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HANDBALL FEDERATION OF SLOVENIA

Association of Slovenian handball coaches

Master Coach Seminar

»DEFINITION OF THE METHOD OF CALCULATING THE PERFORMANCE INDEX RATING IN HANDBALL«

EHF CL FINAL 2012/2013: FC BARCELONA INTERSPORT - HSV HAMBURG

(Seminar Thesis)

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SUMMARY

Statistics is an important part of the sport. It shows us where are the differences between players and teams, it shows us where and when were players or teams better than the opponent. If there were no statistics, there will only be impressions which we will get while watching the game. Impressions are not always objective, especially with people which are not experts in sports. Somebody likes goals, somebody goalkeeper saves, attractive moves...

Statistics are helping us summon and organize the actions on the court in numerical values which are comparable.

Performance Index Rating (PIR) is a summation of everything that some player or a team did on the court expressed in one number.

KEY WORDS

Sport, handball, analysis, statistics, Performance Index Rating.

INTRODUCTION

Despite the abundance of handball available statistical data, in almost every report of the game when selecting the best individuals the most used data are number of goals or goalkeeper saves.

In almost every TV or radio report of the game we can find out that the best player were Uroš Zorman and Luka Žvižej, because they scored five goals each.

Those who are more aware of the handball game knows that the defence specialists players, players which like to assist, players which are very good in special tasks are a very important part of the team.

In order to equalize the assessment of the player or team performance we should introduce so-called valorisation or Performance Index Rating in handball statistics.

DEFINITION OF THE METHOD OF CALCULATING THE PERFORMANCE INDEX RATING IN HANDBALL

Individual and especially team sports which are more complex contain many different elements, which are measured with different statistical data. Handball is monitored by the

statistic most similar to basketball, which has valorisation in the statistics for a long time, but differs according to the type of competition.

In the North American basketball league (NBA) to evaluate the performance of individuals and teams they use PER (Player efficiency rating) by the former journalist, broadcaster ESPN John Hollinger.
The basis for the calculation of the equation PER Hollinger found in baseball, and then modified it for basketball. Efficiency is measured by a player's per-minute performance.
The equation is quite complicated.
Since that the efficiency of the eternal scale at the top of the players are Michael Jordan, LeBron James, Shaquille O`Neal, Wilt Chamberlain, Kareem Abdul-Jabbar, Magic Johnson…, who are otherwise in all objective and subjective methods of selection of the best individuals in the top and apply for the best "of all time", so the method is very realistic.

Performance index rating (PIR):

Another method, which I think that it could be modified for handball statistics is called PIR (Performance Index Rating). Is a statistical formula that basketball used in the Euroleague and Eurocup. Even some of the national Associations are using it to determine the effectiveness of the numerical occurrence of an individual player or team in a particular game or season.

They started to use it in 1991 in the Spanish basketball ACB league to determine the most valuable player (MVP) of the weeks and the season.

The formula for the calculation of the PIR in basketball:

(Points + Rebounds + Assists + Steals + Blocks + Fouls Drawn) - (Missed Field Goals + Missed Free Throws + Turnovers + Shots Rejected + Fouls Committed)

The final result gives a number, which covers everything that the player did in the game. The index value of 20 or more in basketball means a good game, but of course also take care of the specific circumstances that are impossible to take into account in the formula. For example, the fact that the player has played the whole game bad, and even has a negative index, and then in the last quarter of throwing 5/5 for three points, "solves" the match, still the index will indicate that he played lousy.

The weakness of statistics is that it does not take into account the period in which some element of a mistake occurred; the beginning of the game is in the record in the same values like the last, decisive minutes, but in reality this one has a much higher importance.

It could be, by adding weights to statistical elements depending on the time in the game, to achieve that in more important moments of the game the value will be more.

The fact is that PIR cannot change the impression that we get while watching the game, but the way in which the good players through the evaluation of statistical parameters give the best and the worst, what should be the assortment decisive, but not necessarily.

I think it could be, by a combination of PIR and the impression we get when watching the game, easier or more fair to select the most valuable players of the championships, the best team of a championships, MVP of the week...
Example:

Slovenian basketball player Jaka Lakovič has in the season 2001/2002 in the Euroleague statistics:

#	Game	Min	Pts	2FG	3FG	FT	Rebounds			As	St	To	Bl		Fouls		PIR
				M-A	M-A	M-A	O	D	T				Fv	Ag	Cm	Rv	
1	vs KK Zadar	34:17	31	7/8	4/8	5/5		2	2	3	1	1			4		27
2	at Real Madrid	40:00	38	5/8	4/5	16/19		4	4	7	4	5			1	15	55
3	vs Skipper Bologna	36:44	27	3/8	4/6	9/10		2	2	1		3			3	6	22
4	at CSKA Moscow	17:44	5	2/4	0/3	1/2		1	1	2	1				5	3	1
5	vs Panathinaikos	40:00	18	4/6	1/8	7/9				4	3	1			1	8	20
6	at KK Buducnost	32:00	10	2/5	0/4	6/6	1	3	4		2	1			3	4	9
7	vs Pau-Orthez	20:13	6	¼	0/3	4/4				5		1			3	6	7
8	at KK Zadar	32:24	20	1/11	5/9	3/4				4	5	1		1	3	5	14
9	vs Real Madrid	33:49	22	5/7	2/6	6/7		1	1	3	1	4		1	2	6	19
10	at Skipper Bologna	40:00	27	4/8	3/7	10/11	3	5	8	7	4	4		1	2	9	39
11	vs CSKA Moscow	32:59	25	5/7	5/9		1		1	2	2	1			5	2	20
12	at Panathinaikos	38:36	15	4/7	1/2	4/4	1	3	4	5	2	2			4	6	22
13	vs KK Buducnost	29:53	25	¾	3/5	10/11	1	1	2	3	3	8			2	11	30
14	at Pau-Orthez	26:20	24	5/8	2/3	8/8		1	1	7		3			3	7	29
14	Totals	454:59	293	51/95	34/78	89/100	7	23	30	53	28	35	0	3	41	88	314
Average		32:29	20.9	53.7%	43.6%	89%	0.5	1.6	2.1	3.8	2	2.5	0	0.2	2.9	6.3	22.4

(www.euroleague.com, 2013)

Without calculating the PIR it would be hard, because of the quantity of the numerical data, to find if the player's performance was good or bad, but when you look at the final number, which combined both good and bad parameters we get a clearer picture.

The player played good six of the fourteen matches, and five of them very well. The average valorisation of 22.4 tells us that he played a very good season.

We can see that he had, while playing in Euroleague for KK Krka Novo Mesto in the season 2001/2002 index from 1 to 55. Valorisation of 55, which was reached in the match against Real Madrid is the second best index in Euroleague history.

Jaka Lakovič later in an interview said that it was soon after the match in Madrid, where he get the PIR 55, the famous coach of Panathinaikos, Željko Obradovič called him to play in Athens, and that shortly afterwards he moved to Greece. Maybe because of the number of 55.

Handball statistics

Overall statistics SLO men's senior team at the World Championships 2013:

PLAYERS:

NAME	MP	OFFENCE				DEFENCE		PENALTIES			MIN
		G/S	%	ASSIST.	TECH. FAULTS	STEALS	BLOCKED	YELLOW C.	2MIN	RED C.	
Uroš Zorman	9	18/33	55	21	21	6	1	2	2	0	342
Nenad Bilbija	3	3/10	30	1	0	0	0	0	0	0	16
Vid Kavtičnik	9	16/30	53	6	17	3	1	2	2	0	173
Miha Žvižej	9	20/24	83	3	8	5	3	1	6	0	239
Luka Žvižej	9	28/48	58	5	6	3	4	3	1	0	435
Dragan Gajič	5	34/44	77	3	4	2	0	3	0	0	253
Sebastian Skube	9	16/34	47	10	8	1	0	1	0	0	153
Jure Dobelšek	7	9/13	69	5	4	1	0	0	1	0	94
Peter Pucelj	3	1/1	100	1	0	3	0	2	1	0	75
Marko Bezjak	9	10/17	59	20	10	7	0	0	4	1	187
Jure Dolenec	9	39/51	76	26	14	3	2	4	8	0	354
Matej Gaber	9	14/20	70	0	4	6	13	6	6	0	353
Borut Mačkovšek	9	23/39	59	5	7	1	0	1	2	0	133
Uroš Bundalo	9	2/4	50	0	0	2	2	1	5	0	119
Gašper Marguč	7	25/38	66	4	4	2	0	0	1	0	283

(www.handballspain2013.com, 2013)

GOALKEEPERS:

NAME	MP	TOTAL SHOTS		6M		WIND		9M		7M		FAST BREAKS		BREAKTHROUGHS	
		G/S	%	G/S	%	G/S	%	G/S	%	G/S	%	G/S	%	G/S	%
Gorazd Škof	9	74/227	33	11/38	29	5/15	33	43/93	46	3/18	17	8/30	27	4/33	12
Primož Prošt	9	56/143	39	8/21	38	6/16	38	29/52	56	4/12	33	5/23	22	4/19	21

(www.handballspain2013.com, 2013)

From the official WCh 20013 statistics we see that:

1. For a player in handball we recorded:

- Number of matches;
- Number of total shots and success rate, which is further elaborated according to the situation (6m, 7m, 9m, wing, fast breaks and breakthroughs);
- Number of assists;
- Number of technical faults;
- Number of steals;
- Number of blocked shots;
- Penalties (yellow cards, number of exclusions, red cards).

2. For a goalkeeper in handball we recorded:

- Number of matches;
- Number of total shots and number of saves give us a success rate, which is further elaborated according to the situation (6m, 7m, 9m, wing, fast breaks and breakthroughs);

At the championships we can get even more detailed analysis, they draw, where individual players shoots..., what coaches can used to formulate tactics to prepare for the opponent. It is still more offensive than defensive elements that we recorded. Given the fact that we get, because of the development of handball game recently, specialist for the game in attack and defence, which are practically always performing the same special role, it would be right to treat their roles and responsibilities on the court equally.

How to define the formula of calculating the PIR in handball statistics?

1. The equation should be composed in such a way that the difference in value between the best and worst performance will be at least 30, to get a better insight.

2. Goalkeeper. It is difficult to compare a goalkeeper and the players in the field, because they have a completely different role.

a. From the number of saved shots multiplied by a factor, subtract goals that he received, adding good moves (intercepted balls, the fast break passes, defended 7m and fast breaks multiplied by a factor) and subtract technical faults and exclusions.

b. Considering the percentage of saved shots multiplying by a factor, adding good moves (intercepted balls, fast break passes, defended 7m and fast breaks multiplied by a factor) and subtract technical faults and exclusions.

3. Players who are playing exclusively in defence are compared to those who only play in an attack in an unequal position because of that, that all the official handball statistics recorded more offensive than defensive elements. Therefore, it is necessary to add defensive statistical element, such as the number of fouls committed in the defence. Exactly in the EHF Champions League final 2013 in Cologne, we can see that there are also monitored this item (1. Extension 02:35, FCB 37 fouls, HSV 42 fouls).

4. For a better result it is necessary to add an additional option accumulation of positive (defence decisive shot, moves in the end of the game where it is necessary to take responsibility ...) and negative (missed the decisive shot in open situations, disqualification, exclusions because of persuasion ...). On the final match between FC Barcelona Intersport and HSV Hamburg we have seen quite a few such moves, which could be valued at the higher factor then 1 (Jansen's missed fast break shot for +5, Lindberg's shot at 30 seconds left, Bitter's save against Garcia at 30 seconds left in the game ...).

5. 7m and fast break goals will be evaluate the same as the other goals, missed shots also, also because the reasons from 4th point, where we would have the option of adding + or - points.

6. Assistance. In basketball, player's reaching extremely high number of assists, especially in the NBA, where every last pass before scoring count as assistance, even if the player later did activities which allow him to score and pass did not have a direct influence. For assistance in handball would be considered move that allows shot on goal or 7m.

7. Technical fault (lost balls, offensive foul, steps, double dribble, foot ...).

8. Other "errors" (exclusions, caused 7m, disqualifications and negative points from point 4 above).

9. Obtained balls (steals, moves in defence witch player did to force the opponent into a technical error ...).

10. Other positive moves (drawn 7m, drawn exclusions and disqualifications).

11. Blocked shots.

12. Fouls in the defence (all fouls in defence witch prevent scoring and organization of a attacking. Could also be two or more players together that do one foul).

EHF CL FINAL 2012/2013 ANALYSIS:
FC Barcelona Intersport - HSV Hamburg:

EHF CL final 2012/2013 was played before 19,250 spectators in Cologne on 6th of February 2013. In the final there were Spanish team FC Barcelona Intersport and the German HSV Hamburg. The match was very interesting, there were many turning points and interesting tactical solutions and surprises. The winner and the European Champion was, after extra time, HSV Hamburg with a score of 30-29. After 60 minutes played there was a tie 25-25, half time score was 11-9 for FC Barcelona Intersport.

Presentation of the teams:

FC Barcelona Intersport:

(www.fcbarcelona.com, 2013)

Players:

Aguirrezabalaga Garcia Mikel
Arino Bengoechea Aitor
Balaguer Romeu David
Biosca Garcia Ignacio
Entrerrios Rodriguez Raul
Garcia Lorenzana Juan

Gurbindo Martinez Eduardo
Jernemyr Magnus (SWE)
Medina Johnny (BRA)
Montoro Cabello Angel
Morros de Argila Viran
Nöddesbo Jesper Brian (DEN)
Rocas Comas Albert
Rutenka Siarhei (BLR)
Saric Danijel (BIH)
Sarmiento Melian Daniel
Sorhaindo Cedric (FRA)
Sterbik Arpad
Stranovsky Marti (SVK)
Tomas Gonzalez Victor

(www.ehfcl.com, 2013)

Statistical analysis of the match (60 min):

PLAYER	OFFENCE					DEFENCE			
	goals	miss. shots	assist.	tech. faults	other -	obtain. balls	blocks	other +	committed fouls
3 NÖDDESBO J.	2			3	1	3			3
6 GARCIA Juan	1	2	2	2	1				1
8 TOMAS Victor	6	1				2			1
9 ENTRERRIOS R.		2	2	1	1				2
10 SORHAINDO Cedric	1							1	1
11 SARMIENTO Daniel	2	3	6		1			3	2
17 MONTORO Angel	1		1						2
18 GURBINDO E.	3	1	4		1				2
20 JERNEMYR Magnus					2		1	1	7
21 AGUIRREZABALA.									
22 RUTENKA Siarhei	8	5	4	6		1		1	1
24 STRANOVSKY M.	1	1		1		1			2
26 ROCAS Albert									1
27 MORROS Viran						1			5
TOTAL	25	15	19	13	7	8	1	6	30

GOALKEEPER	SAVES	GOALS	%	+	-
1 STERBIK Arpad	6	5	55	2	
12 SARIC Danijel	9	20	31	1	
TOTAL	15	25	38	3	

Statistical analysis of the extra time:

PLAYER	OFFENCE					DEFENCE			
	goals	miss. shots	assist.	tech. faults	other -	obtain. balls	blocks	other +	committed fouls
3 NÖDDESBO J.	1								1
6 GARCIA Juan	2	1			2				
8 TOMAS Victor	1								
9 ENTRERRIOS R.									
10 SORHAINDO Cedric									4
11 SARMIENTO Daniel		2	3		1				1
17 MONTORO Angel				1					
18 GURBINDO E.		1	1		1				
20 JERNEMYR Magnus									1
21 AGUIRREZABALA.									
22 RUTENKA Siarhei			2						
24 STRANOVSKY M.									
26 ROCAS Albert									
27 MORROS Viran									
TOTAL	4	4	6	1	4				7

GOALKEEPER	SAVES	GOALS	%	+	-
1 STERBIK Arpad	1	4	25		
12 SARIC Danijel		1	0		
TOTAL	1	5			

HSV Hamburg:

(www.hsvhandball.com, 2013)

Players:

Bitter Johannes
Brauer Tim-Oliver
Carlén Oscar (SWE)
Djordjic Zoran (SRB)
Duvnjak Domagoj (CRO)
Flohr Matthias
Hens Pascal
Herbst Kevin
Herrmann Max Henri (FRA)
Jansen Torsten
Kraus Michael
Lackovic Blazenko (CRO)
Lijewski Marcin (POL)
Lindberg Hans (DEN)
Meier Florian
Nilsson Andreas (SWE)
Petersen Fredrik Raahauge (SWE)
Schliedermann Marcel
Schröder Stefan
Schulze Robert
Stabick Ole
Stumps Martin
Terzic Stefan (SRB)
Vori Igor (CRO)

(www.ehfcl.com, 2013)

Statistical analysis of the match (60 min):

PLAYER	OFFENCE					DEFENCE			
	goals	miss. shots	assist.	tech. faults	other -	obtain. balls	blocks	other +	committed fouls
2 KRAUS Michael	5	1	4	2					
3 SCHRÖDER Stefan									
4 DUVNJAK Domagoj	2	6	6	1		1	1		6
5 JANSEN Torsten	2	2			1	1			6
6 LACKOVIC Blazenko	2	1				1			1
7 FLOHR Matthias					2				11
9 VORI Igor	2			2	2	1		3	7
18 LINDBERG Hans	5	1	1	1	2	1		1	2
19 TERZIC Stefan									
21 NILSSON Andreas						1			
22 LIJEWSKI Marcin	3	7	3	2	1				4
23 HENS Pascal		2	2	1				1	4
24 PETERSEN Fredrik	4		1	1		1			
TOTAL	25	20	17	10	8	7	1	5	41

GOALKEEPER	SAVES	GOALS	%	+	-
1 BITTER Johannes	15	25	38	1	
12 HERRMANN Max Henri					
TOTAL	15	25	38	1	

Statistical analysis of the extra time:

PLAYER	OFFENCE					DEFENCE			
	goals	miss. shots	assist.	tech. faults	other -	obtain. balls	blocks	other +	committed fouls
2 KRAUS Michael	1		3						1
3 SCHRÖDER Stefan									
4 DUVNJAK Domagoj	2	1	1			1	1		3
5 JANSEN Torsten									1
6 LACKOVIC Blazenko									
7 FLOHR Matthias									2
9 VORI Igor		1						1	1
18 LINDBERG Hans	1								1
19 TERZIC Stefan									
21 NILSSON Andreas									
22 LIJEWSKI Marcin		1							1
23 HENS Pascal									
24 PETERSEN Fredrik	1								2
TOTAL									

GOALKEEPER	SAVES	GOALS	%	+	-
1 BITTER Johannes	2	4	33	2	
12 HERRMANN Max Henri					
TOTAL	2	4	33	2	

METHODS

I analyzed the effect of both teams and individuals. With different methods of evaluation of statistical elements I want to find the right formula that will equally consider all participants (goalkeepers, universal players, specialists ...).

In addition, I conducted a survey among three renowned colleagues Coaches (C1, C2 and C3), which are rated players (player has played excellent, good, fairly good or poor) both teams, based on their coaching sense and knowledge of the game of handball.

Coaches evaluated the effects of individual players from memory and did not have access to the statistics. But they watched the match several times.

I will compare the data and try to figure out the right formula for the calculation. I wonder also if the extra time is necessary to recalculate into 60 minutes of the game.

1. Coaches Analysis (estimate):

FC Barcelona Intersport

PLAYER	excellent, good	good, fairly good	fairly good, poor	other
3 NÖDDESBO J.		C1 C2 C3		
6 GARCIA Juan		C2	C1 C3	
8 TOMAS Victor	C1 C2 C3			
9 ENTRERRIOS R.			C1 C2 C3	
10 SORHAINDO Cedric		C1 C2 C3		
11 SARMIENTO Daniel		C1 C2 C3		
17 MONTORO Angel		C2	C1 C3	
18 GURBINDO E.		C1 C2 C3		
20 JERNEMYR Magnus	C3	C1 C2		
21 AGUIRREZABALA.				did not play
22 RUTENKA Siarhei	C1 C2 C3			
24 STRANOVSKY M.	C1	C2 C3		
26 ROCAS Albert			C1	C2, C3 under-minute
27 MORROS Viran	C3	C1 C2		
1 STERBIK Arpad	C1 C2 C3			
12 SARIC Danijel	C1 C2 C3			

HSV Hamburg

PLAYER	excellent, good	good, fairly good	fairly good, poor	other
2 KRAUS Michael	C1 C2 C3			
3 SCHRÖDER Stefan				did not play
4 DUVNJAK Domagoj	C1 C2	C3		
5 JANSEN Torsten	C2 C3	C1		
6 LACKOVIC Blazenko		C1 C2 C3		
7 FLOHR Matthias	C2	C1 C3		
9 VORI Igor	C1 C3	C2		
18 LINDBERG Hans	C2 C3	C1		
19 TERZIC Stefan				did not play
21 NILSSON Andreas			C1	C2, C3 under-minute
22 LIJEWSKI Marcin	C3	C1	C2	
23 HENS Pascal	C2	C1 C3		
24 PETERSEN Fredrik	C2 C3	C1		
1 BITTER Johannes	C1 C2 C3			
12 HERRMANN Max Henri				did not play

The two tables above show us that all three coaches evaluate the players unified, the only variation occurs with the HSV Hamburg player LIJEWSKI, assessed differently by each coach.

We can see that by their sense in FC Barcelona INTERSPORT well or very well played: TOMAS, RUTENKA, ŠTERBIK and ŠARIČ, poor GARCIA, ENTRERRIOS and MONTORO, others fairly good.

In the HSV HAMBURG team by coaches opinion played well: KRAUS, DUVNJAK, JANSEN, VORI, LINDBERG, PETERSEN and BITTER and that there was no individual who played bad.

2. Analysis by using the formula:

PIR players: (goals+assists+obtained balls+blocks+other good moves+committed fouls) – (missed shots+technical faults+other bad moves)

PIR goalkeepers: (2xsaves+good moves) – (received goals+bad moves)

FC Barcelona Intersport 60 minutes:

PLAYER	OFFENCE					DEFENCE				PIR
	goals	miss. shots	assist.	tech. faults	other -	obtain. balls	blocks	other +	comm. fouls	
3 NÖDDESBO J.	2			3	1	3			3	**4**
6 GARCIA Juan	1	2	2	2	1				1	**-1**
8 TOMAS Victor	6	1				2			1	**8**
9 ENTRERRIOS R.		2	2	1	1				2	**0**
10 SORHAINDO Cedric	1							1	1	**3**
11 SARMIENTO Daniel	2	3	6		1			3	2	**9**
17 MONTORO Angel	1		1						2	**4**
18 GURBINDO E.	3	1	4		1				2	**7**
20 JERNEMYR Magnus					2			1	7	**6**
21 AGUIRREZABALA.										
22 RUTENKA Siarhei	8	5	4	6		1		1	1	**4**
24 STRANOVSKY M.	1	1		1		1			2	**2**
26 ROCAS Albert									1	**1**
27 MORROS Viran						1			5	**6**
TOTAL	25	15	19	13	7	8		6	30	**53**

GOALKEEPER	SAVES	GOALS	%	+	-	PIR
1 STERBIK Arpad	6	5	55	2		**9**
12 SARIC Danijel	9	20	31	1		**-1**

HSV Hamburg 60 minutes:

PLAYER	OFFENCE					DEFENCE				PIR
	goals	miss. shots	assist.	tech. faults	other -	obtain. balls	blocks	other +	comm. fouls	
2 KRAUS Michael	5	1	4	2						**6**
3 SCHRÖDER Stefan										
4 DUVNJAK Domagoj	2	6	6	1		1	1		6	**9**
5 JANSEN Torsten	2	2			1	1			6	**6**
6 LACKOVIC Blazenko	2	1				1			1	**3**
7 FLOHR Matthias					2				11	**9**

9 VORI Igor	2			2	2	1		3	7	**9**
18 LINDBERG Hans	5	1	1	1	2	1		1	2	**6**
19 TERZIC Stefan										
21 NILSSON Andreas						1				**1**
22 LIJEWSKI Marcin	3	7	3	2	1				4	**0**
23 HENS Pascal		2	2	1				1	4	**4**
24 PETERSEN Fredrik	4		1	1		1				**5**
TOTAL	25	20	17	10	8	7	1	5	41	**58**

GOALKEEPER	SAVES	GOALS	%	+	-	**PIR**
1 BITTER Johannes	15	25	38	1		**6**
12 HERRMANN Max Henri						

FC Barcelona Intersport extra time:

PLAYER	OFFENCE					DEFENCE				**PIR**
	goals	miss. shots	assist.	tech. faults	other -	obtain. balls	blocks	other +	comm. fouls	
3 NÖDDESBO J.	1								1	**2**
6 GARCIA Juan	2	1			2					**-1**
8 TOMAS Victor	1									**1**
9 ENTRERRIOS R.										
10 SORHAINDO Cedric									4	**4**
11 SARMIENTO Daniel		2	3						1	**2**
17 MONTORO Angel				1						**-1**
18 GURBINDO E.		1	1							**0**
20 JERNEMYR Magnus									1	**1**
21 AGUIRREZABALA.										
22 RUTENKA Siarhei			2							**2**
24 STRANOVSKY M.										
26 ROCAS Albert										
27 MORROS Viran										
TOTAL	4	4	6	1	2				7	**10**

GOALKEEPER	SAVES	GOALS	%	+	-	**PIR**
1 STERBIK Arpad	1	4	20			**-2**
12 SARIC Danijel	0	1	0			**-1**

HSV Hamburg extra time:

PLAYER	OFFENCE					DEFENCE				**PIR**
	goals	miss. shots	assist.	tech. faults	other -	obtain. balls	blocks	other +	comm. fouls	
2 KRAUS Michael	1		3						1	**5**
3 SCHRÖDER Stefan										
4 DUVNJAK Domagoj	2	1	1			1		1	3	**7**
5 JANSEN Torsten									1	**1**

6 LACKOVIC Blazenko										
7 FLOHR Matthias									2	**2**
9 VORI Igor		1						1	1	**1**
18 LINDBERG Hans	1								1	**2**
19 TERZIC Stefan										
21 NILSSON Andreas										
22 LIJEWSKI Marcin		1							1	**0**
23 HENS Pascal										
24 PETERSEN Fredrik	1								2	**3**
TOTAL	5	3	4			1		2	12	**21**

GOALKEEPER	SAVES	GOALS	%	+	-	**PIR**
1 BITTER Johannes	2	4	33	2		**2**
12 HERRMANN Max Henri						

FC Barcelona Intersport whole match (70 min):

PLAYER	OFFENCE					DEFENCE				**PIR**
	goals	miss. shots	assist.	tech. faults	other -	obtain. balls	blocks	other +	comm. fouls	
3 NÖDDESBO J.	3			3	1	3			4	**6**
6 GARCIA Juan	3	3	2	2	3				1	**-2**
8 TOMAS Victor	7	1				2			1	**9**
9 ENTRERRIOS R.		2	2	1	1				2	**0**
10 SORHAINDO Cedric	1							1	5	**7**
11 SARMIENTO Daniel	2	5	9		1			3	3	**11**
17 MONTORO Angel	1		1	1					2	**3**
18 GURBINDO E.	3	2	5		1				2	**7**
20 JERNEMYR Magnus					2			1	8	**7**
21 AGUIRREZABALA.										
22 RUTENKA Siarhei	8	5	6	6		1		1	1	**6**
24 STRANOVSKY M.	1	1		1		1			2	**2**
26 ROCAS Albert									1	**1**
27 MORROS Viran						1			5	**6**
TOTAL	29	19	25	14	9	8		6	37	**63**

GOALKEEPER	SAVES	GOALS	%	+	-	**PIR**
1 STERBIK Arpad	7	9	44	2		**7**
12 SARIC Danijel	9	21	30	1		**-2**

HSV Hamburg whole match (70 min):

PLAYER	OFFENCE					DEFENCE				**PIR**
	goals	miss. shots	assist.	tech. faults	other -	obtain. balls	blocks	other +	comm. fouls	
2 KRAUS Michael	6	1	7	2					1	**11**
3 SCHRÖDER Stefan										
4 DUVNJAK Domagoj	4	7	7	2		1	2		9	**14**
5 JANSEN Torsten	2	2			1	1			7	**7**
6 LACKOVIC Blazenko	2	1				1			1	**3**
7 FLOHR Matthias					2				13	**11**
9 VORI Igor	2	1		2	2	1		4	8	**10**
18 LINDBERG Hans	6	1	1	1	2	1		1	3	**8**
19 TERZIC Stefan										
21 NILSSON Andreas						1				**1**
22 LIJEWSKI Marcin	3	8	3	2	1				5	**0**
23 HENS Pascal		2	2	1				1	4	**4**
24 PETERSEN Fredrik	5		1	1		1			2	**8**
TOTAL	30	23	21	11	8	7	2	6	53	**77**

GOALKEEPER	SAVES	GOALS	%	+	-	**PIR**
1 BITTER Johannes	17	29	37	3		**8**
12 HERRMANN Max Henri						

We can see that in the calculation by the formula: **PIR players: (goals+assists+obtained balls+blocks+other good moves+committed fouls) – (missed shots+technical faults+other bad moves)**, **PIR goalkeepers: (2xsaves+good moves) – (received goals+bad moves);** we do not get good results:

- Range between the highest and lowest value is too small;

- Best players should have the value of the PIR somewhere around 20;

- In the FC Barcelona Intersport team by using this method played well: TOMAS and SARMIENTO; poor: GARCIA, ENTRERRIOS and ŠARIČ; all others solid;

- In the HSV Hamburg team by using this method played well: KRAUS, DUVNJAK and FLOHR; poor LIJEWSKI; all others solid.

3. Analysis by using the formula:

PIR players: (2xgoals+assists+obtained balls+blocks+other good moves+committed fouls) – (missed shots+technical faults+other bad moves)

PIR goalkeepers: (3xsaves+good moves) – (received goals+bad moves)

FC Barcelona Intersport 60 minutes:

PLAYER	OFFENCE					DEFENCE				PIR
	goals	miss. shots	assist.	tech. faults	other -	obtain. balls	blocks	other +	comm. fouls	
3 NÖDDESBO J.	2			3	1	3			3	**6**
6 GARCIA Juan	1	2	2	2	1				1	**0**
8 TOMAS Victor	6	1				2			1	**14**
9 ENTRERRIOS R.		2	2	1	1				2	**0**
10 SORHAINDO Cedric	1							1	1	**4**
11 SARMIENTO Daniel	2	3	6		1			3	2	**11**
17 MONTORO Angel	1		1						2	**5**
18 GURBINDO E.	3	1	4		1				2	**10**
20 JERNEMYR Magnus					2			1	7	**6**
21 AGUIRREZABALA.										
22 RUTENKA Siarhei	8	5	4	6		1		1	1	**12**
24 STRANOVSKY M.	1	1		1		1			2	**3**
26 ROCAS Albert									1	**1**
27 MORROS Viran						1			5	**6**
TOTAL	25	15	19	13	7	8		6	30	**78**

GOALKEEPER	SAVES	GOALS	%	+	-	PIR
1 STERBIK Arpad	6	5	55	2		**15**
12 SARIC Danijel	9	20	31	1		**8**

HSV Hamburg 60 minutes:

PLAYER	OFFENCE					DEFENCE				PIR
	goals	miss. shots	assist.	tech. faults	other -	obtain. balls	blocks	other +	comm. fouls	
2 KRAUS Michael	5	1	4	2						**11**
3 SCHRÖDER Stefan										
4 DUVNJAK Domagoj	2	6	6	1		1	1		6	**11**
5 JANSEN Torsten	2	2			1	1			6	**8**
6 LACKOVIC Blazenko	2	1				1			1	**5**
7 FLOHR Matthias					2				11	**9**
9 VORI Igor	2			2	2	1		3	7	**11**
18 LINDBERG Hans	5	1	1	1	2	1		1	2	**11**
19 TERZIC Stefan										
21 NILSSON Andreas						1				**1**
22 LIJEWSKI Marcin	3	7	3	2	1				4	**3**

23 HENS Pascal		2	2	1				1	4	**4**
24 PETERSEN Fredrik	4		1	1		1				**9**
TOTAL	25	20	17	10	8	7	1	5	41	**83**

GOALKEEPER	SAVES	GOALS	%	+	-	**PIR**
1 BITTER Johannes	15	25	38	1		**21**
12 HERRMANN Max Henri						

FC Barcelona Intersport extra time:

PLAYER	OFFENCE					DEFENCE				**PIR**
	goals	miss. shots	assist.	tech. faults	other -	obtain. balls	blocks	other +	comm. fouls	
3 NÖDDESBO J.	1								1	**3**
6 GARCIA Juan	2	1			2					**1**
8 TOMAS Victor	1									**2**
9 ENTRERRIOS R.										
10 SORHAINDO Cedric									4	**4**
11 SARMIENTO Daniel		2	3						1	**2**
17 MONTORO Angel				1						**-1**
18 GURBINDO E.		1	1							**0**
20 JERNEMYR Magnus									1	**1**
21 AGUIRREZABALA.										
22 RUTENKA Siarhei			2							**2**
24 STRANOVSKY M.										
26 ROCAS Albert										
27 MORROS Viran										
TOTAL	4	4	6	1					7	**14**

GOALKEEPER	SAVES	GOALS	%	+	-	**PIR**
1 STERBIK Arpad	1	4	20			**-1**
12 SARIC Danijel	0	1	0			**-1**

HSV Hamburg extra time:

PLAYER	OFFENCE					DEFENCE				**PIR**
	goals	miss. shots	assist.	tech. faults	other -	obtain. balls	blocks	other +	comm. fouls	
2 KRAUS Michael	1		3						1	**6**
3 SCHRÖDER Stefan										
4 DUVNJAK Domagoj	2	1	1			1		1	3	**9**
5 JANSEN Torsten									1	**1**
6 LACKOVIC Blazenko										
7 FLOHR Matthias									2	**2**
9 VORI Igor		1						1	1	**1**
18 LINDBERG Hans	1								1	**3**
19 TERZIC Stefan										

21 NILSSON Andreas										
22 LIJEWSKI Marcin		1							1	**0**
23 HENS Pascal										
24 PETERSEN Fredrik	1								2	**4**
TOTAL										**26**

GOALKEEPER	SAVES	GOALS	%	+	-	**PIR**
1 BITTER Johannes	2	4	33	2		**4**
12 HERRMANN Max Henri						

FC Barcelona Intersport whole match (70 min):

PLAYER	OFFENCE					DEFENCE				**PIR**
	goals	miss. shots	assist.	tech. faults	other -	obtain. balls	blocks	other +	comm. fouls	
3 NÖDDESBO J.	3			3	1	3			4	**9**
6 GARCIA Juan	3	3	2	2	3				1	**1**
8 TOMAS Victor	7	1				2			1	**16**
9 ENTRERRIOS R.		2	2	1	1				2	**0**
10 SORHAINDO Cedric	1							1	5	**8**
11 SARMIENTO Daniel	2	5	9		1			3	3	**13**
17 MONTORO Angel	1		1	1					2	**4**
18 GURBINDO E.	3	2	5		1				2	**10**
20 JERNEMYR Magnus					2			1	8	**7**
21 AGUIRREZABALA.										
22 RUTENKA Siarhei	8	5	6	6		1		1	1	**14**
24 STRANOVSKY M.	1	1		1		1			2	**3**
26 ROCAS Albert									1	**1**
27 MORROS Viran						1			5	**6**
TOTAL	58	19	25	14	9	8		6	37	**92**

GOALKEEPER	SAVES	GOALS	%	+	-	**PIR**
1 STERBIK Arpad	7	9	44	2		**14**
12 SARIC Danijel	9	21	30	1		**7**

HSV Hamburg whole match (70 min):

PLAYER	OFFENCE					DEFENCE				**PIR**
	goals	miss. shots	assist.	tech. faults	other -	obtain. balls	blocks	other +	comm. fouls	
2 KRAUS Michael	6	1	7	2					1	**17**
3 SCHRÖDER Stefan										
4 DUVNJAK Domagoj	4	7	7	2		1	2		9	**18**
5 JANSEN Torsten	2	2			1	1			7	**9**
6 LACKOVIC Blazenko	2	1				1			1	**5**
7 FLOHR Matthias					2				13	**11**
9 VORI Igor	2	1		2	2	1		4	8	**12**

18 LINDBERG Hans	6	1	1	1	2	1		1	3	**14**
19 TERZIC Stefan										
21 NILSSON Andreas						1				**1**
22 LIJEWSKI Marcin	3	8	3	2	1				5	**3**
23 HENS Pascal		2	2	1				1	4	**4**
24 PETERSEN Fredrik	5		1	1		1			2	**13**
SKUPAJ	60	23	21	11	8	7	2	6	53	**107**

GOALKEEPER	SAVES	GOALS	%	+	-	**PIR**
1 BITTER Johannes	17	29	37	3		**25**
12 HERRMANN Max Henri						

If we calculate PIR by using the formula: **PIR players: (2xgoals+assists+obtained balls+blocks+other good moves+committed fouls) – (missed shots+technical faults+other bad moves)**, **PIR goalkeepers: (3xsaves+good moves) – (received goals+bad moves);** we get very good results:

- Range between the highest and lowest value is 25 which gives us a clearer picture;

- Best players have the values of PIR between 10 and 20;

- In the FC Barcelona Intersport team by using this method played well: TOMAS, SARMIENTO, GURBINDO, RUTENKA and ŠTERBIK; and poor: GARCIA, ENTRERRIOS and MONTORO;

- In the HSV Hamburg team by using this method played well: KRAUS, DUVNJAK, FLOHR, VORI, LINDBERG, PETERSEN and BITTER; and poor LIJEWSKI and HENS.

