the maximum weight that a player can raise for one time (IRM) for each muscles group aside of the upper and lower limb which are the Bench Press test and the Squat test. Also the skill measurements were performed on the research sample in Cairo University playground on 14/8/2015.

c- Program Application:

The application of the training program took (8) weeks for (2) players and (10) weeks for the other players. The before measurement results showed the existence of muscular imbalance between the upper and lower limb that are relatively bigger than the other two players, hence, the program application for them took (10) weeks while it took only (8) weeks for the other two players.

The weekly units were (4) training units, as the training was divided for each limb of the body on two days as (Sunday and Tuesday) to train the upper limb, and (Monday and Wednesday) to train the lower limb, thus, giving the trained muscles a rest period not less than 48 hours to avoid exhaustion.

Table (2)

**The program of improving the muscular imbalance using weights
for the 1st player**

player	Season period	The developed limb	Weight in maximum IRM	Used intense %	Weight components			Lifted weights (kg)
					volume		Intensity	
					Repetitions no.	Groups no.	Among groups	
1 st player	Establishing period (2) weeks	Upper	90	75 - 85	8 - 12	6 - 8	2 - 3 min.	67.5 - 77.5
		Lower	140	75 - 85	8 - 12	6 - 8	2 - 3 min.	105 - 120
	Establishing period (2) weeks	Upper	95	85 - 90	3 - 6	4 - 6	2 - 3 min.	80 - 85
		Lower	147.5	85 - 90	3 - 6	4 - 6	2 - 3 min.	125.5 - 132.5
	Period before competition (2) weeks	Upper	102.5	90 - 100	1 - 2	1 - 2	3 - 4 min.	92.5 - 102.5
		Lower	157.5	90 - 100	1 - 3	1 - 4	3 - 4 min.	141.5 - 157.5

Table (3)

**The program of improving the muscular imbalance using weights
for the 2nd player**

player	Season period	The developed limb	Weight in maximum IRM	Used intense %	Weight components			Lifted weights (kg)
					volume		Intensity	
					Repetitions no.	Groups no.	Among groups	
1 st player	Establishing period (2) weeks	Upper	75	75 - 85	8 - 12	6 - 8	2-3 min.	57.5 - 65
		Lower	120	75 - 85	8 - 12	6 - 8	2-3min.	90 - 102.5
	Establishing period (2) weeks	Upper	80	85 - 90	3 - 6	4 - 6	2-3 min.	67.5 - 72.5
		Lower	127.5	85 - 90	3 - 6	4 - 6	2-3min.	107.5 - 115
	Period before competition (2) weeks	Upper	90	90 - 100	1 - 3	1 - 4	3-4 min.	80 - 90
		Lower	75	75 - 85	8 - 12	6 - 8	2-3min.	57.5- 65

Table (4)

**The program of improving the muscular imbalance using weights
for the 3rd player**

player	Season	The	Weight in	Used	Weight components	Lifted
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	period	developed limb	maximum IRM	intense %	volume		Intensity	weights (kg)
					Repetitions no.	Groups no.	Among groups	
1 st player	Establishing period (2) weeks	Upper	95	65 - 75	10 - 15	8 - 12	2-3 min.	62.5 - 72.5
		Lower	140	65 - 75	10 - 15	8 - 12	2-3min.	90 - 105
	Establishing period (2) weeks	Upper	102.5	75 - 85	6 - 12	6 - 8	2-3 min.	77.5 - 87.5
		Lower	152.5	75 - 85	6 - 12	6 - 8	2-3min.	115 - 130
	Period before competition (2) weeks	Upper	115	85 - 100	1 - 6	1 - 6	3-4min.	67.5 - 80
		Lower	182.5	85 - 100	1 - 6	1 - 6	3-4min.	155 - 182.5

Table (5)
The program of improving the muscular imbalance using weights for the 4th player

player	Season period	The developed limb	Weight in maximum IRM	Used intense %	Weight components			Lifted weights (kg)
					volume		Intensity	
					Repetitions no.	Groups no.	Among groups	
1 st player	Establishing period (2) weeks	Upper	65	65 - 75	10 - 15	8 - 12	2 - 3 min.	42.5 - 50
		Lower	105	65 - 75	10 - 15	8 - 12	2 - 3 min.	67.5 - 80
	Establishing period (2) weeks	Upper	70	75 - 85	6 - 12	6 - 8	2 - 3 min.	52.5 - 60
		Lower	112.5	75 - 85	6 - 12	6 - 8	2 - 3 min.	85 - 95.5
	Period before competition (2) weeks	Upper	80	85 - 100	1 - 6	1 - 6	3 - 4 min.	67.5 - 80
		Lower	127.5	85 - 100	1 - 6	1 - 6	3 - 4 min.	107 - 127.5

6- Sixth: Applying the Suggested Program:

- The pilot study was applied on 9/8/2015.
- The before study was applied on 23-24/8/2015.
- The suggested program was applied on 30/8/2015.