RESULTS AND DISCUSSION

Comparison of PIR obtained from the following two different methods with coaches analysis, (estimate):

FC Barcelona Intersport:

	GOOD PERFORMANCE	POOR PERFORMANCE
COACHES RATING	**TOMAS** **RUTENKA** **ŠTERBIK** **ŠARIĆ**	**GARCIA** **ENTRERRIOS** **MONTORO**
Analysis by using the formula: PIR players: (goals+assists+obtained balls+blocks+other good moves+committed fouls) – (missed shots+technical faults+other bad moves), PIR goalkeepers: (2xsaves+good moves) – (received goals+bad moves)	**TOMAS** SARMIENTO,	**GARCIA** **ENTRERRIOS** ŠARIĆ
Analysis by using the formula: PIR players: (2xgoals+assists+obtained balls+blocks+other good moves+committed fouls) – (missed shots+technical faults+other bad moves), PIR goalkeepers: (3xsaves+good moves) – (received goals+bad moves)	**TOMAS** SARMIENTO GURBINDO **RUTENKA** **ŠTERBIK**	**GARCIA** **ENTRERRIOS** **MONTORO**

HSV Hamburg:

	GOOD PERFORMANCE	POOR PERFORMANCE
COACHES RATING	**KRAUS** **DUVNJAK** **JANSEN** **VORI** **LINDBERG** **PETERSEN** **BITTER**	
Analysis by using the formula: PIR players: (goals+assists+obtained balls+blocks+other good moves+committed fouls) – (missed shots+technical faults+other bad moves), PIR goalkeepers: (2xsaves+good moves) – (received goals+bad moves)	**KRAUS** **DUVNJAK** **FLOHR**	LIJEWSKI
Analysis by using the formula: PIR players: (2xgoals+assists+obtained balls+blocks+other good moves+committed fouls) – (missed shots+technical faults+other bad moves), PIR goalkeepers: (3xsaves+good moves) – (received goals+bad moves)	**KRAUS** **DUVNJAK** FLOHR **VORI** **LINDBERG** **PETERSEN** **BITTER**	LIJEWSKI HENS

The coaches estimated that at FC Barcelona Intersport in final game the following players played well: TOMAS, RUTENKA, ŠTERBIK and ŠARIĆ. According to the first method of calculation of PIR we get matching with ONE player and according to the second method with THREE players.

Bad they considered: GARCIA, ENTRERRIOS and MONTORO. According to the first method of calculation of PIR we get matching with **TWO** players and according to the second method with all **THREE** players.

In HSV Hamburg from coaching perspective played well: KRAUS, DUVNJAK, JANSEN, VORI, LINDBERG, PETERSEN and BITTER. According to the first method of calculation of PIR we get matching THREE players and analysis by the second method with SIX players.

Since the coaches in HSV Hamburg team nobody tagged for bad, there are no matches.

The first method of calculating the PIR is 43% matched with the assessment of the coaches and the other in 86%; with this it should be noted that the coaches did not have access to the statistics in their assessment.

CONCLUSIONS

The American writer Mark Twain intensified: »Lies, damned lies, and statistics«. This famous statement proves to be true, especially when we have a large number of statistical data and everyone can use those that suit him more.

The information that a player has scored seven goals is impressive, if we do not know that he "spent" 20 shots for that, and he did not play in defence. Therefore it is necessary to combine all relevant statistical data together into a whole, so as to obtain a single value, which includes all activities, good and bad, that the player had during the game.

In basketball, which is the most similar sport to handball, they have used PIR for decades and for a commentator during the match it served as information, that Vassilis Spanoulis already had PIR 28, with 25 minutes into the match. And that gives us even more pleasure to watch the game.

I think that in Handball it is possible to equalize the effect of the goalkeepers, universal players and specialists and get a basis for determining the PIR, as I have shown in the equation:

PIR for the players: (2xgoals+assists+obtained balls+blocks+other good moves+ committed fouls) – (missed shots+technical faults+other bad moves)

PIR for the goalkeepers: (3xsaves+good moves) – (received goals+bad moves)

Of course we can also use other weights and probably one that will introduce PIR in its statistics will do.

We can also recalculate indexes with regard to playing time, but this is not necessary. Because it would unnecessarily complicate the matter, we see that the extra time did not change the image, because the players are at any time collecting and losing points. Even in basketball indexes are not adjusted when playing extra time.

It will be very good if we could agree for a universal formula to calculate PIR, which would be the basis for determining the best, most valuable players and ideal teams, on the Olympic Games, Wold Championships, European Championships... and national Championships, and that number of goals scored will not be a determining factor for good or bad performance of the players.

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Handball Federation of Slovenia

Slovenian Handball Coaches Association

Master Coach Course

STRESS AMONG PROFESSIONAL HANDBALL PLAYERS IN SLOVENIA

Mentor: dr. Marko Šibila **Author: Gregor Cvijić**

Ljubljana, junij 2013

CONTENTS

SUMMARY

The reason for my decision to write a seminar paper on this topic was my own interest in sport and the desire to research how stress is experienced in sport. As I have been a professional handball player not too long ago and as I now work as a handball coach, I believe I know this topic well.
The first part of the seminar paper introduces the theoretical foundations of handball and stress on the basis of existing references and the second part contains the analysis of a survey among male and female handball players in Slovenia. I have formulated 6 hypotheses, out of which 4 were confirmed and 2 were rejected.
I believe this to be an interesting seminar paper. Handball players and coaches will be able to find answers to many questions inside.

Key words: sport, stress, handball player, survey, coach, hypothesis

1 INTRODUCTION

1.1 The purpose and objective of this seminar paper

This seminar paper aims to determine how Slovenian male and female professional handball players experience stress. The reason for selecting this topic was that Slovenian handball players have recently won a lot of trophies and, as a result, the expectations placed on them have increased. These achievements are repeated year after year and it would be interesting to see how they respond to stress in various moments of matches or in different periods during match preparation.

1.2 Objectives

The objectives of this seminar paper are:

1) To determine the most frequent stressors for Slovenian handball players
2) To determine the relation between stressors in everday life and during matches
3) To determine the ways of coping with stress
4) To determine the influence of stress on the behaviour of Slovenian handball players
5) To determine the differences between genders in terms of experiencing stress

1.3 Hypotheses

This seminar paper tries to prove that:

1) The most common stressors of handball players are illness, conflicts with teammates, disagreements with the coach
2) The least common stressors of handball players are sleeping habit changes, partners attending the match and high transfer fees.
3) The stressors that have the highest impact on everyday lives of athletes also have the highest impact on their match performance and concentration.
4) In most cases, the behaviour of athletes does not change when they experience stress - they do not express their feelings.
5) Slovenian handball players most often try to solve club problems, conflicts with teammates or disagreements about tactics in a constructive way.
6) With the same stressors, female athletes have a more powerful experience of stress.

2 STRESS

Stress is a mixture of physical, emotional, cognitive and behavioural responses of an organism to stimuli which interrupt a person's inner balance (Kompare, A. Stražišar, M. Vec, T. Dogša, I. Jauševec, N. Curk: 2001). The stress-inducing stimuli are called stressors. They include everything we perceive as a threat or challenge and they affect our mental and physical state.

Let's imagine a normal day in the life of some persons living and working in a city environment. They are always under pressure from deadlines that must to be respected. There is a lot of traffic and noise on the streets. Cities are also full of smog and have a bad smell. These persons can run out of petrol, they can get stuck in traffic or must endure rides on crowded buses. Their child can become sick and they worry about their health when they are cradling him/her in their arms in the waiting room at the doctor's office which is full of sick people and there is no place to sit. Living in the western world has become very stressful.

You might think these are just normal events during the course of a single day. True, but... These experiences can cause irreparable damage to every individual, if they are exposed to them for too long.

The opposite of negative stress is positive stress. The birth of a new family member is a good example of positive stress, provided that both partners want to have children. Another example of positive stress is the anticipation before going on a first date.

Many people like to use sport to cope with stress. It allows them to relax and recharge their batteries. This is why I was interested in how stress is experienced by professional athletes (handball players in my case), what makes them tick and how do they cope with it. I selected the topic because I used to play handball at the highest level and I am a coach now. I was interested in how professional athletes, who do earn their living in sport, experience stress today.

Before explaining the general adaptation syndrome, I would like to list some of the most common stressors: death of a spouse, divorce, absence of a spouse, prison time, death of a family member, illness or accident, wedding, being laid off, marriage reconciliation and retirement. The least common stressors are minor criminal offences, Christmas, holidays, change of eating habits, small loan, changing social activities, changing religion, changing recreational activities. There and other events were evaluated in terms of their stress-inducing potential by 400 individuals (Kompare et al., 2001).

According to Lindemann (1977), Hans Seyle's **general adaptation syndrome** is a good way to describe the effects of stress. A longer exposure to a stressor results in three stages:

1) alarm
2) resistance
3) exhaustion

We become aware of the stressor at the **alarm stage**. The first reaction is shock followed by the antishock when the sympathetic nervous system is activated and causes a series of physiological changes and other related mental changes. We try to cope with the stressor in the **resistance phase**. If we manage to adapt and can successfully cope, the functioning of the organism returns to normal levels. If we are unable to cope or have to face a series of different

stressors, the resistance phase persists which leads to the **exhaustion phase**. There are physical, mental and behavioural signs of exhaustion.

Failure to recognize the signs and react accordingly can lead to serious mental issues, such as loss of contact with reality or development of other psychosomatic disorders.

2.1 History of stress

According to Lindemann (1977), Seyle was also the first person to start researching stress. At the beginning, he searched for a new hormone. He injected rats with extracts of ovaries and postpartum excrements and observed the response of the test subjects. The reactions were always the same: the adrenal cortex swelled, the thymus contracted, the lymph nodes and the spleen shrank and ulcers appeared on the duodenum. Seyel's first conclusion was that if these effects were the result of injecting various tissue extracts, then they should also appear after injecting formalin (a toxic substance used for disinfection in hospitals). 48 hours later, his assumption proved correct. He did not find any traces of a new hormone, but did make the first step on the path of stress research.
To define the sum of unspecific effects of various factors on the body, he chose the word "stress". Factors that can trigger the general adaptation syndrome are: muscle activity, cold, heat, pathogens, medications, drugs, injuries etc.

2.2 Coping with pressure

According to Kompare et al. (2001), people can be divided into two groups. We all experience stress, but some are often sick, while others are not. Suzanne Kobasa compared two large groups of people with such characteristics. She found three important ingredients and gave them a common name: **hardiness.**
Typical characteristics of hardy people are:
1) They see changes as a challenge and an opportunity for personal growth, not as a threat.
2) They are engaged and dedicated to complete the activities that lead to their goals.
3) They feel they are in control of their own lives.

Hardy people can cope well with frequent stress and are left with few negative consequences - they have a high stress tolerance level. Frustration tolerance can be seen as resistance to failure.

People who see situations as challenges are more likely to act constructively and successfully cope with the stressor.

People who see situations as threats or potential losses are overwhelmed by fear, helplessness, anger and concern. They often cannot see the problem and do not do anything to solve it - they just release emotional tension and do not act constructively.

2.2.1 Overcoming obstacles in a constructive way

To overcome obstacles in a constructive way means to solve a problem in a way that leads to long-term gains without preventing others from fulfilling their own needs. To this end, we collect information, think about the causes and consequences, make a plan, look for support of our friends, tell our friends of our problems and try to fulfil our needs. Some of the ways to overcome obstacles in a constructive way are:

1) Actually overcoming the obstacle.
2) Focusing on another equally valuable goal.
3) Postponing the solution and in the meantime working and arranging our life in a way that will allow us to get what we want at the end.
4) Morally unacceptable motives must be realized in ways that are acceptable in our environment

2.2.2 Overcoming obstacles in an unconstructive way

Unconstructive response to problems can offer only temporary relief, but does not satisfy the need in the long run, so the problems will repeat again and again. Our behaviour can even worsen the situation and make our lives even more complicated. Some of the ways to overcome obstacles in an unconstructive way are:

1) Aggressive behaviour can remove the obstacle, but we also obstruct other people in satisfying their needs, and we ultimately end up in trouble. Destructive behaviour also does not help in most cases; it only allows us to release the accumulated frustrations.
2) Regression means that we go back to the behaviour which is typical of the lowest development stage - to use the behaviour that was once successful. Examples of this are stuttering, tantrums, crying, panic screaming, running away and yelling.
3) Instead of being persistent, we throw in the towel and give up to easily.
4) Running away from an obstacle means avoiding the situation.
5) Suppressing unpleasant feelings that warn of unsatisfied needs with various drugs or food.

2.3 Defence mechanisms

Defence mechanisms are a special way of coping with mental burdens; they are trigged in situations when our self-esteem is in jeopardy. People activate defence mechanisms to try to explain a conflict in a way that does not hurt their self-esteem - "solutions", such as suppressions, denial, projection, introjection, rationalization, transfer, compensation, overcompensation, are not permanent and effective - we just do not want to recognize the true extent of the problems. Defence mechanisms are activated automatically and unconsciously.

2.4 Personality development

According to Kompare et al. (2001), the field of psychology that deals with psychological development over the course of a human life span is called developmental psychology. Personality development from conception to death is divided into the prenatal period, childhood, adolescence and adulthood. In every period, people develop in physical, cognitive,

emotional and social terms. Self-esteem and self-awareness are also developed. The development stages are the following: early childhood (0-2), middle childhood (2-6), late childhood (6-12), adolescence (12-18), early adulthood (18-40), middle adulthood (40-65), late adulthood (65+). In line with this research, I will describe the period of adolescence.

2.4.1 Adolescence

This period is characterized by quick growth and sexual maturity (in terms of physical development). Friendship and socializing in groups is important and adolescents take comparatively more risks (in terms of social and emotional development). Some adolescents reach the formal operational phase and possess the ability to imagine hypothetical and ideal situations (cognitive area). Self-esteem depends on physical maturity; they have an egocentric view of themselves which additionally increases the ability to imagine an imaginary audience (self-esteem area).

2.4.2 Adulthood

Early adulthood (18-40)

During this period, people reach their physical and biological potential (physical area). Sensory and motor skills are also at their peak (sensor and motor area). People establish sexual and asexual intimacy, the number of friends decreases and relationships are permanent (social and emotional area). In this period, thoughts are realistic and some adults develop post-operational thinking (cognitive area). The conflict between loneliness and intimacy is resolved in early adulthood, people often move away from home, become independent, get a career, get married, have a family - their identity is fully formed (self-esteem area).

2.5 Stress in sport

According to Tušak M., Misja R. and Vinčič A., (2003), athletes often respond to sport-related stressors in the right way. However, when other stressors are present (in addition to sport-related ones) in critical situations in life, they can together break the resistance and have a negative effect on sporting performance as well. Exhaustion accelerates burnout. This can lead to emotional and physical withdrawal. A lack of interest, accuracy and vitality is evident.

When we feel we are not getting just rewards for our work, this can be seen a sign of a mismatch between the individual and the work he/she is performing. While money is the most obvious reward, it is most useful in the workplace; in other fields, such as study and sport, other rewards are more appropriate, like praise from friends, coaches, good grades and good results. A mismatch in sport occurs when an athlete does not improve his/her performance despite an increased amount of training. The largest mismatch between a task and the person performing it can be seen when an individual does not have a feeling of inner satisfaction upon completing a task. If this happens, it is perhaps time to think about larger changes.

2.6 Handball

This seminar paper deals with experiencing stress among professional handball players in Slovenia. This is why I will use the next section to quickly describe handball.

According to Šibila (1999), handball is one of the most popular ball games in Slovenia and worldwide. Due to the variety of motor skills needed by the players, handball belongs to multi-structural complex ball-games. It consists of a number of motor skill units which can be executed with or without the ball. All motor skills are executed in specific conditions in the presence of opponents and in relation to the development level of handball-specific psychosomatic dimensions (inner success factors), training conditions and other objective factors (outside development factors).
Slovenian men's and women's handball teams have achieved respectable results in recent years. Celje Pivovarna Laško won the Champions League title in 2004, and RK Krim Mercator won two Champions League titles in addition to reaching the final twice more. The men's national handball team became the first Slovenian national team in any sport to qualify for the Olympic Games - it participated at the 2000 Sydney Olympic Games and the 2004 Athens Olympics Games. RK Cimos Koper has also recently won one of the European cups. And let's not forget RK Gorenje Velenje who twice reached the finals of the EHF Cup. And last but not least, the Slovenian handball national team was the first Slovenian national team to win an international medal after the Slovenian independence when it won a medal at the Mediterranean Games in 1993.

A lot has been said and written about stress in the business world. Top athletes experience a similar level of stress every day. We could say that they are under stress 24 hours a day. There is much room for research in sport and things change daily.

3 PRACTICAL PART

3.1 Survey sample

The sample of the survey includes members of the Slovenian men's and women's national teams. It includes 17 men and 17 women aged from 18 to 48 years. 82% of them are single and 18% are married. 85% of them are aged between 21 and 40 and 9% are younger than 20. They have from 5 to 10 training sessions per week. 58% have 8 training sessions, 24% have 5 training sessions, and 18% have 10 training sessions per week.

Male and female handball players are members of:
1) MEN'S NATIONAL HANDBALL TEAM
2) WOMEN'S NATIONAL HANDBALL TEAM

3.2 Measurements and data collection

The subject of the seminar paper was researched with a survey. The main topic of the seminar paper is experiencing stress among Slovenian male and female handball players. The survey consists of 13 questions with most of them being of the closed-ended type. The participants were able to tick "Other" and enter their own answer. Answers of the type "Other" are considered answers to open-ended questions. The survey was modified multiple times. The final survey consists of 4 pages and contains 4 tables and 8 questions.
I had considerable problems collecting data, because many players were absent. The survey was published at www.1ka where participants were able to take it. I have sent it to 54 potential participants and received 34 responses - 17 from men and 17 from women.

3.3 Procedure and statistical analysis

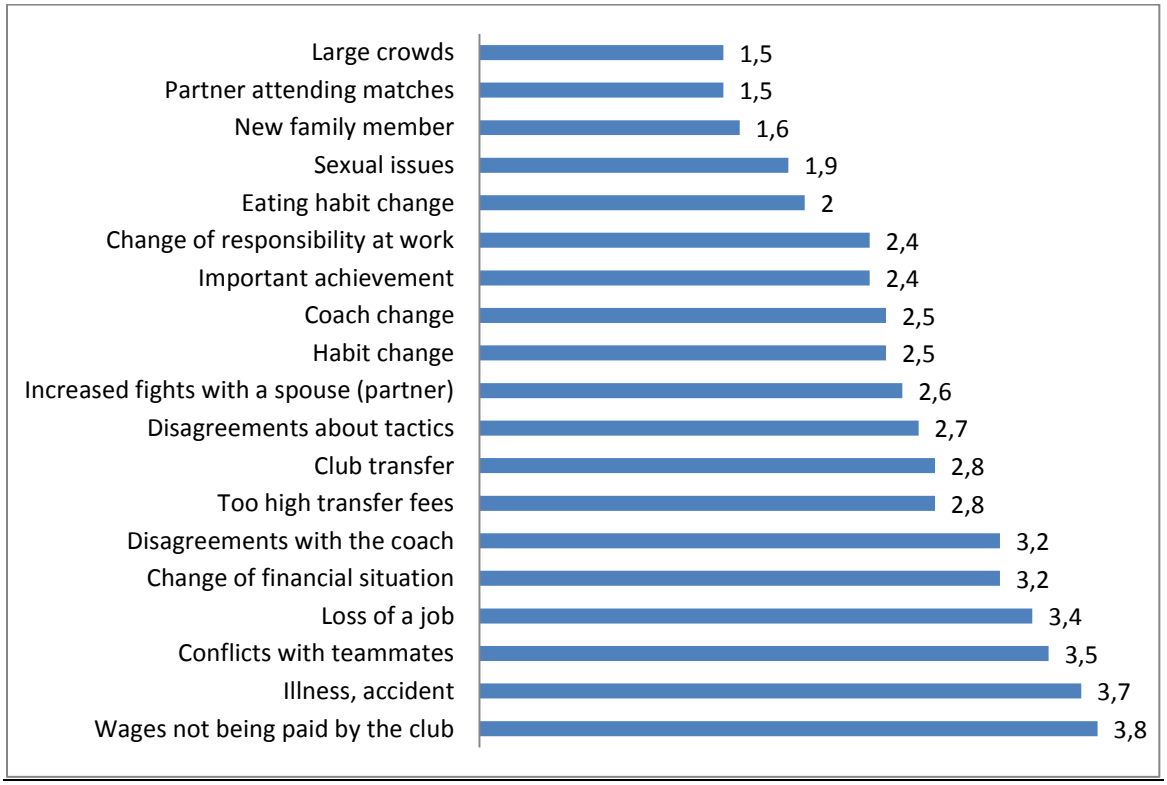
The data collected with the survey was analysed with Microsoft Excel. The individual answers were added up and divided with the number of participants answering the respective question. Male and female surveys were separated to be able to compare genders. After the final analysis, the data was represented with diagrams and tables. For easier interpretation, the results were distributed from low to high. The results are represented by percentage and arithmetic mean.

4 RESULTS AND INTERPRETATION

4.1 What cause the highest stress levels for you? (From 1 (the least) to 5 (the most))

(If, for example, you do not have children yet, please cross out the entire line containing "New family member")

DIAGRAM 1: STRESSORS OF HANDBALL PLAYERS THAT AFFECT THEIR EVERYDAY LIFE



SOURCE: SURVEY

The goal of this question was to determine what stressors are the most and least frequent in Slovenian handball players and whether stressors with the highest impact on men have the same impact on women. The most frequent stressors among men were: **Wages not being paid by the club (3,8), illness, accident (3,7), conflicts with teammates (3,5)**, loss of a job (3,4), a change of financial situation (3,2), disagreements with the coach (3,2).

The most frequent stressors among women were: **Wages not being paid by the club (3,92), conflicts with a superior (coach) (3,58), conflicts with co-workers (teammates) (3,58),** loss of a job (3,5), a change of financial situation (3,5), disagreement about tactics (3,08), (3,00) illness, accident, increased fights with the spouse, an important achievement, club transfer, too high transfer fees.

The results partially confirm the first hypothesis (the most frequent stressors are illness, conflicts with teammates, disagreements with the coach). The reason for high placement of the unpaid wages is the current financial situation in Slovenian sport in general.

According to the textbook *Psihologija, Spoznanja in dileme* (page 199), by comparing the stressors listed in the table above, the most powerful stressors in a particular population of adults are: illness, accident (53), loss of a job (47), sexual problems (39), new family member (39), a change of financial situation (38).

Holmes and Rahe, who analysed the most important events like these, created a list of these events and evaluated them according to how stressful they are in different cultures. According to them, there is a large possibility that an individual would experience a mental crisis or a psychosomatic disorder, if they collected more than 300 points on their scale in a few years. In Europe, these stress events are death of a spouse (100 points), divorce (73 points), prison time (63 points) etc. (Logonder, 2000).

Most participants belong to the early adulthood stage (Stražišar, Jaušovec, Curk, Dogša, 2004). This is the reason for my conclusion that they do not yet know the intensity of a stressor such as job loss or a new family member. I believe the reason for their stressor order is the fact that they are athletes which has the greatest effect on their lives.

The stressors with the least amount of stress among male handball players are: new family member (1,6), high match attendance (1,5) partner attending the match. And among female players: Partner attending the match (2,17), new family member (2,08), high match attendance (1,67).

These data do not confirm the second hypothesis (The least common stressors are sleeping habit changes, partner attending the match and high transfer fees).

TABLE 1: THE ARITHMETIC MEAN OF MALE AND FEMALE STRESSORS

	Men	Women
Experiencing stress in everyday life	2.33	2.87

SOURCE: SURVEY

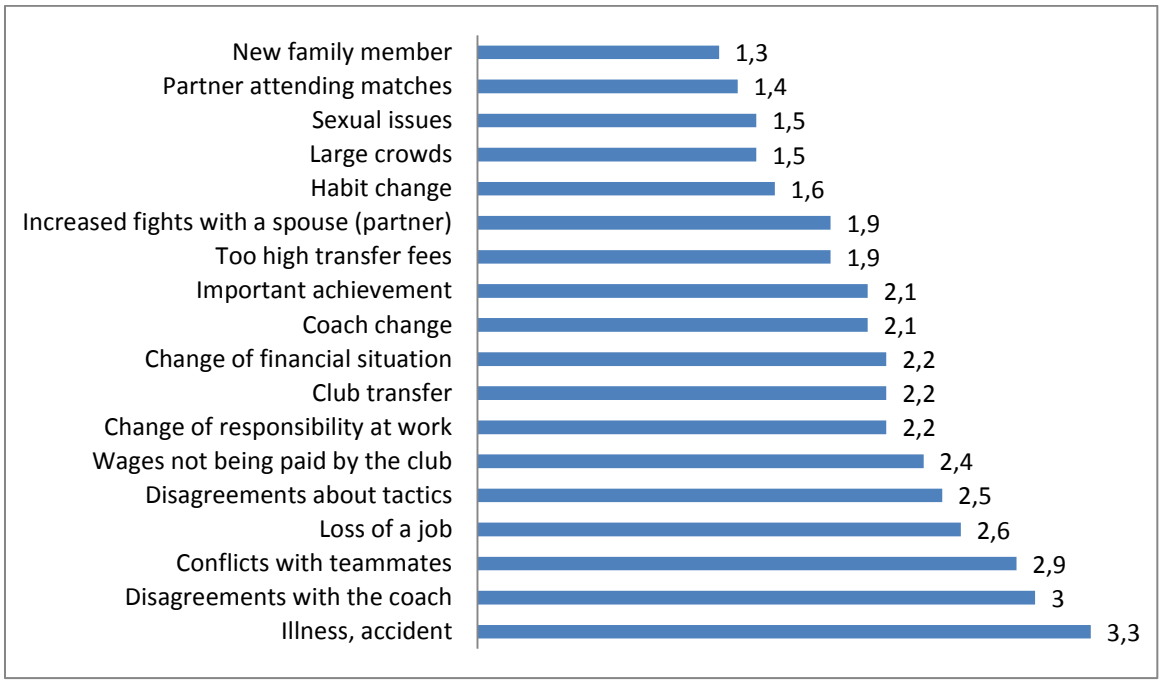
The results indicate that women experience higher levels of stress than men with the same stressors. It is possible to conclude that a higher number of stressors represent a greater threat to female handball players than to male. Perhaps the reason is that women are in general more sensitive than men. How stressful an event is depends on the person experiencing the event (on their hardiness i.e. whether they see the stress event as a challenge) (Logonder 2000).

These data do confirm the sixth hypothesis (With the same stressors, female athletes have a more powerful experience of stress).

4.2 For you personally, what causes the most stress that AFFECTS YOUR MATCH PERFORMANCE AND CONCENTRATION? (FROM 1 (LEAST) TO 5 (MOST))

(IF you, for example, do not have a spouse, please cross out the entire line)

DIAGRAM 2: 4.1 WHAT CAUSES THE HIGHEST STRESS LEVELS FOR YOU?



SOURCE: SURVEY

The most frequent stressors affecting match concentration and performance among male participants are: illness, accident (3,3), disagreements with the coach (3), conflicts with teammates (2,9), job loss (2,6), disagreements about tactics (2,5), wages not being paid by the club (2,4), change of responsibilities at work (2,2), club transfer (2,2).

The most frequent stressors among female participants are: increased fights with the spouse (3,75), illness, accident (3,42), conflicts with a superior (coach) (3,25), conflicts with co-workers (teammates) (3,08), wages not being paid by the club (2,99), disagreements about tactics (2,75).

A comparison between Table 1: Stressors of handball players that affect their everyday life and Table 2: Experiencing stress that affects your match performance and concentration shows that three stressors (**illness, accident, disagreements with a superior/coach and conflicts with teammates**) that have the highest effect on everyday life also appear among those stressors that affect match performance and concentration the most. We can safely assume that handball means a lot to the players participating in the survey and that it plays an important role in their lives even when they are not training or playing matches.

These data confirm the third hypothesis (The stressors that have the highest impact on everyday lives of athletes have also the highest impact on their match performance and concentration).

4.3 How do you experience stress?

a) I feel I am losing control of the situation

b) I am overly confused

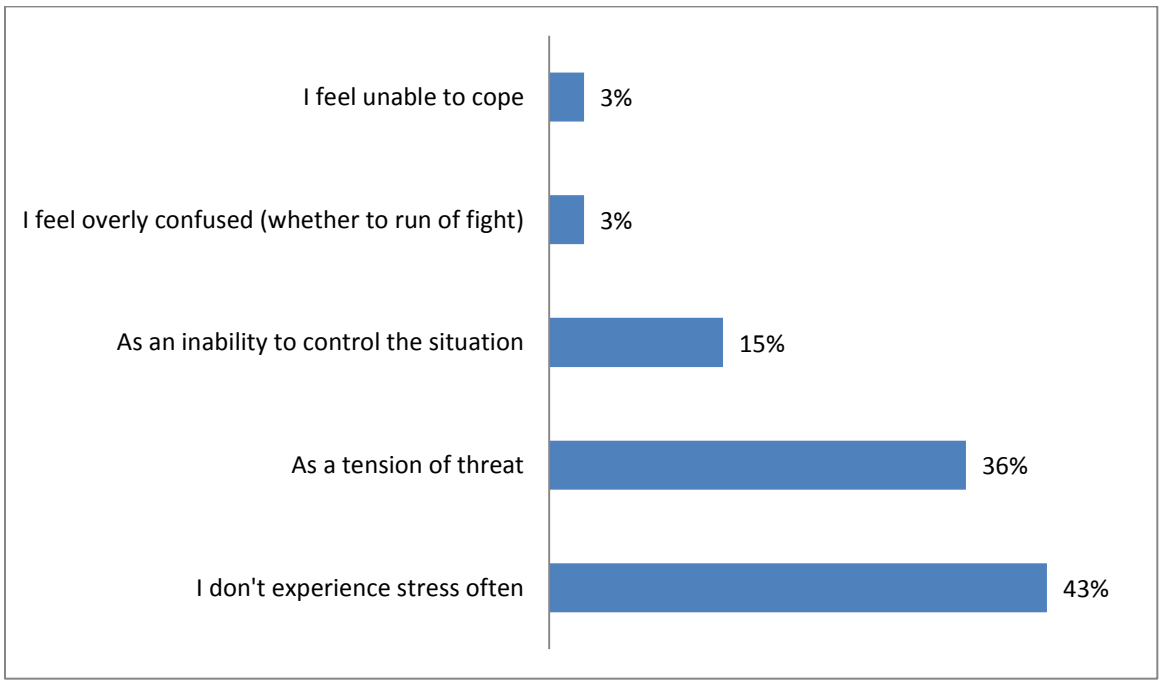
c) I feel threatened and tense

d) I do not often experience stress

e) I feel helpless

f) Other

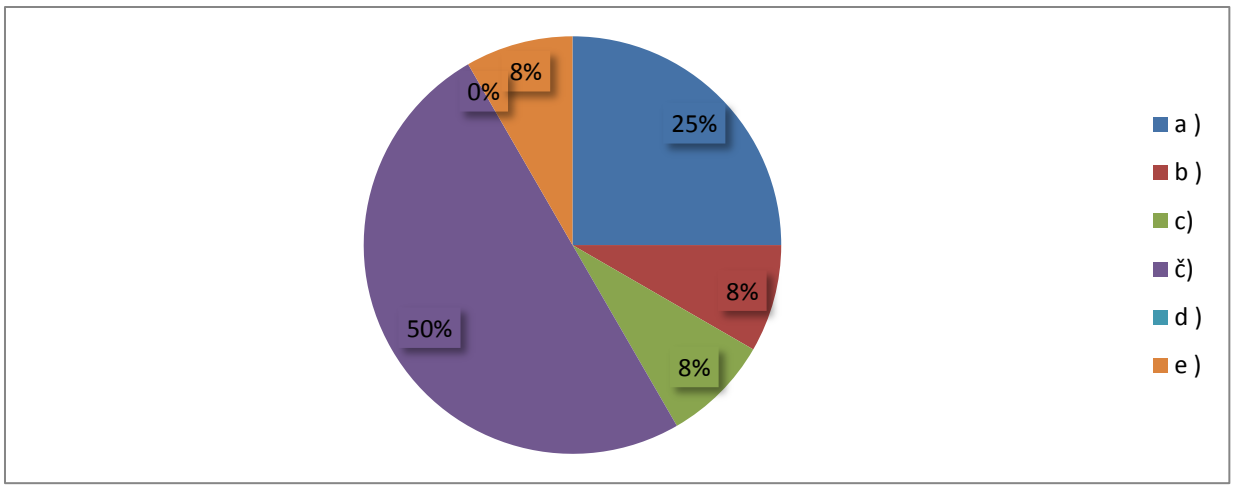
DIAGRAM 3: STRESS EXPERIENCE AMONG MALE HANDBALL PLAYERS



SOURCE: SURVEY

The most frequent answer among men was that they do not experience stress often (48%), while 36% experience stress as tension or a threat. The second most frequent answer among male handball players (26%) was that they experience stress as tension or a threat, while 16% feel overly confused.

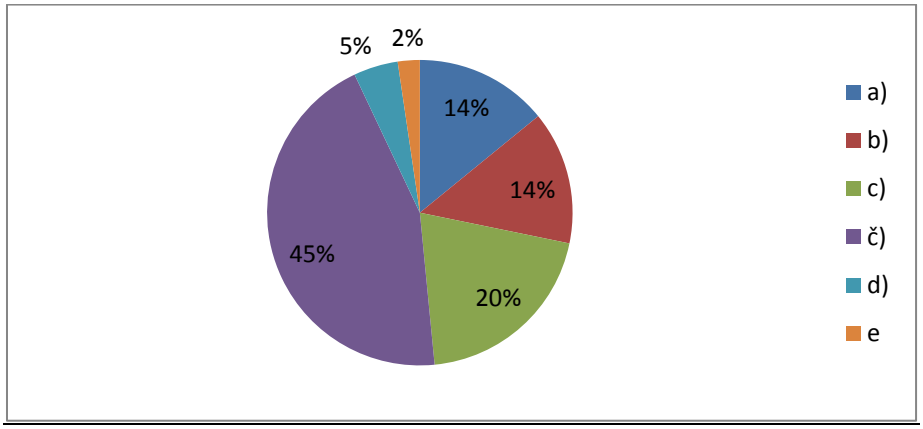
DIAGRAM 4: STRESS EXPERIENCE AMONG FEMALE HANDBALL PLAYERS



SOURCE: SURVEY

The most frequent answer among female handball players was that they do not experience stress often (50%). This is followed by the inability to control the situation (25%). Under answer f) (Other), they said that stress usually motivates them, or that it is expressed as stage fright before matches.

DIAGRAM 5: STRESS EXPERIENCE AMONG MALE AND FEMALE HANDBALL PLAYERS



SOURCE: SURVEY

On average, male handball players do not experience stress often (45%). The second most frequent answer was that it represents tension or a threat (20%). 14% of the respondents answered that they experience stress as an inability to control the situation or that they feel overly confused.

4.4 What goes on inside your body when you are under stress?

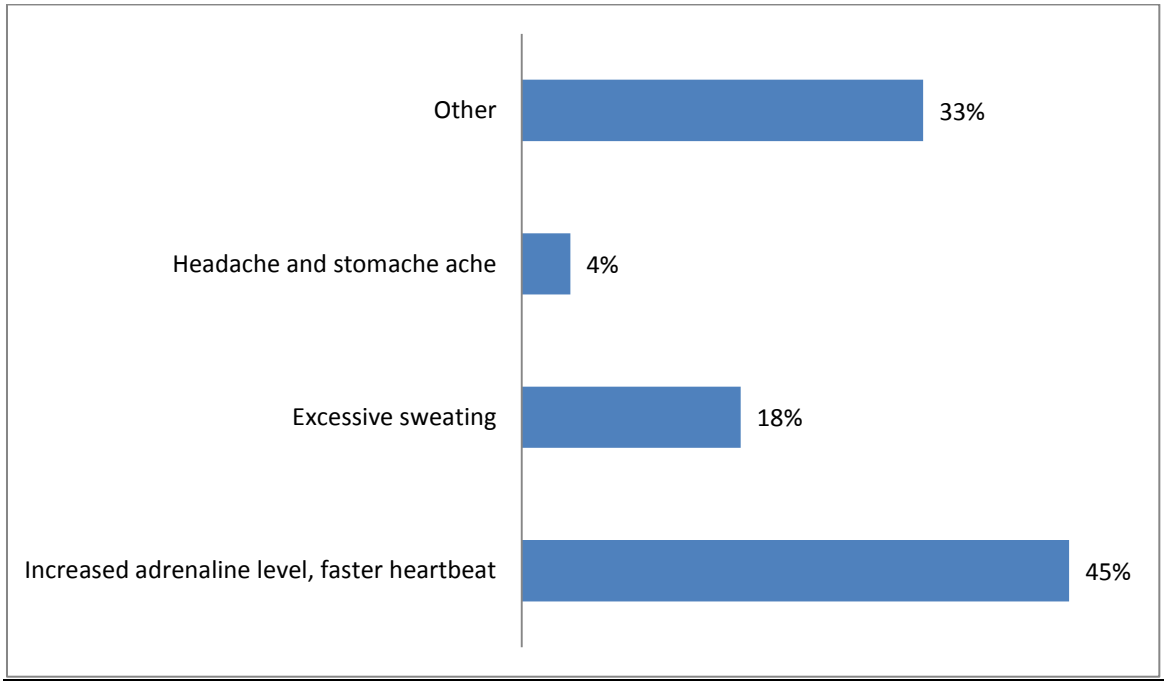
a) Adrenaline levels increase, my heart beats faster

b) I begin to sweat excessively

c) I get a headache and stomach ache

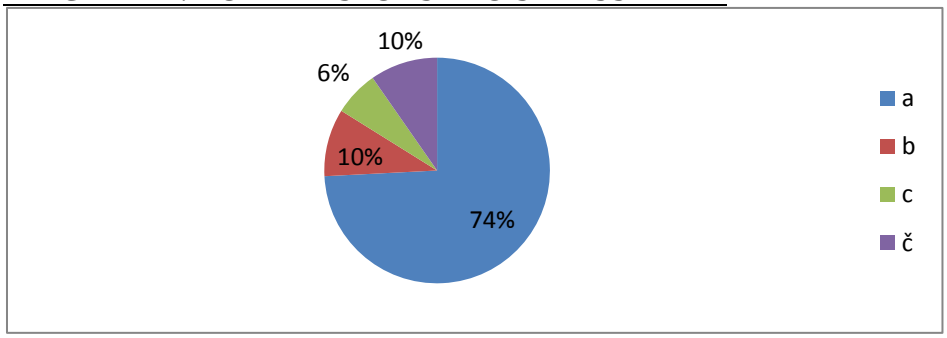
d) Other

DIAGRAM 4: BODY RESPONSE TO STRESS



45% of all handball players experience increased adrenaline levels and a faster heartbeat under stress, while 18% of them start to sweat excessively.

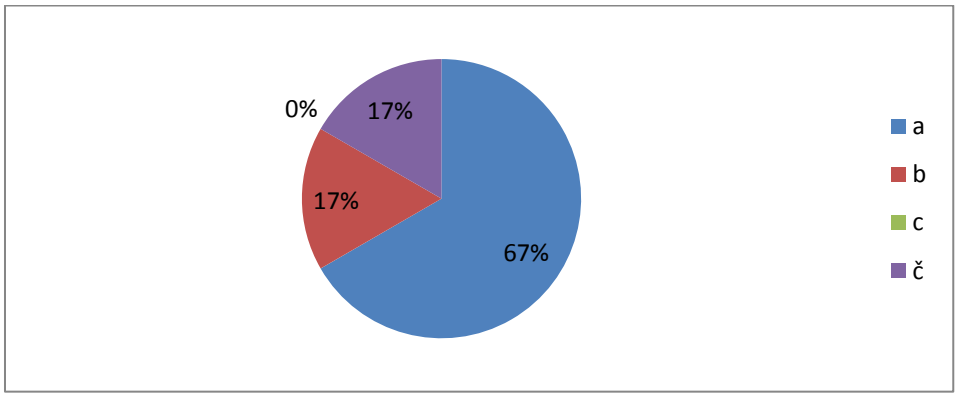
DIAGRAM 4: BODY RESPONSE TO STRESS - MEN



SOURCE: SURVEY

74% of men experience increased adrenaline levels. 10% of them start to swear excessively while another 10% selected answer d) (Other) where they stated that nothing special happens, that they are a bit nervous or that they do not sleep well.

DIAGRAM 6: BODY RESPONSE TO STRESS - WOMEN



SOURCE: SURVEY

The most frequent answer among women was increased adrenaline levels and faster heartbeat. The other two most frequent answers with 17% were excessive sweating and d) (Other): insomnia, nervousness.

According to Stražišar, Jaušovec, Curk, Dogša (2004), we become aware of the stressor in the alarm stage and become upset and worried. The first reaction is shock and our performance level decrease for a short amount of time. As the antishock sets in, the sympathetic nervous system is activated and causes a series of physiological changes and other related mental changes. Energy reserves are released allowing us to get ready for the activity to counter the stressor effects.

During the first stage, the respondents experience antishock with faster heartbeat and increased adrenaline levels which help them respond in the best possible way.

4.5 What feeling do you experience under stress?

a) Fear

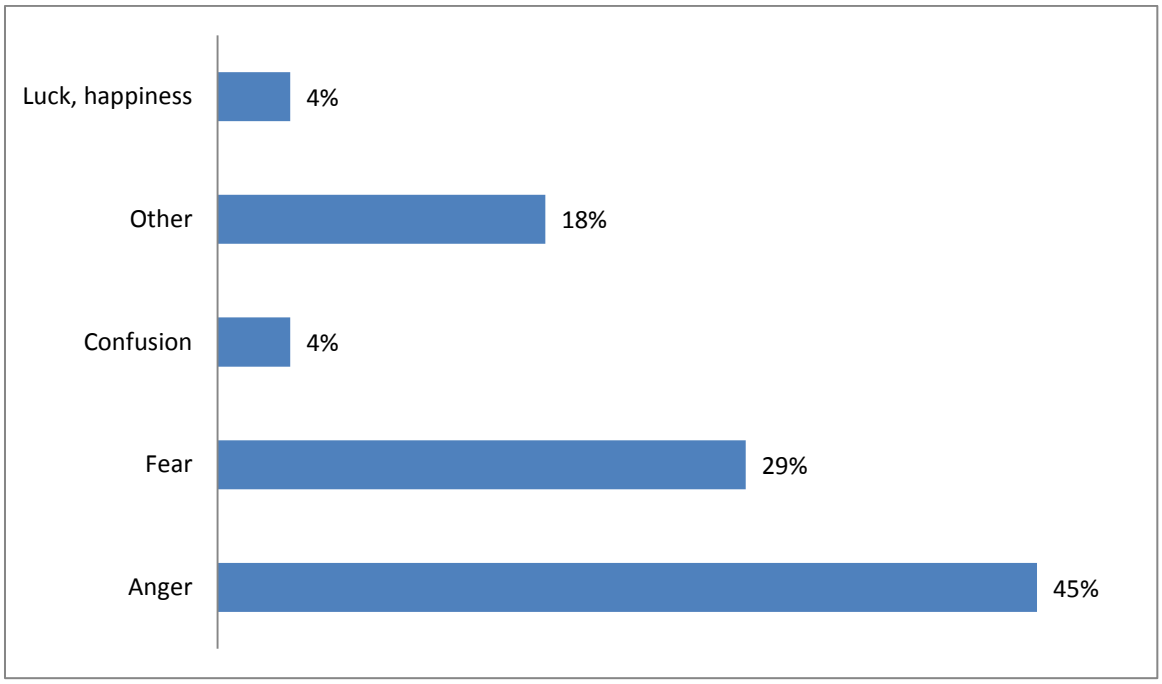
b) Anger

c) Luck

d) Confusion

e) Other

DIAGRAM 5: FEELINGS UNDER STRESS - MEN AND WOMEN



SOURCE: SURVEY

The results indicate that the most frequent feeling under stress among the respondents is anger. The second most frequent feeling is fear.

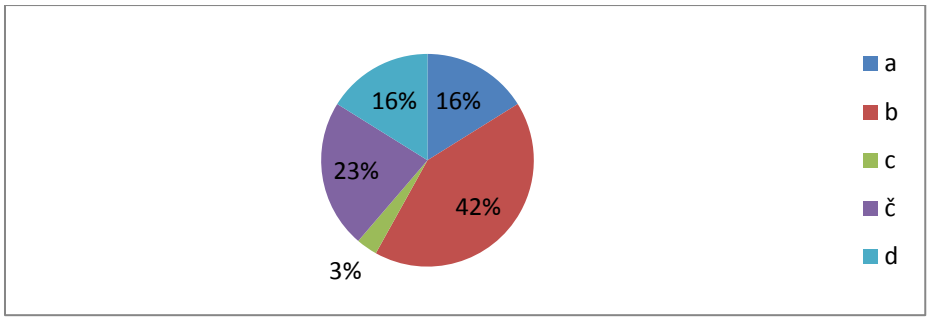
When they are under stress, male and female handball players are angry. Anger is an awkward, stimulating and powerful feeling expressed by facial expressions (clenched jaw, tense muscles, flushed face), posture (leaning forward) and hand and foot gestures (clenched fists). We experience it in the face of obstacles preventing us from achieving important goals or desires. An angry person is aggressive, can be destructive, is screaming, can verbally fight with people around them or can take it out on something innocent (objects, animals). Physical changes, such as shallow breathing, faster blood circulation, slower digestion, higher inflow of blood into muscles, can release body energy and allow us to achieve a higher level of readiness to remove obstacles (Longonder, 2000).

The answers to the previous question (What happens in your body under stress) indicate that players most often experience increased adrenaline levels and faster heartbeats. This can be connected to the physical changes related to anger, because most of the respondents feel angry

under stress. We can assume that they experience anger more often than, let's say fear, because this is what is expected of them. Athletes must be strong and always ready to fight. The ones who are afraid or too often experience other feelings are usually not among the best performers among peers (at least in youth categories - i.e. adolescents). Our culture considers anger as something normal and even something that should be expressed, because it is supposed to be a sign of independence and assertiveness (Kompare et al. 2001). Fear, on the other hand, is a feeling of powerlessness and despair.

Handball is a significant source of stress for handball players - for example disagreements about tactics, disagreements with the coach or conflicts with teammates - and they are taught not to rein in their feelings, but rather express their anger openly. Their aggression should be released in conflict with the opposition. However, this can lead to problems if the angry person injures someone - in this case they harm the opposition or even their teammates.

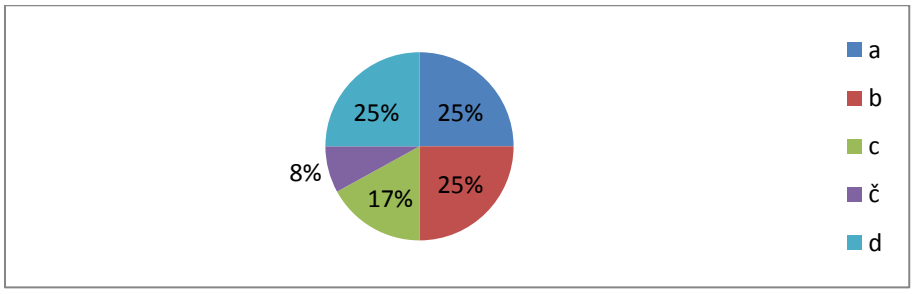
DIAGRAM 7: FEELINGS UNDER STRESS - MEN



SOURCE: SURVEY

The results indicate that the most frequent feeling under stress among respondents is anger. With 45% of all answers, anger is the most frequent response among men. 23% of male handball players feel confused and 16% experience fear. Answers under Other included nervousness, sadness and mixed feelings.

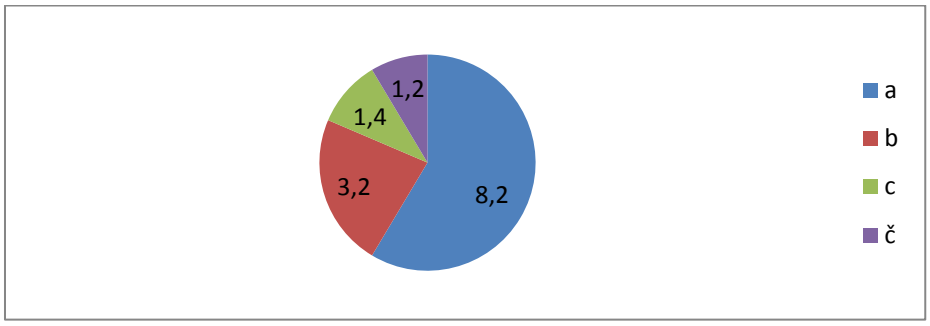
DIAGRAM 8: FEELINGS UNDER STRESS - WOMEN



SOURCE: SURVEY

The results are quite evenly distributed among women with responses such as anger, fear and other taking 25% respectively.

DIAGRAM 9: FEELINGS UNDER STRESS - MEN AND WOMEN



SOURCE: SURVEY

4.6 How does your behaviour change under stress?

a) I try not to show that I am stressed and try to keep behaving as normal

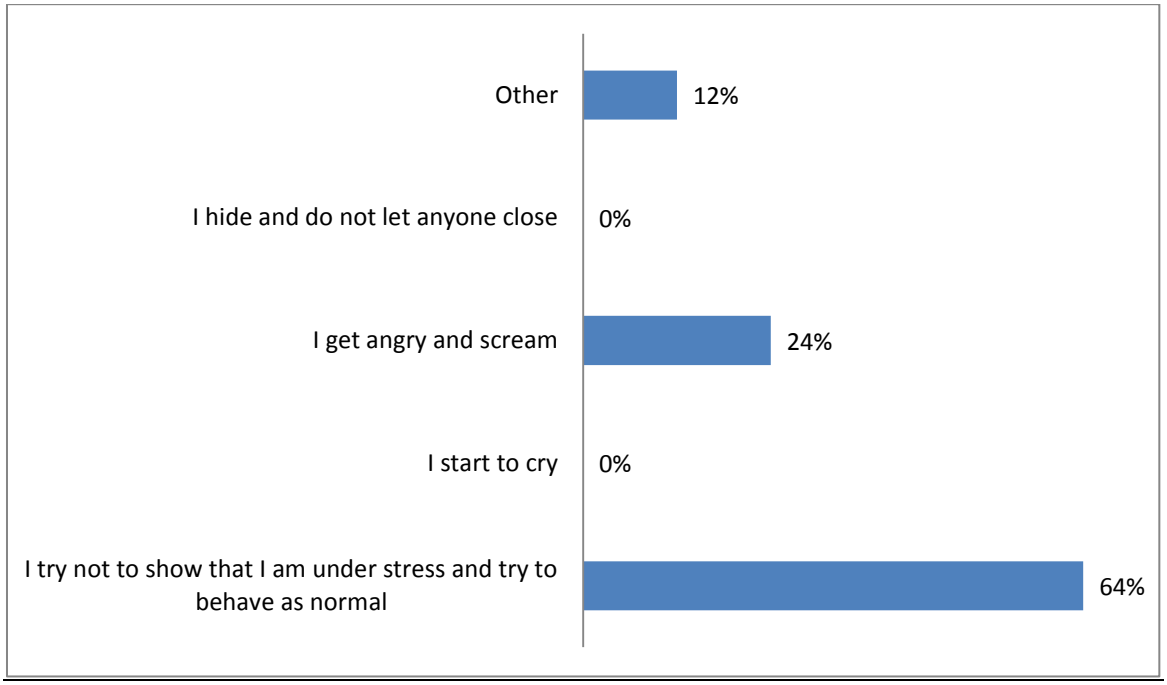
b) I start to cry

c) I get angry and scream

d) I become withdrawn and do not let anyone close

e) Other

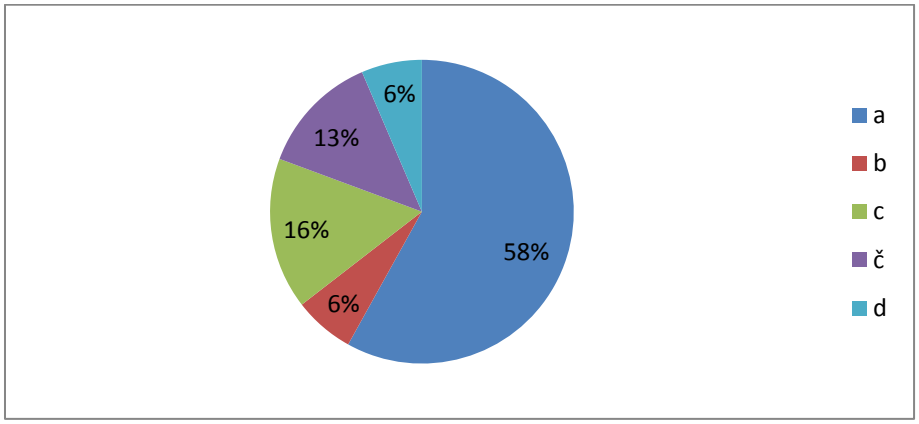
DIAGRAM 6: BEHAVIOURAL CHANGES UNDER STRESS - MEN AND WOMEN



Most (63%) athletes try not to show that they are under stress and try to keep behaving as normal.

Both men and women try to hide their feelings which is perhaps related to the expectation within the team that they remain calm and concentrated all the time. Such behaviour is detrimental to the well-being of the person under stress, but in team sports, such as handball, personal feelings must often be disregarded for the good of the team and for everyone to stick together in good or bad.

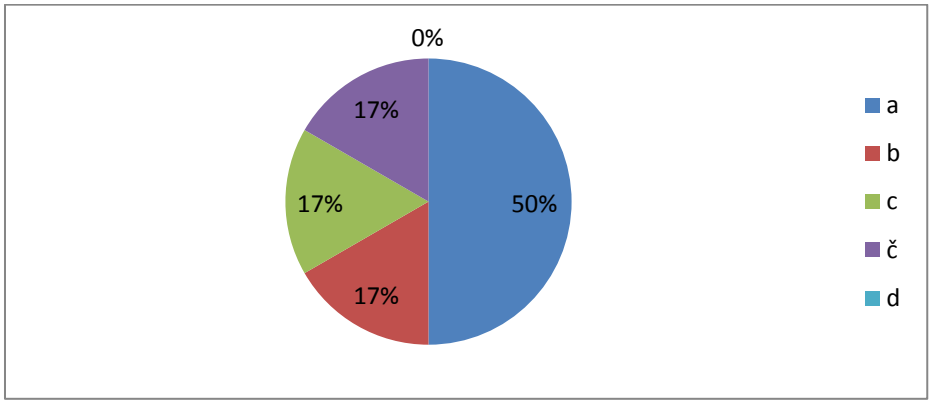
DIAGRAM 10: BEHAVIOURAL CHANGES UNDER STRESS - MEN



SOURCE: SURVEY

Most (58%) male handball players try not to show that they are under stress and try to keep behaving as normal. 16% get angry and scream and 13% become withdrawn and do not let anyone close.

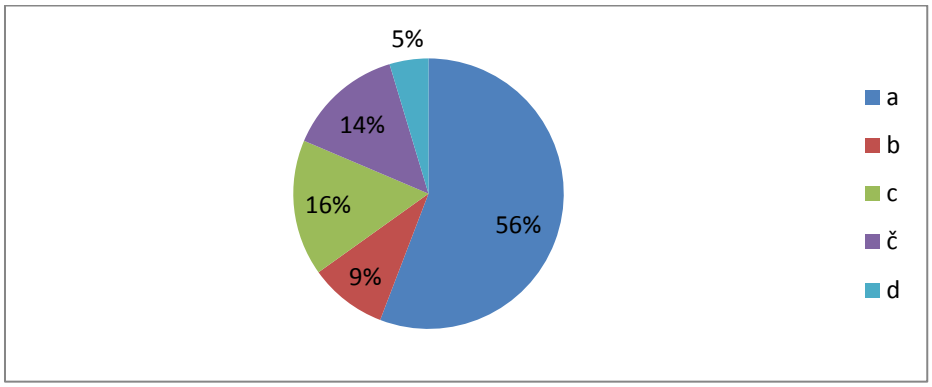
DIAGRAM 11: BEHAVIOURAL CHANGES UNDER STRESS – WOMEN



SOURCE: PERSONAL

Among female handball players, it is interesting to note that three answers are tied at second place. Crying, getting angry and screaming, and becoming withdrawn and not letting anyone close all received 17% of responses.

DIAGRAM 12: BEHAVIOURAL CHANGES UNDER STRESS - MEN AND WOMEN



SOURCE: SURVEY

Both genders experience similar behavioural changes under stress. 58% of men and 50% of women try not to show that they are under stress and try to keep behaving as normal.

Both men and women try to hide their feelings which is perhaps related to the expectation within the team that they remain calm and concentrated all the time. Such behaviour is detrimental to the well-being of the person under stress, but in team sports, such as handball, personal feelings must often be disregarded for the good of the team and for everyone to stick together in good or bad.

These data confirm the fourth hypothesis (In most cases, the behaviour of athletes does not change when they experience stress - they do not express their feelings).

4.7 What kind of matches are the most stressful for you?

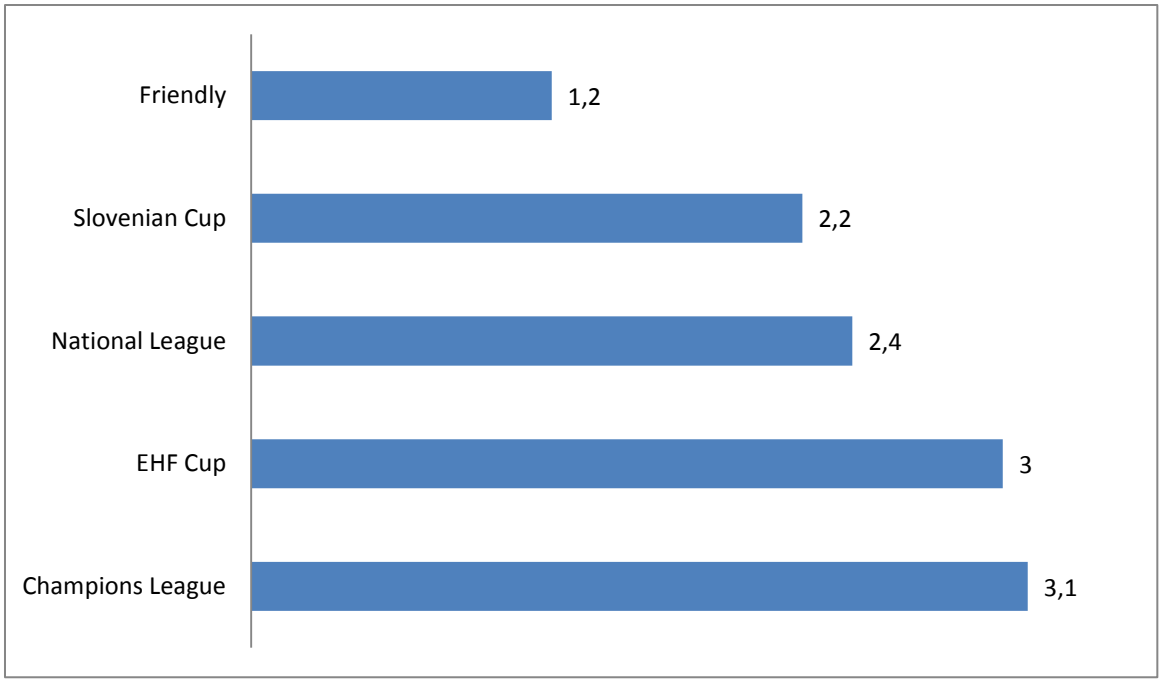
(From 1 (zero) to 5 (the most) - if, for example, you do not play any EHF Cup matches, please cross out the entire line

TABLE 2: WHAT KIND OF MATCHES ARE THE MOST STRESSFUL FOR YOU

Friendly
Slovenian Cup
Champions League
Slovenian League
EHF Cup

SOURCE: SURVEY

DIAGRAM 13: THE MOST STRESSFUL MATCHES



SOURCE: SURVEY

The survey indicates that European cup matches are the most stressful for Slovenian male and female handball players. EHF Cup (Europa League) and Champions League matches achieved practically the same percentage.

Whereas the preceding results have shown that women experience more stress under the same stress, the situation is a bit different in this case. The stress levels for friendly and Slovenian Cup matches are about the same for both. It is interesting to note that women experience significantly higher stress levels during Champions League matches.

It must not be forgotten that the men's EHF Cup is a much more prestigious competition than the women's EHF Cup. This is probably the reason for significantly higher stress levels of men in this competition.

4.8 What methods do you most often use to face problems?

The problems referred here are club issues, conflicts with teammates, disagreements about tactics.

(1-never, 2-rarely, 3-sometimes, 4-often, 5-always)

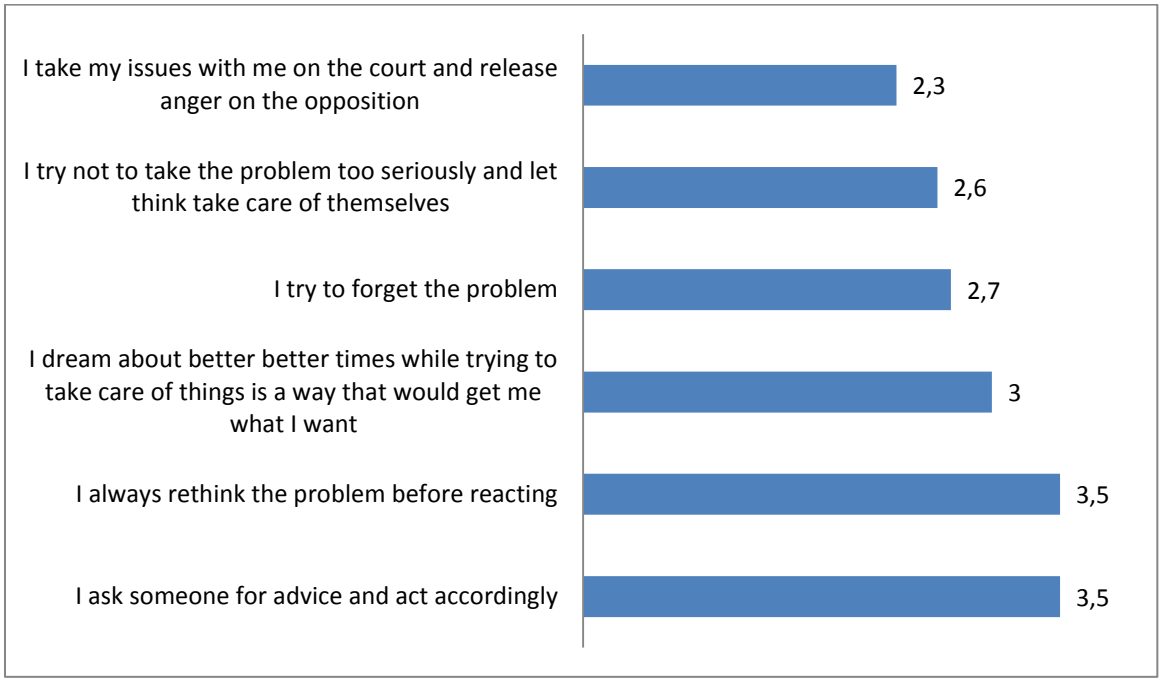
TABLE 3: WHAT METHODS DO YOU MOST OFTEN USE TO FACE PROBLEMS

I ask someone for advice and then act accordingly
I take my issues with me on the court and release anger on the opposition
I dream about better times while taking care of things in a way that would get me what I want

I tried to improve my wellbeing by eating, drinking, smoking or taking medication
I get completely mad and outscream others, so that everyone hear me
I try not to take the problem too seriously and let things take care of themselves
I try to forget the problem
I always rethink the problem before reacting

SOURCE: SURVEY

DIAGRAM 14: METHODS OF FACING PROBLEMS



SOURCE: SURVEY

Male handball players most often face problems by asking someone for advice and then acting accordingly, or by rethinking the problems and then reacting, or by trying to forget about the problem.

Female handball players also most often try to talk to someone they trust and then act accordingly. They also often dream about better times while trying to take care of things in a way that would get them what they want.

Men and women most often try to solve problems in a constructive way when faced with club issues, conflicts with teammates and disagreements about tactics. They often rethink problems before reacting or dream about better times while trying to take care of things in way that would get them what they want.

To overcome obstacles in a constructive way means to solve a problem in a way that leads to long-term gains without preventing others from fulfilling their own needs. To this end, we collect information, think about the causes and consequences, make a plan, look for support of our friends, tell our friends of our problems and try to fulfil our needs (Kompare et al., 2001).

We can assume that these players have learned these coping methods in sport. Handball is a team sport and individuality is not desired, because it makes the team functioning as one more difficult. This is why, when problems occur, athletes must do what is best for the team. Most often, this means asking someone for advice and acting accordingly, because this will allow them to do what is best for the team despite having problems.

These results confirm the fifth hypothesis (Slovenian handball players most often try to solve club problems, conflicts with teammates or tactical issues in a constructive way).

5 HYPOTHESIS INTERPRETATION

1) The most common stressors of handball players are illness, conflicts with teammates, disagreements with the coach. The first hypothesis is confirmed, because illness, conflicts with teammates and disagreements with the coach are all significant stressors for athletes.

2) The least common stressors of handball players are sleeping habit changes, partner attending the match and high transfer fees. This hypothesis is partially confirmed, because these stressors have a small impact on everyday life.

3) The stressors that have the highest impact on everyday lives of athletes have also the highest impact on their match performance and concentration. The third hypothesis is confirmed, because the stressors with the highest impact on everyday life also affect match performance the most.

4) In most cases, the behaviour of athletes does not change when they experience stress - they do not express their feelings. The fourth hypothesis is confirmed, because athletes do not want to show their feelings.

5) Slovenian handball players most often try to solve club problems, conflicts with teammates or tactical issues in a constructive way. The fifth hypothesis is confirmed, because Slovenian handball players most often try to solve problems constructively according to the survey.

6) With the same stressors, female athletes have a more powerful experience of stress. This hypothesis is confirmed, because women experience higher stress levels than men according to the survey.

6 CONCLUSION

I believe this seminar paper will be interesting for people working in handball, because it points out those stressors that have the highest impact on match performance. Many people involved in handball professionally will be able to think about the conclusions and perhaps recognize a bit of themselves in the responses.

I have had to daily face and cope with stress during my 18-year-long playing career. While playing for the national team, we had the option of visiting a psychologist who was tasked with relaxing the players and removing various stressors before important matches. I have learned quite a few successful techniques and methods for coping with stress during that time. Based on my experience I can say that the survey results were expected.