- The 1st follow-up measurement was applied on 16/9/2015.

- The 2nd follow-up measurement was applied on 13/10/2015.

- The after measurement was applied on 12/11/2015.

6- Seventh: Statistical Treatments:

- Arithmetic medium..
- Improvement percentages.

Display & discussion of Results:

First: Display & discussion of muscular balance Results of lower and upper limbs:

Table (6)

**Muscular balance percentage between upper and lower limb
In the before measurement of penalty corner players**

Players	Upper limb	Lower limb	Muscular balance percentage between limbs
First	90	140	1.29 : 2
Second	75	120	1.25 : 2
Third	95	140	1.36 : 2
Fourth	65	105	1.24 : 2

The previous table shows that the muscular percentages between the upper & lower limbs in the before

measurements were (1.29 : 2), (1.25 : 2), (1.36 : 2), (1.24 : 2) for the (1st , 2nd , 3rd, and 4th) players respectively.

Table (7)

**Muscular balance percentage between upper and lower limb
In the after measurement of penalty corner players**

Players	Upper limb	Lower limb	Muscular balance percentage between limbs
First	102.5	165	1.24 : 2
Second	90	145	1.24 : 2
Third	122.5	197.5	1.24 : 2
Fourth	85	135	1.26 : 2

The previous table shows that the muscular percentages between the upper & lower limbs in the before

measurements were (1.24 : 2), (1.24 : 2), (1.24 : 2), (1.26 : 2) for the (1st , 2nd , 3rd, and 4th) players respectively.

Table (8)

The differences between the before measurement, the 1st & 2nd follow-up measurements and after measurement in the upper limb of penalty corner players

Players	measurements	Biggest weight lifted for 1 time	Differences between measurements							
			Before		1st follow-up		2nd follow-up		after	
			difference	%	difference	%	difference	%	difference	%
1st	Before	90			5	5.56	12.5	13.89	12.5	13.89
	1st follow-up	90					7.5	7.89	7.5	7.89
	2nd follow-up	102.0							0.00	0.00
	After	102.0								
2nd	Before	70			5	6.67	15	20	15	20
	1st follow-up	80					10	12.5	10	12.5
	2nd follow-up	90							0.00	0.00
	After	90								
3rd	Before	90			7.5	7.89	20	21.05	27.5	28.95
	1st follow-up	102.0					12.5	12.19	20	19.51
	2nd follow-up	110							7.5	6.52
	After	122.0								
4th	Before	60			5	7.69	15	23.08	20	30.77
	1st follow-up	70					10	14.29	15	21.43
	2nd follow-up	80							5	6.25
	After	80								

between the before measurement, the 1st & 2nd follow-up measurements and after measurement in the upper limb of penalty corner players as follows (5.56%, 6.67%, 7.98%, 7.69%) respectively for the players in 1st follow-up measurement

(23.08%, 21.05%, 20%, 13.89%) respectively for the players in 2nd follow-up measurement. While the differences were (30.77%, 28.95%, 20%, 13.89%) respectively for the players in the after measurement of upper limbs measurements

Table (9)

The differences between the before measurement, the 1st & 2nd follow-up measurements and after measurement in the lower limb of penalty corner players

Players	measurements	Biggest weight lifted for 1 time	Differences between measurements							
			Before		1st follow-up		2nd follow-up		after	
			difference	%	difference	%	difference	%	difference	%
1st	Before	140		7.5	5.36	17.5	12.5	25	17.86	
	1st follow-up	147.0				10	6.78	17.5	11.86	
	2nd follow-up	107.0						7.5	4.76	
	After	170								
2nd	Before	120		7.5	6.25	17.5	14.58	25	20.83	
	1st follow-up	127.0				10	7.84	17.5	13.73	
	2nd follow-up	137.0						7.5	5.45	
	After	140								
3rd	Before	140		12.5	8.93	42.5	30.36	57.5	41.07	
	1st follow-up	102.0				30	19.67	45	29.51	
	2nd follow-up	182.0						15	5.22	
	After	197.0								
4th	Before	100		7.5	7.14	15	14.29	30	28.57	
	1st follow-up	112.0				15	13.33	22.5	20	
	2nd follow-up	127.0						7.5	5.88	
	After	130								

Table (9) shows the differences between the before measurement, the 1st & 2nd follow-up measurements and after measurement in the lower limb of penalty corner players as follows (7.14%, 8.92%, 6.25%, 5.36%) respectively for the players in 1st follow-up measurement. And (14.29%, 30.36%, 14.58%, 12.5%) respectively for the players in 2nd follow-up measurement. While the differences were (28.57%, 14.07%, 20.83%, 17.86%) respectively for the players in the after measurement of upper limbs measurements.