Stress is an everday issue and everything can be a stressor; under stress, we experience anger, fear, happiness and luck. The body responds in various ways - some people have to go to the toilet more often, other sweat excessively. Many try to hide that they are stressed and stay calm, others become withdrawn and do not let anyone close. Life is too short to be afraid or angry every day. Most of the stressors are out of our control. Why should we burden our bodies with them? We must realize that stress is not the reason for our problems. Stress is only the response, a defence mechanism for environmental stimuli that are also called stressors. Let's make sure that we know them, so that, if possible, we can avoid them or face them head on.

Let's see stressors as challenges and let challenges become an everyday matter.

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Handball federation of Slovenia

Master Coach Education

Seminar paper

» DESCRIPTION AND LEARNING METHODOLOGY OF HOW TO DRIBBLE AND FAKE IN HANDBALL «

Author: Brane Dobnik

Velenje, July 7th, 2013

➢ *SUMMARY*

- Dribbles are maneuvering activities that offense players use with intention attacking towards handball goal or to avoid being covered and followed by the defenders / passing the defenders or if they are close to defense players.

- All kinds of dribbles have a common start, which is when the player with the ball goes in the parallel position. The player goes in parallel position after catching the ball or after bouncing the ball. From this starting point he continues with one or more »false« movements and then with the rush past the opposite defender. The attacker has three steps available for realisation of this activity.

- Dribbles can be performed with the ball only. They are connected with faking and penetrations.

- Fakes are called those handball activities which contain one or more »false« activities with which we fake the defenders in order to easily and efficiently carry out one planned activity.

- Every deceiving action consists of two or more parts / from the »false« and the right activity / most frequently carried out by players with the ball.

- Elements of dribbling demand a high degree of coordination – of motor technical-tactical knowledge. Once the elements of dribbling used to be carried out mostly by short players who had very good motor skills and were able to easily pass the taller and clumsy defenders. Of course, the trend developed rapidly and today we see very good tall dribblers and faking players which are 200 cm and more.

- In a handball match, players can perform dribbling practically in all playing positions, (on wing positions, on back positions, on circle positions). So, the beginners should be taught how to carry out the dribbling elements on all playing positions

- The objective of the dribbler shall be to get free from the player that guards him and thus gain the opportunity for a shot or to create a scoring chance to teammates who are in a favorable position for a shot.

- Dribbling is mostly used for playing against »deep« defenses /3:2:1; 5:1;5+1;4:2…/

➢ **Key words:** dribbling, penetrations, faking, attackers, defenders

➢ INTRODUCTION

- Handball is believed to have its roots in ancient Greece. The Greek's game was called urania and later it was played by Romans as well as in the middle ages. Modern handball began to develop at the end of 19th century in Scandinavia, especially in Denmark, Sweden, Norway and in Germany. A Danish sports teacher Holger Nielsen developed the rules for modern handball in 1898 (Haanbold) and published them in 1906. Some other sports administrators also tried to write similar rules.

- A modern set of rules was prepared and published by Max Heiser, Karl Schelenz and Erich Konigh from Germany. Later on Karl Schelenz improved the rules.

- The first international game with new rules was played between the men teams of Germany and Belgium in 1925 and between the women teams of Germany and Austria in 1930. The International Amateur Handball Federation has been founded in 1928, while the present International Handball Federation (IHF) was founded in 1946. Upon the demand of Adolf Hitler handball was played in 1936 for the first time at the 11th Olympic Games in Berlin. After that it was eliminated from the Olympics in 1940. Because the handball was becoming increasingly popular and highly developed the game returned to the Olympic Games in Munich, Germany in 1972. In 1976 the women's handball was added to the Olympic sports.

- The International Handball Federation (IHF) organized the first Men's World Championships in 1938 and then every 4 or 3 years since the World War II until the championship in Iceland (1995). Since that time the championship has been played every two years. The first Women's World Championships have been played in 1957. The IHF is also the organizer of other competitions for junior selections on the international level.

- Handball is played in 183 countries of the world. As of July 2009 the IHF has registered 166 member countries, representing approximately 795.000 teams or 19 million of players.

- In last decade handball games changed significantly. Changes are evident in speed and dynamics as well as in strength of players on all levels of the game. These changes were also influenced by changed rules related to the initial shot, passive play, greater number of players on a team and various types of dribble.

- In a handball game, particularly in the phase of attack, the attackers dribble and fake a lot. These actions are carried out by players in different ways, with or without the ball, with a change of speed of movement, with a change of direction of movement, etc.

- In counterattack, a player several times dribbles after »false« passing and «false« penetrations. Since in counterattack is more space among players and their

opponents, a player often dribbles with unique repulsion of the ball against the floor. In counterattack the players carry out dribbling to pass the ball to the opposing team's goal and at the end of counterattack, to prepare for a shot in the goal area.

- Players mostly dribble towards the opposite direction of the defender's movement. They make this best, if the direction is changed when receiving the ball so they still have three steps left to dribble. While doing this, they effectively use also side catching when the ball is not carried in front of the body but it is pushed in the new direction already at change of direction. Players must pay particular attention to changes of direction which must be realized convincingly, suddenly and quickly. Instead of step forward in the direction of running, the player drops the centre of gravity and with "rear" leg immediately makes a step in a different direction. It is important that fakes are performed during running and that this is done convincingly. To change the direction, the players also use jump with landing on both feet in front of the defender, but the landing shall be on both feet straight so that one step more remains for the dribbling. For stable support, better balance and easier change of direction, the gap is wide.

- Players dribble also in the offensive position, they may not score, but they will, by all means, attract two defenders and pass the ball to free teammate - much more easily than with the ball in front of the body.

- **The first, "false" step (rush), should be short, the second and the third step after the change of direction shall be particularly rapid in the direction of the goal (Balič). The attacker will withdraw from defender's foul. Particular attention should be paid to the convincing change of direction.**

- IT IS VERY IMPORTANT THAT PLAYERS FACE THE GOAL ALSO DURING THE DRIBBLING AND THAT THEY DO NOT HOLD THE BALL IN FRONT OF THE BODY BUT, WHEN CHANGING THE DIRECTION, THEY IMMEDIATELY REMOVE IT OUTSIDE THE REACH OF THE DEFENDER AND THUS AVOID UNNECESSARY FOULS.

- **I have chosen the subject of learning methodology to dribble in handball for my seminar report because I believe that attractive dribble plays a significant role in the dynamics of a game.**

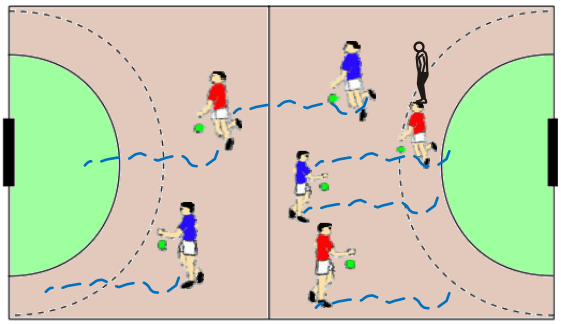
➢ *CONTENTS*

Learning methodology and training of basic dribbling:

- *Warm up exercises containing elements of the dribble (change of direction)*
- *Pre-exercises for learning the elements of the dribble.*
- *Dribble to the left with fake break-through to the right.*
- *Dribble to the right with fake break-through to the left.*
- *Dribble to the left and right after the legs together landing in front of the defender.*
- *Dribble »over the head« /so-called Rađenovič /*
- *Dribble by a pivot*
- *Dribble with »rolling« (turning to the left and right)*
- *Dribble after »fake« pass.*
- *Dribble after »fake« shot.*
- *»Double« dribble to the left and right.*
- *Dribble after ball bouncing.*
- *Basic exercise dribble »to create one player more« (Play 3/3)*
- *Deep in defense dribble 3:2:1.*
- *Attacker´s fake without ball.*
- *Dribble during counterattack.*
- *Misleading of the defender without ball during counterattack.*

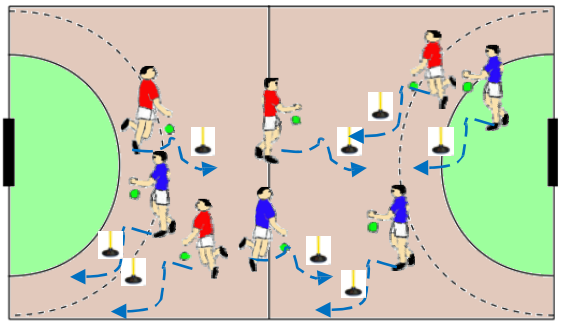
➢ ***DRIBBLE LEARNING METHODOLOGY***

- ***Players warming up***



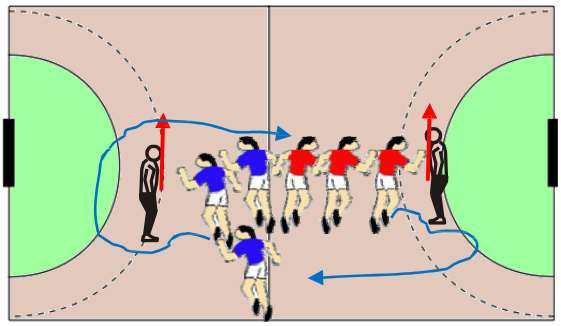
Slika 1:

Bouncing of the ball during slow running and free change of direction, pace, movement and bouncing height.



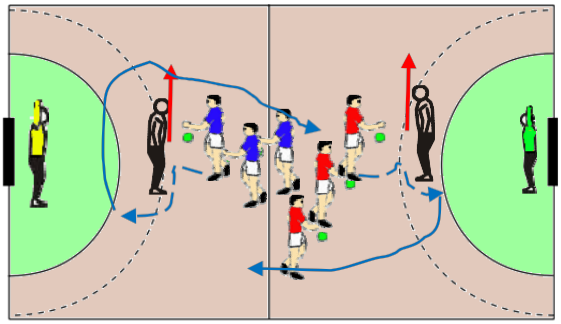
Slika 2:

Players are running on the field and quickly changing the direction of their movement at the positioned hurdle.



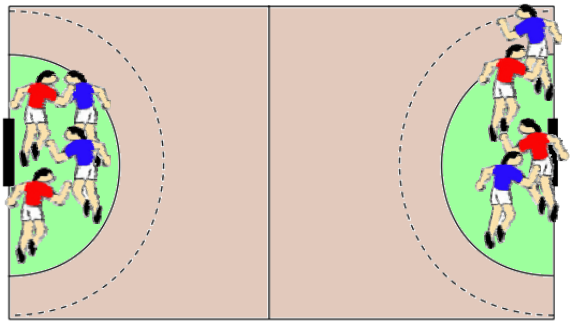
Slika 3:

Players are running in a row towards the center of the field where coach is standing. In the split second move the coach indicates by his hand the running direction.



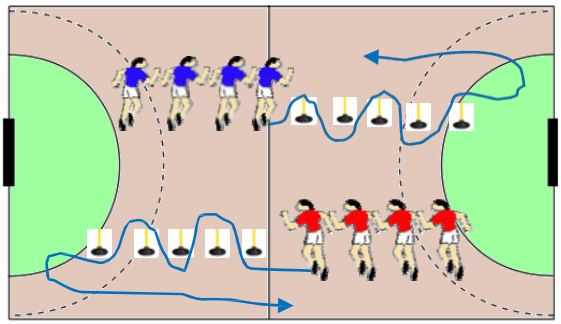
Slika 4:

The same exercise with bouncing the ball.



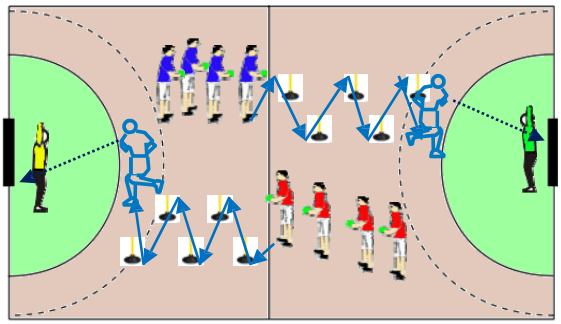
Slika 5:

Catching of pairs inside 6m area. After physical contact the players change roles. Players must avoid playfellows and change direction of movement which is very important for dribbling.



Slika 6:

Running in changing directions left-right (slalom)



Slika 7:

Training the change of moving direction / stopping on the outer leg. /

Training dribble to the left and right side.

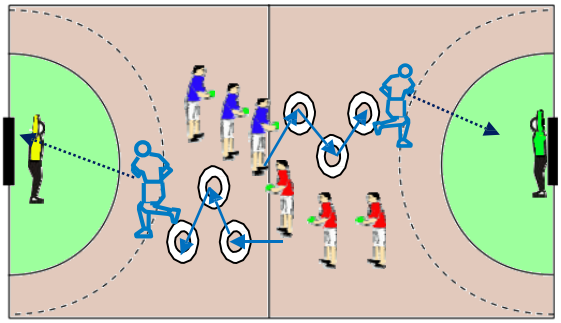
The two-leg landing and fake dribble to the left and right side.

Training of the arm swing over the head (Rađenovič)

Players practice »rolling« to the right and left side.

Indicated «Fake« pass and dribble.

Players practice »double dribble«

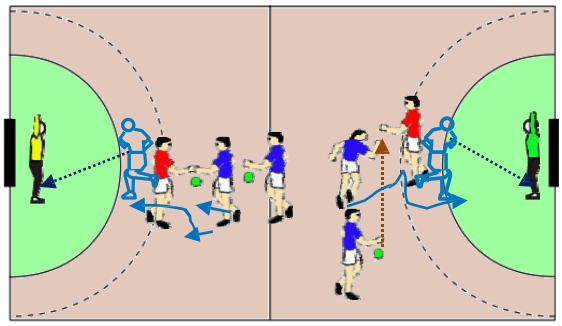


Slika 8:

Jumps, left - right into placed circles.

By jumping we are changing direction of movement to the left and right side. This is very often used in dribble.

- ***»Pre-exercises« for dribble to the right side:***



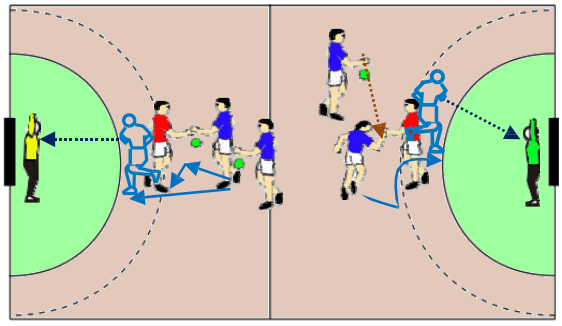
Slika 9:

1. «Step« to the left with the left leg.

2. «Step« to the right with the right leg.

3. Step forward with the left leg.

- ***»Pre-exercises« for dribble to the left side:***



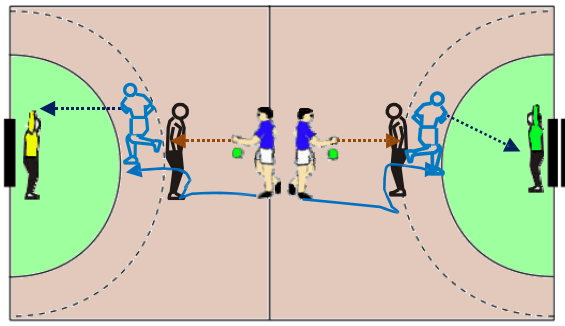
Slika 10:

1. «Step« to the right with the right leg.

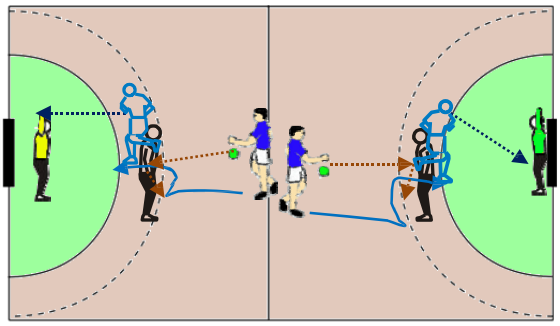
2. Afterwards step to the left with the right leg.

3. Step forward with the left leg.

- ***»Pre-exercises« for dribble to the left and right side :***



Slika 11:



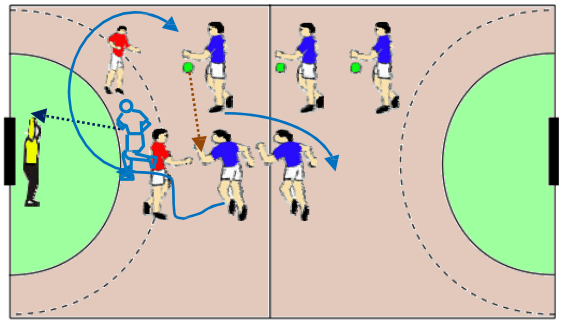
Slika 12:

Coach holds the ball in his right hand which is in stretched out position. The player comes running to the coach, steps forward with his left leg, takes the ball, steps to the right with his right leg, continues with his left leg, jumps up and shoots.

The same exercise, only the coach throws the ball up in the air.

The same exercise to the right side, coach holds the ball in his left hand which is in stretched out position. The player comes running to him, steps forward with his right leg, takes the ball, steps to the right with his right leg, continues with his left leg, jumps up and shoots.

- ***Dribble to the right after pass from the right side***

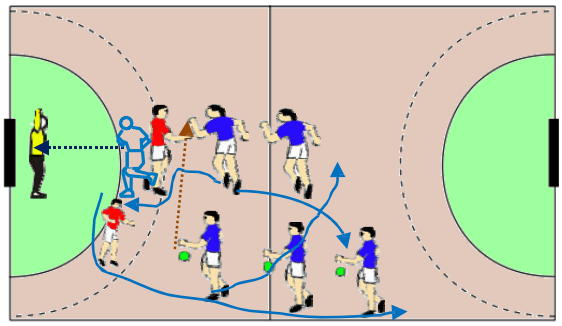


Slika 13:

RB+CB =

When catching the ball the player steps to the left, with his right leg changes direction to the right side and with left leg forward continues directly toward the goal.The second and third step after changing the direction must be performed very quickly. The hand holding the ball is quickly moved away from the defender preventing him to make a foul, however if the foul is already made, the player has a free hand and he can make a shot under foul position or passes the ball to his teammate. The free arm is stretched out in order to prevent any direct impact by the defender.

- ***Dribble to the left after passing the ball from the left side***

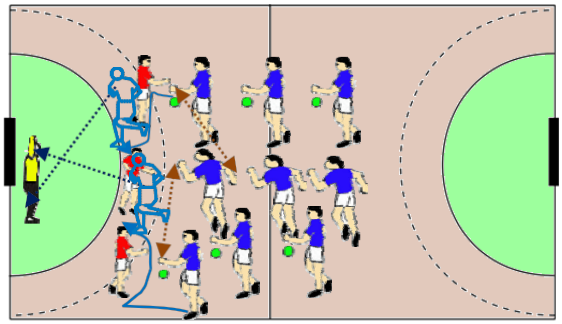


Slika 14:

LB + CB =

When catching the ball the player steps to the right, with his right leg changes direction to the left side and with his left leg forward continues directly toward the goal. Second and third step after changing the direction must be performed very quickly. The hand holding the ball is quickly moved away from the defender preventing him to make a foul, however if the foul is already made, the player has a free hand and he can make a shot under foul position or passes the ball to his teammate. The free arm is stretched out in order to prevent any direct impact by the defender.

- ***Dribble after passing the ball from the left and right side (Organization of trainings)***



Slika 15:

LB+CB+LB=;RB+CB+RB=

After return pass (LB+MB+LB and RB+MB+RB), left back and right back practice dribble to the left and right side (also practice jumps with landing on both legs). The ball must be caught in the direction of »false« break-through and direction of movement quickly changed past the defensive players. The players switch positions.

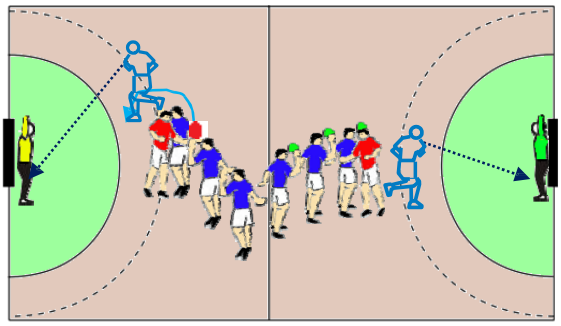
- ***Dribble to the left and right side with jumps landing on both legs simultaneously in front of the defender***


Slika 16:


Slika 17:

This is a form that is most frequent in a modern handball. Players accept the ball in »a zero« step right before landing in »astride« position, which is also best possible basis for dribble in both directions. With slightly bent position of the knees the centre of gravity of the body is reduced, contributing to a stronger push–off in the phase of dribble. By weight transfer the leg flexes a bit more and then follows strong push-off and transfer of the ball into immediate arm swing for a shot. The important point is the weight transfer left-right / right-left without lifting the legs, but only fake break-through indication with the body

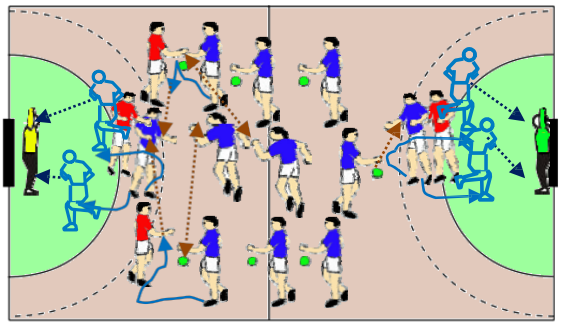
- ***Dribble with the arm swing over the head of a defender (Rađenovič)***




Slika 18:

Dribble is named after a former Yu representative Rađenovič, who performed it for the very first time. In first phase the player with the body indicates a break-through to the right side, after that he swiftly swings with outstretched arm over the defender to the left. The strength of swing is so forceful, that it lifts the defender from the ground. After getting free of the defender he does a short or long jump on the left leg and shoots toward the goal.

- ***Dribble of a pivot***

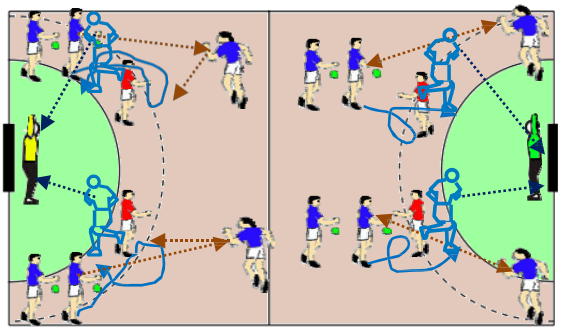


Slika 19:

LB+CB+LB+P=;RB+CB+RB+P=

The pivot gets the ball on the line of 6-m field. In the phase of attack the centre back misleads the defender. It is important that he is rotating on his inner leg and that the ball is not near the defender (turn right on the right leg, carry the ball in the left hand and vice versa – left leg, right hand).

- ***Dribble with »rolling« (turn on right and left leg)***



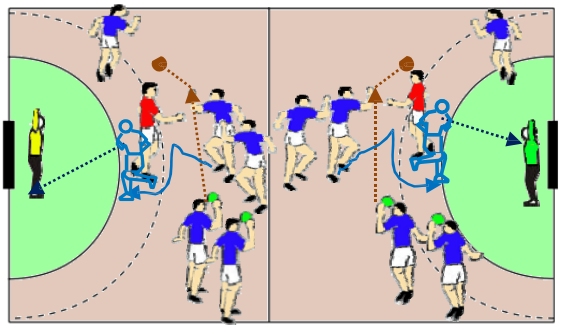
Slika 20:

Miha

RW+RB+RW=; LB+LW+LB=
LW+LB+LW=; RB+RW+RB=

In the past dribble with »rolling« was commonly used. Due to more flexible zone defenses, we are using more contemporary elements at present. In »rolling« the player can carry out the turn on his left leg, followed by steps right-left with any conclusion. The turn on right leg is carried out the same way.

- ***Dribble after fake pass to the left and right side.***

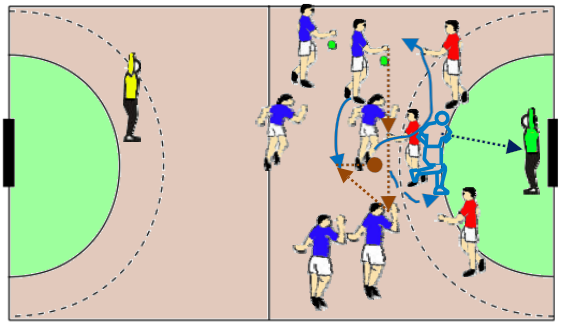


Slika 21:

LB+CB=; RB+CB=

A player simulates a pass toward his playfellow, whereupon he changes his mind and makes change of direction to the other side past the defender. It is important that an attacker convincingly simulates the direction and after that quickly changes it.

- ***Dribble after fake shot in a jump.***



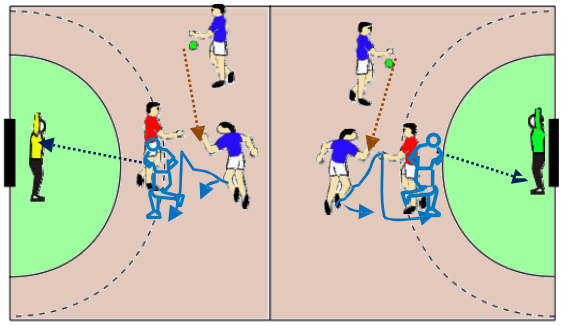
Slika 22:

Combination

LB+CB+RB+LB(CB)=
RB+CB+LB+RB(CB)=

This dribble is used in playing situations, where the attacker after run »on zone«, attempts to shoot in a jump. When he notices, that a defender sest a block well, he changes his mind in a moment and throws the ball on the ground before landing, catches the ball after landing and moves towards the goal. At this moment it is important that the upper part of his body flexes forward quickly and strongly and that he throws the ball on the floor with a short a strong movement of the wrist, so that he exploits the time difference correctly during the jump and the landing.

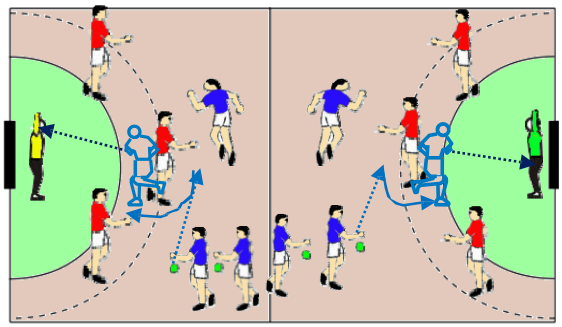
- ***Double fake to the left and right***



Slika 23:

In practice this is an extremely demanding technically-tactical element, however the players in contemporary handball must urgently be fully acquainted with it, since the defenders are already well prepared for »single« deception. First phase must be convincing, not too close to a defender's place as in first dribble. Acceptance of ball is on left (right) leg (» zero step«), first step with right (left) leg indicates the break-through to the right (left), followed by step out on left (right) leg, quick passing of the defender and a shot. It is important to indicate false break-through with a body by shifting of weight left-right (right-left) without lifting the legs and strong push-off in final phase.

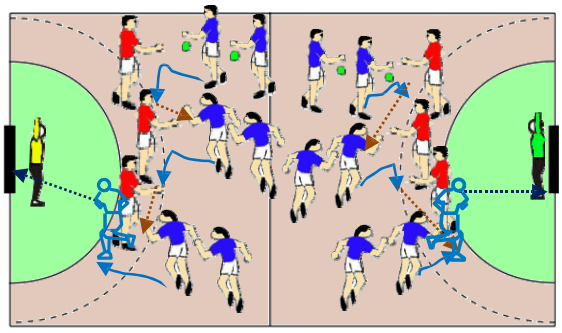
- ***Misleading of the defender after ball bouncing***



Slika 24:

The player can dribble with single or multiple ball bounce. The dribbles are used in specific situations when a player is forced to bounce the ball or on deep located defensive settings. These dribbles are very suitable for players with good motor functions.

- ***The basic exercise dribble » to create one player more« (3 against 3).***

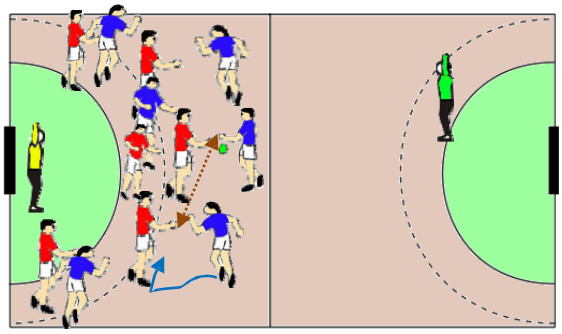


Slika 25:

RB+CB+LB=
LB+CB+RB=

The player must always dribble between two defenders and pass the ball to his teammate prior to an offence. This situation enables uninterrupted shot on goal.

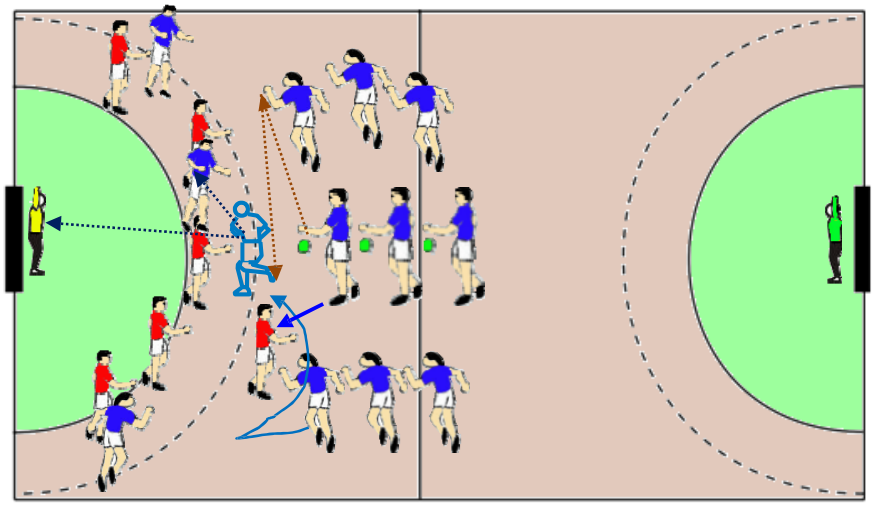
- ***Attack on defense 3:2:1 with dribble***



Slika 26:

Dribble in play is mostly used during the attacks on deep defenses e.g.:3:2:1; 5:1; 4:2..

- ***Attacker faking without ball ("pressing ")***



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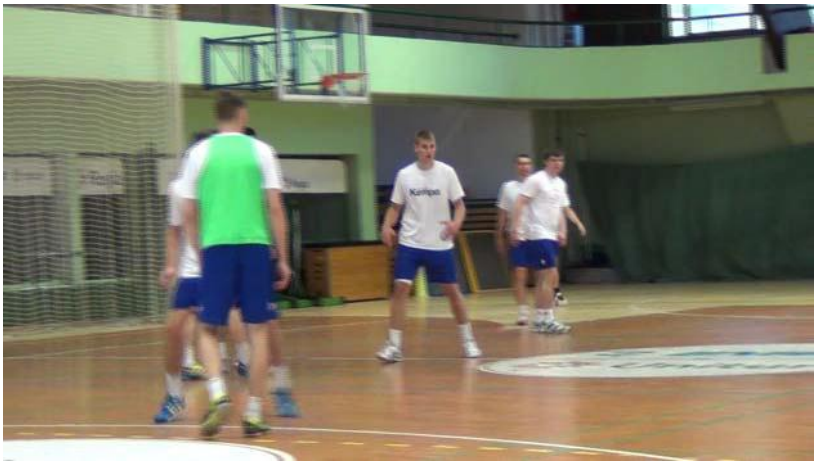
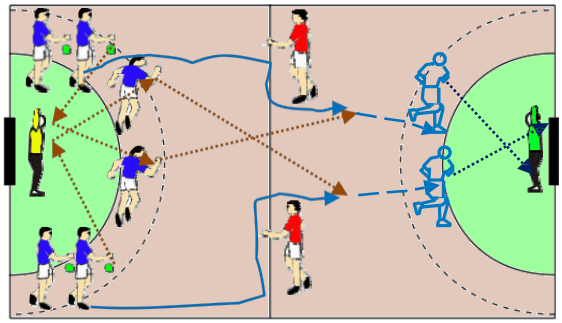


CB+RB+LB= or +P…..(CB make block on defender after pass ball RB)
CB+RB+LB*RB=or continue action.
CB+RB+LB*RB+LB (CB)=or continue action.
***cross**

CB pass the ball to RB (**CB** deploys block on the defender – »pressing«), LB without ball makes fake penetration to the left side faking the defender. RB passes the ball to LB. The LB shoots or continues with another activity (pass to the pivot, cross with RB……..).

- ***Fake without the ball in counterattack***

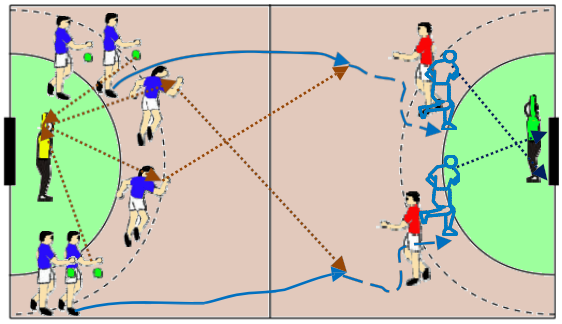


Slika 28:

LW+GK+RB+LW=
RW+GK+LB+RW=

Players without the ball mislead a defender and create an opportunity to get the ball uninterruptedly from the offense and to finish the counterattack.

- Dribble in counterattack (ball bouncing and dribble)



Slika 29:

LW+GK+RB+LW=
RW+GK+LB+RW=

These dribbles are used when the offense during counterattack remains without the help of playfellows, therefore he is forced to execute several ball bounces and after that misleads the defender.

Legenda :

- *Player with ball*

- *Attacker*

- *Shooter*

- *Defender*

- *Goalkeeper*

- *Pass the ball*

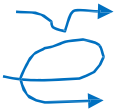
- *Return pass*

- *Shoot on the goal*

- *Bouncing ball*

- *Dribble to the right*

- *Dribble to the left*



- *»rolling«*

- *Circle*

- *Stand*

- *LB (left back)*

- *CB (centre back)*

- *RB (right back)*

- *P (pivot)*

- *GB (Goalkeeper)*

- *LW (left wing)*

DISCUSSION

In the seminar report I wished to represent systematic approach to learning and training different types of dribble and faking.

The training process is gradual from so-called pre-training, toward passive defenders, maximum active defenders, after individual action, after receiving the ball from playfellows and finally to dribble in play situations where the attacker and the defender are fully active.

The success of dribbling is influenced by many factors which are very important in the implementation of these elements:

-The **Fake phase** is the most important, irrespective of the fact whether it is a fake pass, penetration or shot. The more the fake activity is similar to the real element, the greater the chance of successful implementation is.

- **Good coordination of legs** contributes to the ease of the technical performance of numerous ways of dribbling.

- **Rhythmic change of direction** is important, when the defender aggressively steps out towards the attacker.

- **The speed of dribbling** is the most important in the final phase. By the preliminary fake phases we try to unbalance the defender and gain space.

- **Catching the ball in movement** is the basis for the attacker to be much faster and stronger in dribbling.

- **Avoiding fouls allows the continuity of attack**. Here it is very important that a player does not carry the ball in front of the body, but he moves the hand with the ball away from the defender in time. The attacker shall be outside the reach of defender's hands.

- **Oversight over the play** shall be kept also during execution of fake and dribbling. We have to face the handball goal constantly.

- **When performing dribbling with jump**, landing on both feet, the player should pay attention to catch the ball in the so called "Zero" step. He carries out the fake penetrations with the body by transferring the weight (left-to-right and right-to-left) without lifting his legs. He lands in a wide straddle to prepare the legs for further activity. In the final phase he has to energetically take-off.

- Protection of the body. Players insufficiently use their free hand to protect the body. If a player has a free hand in front of the body, he prevents the direct contact with the defender and this allows him to continue his activity without interruption of the attack.

- **Player can efficiently fake** also by looking and transferred movements of the body in opposite direction.

➢ CONCLUSION

For learning and methodology it is important:

- The players first learn about fake and dribbling.
- That we show and explain dribbling and fake.
- Use of pictures, videos and other visual elements.
- We have to teach elements of dribble gradually.
- During implementation of the activity we need to make sure that players do not make steps.
- It is also the problem during fake with indicated shot and taping the ball to the floor (has the player dropped the ball before or has he touched the floor together with the ball).
- Players shall first practice a lot of dribbling without and with an active defender.
- When the players master the dribbling activity, they shall use it in situations where the attacker and the defender play fully active.
- In the modern handball there are more different dribble elements, which will help the attackers to easier penetrate past so-called specialist of defense, which will make the handball even more attractive.

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***Coach career**:*

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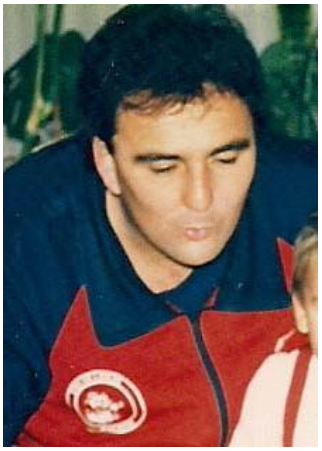
Woman handball club Mlinotest Ajdovščina (1994 – 1995)-first league

Youth handball club Gorenje Velenje (1996 – 2007)

Woman handball club Nazarje (2010 -))-first B league

***National level**:*

Coach of the woman team of Slovenia (1993 – 1995)
Coach of the youth female team of Slovenia (1993 – 1995)

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Master Coach Course

Defensive Assignments in the 3-2-1 Defensive Formation

(Seminar paper)

Mentor: Dr. Marko Šibila

Author: Zoran Jovičić

Koper, June 10, 2013

ABSTRACT:

The 3-2-1 defence emerged in the 1960s in the area of former Yugoslavia. It is a deep zone defence with multiple variations and has seen some significant development through the years. Its style, especially when defending against two line players, has changed considerably compared to its beginnings, but the basic idea of the 3-2-1 defence has remained the same to this day.

Keywords: handball, 3-2-1 defence, game analysis

CONTENTS

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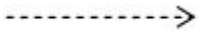
KEY:

attacker 

defender 

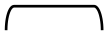
ball 

pass 

shot 

dribbling 

feint 

screen 

player movement 

1 INTRODUCTION

Games that include throwing a ball by hand towards a certain destination have been played for a long time. The 19th century saw significant development of games similar to handball, but handball itself only appeared at the end of this century. In 1898, the *handebold* game emerged in Denmark - it is now considered the immediate precursor of modern handball. The court dimensions were 30x40 meters with a marked goal area that players were not allowed to enter. Each team had 11 players. The rules of this game were recorded and published in 1906 and 1926.

Modern handball no longer consist of static defences and attacks that aim to outsmart such defences. The activities are much more evenly spread along the entire court (fast break, extended fast break, quick repeated attacks, transition into defence, deep zone defences, man-to-man defences, combined defences etc.).

Defensive developments have also followed the global trends in handball:

- Teams return to defence faster after scoring a goal
- Preventing fast breaks and fast breaks initiations in the offense half
- Transition adjustments depending on the opposition
- The most frequent defensive formations are 6-0, 3-2-1, and 5-1.
- Individual defensive adaptation based on the attack and own defensive abilities, as well as ever smaller differences between the typical formations
- More effective prevention of passes to line players
- Faster and better footwork and improved coordination and orientation
- Better physical condition and tactical preparation
- Use of defensive specialists, especially in the middle block of the defence

Handball is a complex game that consists of various individual and collective technical/tactical elements and components. All these details are used in cooperation with or conflict between all parties that participate in the game of handball. Some situations and challenges on and off the court are predicable and we can prepare for these accordingly at least to some extent. Others are unpredictable and unique, or occur very rarely. In order to understand the game better we have broken it down in phases and parts due to its complexity.

The basic definition consists of two main phases:

- Defence - The oponnents have the ball and our team defends against them and tries to prevent them from scoring a goal;
- Attack – Our team has the ball and tries to score a goal (Šibila, 2004).

This seminar paper is focusing on the defence phase, specifically the 3-2-1 zone defence. Defence consists of multiple sub-phases - from the moment the team loses the ball to the moment when the ball is won back.

Handball defence can be broken down into two sub-phases:

- Turnover play - Teams try to return into defence in an organized wayto prevent fast breaks and to form a man-to-man, zone or combined defence as quickly as possible.
- Set-Defence - Teams use zone, combined or man-to-man defence (man-to-man defence is used during transition as well – for example an organized defensive formation after a lost ball without actually forming a zone or combined defence) (Šibila, 2004).

1.1 Defence characteristics: man-to-man, zone, combined

This section describes the basic characteristics of the three defence types: man-to-man, zone, or combined.

1.1.1 Man-to-man defence

Man-to-man defence is ideal to fulfil the educational goals during regular physical education classes in schools and during training sessions of school handball teams. In competitive handball at the highest level, man-to-man defence is rarely used in official matches, because most teams use zone or combined defences which are better suited to competitive play, due to the fact that they are concentrated on a limited area of the court where the attackers have the best chance of scoring. Man-to-man defence is used only in the dying minutes of matches, when the losing team tries to force the opponents into mistakes (finishing the attack to quickly and inefficiently). However, teams can also use man-to-man defence to surprise the opposition and win a few balls by changing the tempo and, if successful, the course of the game (Šibila, 2004).

When we are introducing handball to new players, the result is of secondary importance and it's better to use man-to-man defence. The most important reasons for this decision are:

- Technical/tactical requirements to play defence successfully are higher for zone or combined defences compared to man-to-man defence. Because children at the beginning do not have the necessary skills for playing the defence successfully, man-to-man defence is more appropriate. An even more imporant reason is a lack of technical/tactical skills needed to attack a zone or combined defence. To play against a zone defence successfully (even if the defenders themselves are not very good at it), players must possess far more technical/tactical skills (especially group and collective skills) than for man-to-man defence. Because beginners lack this knowledge, the game gets boring, there are few goals and the cooperation between players is weak.
- The responsibility of players is much higher, mistakes are clear, because everyone is responsible for their own opponent.
- The higher the number of activities executed by the players (runs, jumps, shots etc.), the higher the game dynamics which leads to faster development of motor and functional skills. In addition, technical/tactical abilities will improve as well.
- Players learn to execute various technical/tactical skills in difficult conditions, because they have to catch and pass the ball and make themselves available under constant defensive pressure, so every mistake can prove fatal.
- The whole team participates, not just one or two best players - this can also be achieved by adapting the rules.
- Modern handball requires that the game must be played on the entire court (various types of fast breaks,turnover play). The skills required of players to play in modern handball successfully can be developed faster by using man-to-man defence. For this reason, children must be trained to develop those skills that will be useful later when playing at higher levels (Šibila, 2004).

1.1.2 Zone and combined defence

In zone defences, every defender is responsible for defending a certain area on the court i.e. is responsible to defend against the attacker entering this area. In addition, defenders must also support teammates if necessary. In combined defences, one part of the team plays zone defence, while one or two players play man-to-man defence. Teams use combined defences when the opposition has a particularly dangerous player (or two) who is crucial for their success. This player is usually a successful score or a great playmaker. By using a combined defence, the defenders are trying to prevent this attacker from even receiving the ball (very tight marking) or they are trying to thwart his actions immediately after receiving the ball, because these activities could result in a goal or a goalscoring oportunnity (man-to-man marking from a distance). There are various zone (e.g. 6-0, 3-2-1, 5-1, 4-2, 3-3) and combined defences (e.g. 5+1, 4+2) (Šibila, 2004).

Every zone defence must fulfil three requirements:

1. **Zone defence width:** In principle, defenders in every zone defence should use various activities to mark attackers along the entire width of the court. The attackers should be able to shoot only from tight (dead) angles (approximately 20 degrees from the goal line). Of course, this depends on many factors - the quality of the shooter, the quality of the goalkeeper, tactics etc.

2. **Zone defence density:** In every location where attackers have a chance to break through the defence, the defence must be dense, so that defenders can use various activities to prevent the attackers breaking through.

3. **Zone defence depth:** In handball, goals are scored not only from the wings or after breakthroughs on the line; good shooters can score goals from a distance of 9 or 10 meters or even further away from the goal. The best location to score goals from distance is the middle of the court. This means that the depth requirements are the greatest in the centreof the defence (Šibila, 2004).

In essence, the most frequent basic defensive formations have different characteristics in terms of the these three basic requirements.

- 3-2-1 offers depth, but has weaknesses in terms of width and density
- 6-0 offers width and density, but its weakness is depth
- 5-1 offers all three, but to a lesser extent and is, in a way, a compromise of the two

2 SUBJECT

I will analyse how defenders have to play in a 3-2-1 zone defence. This defence is a deep zone defensive formation. The defenders' starting positions are further up the court - closer to attackers. The basic formation resembles a triangle with the defenders standing in three levels in terms of depth. The two first defenders (left and right) and the back-centre are standing at the goal area line. A bit further forward we find the second defenders from the left and right, and the forward is even further ahead.

Vlado Štencl, a Yugoslav handball coach who won an Olympic gold medal at the 1972 Games in Munich, is considered the father of the 3-2-1 defence. The formation should prevent shots from the backs which is the one great weakness of the 6-0 formation. The triangle positioning allows defenders to go deep far from the goal to close the attackers down sooner. In addition, it increases the defence density in the most dangerous central area.

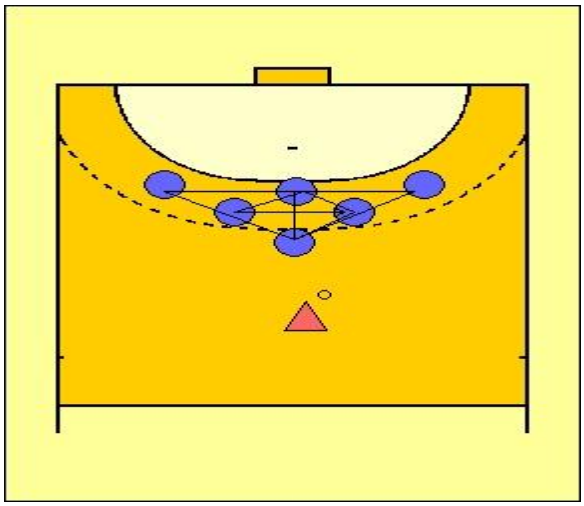


Figure 1.a: The basic defensive formation of the 3-2-1 defence when the ball is with the CB

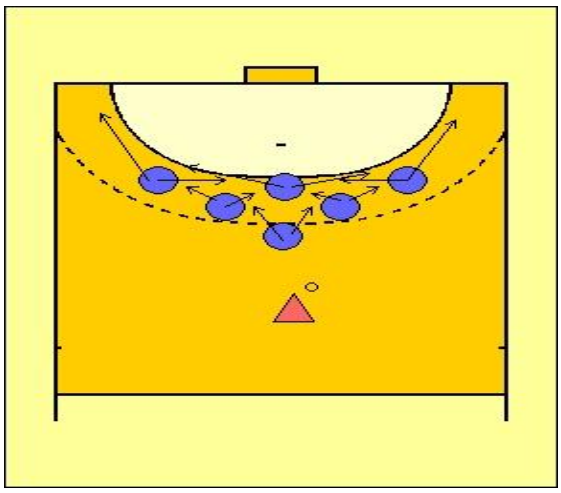


Figure 1.b: Defensive movement

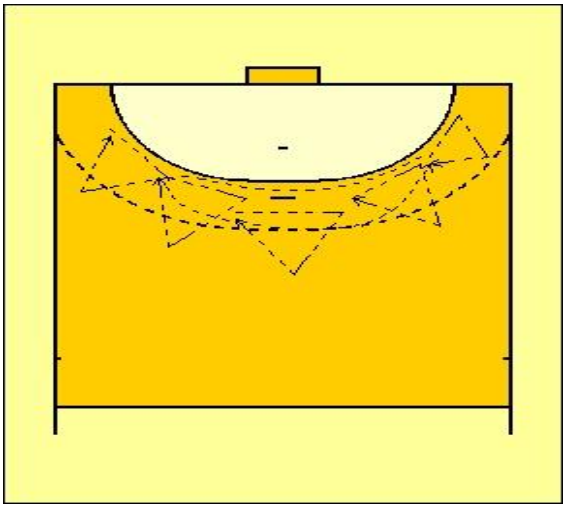


Figure 1.c: Defenders' area of operation

In recent years teams at the highest level have mostly used the 6-0 defence. However, two teams that regularly win medals at competitions at the highest level - Croatia and France - use 5-1 and 3-2-1 defences. In recent years, they have been joined by Montenegro as well. The Croatian variant of the 3-2-1 defence is unusually shallow and very mobile which makes it even denser. On the other hand, the 6-0 defence - being the most frequently used defence - has gradually become deeper with defenders falling further out. In some aspects, it already includes elements of the 3-2-1 defence. The essential issue of defence training is the player movement and specific situations against two line players - this can be particularly problematic at youth levels. In this defence, younger children leave even more space around them and the slightest error can lead to a lot of space for line players.

3 METHODS AND OBJECTIVES

This seminar paper aims to:

- Analyse the defenders in terms of solving the typical situations in the 3-2-1 zone defence
- Analyse the differences of various types of the 3-2-1 defence
- Describe examples of exercises to train typical assignments in the 3-2-1 defence

In this seminar paper, I have used domestic and foreign handball references, in particular in chapters dealing with the 3-2-1 defence. In addition, I have relied on my extensive experience acquired during years of playing handball at the highest level and working with some of the best and most experienced coaches, as well as my the experience gained during my short but already rich coaching career.

Image 1

4 3-2-1 DEFENCE RULES

In addition to perfect tactical preparation and physical condition, the 3-2-1 defence requires a lot of cooperation between players. The cooperation must follow the initial instructions and assignments defined by the coach. The coach's rules must be followed to the letter, because this defence does not allow any improvisation or individual defensive interventions. If the players follow the rules and cooperate correctly, the coach can expect this formation to be successful (Šibila, Bon and Pori, 2006).

The defensive position of a player does not depend only on their defensive abilities, but also on their respective attacking position. If the abilities of our players allow it, teams should play in the following formation:

DEFENCE	ATTACK
first defender from the left	left back
second defender from the left	left wing
Back-centre	centre back
Point (=forward)	line player
second defender from the right	right wing
first defender from the right	right back

This formation allows the fastest transition into fast breaks and later into an offense set-play. The players have the shortest routes to their offense positions which leads to high-quality attacks against a fully or partially formed defences - which in turn means that it is easier to score goals. This formation also allows good transition into defence, because players can quickly return and form the required formation as soon as possible. This is a prerequisite for a successful collective defence, such as the 3-2-1-defence.

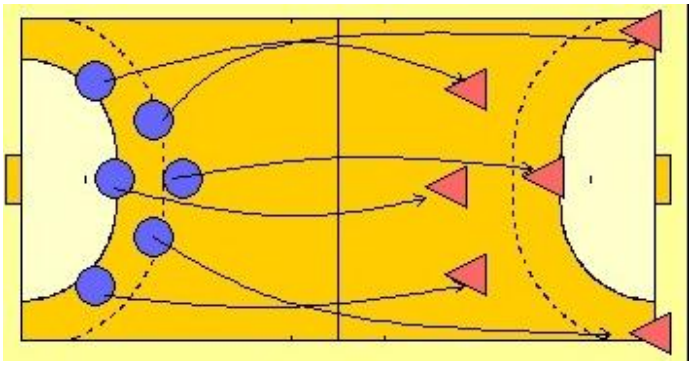


Figure 2: Formation and transition routes of players in 3-2-1

Advantages of the 3-2-1 defence

- Quick transition into fast breaks after winning the ball, because the defenders are located at least nine meters from the goal line
- Preventing shots from distance
- With a quality goalkeeper, who is better at saving wing and line shots, we offer the goalkeeper a chance to take advantage of his strengths and save a higher percentage of shots
- Quick throw-off after conceeding a goal
- If a defender is beaten in a one-on-one situation, there is time for teammates to help due the formation's depth

Disadvantages of the 3-2-1 defence

- Can only be played if the players are in excellent physical condition
- A lack of concentration at the beginning and tiredness at the end of matches
- Due to large depth, problems can occur in terms of width and density of the defence
- Errors when attackers use two line players
- If we do not use the ideal attacking and defensive formations, players' routes will cross in transition

4.1 Defensive assignments at individual defensive positions

This section contains descriptions of assignments at individual defensive positions in the 3-2-1 defence. At the same time, it also deals with various ways of solving specific situations that occur when one of the attackers starts some transition to the line. Furthermore, it contains descriptions of various situations occurring at different positions with the solutions depending on the coach's tactical formation.

The first two defenders

The first two defenders are very important in the 3-2-1 defence - in fact considerably more than in other formations. This formation tries to force the attackers to shoot from the line, especially from both wings, so the first two defenders are very important - their movement can reduce the shot angle of the opposing winger. They can also affect the timing of the transitions to the line made by the opposing wings and, by doing so, break down the offense dynamics and the timing of the attackers' positioning.
By moving laterally, they increase the density and visually reduce space which makes it more difficult for the attackers to see passes or execute set-plays. The first two players almost always move laterally - if they were to move forward and back they would allow opposing wings to take advantage of the space behind them and run to the line.
When the opposition is using two line players, it is very important that they close down the space towards the centre as far as possible when the ball is on the other side. By doing so they reduce the distance the back-centre has to cover between the two line players.
Moving forward and back is allowed only when we want to prevent wings from receiving the ball. By moving forward, the first defender prevents the back from passing the ball to the wing and narrows the space available to the attackers. This slows down the flow of the ball and the speed of the left or right back's piston movement. However, this defence is wider and has more gaps which can lead to a quick pass to a player making a cut.

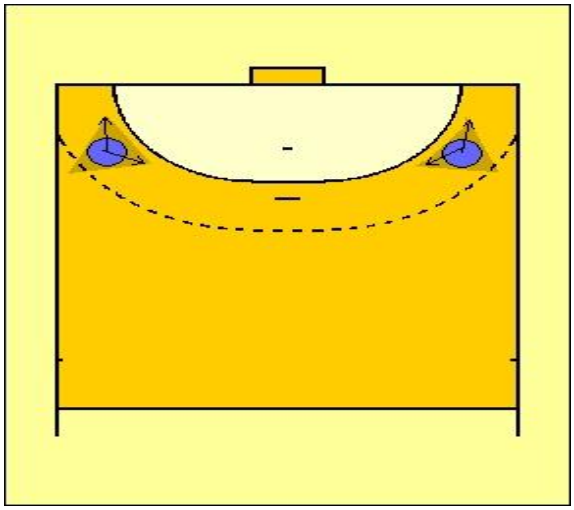


Figure 3: First defenders

The back-center

The back-centre is limited to the goal area line. The area he has to cover depends on the support by the two first defenders. His main task is to mark the line players, but this is not the only one: he must also support other teammates who lose their attacker in a one-on-one situation. At the same time, he is the leader of the defence who informs the other defenders of screens and cuts to the line.

As already said, his basic movement is limited to the goal area line, but he can still come forward in exceptional cases. Coaches can use various variants of the centre-half movement when the opposing line player screens one of second defenders or the forward. In one variant, the back-centre is following the line player making the screen, pushing him towards the attacker to prevent him from moving into the open space after the screen to receive the pass. The other version consists of the back-centre staying on the line and trying to block the shot from distance. This variation can be used when the back is not a good shooter.

When one of the attackers cuts in to the line, the back-centre must repeatedly move from one line player to the other, help any teammates who lose their defender, and block shots.

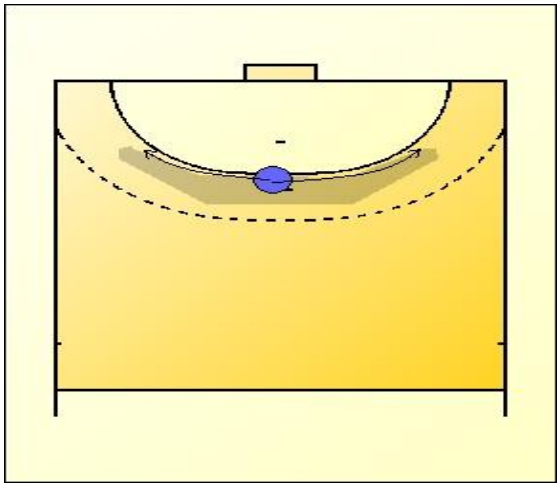


Figure 4: Movement and area of operation of the centre-half

Image 2

The second defenders

The second defenders operate between the goal area line and the 9-meter line; if the attacker is extremely dangerous, they can go even deeper. Their main job is to prevent shots from distance and to cover the space between the goal area line and the 9-meter line when the ball is on the other side - this will provide the depth of the defence. Their movement resembles a triangle. A special danger for the second defenders are blocks by the line players. When the line player blocks them, they must move directly towards their attacker to avoid the block. If this is not possible, the back-centre must mark the back and the second defender must move in front of the line player to prevent him from receiving the ball.

When the opposition is using two line players, the second defenders must move towards their respective attacker when he has the ball; when the ball is on the other side, they must mark the line player closer to them.

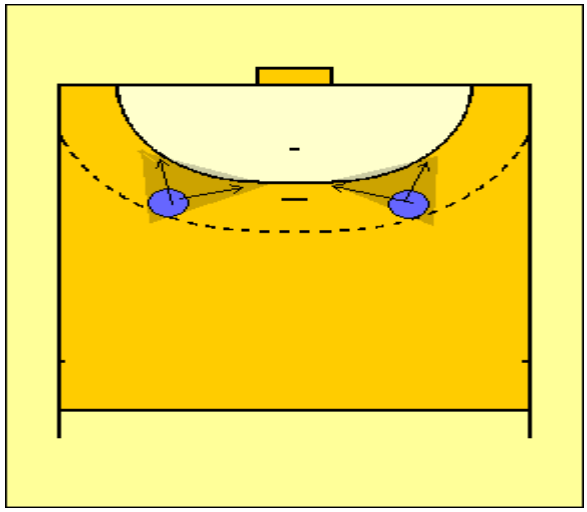


Figure 5: Movement of the left and right second defender

Image 3

Forward (Point)

The forward marks the centre back or the player who arrives at this position. His main task is to cover the area around the penalty shot line when the ball is on the left or right-hand side to increase the depth of the defence. The forward constantly faces feinting by the centre back. In addition, he must assist the second defenders when the left or right back is attacking towards the middle, as well as provide depth when the centre back crosses the ball to one of the shooters at the left or right back position.
When an attacker cuts in to the line, the forward must move back and try to prevent the diagonal pass to one of the line players. If one of the backs makes a run towards the middle, the forward must leave the line player to another defender and close down the player penetrating.

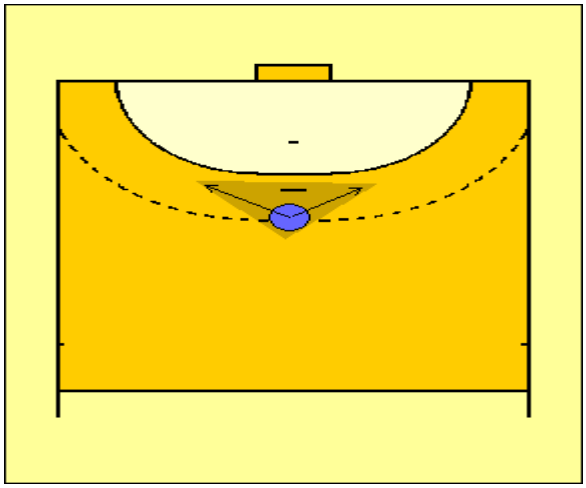


Figure 6: Movement and area of operation of the forward

4.2 Basic positioning of defenders in the 3-2-1 defence depending on ball location

Ball with the wing

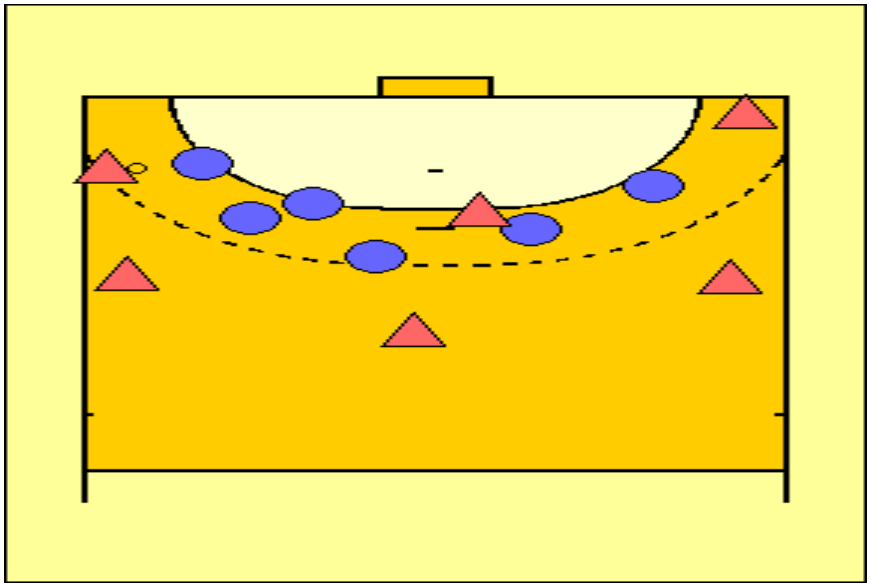


Figure 7: Ball with the left wing (the LP stands on the opposite side)

a) When the ball is with the left or right wing and the line player is on the opposite side, the entire formation moves towards the ball. The first defender marks the wing with the ball and the second defender partially covers the space where the wing could break through the defence and at the same time also follows the movement of his own attacker. The centre-half moves towards the ball and also covers the pass to the line player. The forward moves diagonally and marks the centre back and, if necessary the left back if he makes a run very far towards the middle. The other second defender moves to the goal area line to prevent a pass to the line player. The distant first defender must prevent a run of his wing to the line as well as a zepellin pass to the distant back.

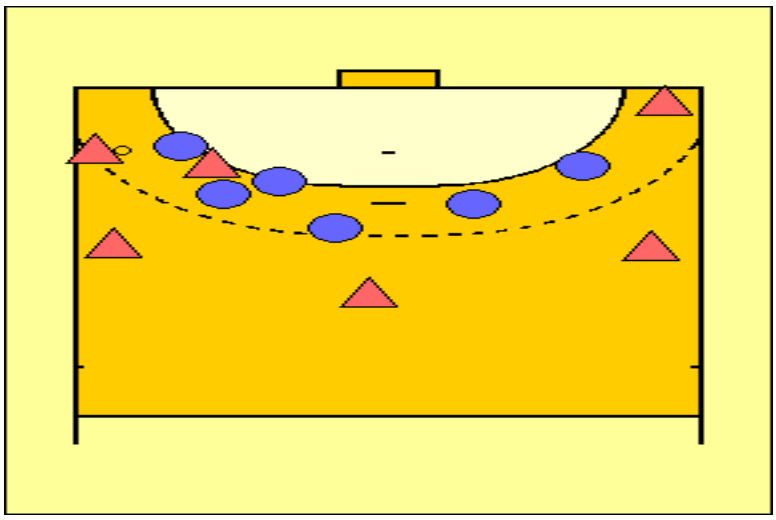


Figure 8: Ball with the left wing (the LP stands on the same side)

b) When the wing has the ball and the line player is on the same side, the second defender is even closer to the goal area line to prevent a feint or a pass to the line player. The back-centre moves to the line player, and the forward's positioning stays similar to the situation above. The same holds true for the distant second and first defender, except that the second defender can stay a bit deeper forward because there is no one on the line. The first defender must pay attention to the sweep of the wing to the line.

The ball with a backcourt player

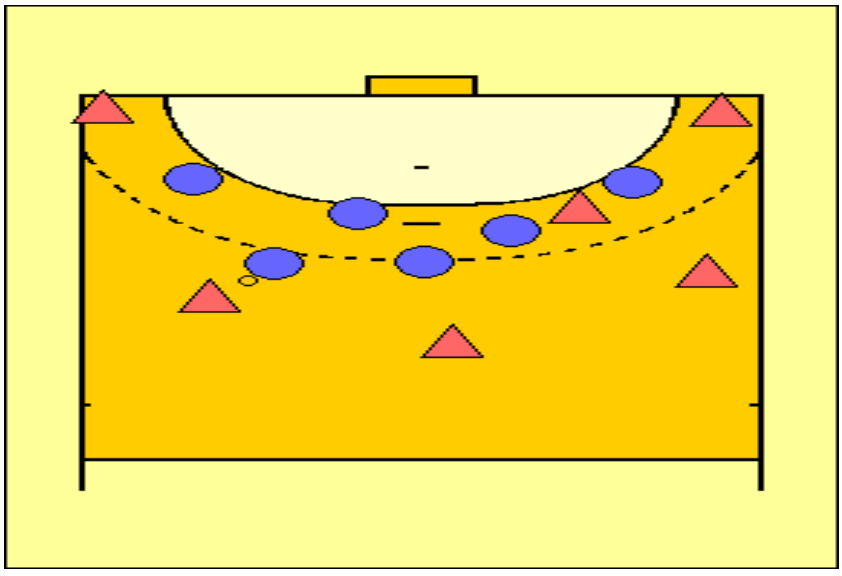


Figure 9: Ball with the left back (the LP stands on the opposite side)

When the left or right back has the ball and the line player is on the opposite side, the second defender on the side of the attacker with the ball moves closer to the attacker to prevent a shot from distance. In addition, he also reduces the space available for a run up which would make a feint easier to execute. The back-centre stands at the goal area line between the ball and the goal to be able to block a shot from distance. The forward covers the diagonal pass and stands at a distance of eight meters from the goal while also paying attention to the movement of the centre back. The second defender on the other side stands on the goal area line and marks the line player. The far first defender moves towards the middle and must mark the wing as well as the back if he makes a quick run and receives the ball on the 9-meter line. The left and right first defenders must be focused on possible runs to the line by the opposing wings.

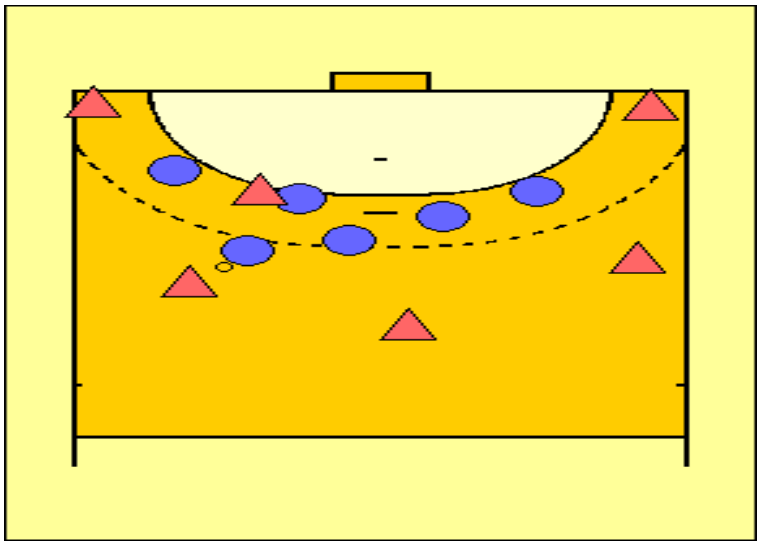


Figure 10: Ball with the left back (the LP stands on the same side)

b) When the left or right back has the ball and the line player is on the same side, the second defender must move even closer to the attacker with the ball to prevent a shot as well as a screen by the line player. If the line player nevertheless manages to screen the defender, the back-centre must comes for help. The forward moves to the side of the player with the ball while still paying attention to the centre back. The second defender on the other side stays close to the line to reduce the space available for the line player. Both first defenders, especially the one opposite of the ball, must pay attention to the cuts to the line by the wings.

Positioning of defenders when the ball is with the centre back

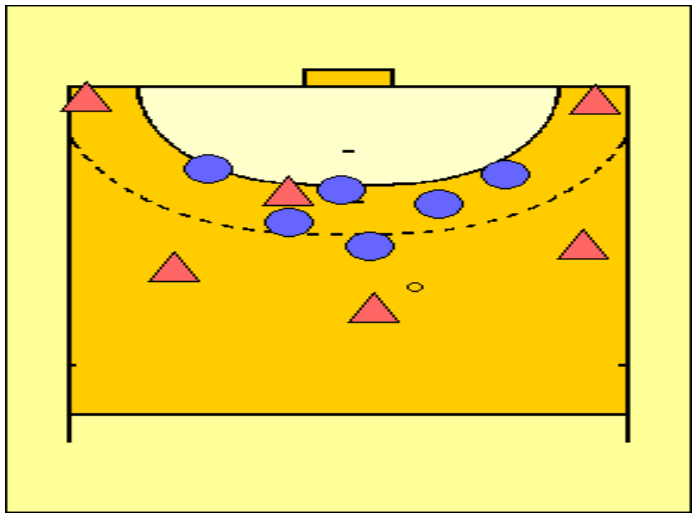


Figure 11: The centre back has the ball (the LP is on the attacker's left side)

The positioning of the defenders when the centre back has the ball stays the same regardless of the line player's position. The only difference is whether the line player is closer to the wing or the middle. The point goes deep towards the centre back, the second defenders move about a meter away from the goal area line to help him in case the centre back executes a feint and to prevent passes to the line player with their arms. In addition, they must pay attention to the pass wide to their respective back. The back-centre stands behind the forward and marks the line player. Both first defenders must pay attention to cuts to the line by the wings as well as the diagonal pass to the back - in this case they must close down the space between the first and second defender.