Table (8) shows the existence of differences between the before and after measurements in improving the muscular balance of the lower limb in penalty corner players where the highest difference between the four players was in the 4th player, as the improvement percentage in muscular balance reached (30.77%), followed by the 3rd player (28.95%), then the 2nd players (20%), then the first player (13.89%).

The two researchers attribute this improvement to the training program using weights which was designed individually according to the

status of each player aside to suit the targeted aim of muscular balance.

Table (9) shows the higher improvement differences in muscular balance of the four players in the after measurements than the before measurements, as the best differences were in the 3rd player (41.7%), followed by the 4th players (28.57%), then the 2nd player (20.83%), then the 1st players (17.86%).

Tables (8 & 9) show the high improvement differences between the upper and lower limbs in favor of the lower limb as the improvement percentage of the lower limb of the 1st player was (17.86) versus (13.89%) in the upper limb. And in the 2nd player was (20.83%) in the lower limb versus (20%) in the upper limb, and in the 3rd players was (41.7%) in the lower limb versus (28.95%) in the upper limb.

This indicates that the program designed for the muscular balance of players has achieved its aim. As the muscular imbalance was due to the decline of muscle strength in the lower limb which clearly displays the research problem

and the 1st researcher's observation; as he referred to a higher muscular strength in the upper limb of the penalty corner players than the lower limb.

Also, the same two tables show that the least improvement percentages was in the 1st and 2nd players in the upper and lower limbs which were respectively (17.86%, 13.89%), (20.83%, 20%).

The two researchers attribute this to tables (6 & 7) which show the existence of balance in the players but it is less than the targeted. Also, the program period was only (8) weeks which explains the less improvement percentages compared to the other two players.

The two researchers also see that the explosive power of the arms and shoulder are important and necessary for hockey players as it plays a key role when using the skills of (pushing ball, flick, shooting at the goal, and shooting the ball). This agrees with what Abu Ela Abdel Fatah (1997) (9) mentioned, that the exercises that lead to the maximum

speed result in the increase of speedy fibers effectiveness.

Also, Abdel Aziz Elnemr and Nariman Alkhateib (1996) (10) refer to that the movements of explosive ability in chest, arms and shoulders is the final outcome of power chain, which starts from legs, butt and passes through the trunk. These moves include push and pull and they are of the upper limb activity but after accurate analysis we find that the legs, the butt and the trunk play important role in supporting

body movement and balance. As legs muscular power is very essential for hockey players because they depend on it directly in the physical aspect of hockey players (power, speed, agility and ability), or from the skill aspect which depends on legs muscular power during the penalty corner performance of both skills (flick and shooting) as both skills depend on legs besides arms and shoulders.

Second-Display & Discussion of skill level results:

Table (10)
Differences between the before and after measurements in the skill level of penalty corner players

tests	1 st player				2 nd player				3 rd player				4 th player			
	before	after	Difference	Improvement Percentage%	before	after	Difference	Improvement Percentage%	before	after	Difference	Improvement Percentage%	before	after	Difference	Improvement Percentage%
Flick accuracy (mark)	3	8	5	72.0	2	2	0	71.4	3	7	4	57.1	1	6	5	83.3
Flick ability (m.)	0.0	7.0	7.0	23.1	4.0	4.0	0.0	20.0	4.3	0.8	1.0	20.8	4.0	0.0	1.0	27.2
Flick speed (sec.)	8	0	3	52.7	8.8	8.8	3.2	57.1	9.2	7.1	3.1	50.8	9.7	7.3	3.3	52.3
Shooting accuracy (mark)	28	36	8	22.2	23	23	9	28.1	19	29	10	34.4	19	20	7	24.0
Shooting ability (m.)	8.8	12.4	3.6	29.0	7.4	7.4	4.7	38.3	7.9	11.8	4.9	41.0	7.0	11.3	4.8	42.4
Shooting speed (sec.)	8.2	0.3	3	57.7	8.9	8.9	3.0	74.8	9.8	7	3.8	73.3	10.1	7.2	3.8	71.4

The previous table shows that the highest improvement percentage of shooting accuracy test was in

the 4th player as it reached (83.3%), and for the flick ability test was in the 4th player also (27.2%), as for the

flick speed, the highest percentage was in the 2nd player (57.1%), and for the shooting accuracy test the 3rd player was the highest (34.4%). The shooting ability test was the highest in the 4th player (42.4%), and the shooting speed was the highest in the 2nd player (64.8%).