In case the offense will use two line players, the forward moves back to the penalty shot line and is preventing passes to the line players.

Supporting a teammate who lost his player in the 3-2-1 defence

When a defender loses his player, the closest teammate as well as the back-centre must help. The back-centre must stand between the ball and the goal and is the last one who can stop any attacker. In addition, he must also block shots and prevent passes to the line player. The positioning of the back-centre increases the defence density on the side of the attacker with the ball - this means that it is easier to foul or stop opponents in their activities. The back-centre must move a lot which means that a 3-2-1 defence must strive to interrupt the attacking play as quickly as possible. However, an unfavourable situation when a defender loses his player can quickly turn into a favourable one by intercepting a pass due to the increased density and additional help from teammates. This will occur only if defenders are fast and have good understanding.

Defending against two line players

The general tactics can differ a lot. Some use 4-2 or 6-0 defences, but in essence, the objective of the defence when facing two line players is to prevent the second line player to arrive at his position on time and to interrupt the attacking play as quickly as possible.

- *A run from the wing:* The most important task of the first defenders is to stop the wings from cutting in along the goal area line (behind the defenders' backs) because the other defenders will not be able to spot them on time and react accordingly. The attacker must be pushed in front of the defence and passed along to the next defender (second) while also alerting all other defenders - the wing is now less dangerous and actually increases the density of the defence which makes the job of the defenders easier. It is important that players are always aware of the attackers' positions; otherwise it can happen quickly that one of the first defenders has no one to mark.

- *A run from the back:* Again, it is important that the player making the run is held back and passed on to teammates. This interferes with the timing of the positioning in attack and allows the defenders to interrupt the attack quicker. The objective in defence is to interrupt attacks as often as possible, because this prevents the attackers from organizing attacks.

Defending against blocks and screens by the line players

When a line player blocks the forward or one of the two second defenders, it is essential that the back-centre loudly alerts the defender of the block. This allows him to avoid the block in time and close down his own attacker. A less ideal solution is that the forward takes the line player and the back-centre tries to block the attacker's shot or closes him down.

5. TRAINING METHODS

Even in youth categories, training individual defensive movements and assignments forms the basics of 3-2-1 defence training. Later we must teach our players how to help teammates and pass the attackers on as well as how to react when the attackers use typical set-plays. There are a lot of exercises to train motor skills and technical/tactical abilities. I will describe a few of them below.

Exercise 1 Playing one-on-one after a pass from a teammate

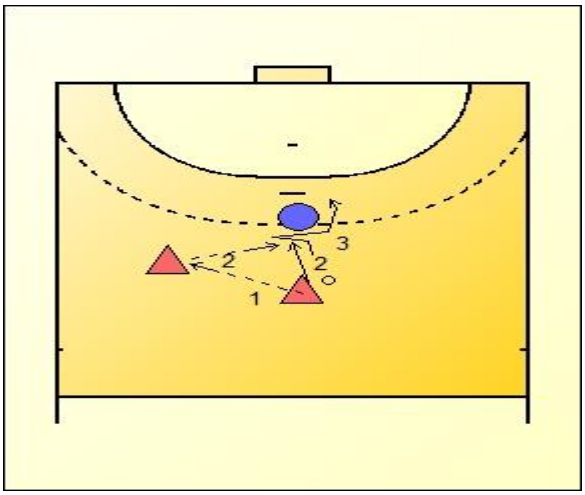


Figure 12: Playing 1-on-1

Tools
Balls

Exercise description:
The defender is standing in the diagonal defensive stance with the chest facing the attacker with the ball. The attacker passes the ball to an open teammate who passes it back. The attacker receives the ball in full flight and tries to beat the defender and score.

Variations
- The defender must execute an additional exercise before the attacker receives the ball (various movements, jumps etc.)
- The defender passes the ball to the attacker
- The activity starts with a dribble

Exercise 2 Playing two-on-two against two second defenders

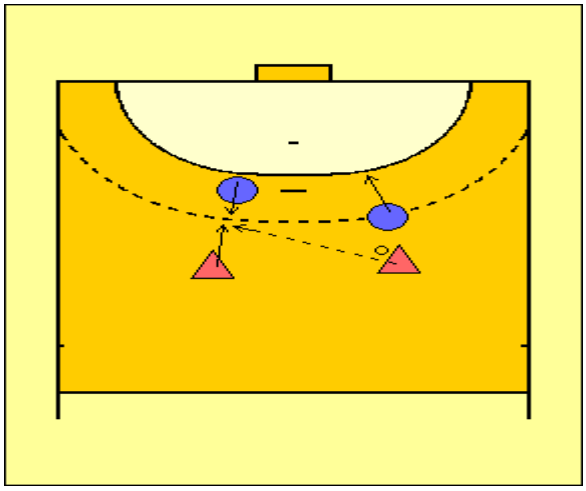


Figure 13: Playing 2-on-2

Tools
Balls

Exercise description:
The defence consists of both second defenders and the attack consists of the left and right back. The attackers are repeatedly passing the ball in piston movement and the defenders are closing them down and returning back to about 7 meters from the goal. The attackers are alternately approaching the defence and passing the ball and the defenders are alternately moving forward and back.

Exercise 3 Playing four-on-two against two second defenders

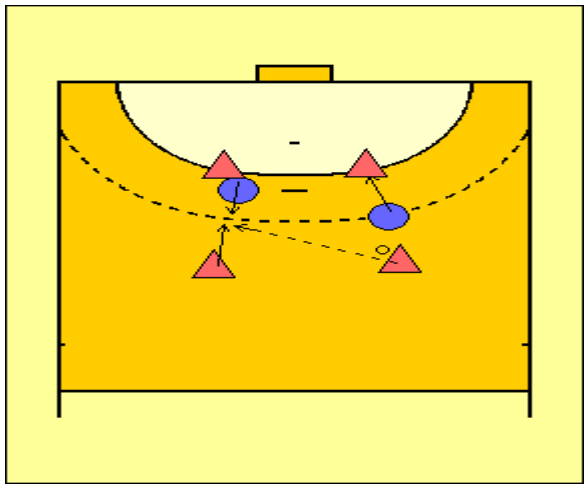


Figure 14: Playing 4-on-2

Tools
Balls

Exercise description:
We have four attackers (two backs and two line players) and two (second) defenders. The backs are passing the ball in piston movement. After a few passes, they can also pass diagonally to a line player (the line players are standing on the line and do not move). Both defenders must close down the attacker with the ball (each their own) and prevent the diagonal pass by quickly moving back when the ball is in the hands of the other attacker.

Variations
- Playing with only one LP (on the left or right-hand side)

Exercise 4 Playing two-on-two against the first and second defender on both sides at once

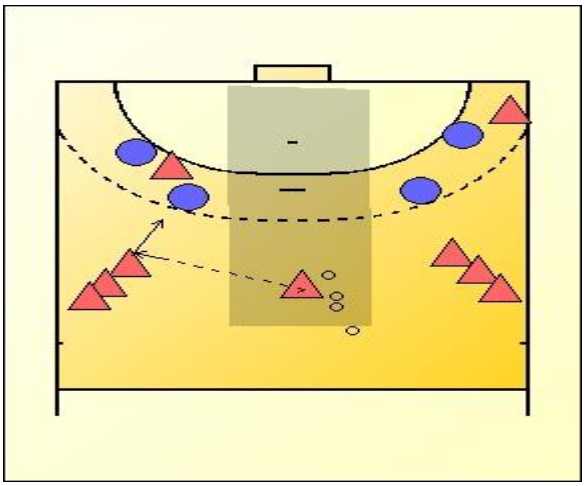


Figure 15: Playing 2-on-2 on both sides

Tools
Balls, cones, training bibs

Exercise description:
The court is divided into two equal parts with cones. In addition to the first and second defender on both sides, we also have a LP on one side and a wing on the other. An additional player is located in the middle of the court, but no one marks him. He is passing the ball to the backs on both sides and they must receive it in full flight. After receiving the ball, the back plays 2-on-2 with the line player or the wing. After the end, the left back moves to the right back and the right back goes the other way.

Variations
- Playing with a line player on both sides
- Playing with a wing on both sides

Exercise 5 Playing four-on-three against two second defenders and the centre-half

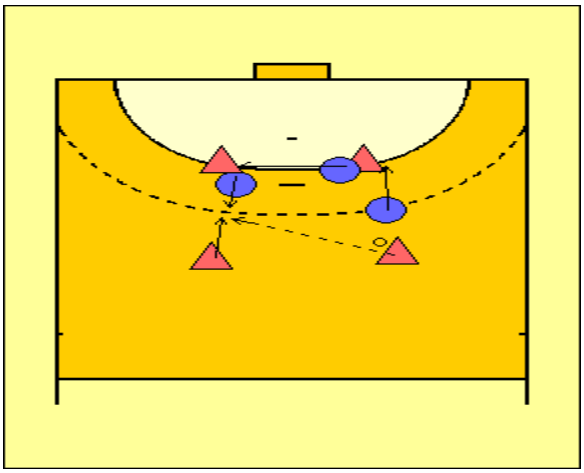


Figure 16: Playing 4-on-3

Tools
Balls

Exercise description:
The defence consists of three defenders (both second defenders and the back-centre) and the attack of two backs and two line players. The backs are passing the ball to each other in piston movement. After a few passes, they can also try to pass the ball to one of the line players. Each second defender is closing down his attacker when he has the ball and is returning to the line when the ball is on the other side to prevent a diagonal pass to the line player. The back-centre is following the flight of the ball from one line player to the other and must prevent straight passes to the line players.

Exercise 6 Playing four-on-three against two second defenders and the forward

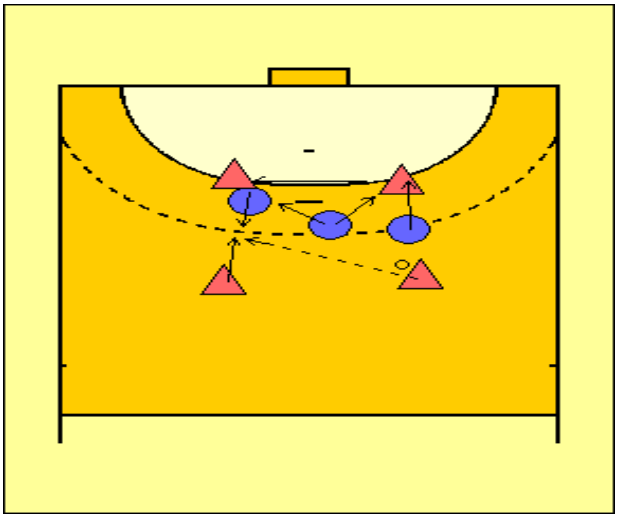


Figure 17: Playing 4-on-3

Tools
Balls

Exercise description:
There are three defenders (the two second defenders and thepoint), two backs (left and right) and two line players (who do not move and only wait for a pass). The right back, with the ball, is marked by the second defender on the left who closes him down far away from the goal area line. While trying to stop the attacker, the second defender must also hold arms high to prevent a pass to the line player standing behind his back. The second defender on the right marks the line player on the other side and must prevent a diagonal pass to the line player. The forward is moving between the two second defenders up to 10 meters away from the goal and is focused only on preventing the diagonal passes to one of the line players. The situation is reversed if the ball is passed to the left back.

Exercise 7 Playing four-on-four against two second defenders, point and the back-centre

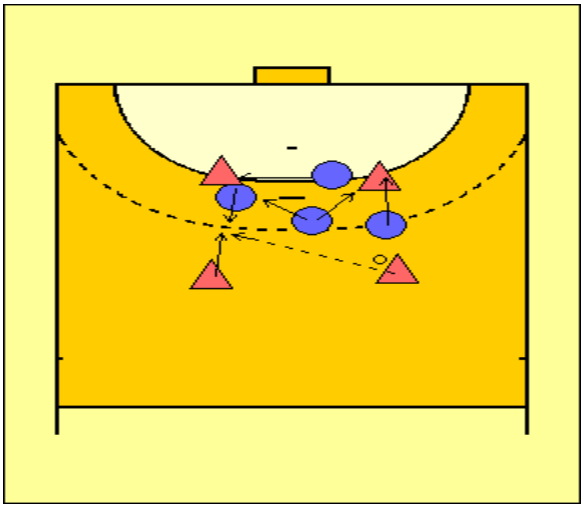


Figure 18: Playing 4-on-4

Tools
Balls

Exercise description:
There are four defenders (the two second defenders, the forward and the centre-half), two backs and two line players (do not move and only wait for a pass). The attacker with the ball (right back) is marked by the second defender on the left, the back-centre marks the line player behind his back, and the second defender on the right marks the line player on the other side of the defence and must prevent diagonal passes. The forward must obstruct the backs when they try to pass a long ball to the other back as well as preventing diagonal passes to line players. When the ball is travelling from one back to the other the defensive assignments change. Now the second defender on the left is marking the line player, the second defender on the right is marking the left back, and the back-centre is marking the line player behind his back. The forward's role is unchanged. Straight and diagonal passes to the line players are allowed.

Exercise 8: Playing five-on-four against two second defenders, the point and the back-centre

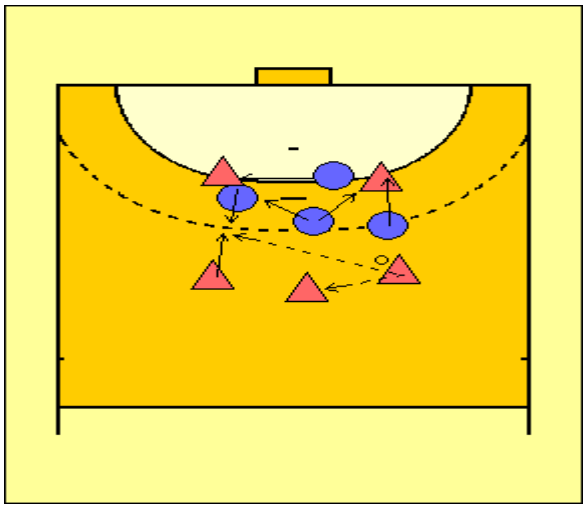


Figure 19: Playing 5-on-4

Tools
Balls

Exercise description:
There are four defenders (the two second defenders, the forward and the back-centre) three backs and two line players (do not move and only wait for a pass). The attacker with the ball (right back) is marked by the second defender on the left, the back-centre marks the line player behind his back, and the second defender on the right marks the line player on the other side of the defence. The forward must obstruct long passes between the two backs and prevent diagonal passes to the line player. When the ball is travelling from one back to the other, the defensive assignments change. Now the second defender on the left is marking the line player, the second defender on the right is marking the left back, and the back-centre is marking the line player behind his back. The forward's role is unchanged. Diagonal and straight passes to line players are allowed.

At the moment of a pass from the right back to the centre back, the defensive formation is the following: the point marks the centre back as both second defenders stand inside the 9-meter area and prevent passes to the line players on their respective side. At the same time, they must pay attention to their respective back. The back-centre stands between both line players facing the pass direction.

6. CONCLUSION

The 3-2-1 zone defence is the most aggressive zone defence still being played at the highest level and teams that use it are still winning medals at competitions of the highest rank. It remains the most popular set-defence in the area of former Yugoslavia, which is considered its cradle. The Yugoslav national team that won the gold medal at the 1972 Olympic Games used the 3-2-1 defence. Due to its aggressive character and depth, this defence was a key factor of success in those times when other teams were not familiar with it. However, almost everyone knows it advantages and disadvantages today. Its most successful proponent at the highest national team level is Croatia. A few other teams, like Montenegro and Argentina, use a modified version of the 3-2-1 defence.

As a former national team player who was raised in the cradle of the 3-2-1 defence, I believe I am well positioned to provide my personal opinion of this zone defence. It requires quick footwork, contains a lot of physical contact, players need to be aggressive and the game flows fast. It is meant to nullify good shooters and put them in an uncomfortable position. By this I mean forcing them into less than ideal situations: shooting from (too) far out, shooting under pressure or physical contact, shooting from wide positions or from the wings. All defenders must be mobile and aggressive and provide sufficient depth of the formation. To play this defence successfully at the highest level, defenders must know each other well which requires a lot of time on the court, so that all critical situations are known to all defenders. There are a lot of one-on-one situations, physical contact and movements which requires good physical condition or more frequent substitutions - players find it difficult to play the entire match in attack and defence given the speed of modern handball. The forward must literally tackle the attackers, while the first defenders and the back-centre provide sufficient density at the goal area line. Due to its depth, the 3-2-1 defence allows fast transition in fast breaks which are the easiest way of scoring goals and a great source of motivation for continuous aggressive and inspired defending. In practice, the 3-2-1 defence is often used against teams of lower technical quality or as a temporary surprise (10-20 minutes) to exhaust the opponent.

When watching youth matches and training sessions in Slovenia, I noticed that players often practice the foundations of the 3-2-1 defence - man-to-man defence and one-on-one situations - but later, when they join the U21 or senior teams, they are not familiar with the rules and the specific characteristics of this defence. They often visually form the 3-2-1 defence, but then play individually or only try intercepting passes. This is where I see a lot of room for improvement in Slovenia in youth categories as well as senior teams. This formation allows us to make up for some of the physical deficiencies (scarcity of tall players) of small countries like Slovenia, the lack of which otherwise makes it difficult to succeed in modern handball.

I would like to see more attention being paid to defence by coaches, and that good defenders, who are often underappreciated by the public, would get their due praise and rewards. Only in the last few years have defensive specialists got the public recognition - and the appropriate financial value - they deserve. Many teams and coaches cannot envision modern handball without defensive specialists anymore. This is why I hope that coaches of youth and senior teams will find my seminar paper useful.

7. REFERENCES

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HANDBALL FEDERATION OF SLOVENIA

Slovenian Handball Coaches Association

Master Coach Course

Goalkeeper Drills in Cooperation with Court Players for Saving Shots from Backcourt Positions

(Seminar paper)

Mentor: dr. Marko Šibila

Author: Grega Karpan

Ljubljana, May 5, 2013

Abstract

Just as in other sports (football, hockey, water polo), the role of the goalkeeper in handball is unique in its own way. Because of their specific role, handball goalkeepers differ significantly from the other players – their technique and tactics are vastly different from players in other positions. Time and again we can see good goalkeepers tipping a match in their favor, especially in the final rounds of European and World Championships. This means that it is extremely important to have a goalkeeping training system. Goalkeeper training must be adapted to different situations at every playing position - wingers, circle runners and backcourts - because the goalkeeper positioning and shot-stopping technique vary significantly between them. For this reason, training must be adapted to every playing position. This paper describes goalkeeping exercises that can be used to train stopping shots from backcourt positions. After the introductory part with a short polygon and a few individual goalkeeping exercises, other players join in.

Keywords: goalkeeper, shot-stopping technique, backcourt positions

1 Introduction

Every playing position consists of general (used at multiple positions) and specific (used predominantly at one position) activities. As stated above, the goalkeeper is the most specific position in handball in terms of the activities and rules of the game. The goalkeeping technique and tactics differ significantly from the technique and tactics used by players in other positions. The goalkeeper role is unique in its own way in other team sports as well (football, hockey). Their individual goal is to stop the opponents' shots. Successful goalkeepers can have a significant impact on their team's performance. Typical goalkeeper attributes are mostly consistent with typical attributes of other handball players. Perhaps the single most important goalkeeper attribute is bravery (Šibila, Pori and Imperl, 2008).

The basic goalkeeping activity is shot-stopping which slightly differs from goalkeeper to goalkeeper. Three shot-stopping techniques have been developed in countries where handball is popular: the Russian style, the Balkan style and the German style. Regardless of the relatively unified shot-stopping technique definition, goalkeepers have their own style which depends on their abilities, attributes, experience and skills. A goalkeeping style can be considered an individual adaption of the basic goalkeeping technique (as well as tactics). Good goalkeepers never stop correcting and optimizing their technique throughout their careers (Avsec, 1999; Šibila et al., 2008).

When stopping shots from the backcourt positions, goalkeepers are moving along the goal line in the basic goalkeeping stance. To save high and semi-high shots, they can use one hand or both hands. When saving low shots, there are again two options – a lunge to the side or the split technique. When saving shots from backcourt positions, it is important that goalkeepers don't cover a particular goal area too soon (i.e. they shouldn't react too fast), as this would make the job of the shooters much easier (especially if they delay their shot). Cooperation with the defense and agreements with individual defenders are also important. Due to different defensive formations and periodic congestion of players in a particular area of the field, goalkeepers don't always have a clear sight of the ball, so they must adapt their stance to have a better overview of the situation on the field.

For this reason, it is vital that the training process includes dedicated goalkeeping sessions and a lot of knowledge is needed to implement them successfully.

2 Subject

We will focus on goalkeeping exercises meant to train stopping shots from the left, right and center backcourt positions. Goalkeepers must save shots that are coming over or past the defenders. The attackers can shoot under pressure from the defense or completely unobstructed. These shots include mostly jump shots, shots after feints, overarm running shots or overarm ground shots and leaning shots.

A research of the last six European Championships (Karpan, 2011; Mohorič, 2012) indicates that the highest number of shots during a match is taken from backcourt positions (shots taken from behind the 9-meter line) - on average 22.27 per match. 15.88 of them are on target and goalkeepers save 7.09 shots per match on average. This represents a 44.6% success rate (the average success rate for shots from all positions is 32.7%). It is interesting to note that the number of saved 9-meter shots is normally the largest difference between winning and losing teams. Winning goalkeepers save 14.76 shots on average with 7.96 of them being 9-meter shots, while losing goalkeepers save 12.47 shots on average with 6.3 saves being 9-meter shots. This is the origin of the statistical difference.

This points to the importance of shot-stopping, in particular from backcourt positions and is the reason why this paper (and the training session described) will focus on specific exercises for saving shots from backcourt positions (left, right, center). Players will use all shot types, just as during a match.

The session will include an introductory goalkeeping polygon to warm up and prepare the goalkeepers for the main part. This will be followed by a few individual exercises, after which other players will join in and start shooting on goal according to the instructions of the coaching staff.

3 Main part

The main part describes the goalkeeping exercises in three sub-chapters.

3.1 Goalkeeping polygon

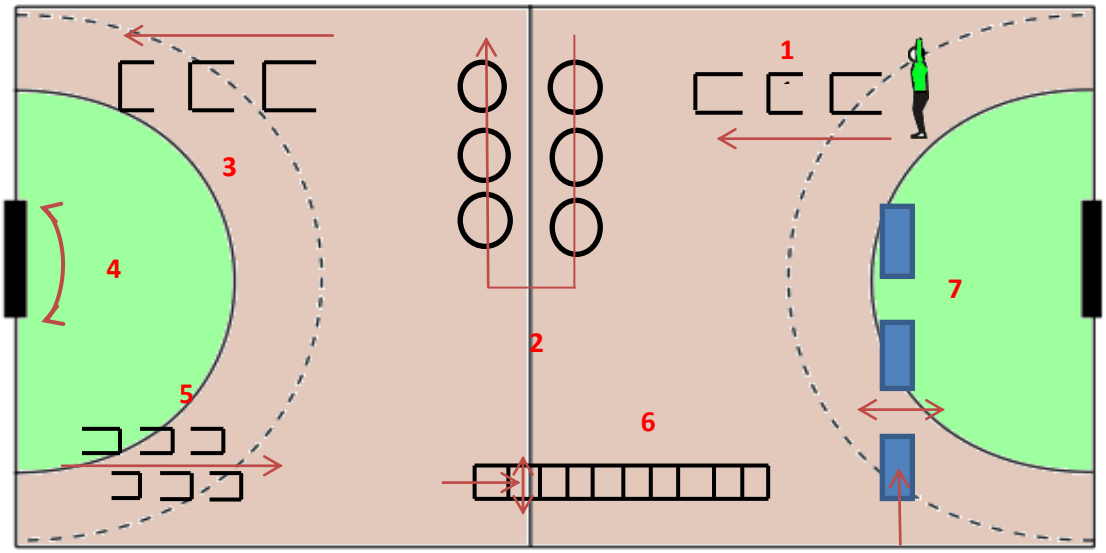

Figure 1: Drill.

Goalkeepers start executing exercises at station 1 and then move to the next station. They jog between stations and perform the exercises with maximum speed and highest intensity. The following exercises are executed at individual stations:

1. The first station consists of 60 cm hurdles. The goalkeeper stands parallel to the hurdles on one side and lifts the inside leg over a hurdle in a way that simulates stopping semi-high shots (raising the knee).
2. The second station consists of rings. The goalkeeper shuffles over the rings laterally – one foot must always be inside a ring and the other outside.
3. The third station is the same as the first, except that the exercise is executed with the other leg.
4. At the fourth station, the goalkeeper runs from post to post three times with feet wide apart making quick short steps.
5. The fifth station consists of hurdles (60 cm high) on the left and right-hand side. The goalkeeper is positioned between the hurdles and passes them by raising the knees (simulating stopping semi-high shots by raising knees).
6. The sixth station consists of an agility ladder. The goalkeeper skips forward with minimal knee lifting. At every second square, the goalkeeper simulates saving a high shot to the left and right-hand side.
7. The seventh station consists of three mats. The goalkeeper executes a forward roll on a mat, stands up, and simulates stopping a low shot to the left by lunging to the left. This is immediately followed by simulating stopping a shot to the right with the split technique. The goalkeeper then makes another forward roll and repeats the exercises in the other direction.

3.2 Individual work with goalkeepers

Exercise 1:

EXERCISE DESCRIPTION: The goalkeeper stands on the goal line somewhat closer to one post (0.5m from the post) in the basic stance. At the signal of the coach, the goalkeeper starts running in place with feet wide apart making quick short steps (5-10s). At the second signal of the coach, the goalkeeper tries to catch a ball thrown by the coach towards a particular goal area.

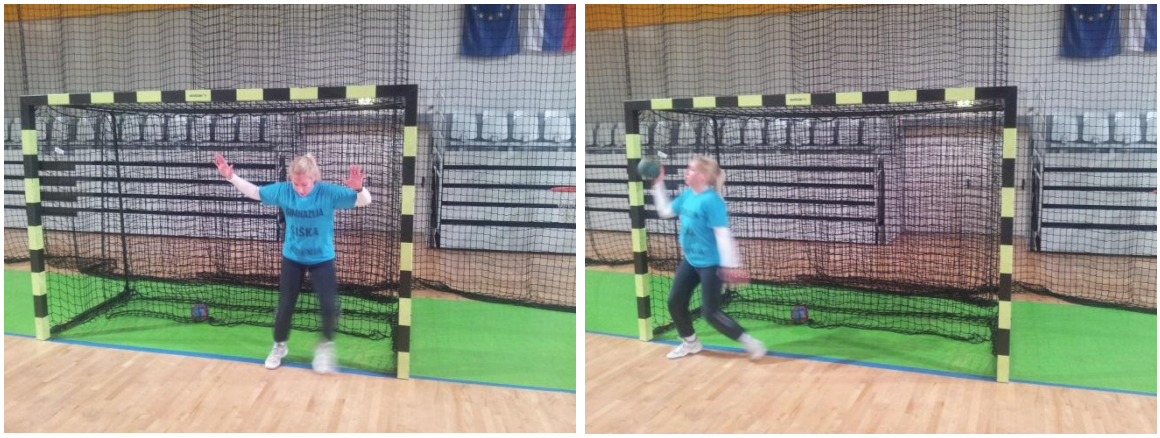

Figure 2: Exercise 1.

TASKS AND VARIATIONS:

- Running in place with feet apart making quick short steps, jumping forward/back or left/right, running in place with quick short steps while moving the feet wide apart and close together, skipping.
- Balls can be thrown high, semi-high, low, anywhere etc.

QUANTITY: 6-8 repetitions

Exercise 2:

EXERCISE DESCRIPTION: The goalkeeper stands in the basic stance. A coach or a teammate throws training bibs to the left and right from a distance of 3-4m. The goalkeeper catches the bib and throws it back.

Figure 3: Exercise 2.

TASKS AND VARIATIONS:

- The coach throws the bibs (to goalkeeper's left and right) high, semi-high, low, diagonal, anywhere etc.

QUANTITY: 12-15 repetitions

Exercise 3:

EXERCISE DESCRIPTION: The goalkeeper stands in the goal in the basic stance. At the signal of the coach, the goalkeeper starts running in place with feet wide apart making quick short steps (5-10s). After the second signal, a teammate or the coach start passing tennis balls to the left/right of the goalkeeper from a distance of 3-4m (8-10 passes). The goalkeeper catches them and passes them back.

Figure 4: Exercise 3.

TASKS AND VARIATIONS:

- Running in place with feet apart making quick short steps, jumping forward/back or left/right, running in place with quick short steps while moving the feet wide apart and close together, skipping
- Balls can be thrown high, semi-high, low, anywhere etc.

QUANTITY: 6-8 repetitions

3.3 Goalkeeping session with court players

3.3.1 Players are lined up on the 9-meter line from LB to RB

Exercise 4:

EXERCISE DESCRIPTION: Players are evenly lined up behind the 9-meter line from LB to RB. The goalkeeper is standing in the basic stance and looking towards the player at the far right/left. One after another, the players start shooting towards a pre-defined goal area. After every shot, the goalkeeper adapts positioning and tries to stop the next shot.

Figure 5: Exercise 4.

TASKS AND VARIATIONS:

- Players shoot left/right and high/semi-high/low.
- Players shoot diagonally (high-low).
- Players alternate direction (left/right), but can freely choose shot height.

QUANTITY: 10-14 repetitions

Exercise 5:

EXERCISE DESCRIPTION:

Players are evenly lined up behind the 9-meter line from LB to RB. The goalkeeper is standing in the basic stance and looking towards the player at the far right/left. The players start alternately shooting (the first shot from the left, the second from the right etc.) towards a pre-defined goal area. Before each shot, the goalkeeper moves laterally to the correct position and then tries to stop the shot.

Figure 6: Exercise 5.

TASKS AND VARIATIONS:

- Shots only into the near corner – high, semi-high, low, anywhere.
- Alternate left/right high or low shots.
- Free shooting.

QUANTITY: 10-14 repetitions

Exercise 6:

EXERCISE DESCRIPTION: Players are evenly lined up behind the 9-meter line from LB to RB. The two players in the middle shoot one after another and the players to the right and left of them continue. The players must shoot towards a pre-defined goal area.

Figure 7: Exercise 6.

TASKS AND VARIATIONS:

- Shots only to the near corner – high, semi-high, low, anywhere.
- Alternate left/right high or low shots.
- Free shooting.

QUANTITY: 10-14 repetitions

3.3.2 Players are lined up at CB

Exercise 7:

EXERCISE DESCRIPTION: Players are standing in a line in the middle of the field (CB). Three rings are placed on one side of the goal. The goalkeeper must laterally skip over the rings. After passing all three rings, the goalkeeper must save a teammate's shot. The players must shoot towards a pre-defined goal area.

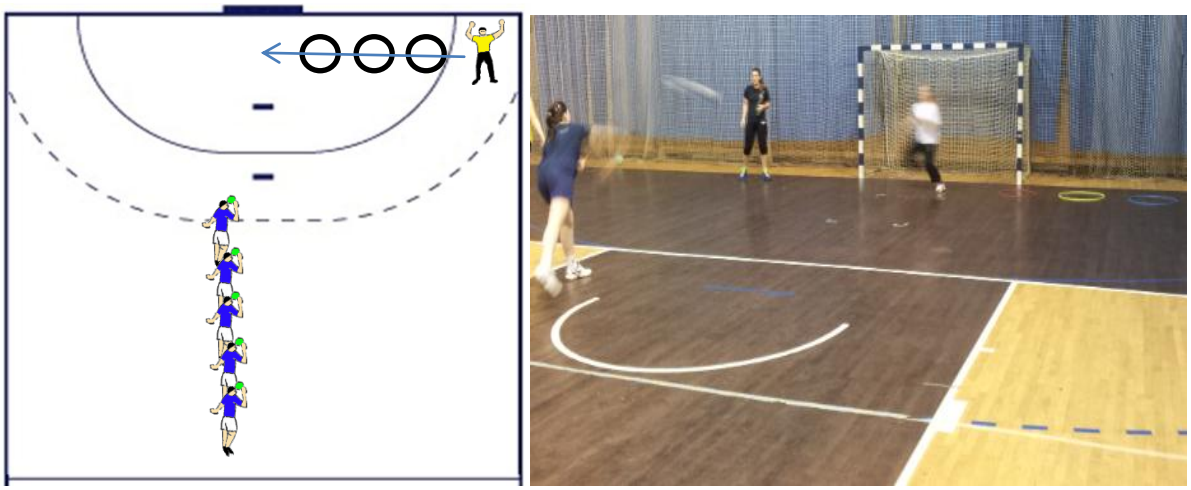

Figure 8: Exercise 7.

TASKS AND VARIATIONS:

- High, semi-high, low shots, anywhere on one side (left/right).
- Low hurdles can be used instead of rings.
- We can also use an agility ladder and define the exercises for the goalkeeper to perform.

QUANTITY: 6-8 repetitions

Exercise 8:

EXERCISE DESCRIPTION: Players are standing in a line in the middle of the field (CB). The goalkeeper is moving towards a goal post in the basic stance; after touching it, the goalkeeper accelerates in the opposite direction to save a teammate's shot. The players must shoot towards a pre-defined goal area.

Figure 9: Exercise 8.

TASKS AND VARIATIONS:

- High, semi-high, low shots, anywhere on one side (left/right).
- Players are standing in two lines at the CB (the distance between them is the goal width). The goalkeeper touches a post and must save a shot to the left and then immediately another one to the right. After two shots, the goalkeeper starts the exercise again by touching a post.

QUANTITY: 6-8 repetitions

Exercise 9:

EXERCISE DESCRIPTION: Players are standing in a line in the middle of the field (CB). They are divided into groups of three (the first three, the second three etc.) The goalkeeper is facing away from the players. At the signal of the coach, the goalkeeper turns around and tries to save shots by the first group of three players. The players must shoot towards a pre-defined goal area. The goalkeeper then again turns away from the players and waits for the signal of the coach.