The same table also shows that the highest improvement percentage of flick skill in penalty corner players was in (flick accuracy) test as it reached (83.3%) and was higher than both tests of (flick ability and flick speed).

The two researchers attribute this to that if the program of improving the muscular balance was planned well; it will result in improving the accuracy element; which is very important for the penalty corner players as it requires that the player directs the ball to a certain area of the goal. For example, he may be asked to direct the ball to certain area accurately and using the same power.

Cadman (1988) (11) mentioned that the penalty corner player should master accuracy during shooting either in flick or shooting skills. This

can be done by putting marks in the goal or drawing on the wall and try to shoot the ball inside these areas. He also indicated that without mastering the accuracy element during shooting on the goal, many of the attacks will lose its value and become in vain and the evidence on that is the shooting during the penalty corner.

Mohammed Sobhi Hassanin and Mohammed Abdel Salam Ragheb (1995) (12) mentioned that there is a close relation between accuracy and muscular power as the increase of power rate either in foot or hand means the optimal use of energy efforts, therefore, it is easier to control this energy and direct it. Such as the bow and arrow where the coherence and cooperation between the accuracy and power elements are very important; if the power was weak then the arrow directing will be weak and consequently will not hit the aim.

Conclusions:

In light of this study's nature, sample, used method and statistical analysis, the two

researchers reached the following conclusions:

1-There is more improvement in the muscular balance of penalty corner players in the after measurement than the before measurement of upper and lower limbs.

2-There is an improvement in the skill performance level of penalty corner players after improving their muscular balance in both skills (flick and shooting).

Recommendations:

In light of research results and conclusions, the two researchers recommend the following:

1-Implementation of Proposed training program to improving the muscular imbalance of hockey players especially those of the high level, for its importance in physical fitness elements of hockey players.

2-The necessity of rationing the training weights and the necessity to have coaches to plan weights inside athletic teams to avoid the muscular imbalance of players.

3-To make studies that improve the muscular imbalance through forms of occurrence (body sides, and around the joint).

References:

1- Jenson. C, schultz. C. (1977): Applied kinesiology, New York, McGraw, Hill Book Company

2- Abu Ela Ahmed Abdel Fatah, Ahmed Nasereldin Saied (1993): Physical Fitness Physiology, Dar El Fekr Elaraby, Cairo.

3- Supreme Council of Youth and Sport (1997): Specifications distinguish Alsharqia players in Hockey, the General Administration of Athletic researches.

4- Mohammed Abdel Azim and Mohammed Abu Elmaatei (2002): the Anthropometric measurements and skeleton status of national hockey team, a descriptive study, physical & sport Sciences magazine, 2nd issue, January, Faculty of Physical Education, Menoufia University.

5- Hany Abdel Aziz, Abdel Maksoud Eldeeb (2003): the effect of a training program on muscular power on improving the muscular balance, an unpublished Ph. D. thesis, Faculty of Physical Education for males, Helwan University.

6- Brian Mac (2001): Strength & muscle balance

checks, [http:// www. Brian Mac.Demon.com.uk /cambc.htm](http://www.BrianMac.Demon.com.uk/cambc.htm).

7- Mohammed Salama Younis (2003): improving the muscular imbalance between the upper and lower limbs of volleyball players, scientific magazine of athletic education sciences, 2nd issue, June, Faculty of Physical Education, Tanta University.

8- Mohamed Ali Ahmed (1996): the role of hierarchical training in developing the muscular power and its relation with body structure and the digital achievement of short distance junior swimmers, sport sciences and arts magazine, Faculty of Physical Education for girls, Cairo.

9- Abu Ela Abdel Fatah (1997): Athletic Training; Physiological Bases, Dar Elfekr Elarabi. Cairo.

10- Abdel Aziz Elnemr, Nariman Alkhateib (1996): weights training, designing a power program and planning athletic training season, Elketab center for publishing, Cairo.

11- Cadman, J., (1988): Hockey, The Skills of The Game, The Croucod Press, Great Britian.

12- Mohamed Sobhi Hassanin, Mohamed Abdel Salam Ragheb (1995): The Proper Shape for Everybody, Dar Elfekr Elaraby, Cairo.