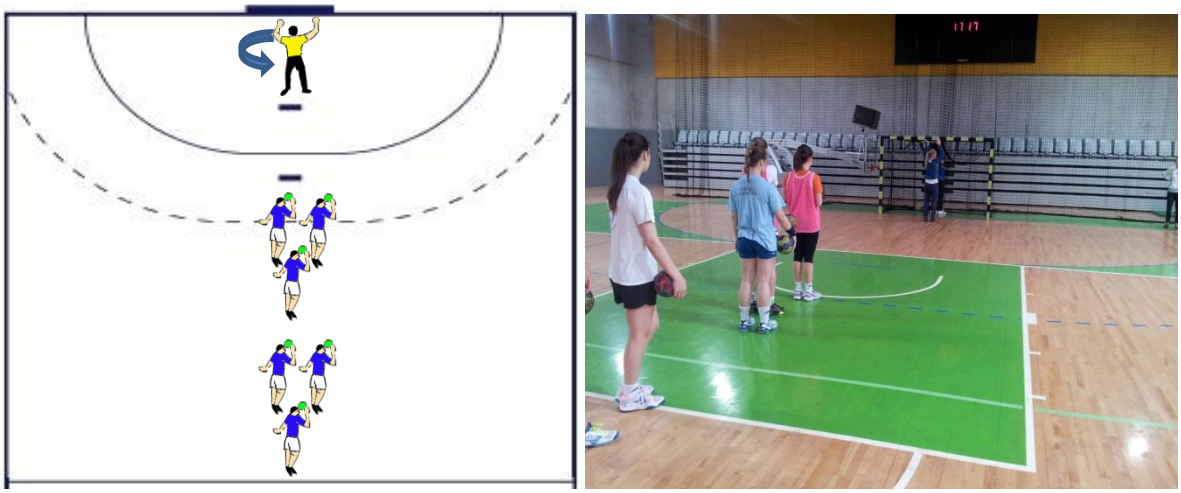

Figure 10: Exercise 9.

TASKS AND VARIATIONS:

- The first player in a group of three shoots high and left, the second high and right, and the third low and left.
- The shot direction can be changed (low and left, low and right, high and left etc.)

QUANTITY: 3-4 groups of three

Exercise 10:

EXERCISE DESCRIPTION: Players are standing in a line in the middle of the field (CB). After a three-step run up, they shoot from the ground from behind the 9-meter line. A mat or a couple of passive players are positioned at a distance of 8 meters from the goal. The players must shoot towards a pre-defined goal area.

Figure 11: Exercise 10.

TASKS AND VARIATIONS:

- Players alternately shoot to the left/right one after another; the direction of the shot is determined by the side where they pass the defensive block (a mat or a couple of players).
- Players can freely choose the run up direction and then shoot in the same direction.
- The players can lower the arm and shoot past the mat; only low shots in any direction.
- The players have three options: low arm – low shot anywhere; high arm – shot to the left if running up to the left/shot to the right, if running up to the right.
- Any shot type in any direction.

QUANTITY: 10-14 repetitions

Exercise 11:

EXERCISE DESCRIPTION: Players are standing in a line in the middle of the field (CB). After a three-step run up, they shoot from the ground from behind the 9-meter line. A mat or a passive player is positioned at a distance of 4 meters from the goal. This makes the goalkeeper's job harder and prepares them for situations when they don't see the shooter or the ball and a reflex save is needed.

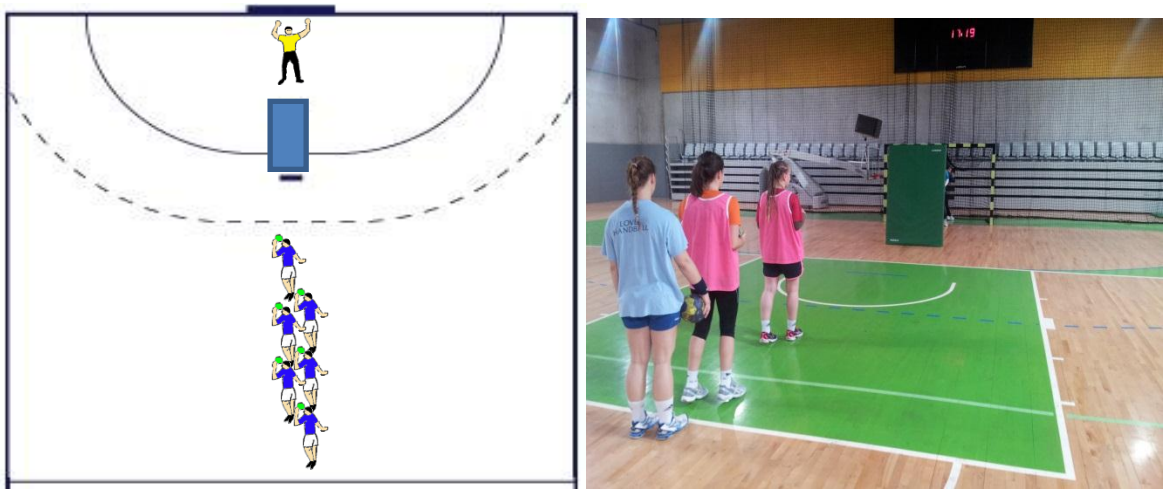

Figure 12: Exercise 11.

TASKS AND VARIATIONS:

- Only low shots.
- Only high shots.
- Alternate left/right shots.
- Free shooting.

QUANTITY: 10-14 repetitions

3.3.3 Players are lined up at LB or RB

Exercise 12:

EXERCISE DESCRIPTION: Players are standing in two lines at the left or right backcourt positions. The goalkeeper is in the best possible basic stance between the shooter and the goal and tries to save shots from the players who alternately shoot one after another towards a pre-defined goal area.

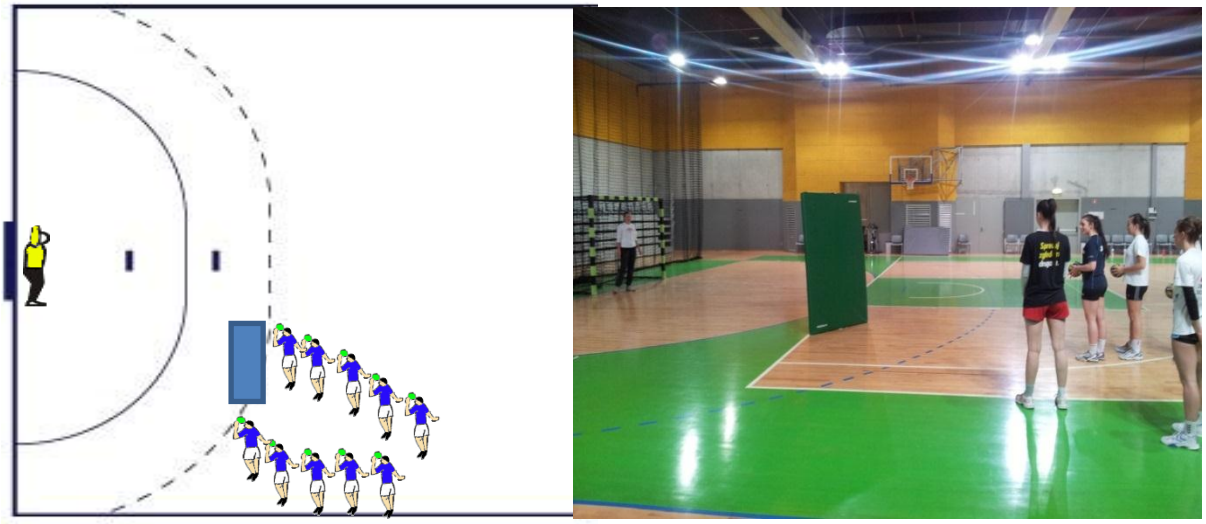

Figure 13: Exercise 12.

TASKS AND VARIATIONS:

- Alternate left/right high, semi-high and low shots.
- Diagonal shots (high from the left line, low from the right line).
- The outer line shoots high to the near corner; the inner line shoots low to the far corner. The goalkeeper must save the shots with the split technique.
- Alternate shots to the left/right (any height).

QUANTITY: 10-14 repetitions

Exercise 13:

EXERCISE DESCRIPTION: Players are standing in two lines at the left or right backcourt positions. One half of the players have training bibs and they are randomly positioned in both lines. Players alternately shoot towards a pre-defined goal area one after another. Depending on whether a player has a training bib, the goalkeeper can guess the shot direction and tries to save it.

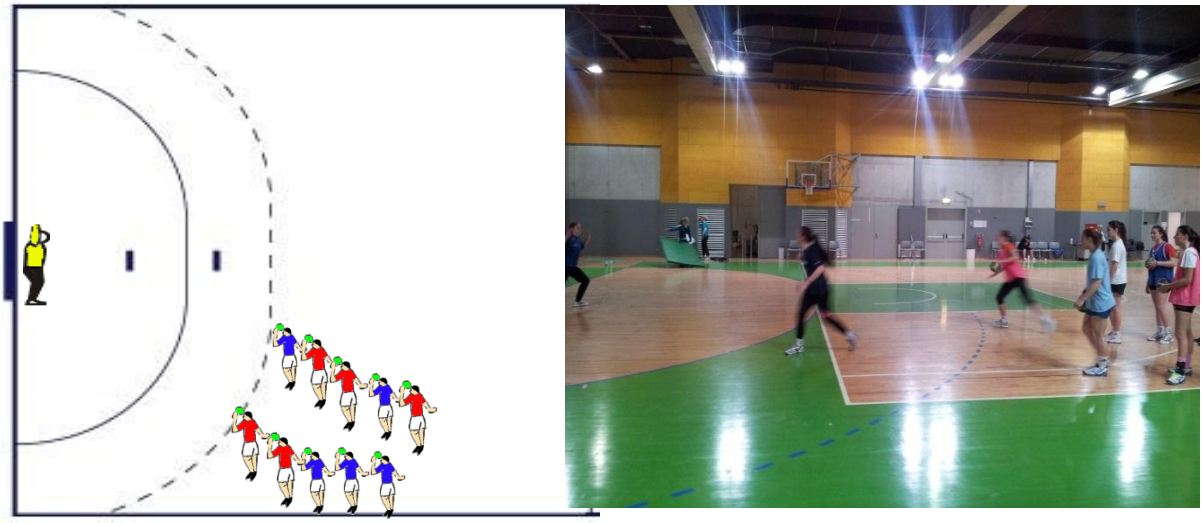

Figure 14: Exercise 13.

TASKS AND VARIATIONS:

- Players in bibs shoot to the left, and the rest shoot to the right and vice versa.
- Players in bibs shoot only low, the rest shoot high.
- Players can jump off a low bench. This allows lower players to reach greater height.

QUANTITY: 10-14 repetitions

3.3.4 Players are lined up at LB and RB

Exercise 14:

EXERCISE DESCRIPTION: One line of players is positioned at the left backcourt position and another one is at the right backcourt position. The goalkeeper is in the best possible basic position between the shooter and the goal and tries to save shots towards a pre-defined goal area (the players from both lines are shooting alternately).

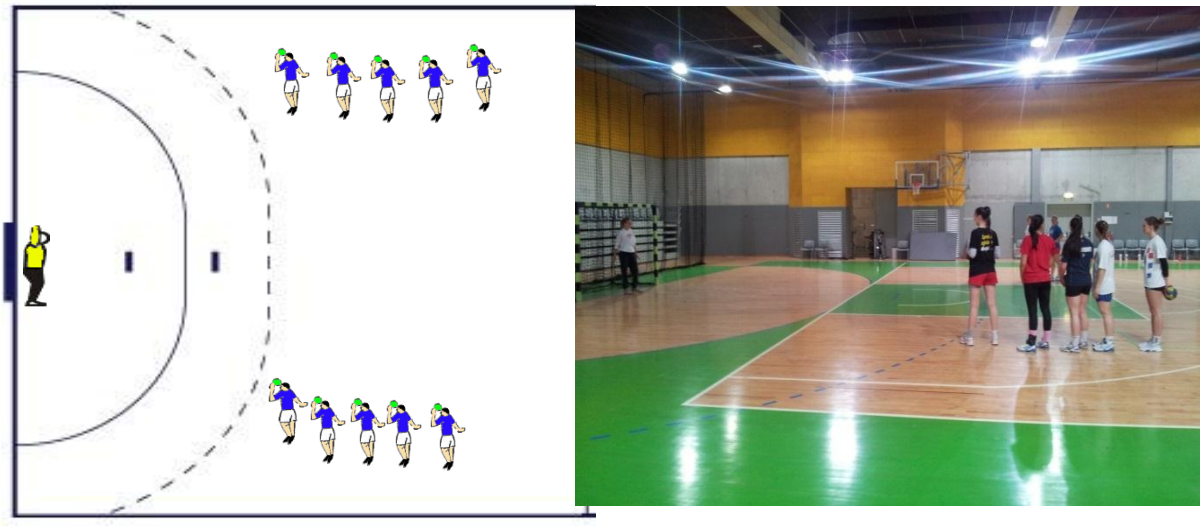

Figure 15: Exercise 14.

TASKS AND VARIATIONS:

- High, semi-high and low shots to the near corner as well as shots anywhere to the near corner.
- Diagonal shots (high-low). RB low to the near corner, RB high to the near corner.
- LB shoots anywhere low; RB shoots anywhere high and vice versa.

QUANTITY: 10-14 repetitions

3.3.5 Players are lined up at LB, CB and RB

Exercise 15:

EXERCISE DESCRIPTION: Players are standing in lines at the left, center and right backcourt positions. The goalkeeper is in the best possible basic position between the shooter and the goal and tries to save shots towards a pre-defined goal area (the players from all three lines are shooting alternately): LB – CB – RB and then again LB.

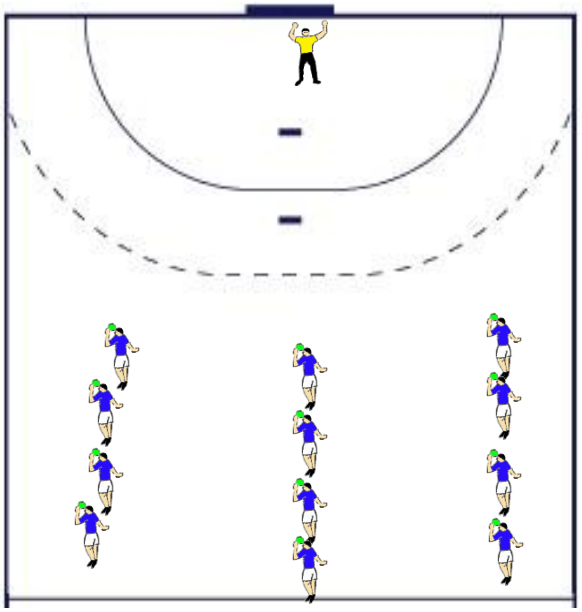

Figure 16: Exercise 15.

TASKS AND VARIATIONS:

- LB and RB shoot high to the near corner; CB shoots between the legs/close to the legs.
- LB and RB shoot low to the near corner, CB shoots anywhere.
- LB and RB shoot anywhere to the near corner, CB shoots anywhere low.

QUANTITY: 10-14 repetitions

Exercise 16:

EXERCISE DESCRIPTION: Players are standing in lines at the left, center and right backcourt positions. A mat is placed in front of each line at a distance of 8 meters from the goal. Two players at the CB position are passing balls to the LB and RB. The CB passes the ball to the LB who must decide how to run up and select the mat to shoot past. Shot direction depends on this. The same sequence is then repeated by the RB.

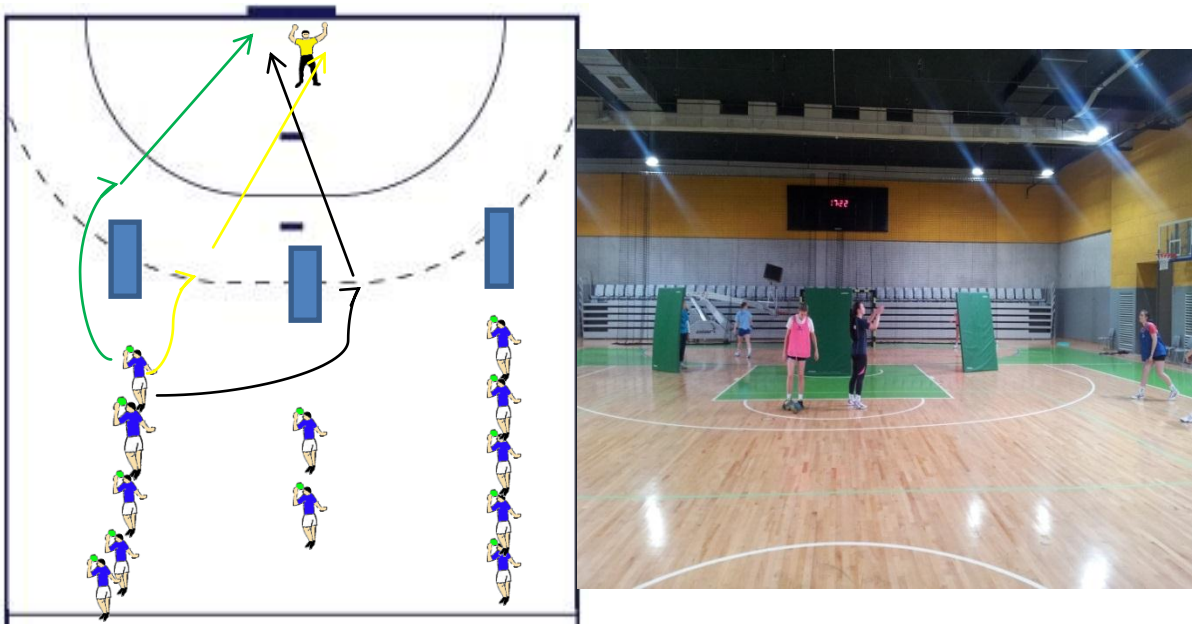

Figure 17: Exercise 16.

TASKS AND VARIATIONS:

- When shooting past the outer edge of the mat at the LB position, the player must shoot to the near corner; when shooting past the inner edge, the players must shoot to the far corner. When shooting past the mat at the CB position, the shot must be directed to the diagonal corner. The same applies to the RB.
- Passive defenders or defenders who are actively trying to block shots can be used instead of mats.

QUANTITY: 10-14 repetitions

Exercise 17:

EXERCISE DESCRIPTION: Players are standing in lines at the left, center and right backcourt positions. A mat is placed in front of each line at a distance of 8 meters from the goal. Two players at the CB position are passing balls to the LB and RB. The CB passes the ball to the LB who must decide how to run up and select the mat to shoot past. This exercise is the same as exercise 16, except that a half of the players have training bibs and they are randomly positioned in both lines. Depending on whether a player has a training bib, the goalkeeper can guess the shot direction and will try to save it.

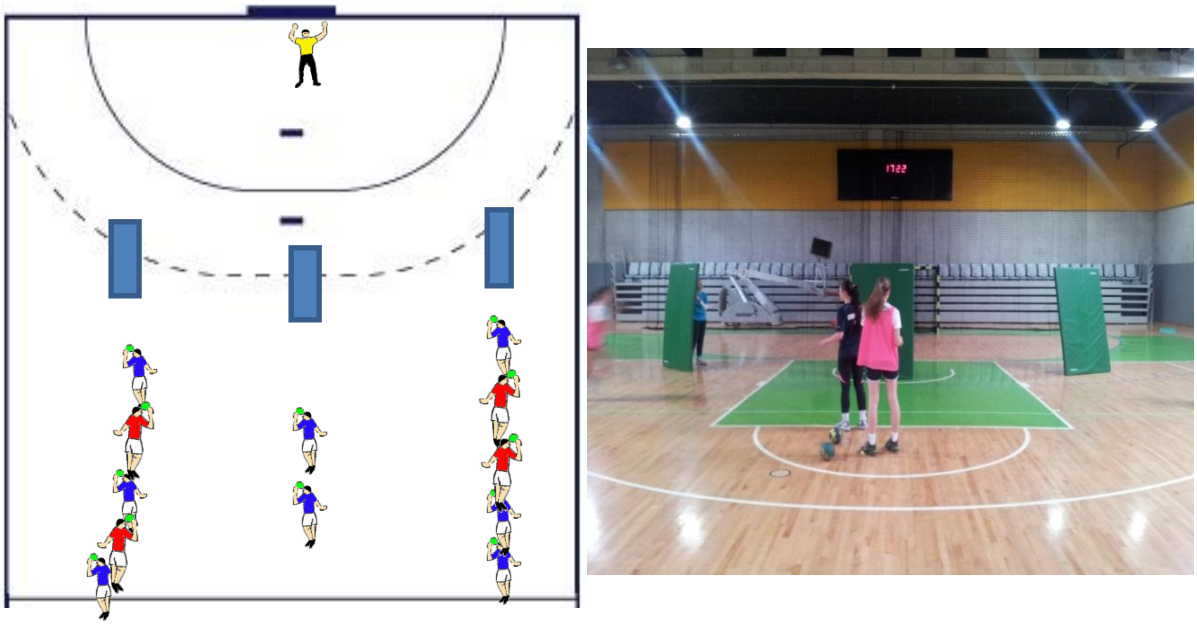

Figure 18: Exercise 17.

TASKS AND VARIATIONS:

- Players in bibs shoot to the left, the rest to the right and vice versa.
- Players in bibs shoot low, the rest high.

QUANTITY: 10-14 repetitions

Exercise 18:

EXERCISE DESCRIPTION: Players are standing in lines at the left, center and right backcourt positions. A mat is placed in front of each line at a distance of 8 meters from the goal. Two players at CB position are passing balls to the LB and RB. The CB passes the ball to the LB who must decide how to run up and select the mat to shoot past. The same sequence is then repeated by the RB. Players put sweatbands on the wrist of their dominant hand and randomly position themselves in lines. The sweatband color indicates shot direction. The goalkeeper is observing the shooter's dominant hand and must guess the shot direction based on the sweatband color.

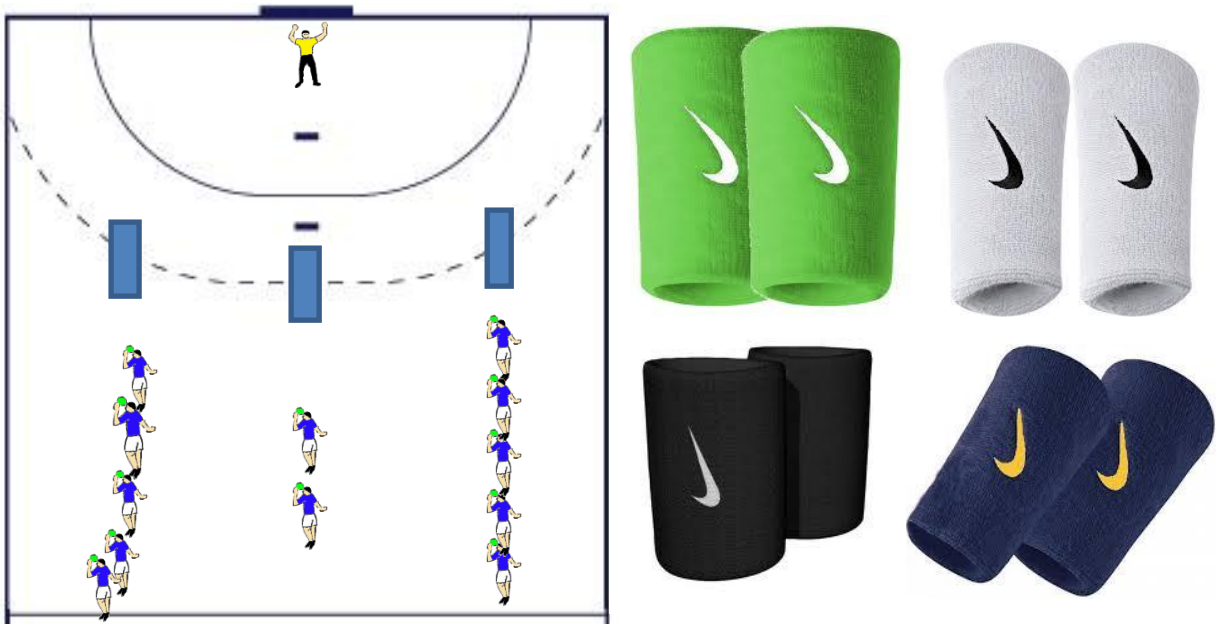

Figure 19: Exercise 18.

TASKS AND VARIATIONS:

- Players with green sweatbands shoot high to the left, players with white sweatbands shoot high to the right, players with black sweatbands shoot low to the left and players with blue sweatbands shoot low to the right.
- Players with green and white sweatbands shoot high in any direction and players with black and blue sweatbands shoot low in any direction.
- Players with green and white sweatbands shoot anywhere to the near corner and players with black and blue sweatbands shoot anywhere to the far corner.
- Players with green sweatbands shoot into the near corner, players with white sweatbands shoot to the far corner, players with black sweatbands shoot low and players with blue sweatbands shoot between the legs/close to the legs.
- Passive defenders or defenders who are actively trying to block shots can be used instead of mats.
- Player positioning can be freely changed: one line at CB, two lines at LB and RB, everyone lined up behind the 9-meter line from LB to RB.

QUANTITY: 10-14 repetitions

3.4 Games involving goalkeepers and outfield players

Exercise 19:

EXERCISE DESCRIPTION: **Relay:** All the players are distributed into two teams – each team is positioned in one corner of their own half. At the signal, the first player runs to the LB (RB) position, executes a three-step run up, jumps off a low bench and tries to score. If successful, the player then runs back towards the line and slaps the palm of the teammate who is next in line to allow them to start the exercise. If not successful, the player must repeat the exercise until scoring. The fastest team wins - provided that everyone scored. This game can be prolonged by demanding that players score two goals each.

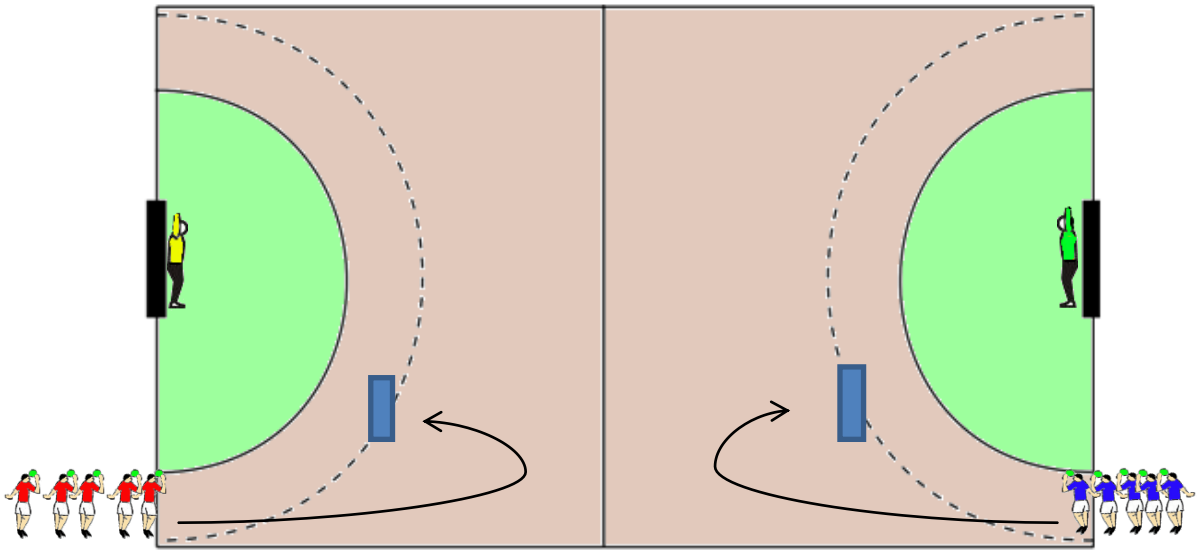

Figure 20: Exercise 19.

Exercise 20:

EXERCISE DESCRIPTION: Players are standing in line at the CB position and are shooting one after another from behind the 9-meter line. The first player can shoot anywhere (low to the left/right, high to the left/right). If successful, the next player must shoot into the same corner. If the goalkeeper saves the shot or the player misses the goal, the next player can again shoot anywhere. Or we could use another variation: After a goal is scored, the next player must shoot into the diagonal corner. If the player is not successful, the next shot can again be directed anywhere.

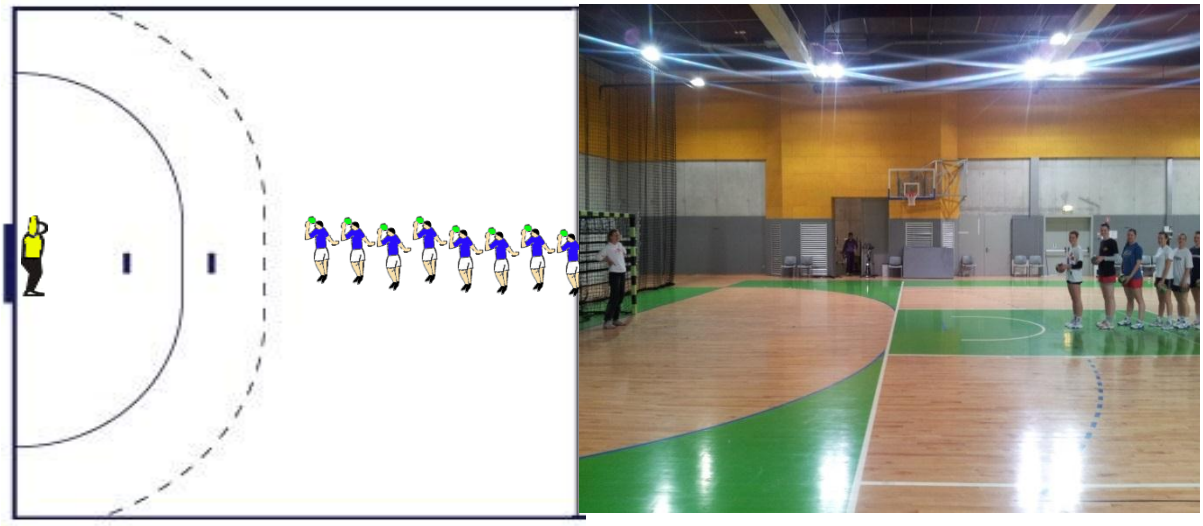

Figure 21: Exercise 20.

QUANTITY: 10-14 repetitions

Exercise 21:

EXERCISE DESCRIPTION: Players are standing in lines at the left, center and right backcourt positions. The players shoot from all three positions from behind the 9-meter line one after another and compete against the goalkeeper. If the goalkeeper concedes 3 goals in a row, he gets punished with extra exercises, and if the players don't score a goal in three shots straight, the players get punished. The punishment is determined by the coach.

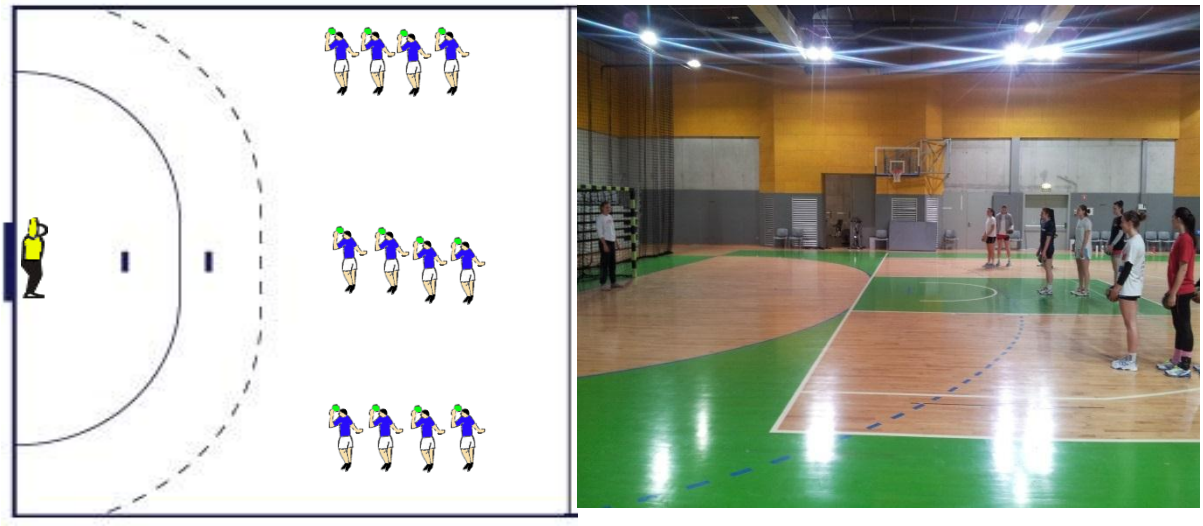

Figure 22: Exercise 21

QUANTITY: 10-12 shots per goalkeeper

Exercise 22:

EXERCISE DESCRIPTION: Players are standing in lines at the left, center and right backcourt positions (Figure 22). The players shoot from all three positions from behind the 9-meter line one after another. If the players score with more than 50% of shots, the goalkeeper gets punished, and if the players score with less than with 50% of shots, they get punished. The punishment is 10 push-ups.

TASKS AND VARIATIONS:

- Shot direction is limited: only low, only high etc.
- The scoring percentage must be adapted to strike a balance between the abilities of your players and goalkeepers.

QUANTITY: 10-12 shots per goalkeeper

Exercise 23:

EXERCISE DESCRIPTION: Players are evenly lined up behind the 9-meter line from LB to RB. The player farestleft starts shooting on goal one after another. If a player scores, then the next one shoots; if a player misses, the previous one must shoot again and must score. If this player misses, the player to the left must shoot again. The goalkeeper's objective is to keep to ball as far left as possible. The exercise is over only when every player from the LB to the RB scores.

Figure 23: Exercise 23.

TASKS AND VARIATIONS

- The exercise can be made easier by changing the rules so that the players must shoot on goal repeatedly until they score. Only then can the next player start shooting and the ball does not move back to the left.
- The goalkeeper's job can be made easier by allowing only low shots.

QUANTITY: 10-12 shots per goalkeeper

4 Conclusion

This paper describes a lot of exercises with even more variations. All of them cannot be included into one training session. Coaches must select the appropriate quantity depending on the time available and the number of goalkeepers participating. The exercises described here cover only shots from backcourt positions. A goalkeeping session can additionally include shots from the 6-meter line and from the wings. It is recommended that a goalkeeping session should be performed at least once a week. The exercises are suitable for all age categories, but they must be adapted to the goalkeepers' skill level.

In addition, goalkeeping training in handball must be properly planned. Periodization should be considered when preparing goalkeeping sessions at the senior level. In most cases, a season is broken down in shorter cycles (macro cycle, meso cycle and micro cycle) depending on the fixture list. By selecting the appropriate exercises in various cycles, the goalkeepers will be able to reach best form at the right time and will remain at this level for as long as possible. In general, pre-season training should include exercises with a lot of repetition and lower intensity. This allows us to better control the goalkeeping technique. A lot of focus should also be placed on basic individual physical preparation. During the season and in the lead-up to an important fixture, the repetition count should be lower and the intensity should be higher. This allows the goalkeeper to develop those technical and physical skills and abilities that have the greatest impact on competitive performance. The quantity of individual goalkeeping exercises is also somewhat lower during the season, while the quantity of situational exercises performed together with some teammates or the whole team is increased (Šibila et al., 2008).

Weekly periodization is also important for goalkeepers. During the season, motor skill exercises should be performed at the beginning of the week – they will improve endurance, power, speed, agility and general physical condition. These exercises can lead to tiredness, but these are still a few days left to rest - provided that the match is played at end of the week. During the final days before a match, the goalkeeper must start mentally preparing on the match and the opposition. The goalkeeping exercises should have the aim of improving reaction time. Goalkeepers must practice reflex saves, reaction time and precision (accurate reaction to shots and balls coming towards the goal). This is the best possible match preparation. The skills acquired with these exercises (better reflexes and improved reaction time) are only short term. In most cases, a goalkeeping session with the aim of improving reaction time should be performed one or two days before a match. Tactical preparation is also a very important aspect in this period. This includes video analysis of opponents' shots, because most shooters tend to repeatedly use similar shots in similar situations on the field. Some players can be very predictable and studying their shooting habits can greatly improve the goalkeeper's performance (Šibila et al., 2008).

I would like to sincerely thank the U-21 team of RK Krim Mercator (2012/2013) for demonstrating the exercises for the photographer.

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Handball Federation of Slovenia

Slovenian Handball Coaches Association

Master Coach Course

Strength Training in Handball

(Seminar paper)

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Koper, June 14, 2013

Key words: handball, periodization, training, strength

Abstract

Strength is a motor skill with significant impact on performance in handball. Power in particular is responsible for more powerful shots, higher jumps and greater agility. Power can be developed by weight training which for years has been an integral part of physical conditioning in handball. For high training efficiency, a good training strategy must be based on the principles of periodization - selecting the appropriate tools, methods and quantities in various periods. Attention must be paid to individual characteristics of the players, especially their age. For safe weight training, safety rules must be respected and the training parameters must be increased gradually. Finally, it is important that the training takes place at the right time, because weight training must have a certain purpose within the context of handball. This means using exercises that activate multiple muscle groups at the same time. The most appropriate technique for this is Olympic-style weightlifting.

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TOC

Introduction

This seminar paper aims to introduce various weight training methods, as well as the training quantities and how to include them in various periods. These periods will be dealt with from the individual player point of view as well as in relation to the team performance as a whole. The seminar paper is limited to weight training taking place off the handball court. A somewhat greater focus will be placed on the Olympic-style weightlifting.

In a complex ball-game, such as handball, strength has many manifestations. The most important for handball is power. This is a form of strength that is used when we want to produce the greatest strength in the shortest amount of time. Producing more power allows players to jump higher, shoot faster and change direction... Muscle mass is also important; we can increase it with proper diet and strength training methods that cause muscle hypertrophy. Finally, it is important that we are able to execute various handball activities longer and with higher intensity. This means that high endurance in terms of all strength manifestations is also important. All of this depends on multiple physical factors, such as muscle fibre type, energy reserves, neuromuscular conductivity, hormonal regulation, inter- and intramuscular coordination, individual morphology etc.

Due to handball's complexity, the high number of matches and various individual needs, proper strength training planning is vital. The largest problem is usually lack of time, which means that we must select methods that have the best results in the shortest amount of time. The Olympic-style weightlifting is a very effective method. It is extremely time-effective and can be included into any period of the match schedule without major organizational issues. However, before an individual is capable of performing Olympic-style weightlifting exercises safely and effectively, some preliminary preparation is needed. It should start already in adolescence (ensuring appropriate flexibility). This is why this seminar paper also aims to describe how to develop the strength of a player still growing up, what to pay attention to and what methods and quantities to use to develop his/her strength to safely achieve the maximum

Main part

This seminar paper will describe training methods using various types of weights. It will include a description of a logical sequence of exercises as well as training methods and load and intensity parameters. The exercises are presented from easier to more difficult ones and from simpler to more complex ones. The plans must take into account the training periods and the players' age. For better understanding, the first part of the seminar paper includes a short description of the basic concepts used in weight training planning in handball.

Periodization

Periodization denotes the arrangement of various exercise quantities to achieve the best results. (Ušaj, 1997). When planning our strength training strategy, we can further break down periods into smaller ones. A competition season can be broken down into autumn and spring parts, and both can have a pre-season segment, a pre-competition segment, and a competition segment. These periods, which can last multiple months, can be divided into mesocycles that usually last from 3 to 6 weeks. This is a sensible timeframe to set objectives for players to change certain skills or characteristics. At the beginning of this period in strength training, we perform tests to check progress and set new objectives according to our strategy. Mesocycles are divided into microcycles that usually last one week. Microcycles include an intermediary objective which is related to the mesocycle objective. Microcycles consist of various training units, normally from 4 to 9. A training unit lasts from the start of physical activity in one training unit to the start of physical activity in the next training unit. A training unit consist of the catabolic phase (training) and anabolic phase (rest). (Ušaj, 1997)

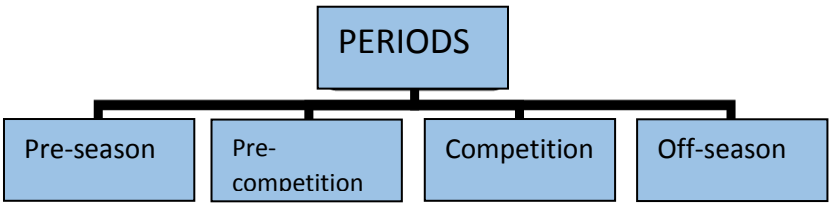


Figure 1: Training periods, source: original

Training units can be arranged in multiple ways. Usually, activities are repeated in the incomplete rest phase. This is repeated 3 to 4 times in a strength training microcycle which is then followed by a complete rest phase and super compensation. The super compensation denotes the phase when we achieve a higher performance capacity compared to the beginning of the training. The super compensation phase is the best period for match performance.

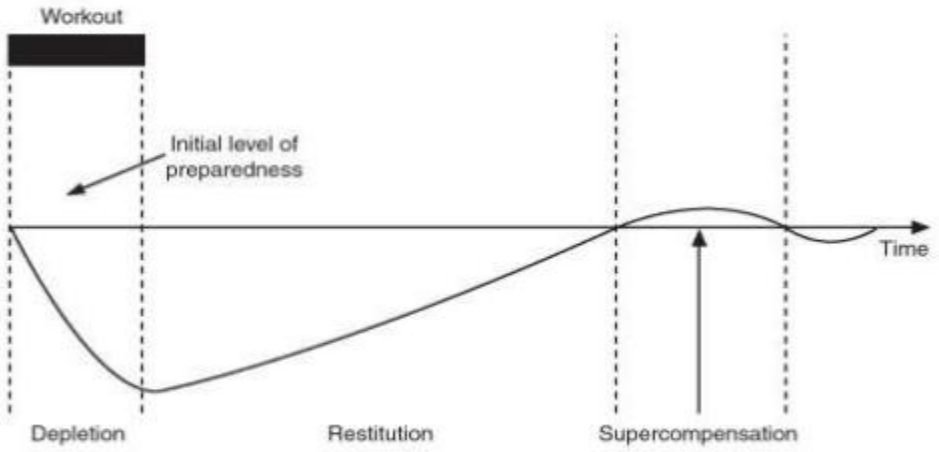


Figure 2: Super compensation after one training unit with a complete rest. Source: Kraemer, W.J., Zatsiorsky, V. M., (2006). *Science and practice of strength training – second edition*

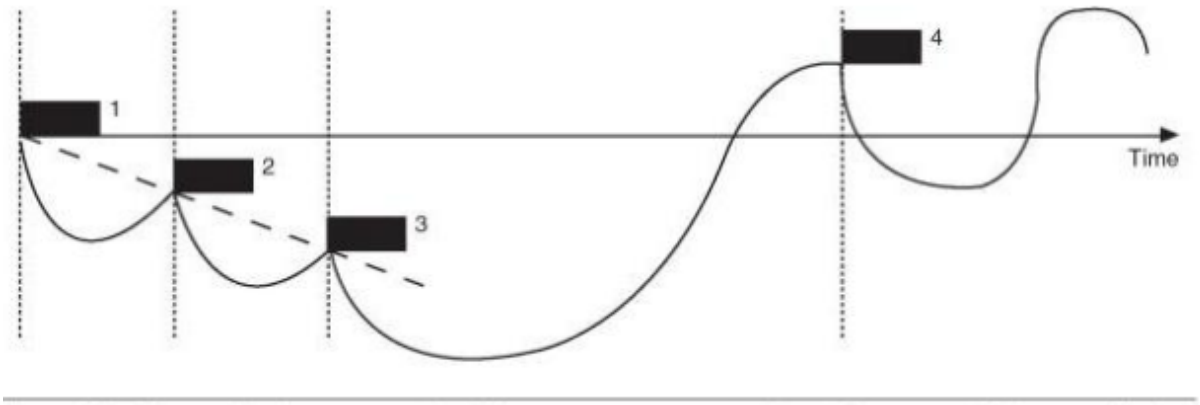


Figure 3: Super compensation after three consecutive training units with an incomplete rest. Source: Kraemer, W.J., Zatsiorsky, V. M., (2006). *Science and practice of strength training – second edition*

Handball and other ball-games typically have long competition phases and relatively short pre-season phases. In practice, a typical pre-season and pre-competition period lasts 6 to 8 weeks. A pre-competition phase is usually so short (1-2 weeks) that it cannot even be classified as a mesocycle, but only as a relaxation microcycle. Most strength training periodization models prepared for athletes in individual sports with short competition periods must be adjusted for handball.

Track and field athletes and weightlifters are an important source of information and experience, because their performance almost completely depends on proper strength training. But these athletes must achieve maximum performance only at two competitions per year. A top handball player playing league and domestic cup matches, European matches and national team matches takes part in more than 50 matches per season. In addition to strength training, their time must be devoted to technical and tactical preparation and to the development of other motor skills, as well as to rest appropriately before matches. This means there is not

much time left for strength training and progress is less significant. Sometimes, we must contend ourselves with the fact that we maintained the pre-season strength levels.

Every handball training session has a comprehensive effect on the body. Almost every motor skill is being developed while playing handball, so it is difficult to assign exact training parameters to technical/tactical training sessions. Handball training requires maximum intensity and the ability of coaches to adjust intensity and quantity, such as in track and field training, is limited. Reducing the intensity during technical and tactical exercises is out of question.

Strength

Strength is arguably the most researched motor skill, because it is a key factor in many sports. There are a lot of effective strength development tools and methods and models of placing these methods in various training periods. The specific characteristics of handball must be taken into account.

Contrary to technical and tactical training in handball, the training parameters of strength training with weights can be easily determined. The intensity is defined by “repetition maximum” (1RMax). This is the maximum weight that can be lifted with a particular muscle group in one attempt. Quantity can be defined by the number of lift repetitions. However, the issue of the undefined overall effect of handball training on the total training quantity remains unresolved. When the back-room staff consists of multiple coaches, it is vital that they cooperate, so that the players' loads are not too large or too small.

Strength development in handball is aimed at power development, power endurance and a certain level of hypertrophy to increase the two strength manifestations described above; however, it can also be aimed at developing muscle mass to directly improve match performance. Increased muscle mass is useful in defence and attack.

Power

Power as a physical quantity is defined as the amount of work performed per time unit. Less time spent performing a certain amount of work means higher power. We must distinguish the concept of power from strength, because players find it difficult to understand that a person able to lift 50kg in 1 second is more powerful than a person able to lift 100kg in 4 seconds over the same distance. This is particularly important in weight training when the load and the distance are clearly defined. Athletes usually do not consider the time needed to lift a load.

Power is one of the strength manifestations that are the most difficult to improve with training. It largely depends on the presence of type II b muscle fibres whose amount in the body is genetically determined. These fibres have the highest excitation levels, produce the largest force, but only for a short amount of time. To regenerate ATP, they use phosphocreatine which offers only about 6 seconds of maximum intensity effort.

Due to the amount of type II b muscle fibres being genetically determined, the best handball players are usually among the selected group of the most talented individuals. These players

have the highest potential for power development and power training makes even more sense for them than for the average population.

Constant high intensity training is needed to maintain the performance of type II b fibres. If these fibres are not stimulated properly by the central nervous system in a certain period, they degrade or transform into slower types of muscle fibres that are not capable of producing similar forces.

Power is largely related to the central nervous system which is directly responsible for the level of muscle activation.

Activation

Activation denotes the ability of the central nervous system to send strong and energy-efficient nerve impulses to develop maximum power. The impulse must quickly activate a specific muscle group and at the same time relax the antagonistic group. This is related to intra- and intermuscular coordination. Intramuscular coordination is primarily responsible for the speed of force development in muscles. The force in a muscle increases with time. The higher the activation, the faster force increases. On the other hand, intermuscular coordination regulates the time individual muscles are activated during a particular movement, as well as stabilizing movements and relaxing antagonistic muscle groups to prevent them from blocking the desired movement.

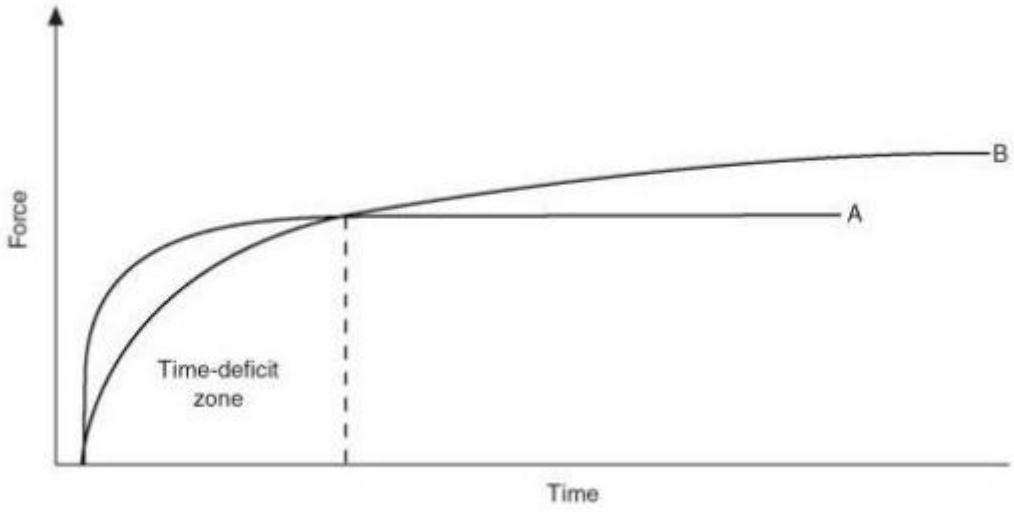


Figure 4: Diagram of the speed of force increase in muscles Source: Kraemer, W.J., Zatsiorsky, V. M., (2006). *Science and practice of strength training – second edition*

Strength endurance

The specific handball endurance is largely related to strength training. In its essence, handball consists of aerobic lactate and alactate energy supply re-synthesis intervals interrupted by periods of less intensive activity or rest. The majority of activities consist of anaerobic lactate activities. This means producing energy to regenerate ATP by means of glycogen to lactate transformation. Glycogen reserves are found in liver and muscles, especially in type II a muscles. These reserves can be vastly increased with proper training methods. The result is

also an increase of the muscle mass. If we were to analyse the morphological characteristics of the top handball players we could see that most have high muscle mass. There are differences depending on playing positions, but high muscle mass allows them to develop high forces on the one hand, and increases their momentum when moving on the other. It also absorbs impacts of physical contacts and reduces the risk of injuries.

Hypertrophy

Hypertrophy is the increase of volume of muscle fibres due to the increase of actin and myosin filaments, energy supplies, plasma and other substances in muscles. The volume of the tendons connecting the hypertrophic muscles also increases. Hypertrophy is used to increase muscle mass. However, a muscle mass increase is not always beneficial in handball, because it has positive and negative effects. The most effective muscle mass increase methods are based on the principle of type II a muscle cell depletion and often do not include type II b fibres. They also do not affect the nervous system, which means no improvements in terms of activation. They can sometimes even inhibit activation- due to a high number of movements at slow or medium speed, a stereotype of slow muscle activation can appear - which is not desirable in handball.

Trained athletes are able to use methods that lead to fibre II b hypertrophy. Loads between 90-120% are needed for this.

After athletes reach a very high activation threshold with other methods and they cannot increase their maximum strength and power, we can use methods that are suitable for achieving hypertrophy. The newly-acquired mass will allow them to break through the previous plateau.

Anatomical adaptation

The goal of the anatomical adaptation is to prepare the body to endure the strength training effects. The tendons must be able to withstand higher forces and the relationships between agonists and antagonists must be adjusted to allow harmonic joint movements. Hypertrophy also appears in tendons, but to a lesser extent than in muscles (Ušaj, 1996). The skeleton adapts to strength training as well. The bones are reinforced, but long-term training with high loads can cause the seams to weaken. This means periods of training with lower intensity are necessary. (Bompa, 2000) Strength training before the ages of 16 to 17, when weight training can start, is actually anatomical adaptation. This is why it is vital that we always stick to the principle of gradual load increase, pay attention to the optimal flexibility and strengthen the torso before the limbs. If we are successful, we can start with weight training safely.

Power transfer

A higher or lower power transfer is related to the extent exercises mimic the movements that are important in a certain sport discipline. For example, a medicine ball throw has a high transfer for handball, while a behind-the-head pull-down on an exercise machine has a low transfer. In terms of the Olympic-style weightlifting, the snatch has a higher transfer than the clean and jerk. The snatch final position resembles the defensive stance in handball and the high pull and catch phases of lifting the barbell above the head resembles the trajectory of the

saw in the whip-shot technique. The speed of the force development in the muscle also plays a significant role with power transfer. For a higher power transfer, the force development duration in an exercise should be similar to the respective handball element. For example, putting a 7kg shot has a lower power transfer than throwing an 800g medicine ball, because we strive to develop the largest possible force in the time needed to throw a handball. Longer force development has no effect on a handball throw, regardless of the size of the force. Figure 4 shows an example of this: A represents force development with a lighter load, and B represents one with a heavier load.

Training parameters

A strength training method is defined by training parameters. Regardless of the tools used, an appropriate parameter selection allows us to develop the desired strength manifestation. These parameters are intensity and volume.

Intensity

Various maximum weight, speed of execution, exercise complexity and rest duration values are used to adjust the training intensity. The heavier the load and the faster the execution, the higher the intensity. The intensity is also higher for multi-joint exercises, which include multiple muscle groups, compared to single joint exercises for individual muscles. The intensity can also be increased with minor exercise adjustments. For example, using distractions that affect balance, reducing contact surface or changing body angle to make the conditions more difficult. High intensity exercises are usually followed by longer rest periods between repetitions or different exercises. The rest periods do not affect only the heartbeat and energy reserves, this is also when hormones are released immediately after the activity. Shorter rest periods primarily cause the secretion of growth hormone that causes the type II a muscle fibre hypertrophy; longer periods (3-5 min) cause the secretion of testosterone that causes type II b muscle fibre hypertrophy and increases activation.

Volume

Volume is defined by the repetition, series and training unit count. Olympic-style weightlifters count the total weight of the loads lifted to always have an idea of how much they lifted in a certain period of time (tonnage). However, this is possible, because the distance to lift the load is approximately the same for all exercises and the speed of execution is always the highest possible. With different weightlifting exercises and varying speeds of execution, the tonnage data has limited value, because the lift distance of various loads is not known.

The sequence of execution of the selected exercises is important. We distinguish the vertical and horizontal sequence. The vertical sequence means that players execute the first series of the first exercise, followed by the first series of the second exercise, etc. The horizontal sequence on the other hand means that player first complete all series of the first exercise,

then all series of the second exercise, etc. The rest periods for various muscle groups are different - they are longer in vertical sequences than in horizontal ones.

Maximum weight

The maximum weight (1 RMax) can be measured in multiple ways. Experienced players aged above 21 years can try lifting the desired weight immediately after warming up. If they are successful, they can increase it. The players continue until they are unable to lift the load anymore. The rest period between the tries should be 3-5 minutes.

Less experienced players and younger players must use an indirect method of 1 RMax calculation based on the number of repetitions the player completes with a certain load weight. When a player performs the test for the first time, the coach must approximately evaluate their 1RMax and the player tries to lift 30% of the evaluated weight 12 times. After a rest of 1 minute, the player tries to lift 60% of the evaluated weight for 4-6 times. After 3 minutes, the player tries to make as many 80-95% 1RMax lift repetitions as possible. Their actual 1 RMax can then be calculated with computer software or calculation tables. With the emergence of smartphones and tablets in recent years, players have access to a huge number of maximum weight calculation applications which allow them to be much more independent.

Load parameter format

The following format is used for easier data presentation and planning:

$$\frac{\%1RMax\ (load)}{repetitions}series$$

Example:

$$\frac{70}{12}3$$

The above formula means: 12 repetitions with 70% of 1 RMax in 3 series

Methods for goal specific strength training

An appropriate method must be selected for a goal specific strength training. These methods can affect multiple goals at the same time. They can have a cumulative effect, or they can develop one goal and inhibit another one. An individual method can have a positive impact in a certain period of time, and a negative one on the same goal in another period.

Anatomical adaptation method

Anatomical adaptation training is not just strength training with weights. Before starting with the actual weight training, we must first develop flexibility and strengthen the body by means of body-weight exercises, whose intensity is gradually increased, static strength exercises, stabilization, dynamic flexibility and mobilization. Elastic bands, medicine balls and other tools are very effective at this stage. Usually, they are executed as a circuit training. The anatomical adaptation method with weights is very similar to the muscle hypertrophy method, but the quantities are somewhat lower. It makes sense to use weight machines, because they make the execution much safer. However, it should not be forgotten that the weight machine movement is not natural, because the muscle acts without its synergists that would normally stabilize the joint.

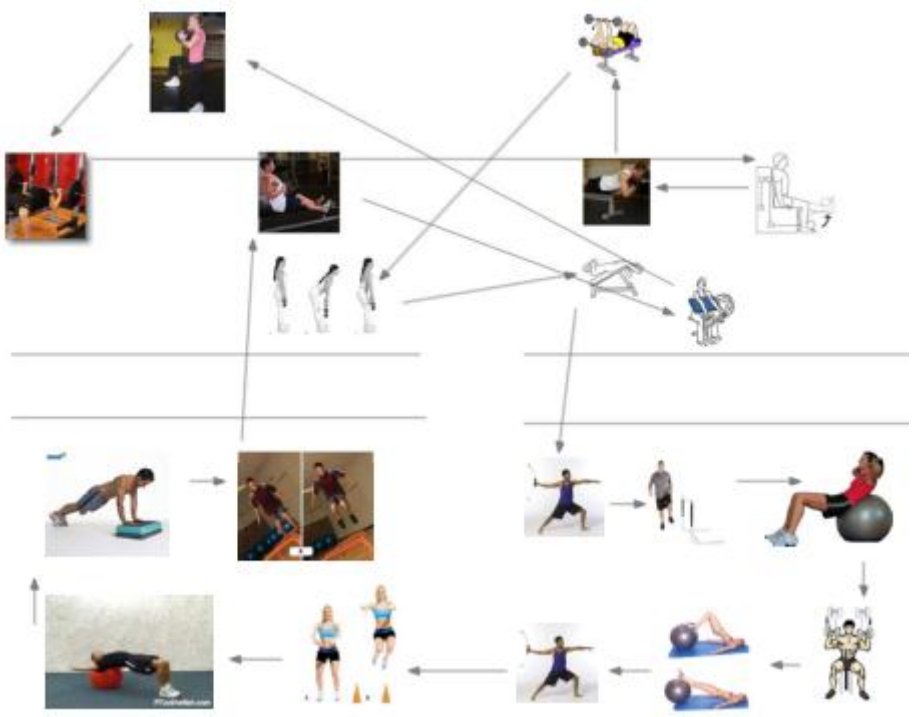


Image 5: Anatomical adaptation circuit; Source: original

Training parameters:

Beginners: $\frac{30-40\%\ 1RMax}{10\ to\ 15\ repetitions} 2-3\ series$

Trained athletes: $\frac{40-60\ 1RMax}{10-15\ repetitions} 3$

Athletes should perform the majority of the anatomical adaptation exercises independently before the start of pre-season training.

Muscle fibre hypertrophy methods

Every higher intensity method will cause a certain level of muscle fibre hypertrophy. However, bodybuilding-like methods are the most appropriate for the highest muscle mass gains. These methods can also be used for anatomical adaptation with trained athletes during the initial microcycles of a pre-season. Youth players should perform them more often to create a muscle mass base for subsequent maximum strength and power development.

During the competition period, these methods can negatively affect short-term results. The problem is that muscles have to be completely exhausted and this leads to long regeneration times (up to 72 hours) when fitness is low and injury risk is high. In addition, the speed of the exercise execution gives the stereotype of slow movement which is not desirable in handball. Heavy load or negative repetition methods do not generate this effect , but can lead to significant muscle exhaustion and tendon micro-traumas which can in turn lead to injuries.

The characteristics of this method are medium-heavy loads, high repetition count, lots of series, short rest periods and slow to semi-fast execution speed.

Bodybuilding method: $\frac{60\ do\ 80\%\ 1RMax}{6\ to\ 15\ repetitions} 3\ to\ 5$ - Rest of 1-1.5 minutes

Pyramided method:
$\frac{60\%\ 1RMax}{12\ repetitions}; \frac{70\%\ 1RMax}{10\ repetitions}; \frac{80\%\ 1RMax}{6\ repetitions}; \frac{80-85\%\ 1RMax}{6\ repetitions}; \frac{70\%\ 1RMax}{10\ repetitions}; \frac{60\%\ 1RMax}{12\ repetitions};$ Rest of 60 to 90 seconds

Power development methods

Power can be developed in multiple ways. We can first try to develop maximum strength to a higher level and then focus on the contraction speed. Or we can try to train with loads with high ratios between the work carried out by the muscles and the time spent performing a single repetition. Methods that yield the same result can be combined.

Sometimes it is necessary to increase the muscle mass before trying to increase maximum power. The execution speed is the highest possible with all exercises, although the exercises with heavy loads can only be executed slowly or cannot be executed at all. Rest periods always last between 3-5 minutes, or long enough to be able execute all repetitions in a series at maximum speed. If rest periods are too short, the training effect might not be what we imagined. Methods that use less than maximum loads are particularly prone to repeating at less than maximum speeds - the training would result only in the type II a muscle fibre hypertrophy with no improvements to the nerve impulse conductivity. Power would not be developed and hypertrophy would be the only effect. Some handball players find it difficult to understand this, because they are used to the muscle exhaustion feeling - they believe a training session is not good enough without any muscle pain.

The method must be adjusted for individuals, especially their age. Power development should start at ages of 18 to 19. Athletes should use less than maximum loads - between 80 to 85% of 1RMax. Trained athletes over 20 years of age should lift maximum loads between 90 and 100% of 1RMax or should even use negative repetitions (105-120%). A negative repetition means that athletes lift the load with the help of assistants, because it is too heavy - this is when eccentric muscle contraction appears. The force in the muscle is larger than with other forms of concentric muscle contraction

(figure 6). This method has an enormous effect on maximum force development, and it is why the anatomical adaptation must never be forgotten. Excessive use of this method would lead to a high tendon deficiency in terms of the muscle force. This is why this method should be introduced gradually. After a training unit containing negative repetitions, enough rest should be allocated or even a relaxation cycle should be scheduled.

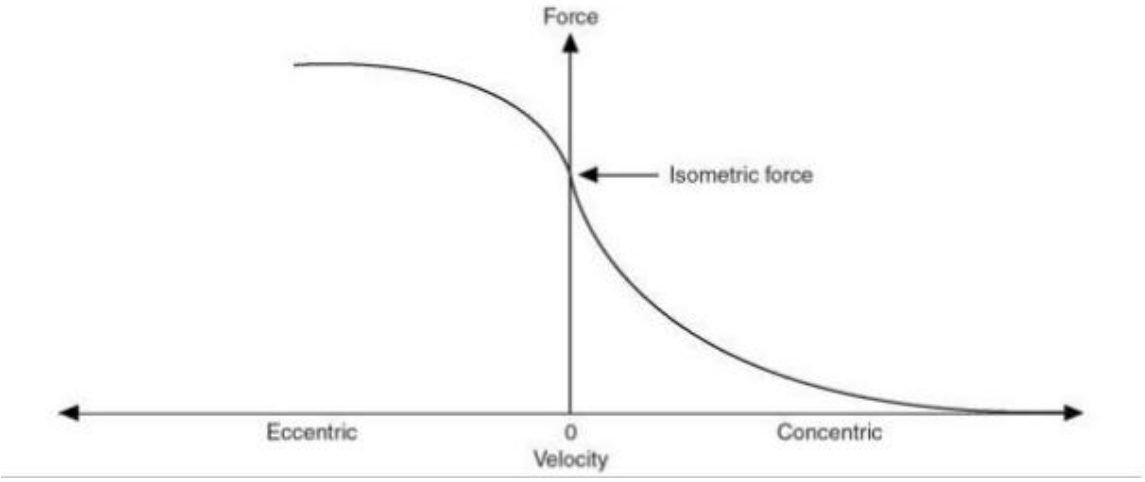


Figure 6: The ratio between force and contraction speed. Source: Kraemer, W.J., Zatsiorsky, V. M., (2006). *Science and practice of strength training – second edition*

Free weights are used. Weight machines can also be used to develop maximum strength, but the synergists of the main muscle group will not develop accordingly and they play an important role in joint stabilization. Weight machines are useful for beginners or at the start of the pre-season, because they are a bit safer. Modern gym equipment trends favour replacing weight machines by free weights (figure 7).

Figure 7: Modern gym for athletes

Contraction speed development methods can use free weights, medicine balls or jumps. To maintain a high activation level (i.e. contraction speed), every exercise should be followed by a complementary one that includes quickly switching the roles of the agonists and antagonists of the muscle group that has just been loaded. If we performed a leg exercise, we should immediately after the end quickly skip for 3-5 seconds or make 2-3 jumps from a semi-squatting position. If we performed an arm exercise, we can select medicine ball throw, dumbbell press with small loads or boxing into empty space as the complementary exercise. It is important that no more than 5 seconds elapse between the main exercise and the complementary one. A combination of weight exercises and pure handball elements is very effective, provided that we can use weights on a handball court. A good example of a combination is the French press followed by a ground shot on goal, or a squat with a load followed by a jump shot or a jump to block an incoming shot.

Free weights are used for non-combined methods when we want to perform the movements as fast as possible and with a load that has the highest ratio of work performed by the muscles. Probably the most effective method is the Olympic-style weightlifting technique. In handball, a simpler version of the exercises with a less pronounced squat is used - the so called "power" version that is much simpler, because it does not need extraordinary flexibility like the full squat version. The advantages of the Olympic-style weightlifting technique are:

- It forces us to execute the exercises as fast as possible. The execution speed is practically constant. By increasing the load weight, power is increased.
- Both the snatch and the clean and jerk activate practically every muscle in the body and produce enormous power output (table 1).
- It inproves muscle activation.
- The relationship between agonists and antagonists is natural.
- A relatively high power transfer for handball (especially the snatch).
- Can be used in all training periods.
- Time-effective and extremely suitable for activation level maintenance in phases of highest competitive activity.

This technique guarantees positive effect on power, because fast execution and high activation levels are essential for actually lifting the weight. Applicable to lighter loads as well. Complementary activation exercises (skipping, jumping, pressing, boxing etc.) are recommended immediately (5 seconds) after the execution of the main exercise.

POWER OUTPUT DURING EXECUTION OF SELECTED LIFTS

Lift	Subject	Power (W)	Ref.
Bench Press	Novice (60%—2 RM)	481	74
	Novice (85%—2 RM)	366	74
	Novice (100%—2 RM)	247	74
	Light novice	243	58
	Light elite	267	58
	Heavy elite	415	59
Deadlift	(Similar to squat values)		75
Squat	Heavy elite (93%)	1259	75
	Heavy elite	900	75
Snatch	Light elite (95%)	2821	73
	Light elite	2675	73
Clean	Heavy elite (92%)	3877	73
	Heavy elite	3413	73

Table 1: Power output of individual exercises Source: Vaughan (1989)

Combined methods for power development:

Maximum muscle force development methods (always execute a complementary exercise immediately after):

For youth players: $\frac{80-85\%\ 1RMax}{4-6\ repetitions} 3-4\ series$; 3-5 minutes rest,

For trained players: $\frac{85\%-100\ 1RMax}{1-4\ repetitions} 3-5\ series$; 3-5 minutes rest,

For trained players, negative repetition method: $\frac{105-120\%\ 1RMax}{1-2\ repetitions} 3-4\ series$; 3-5 minutes rest,

Pyramid method:

$$\frac{85\%\ 1RMax}{6\ repetitions}; \frac{90\%\ 1RMax}{3-4\ repetitions}; \frac{95\%\ 1RMax}{2-3\ repetitions}; \frac{100\%\ 1RMax}{1\ repetitions}; \frac{85\%\ 1RMax}{6\ repetitions},$$

Inverted pyramid method:

$$\frac{80\%\ 1RMax}{4\ repetitions}; \frac{85\%\ 1RMax}{3\ repetitions}; \frac{90\%\ 1RMax}{2\ repetitions}; \frac{95\%\ 1RMax}{1\ repetitions}; \frac{90\%\ 1RMax}{2\ repetitions}; \frac{85\%\ 1RMax}{3\ repetitions}; \frac{80\%\ 1RMax}{4\ repetitions}$$

Skewed pyramid method:

$$\frac{80\%\ 1RMax}{4\ repetitions};\frac{85\%\ 1RMax}{3\ repetitions};\frac{90\%\ 1RMax}{2\ repetitions};\frac{95\%\ 1RMax}{1\ repetitions};\frac{80\%\ 1RMax}{4\ repetitions}$$

Flattened pyramid method:

$$\frac{80\%\ 1RMax}{4\ repetitions};\frac{90\%\ 1RMax}{2\ repetitions};\frac{90\%\ 1RMax}{2\ repetitions};\frac{90\%\ 1RMax}{2\ repetitions};\frac{90\%\ 1RMax}{2\ repetitions};\frac{90\%\ 1RMax}{2\ repetitions};\frac{80\%\ 1RMax}{4\ repetitions}$$

Every 4 training units consisting of maximum strength methods should be followed by an unit for improving the muscle contraction speed: $\frac{30-40\%\ 1RMax}{5\ repetitions}\ 5-7\ series$; the rest period lasts to the moment the player repeats the exercise at maximum speed.

Power development with Olympic-style weightlifting

The training parameters are the same as with the maximum force development. We can use the 4x4 method. This means 4 repetitions and 4 series with a load of 80-90% of 1RMax.

Olympic-style weightlifting technique

Snatch

There are two techniques: the snatch and the clean and jerk. Snatch means lifting the barbell off the floor above the head in continuous movement. When executing the clean and jerk, the barbell is first held on the shoulders and then jerked above the head. (Figure 8)

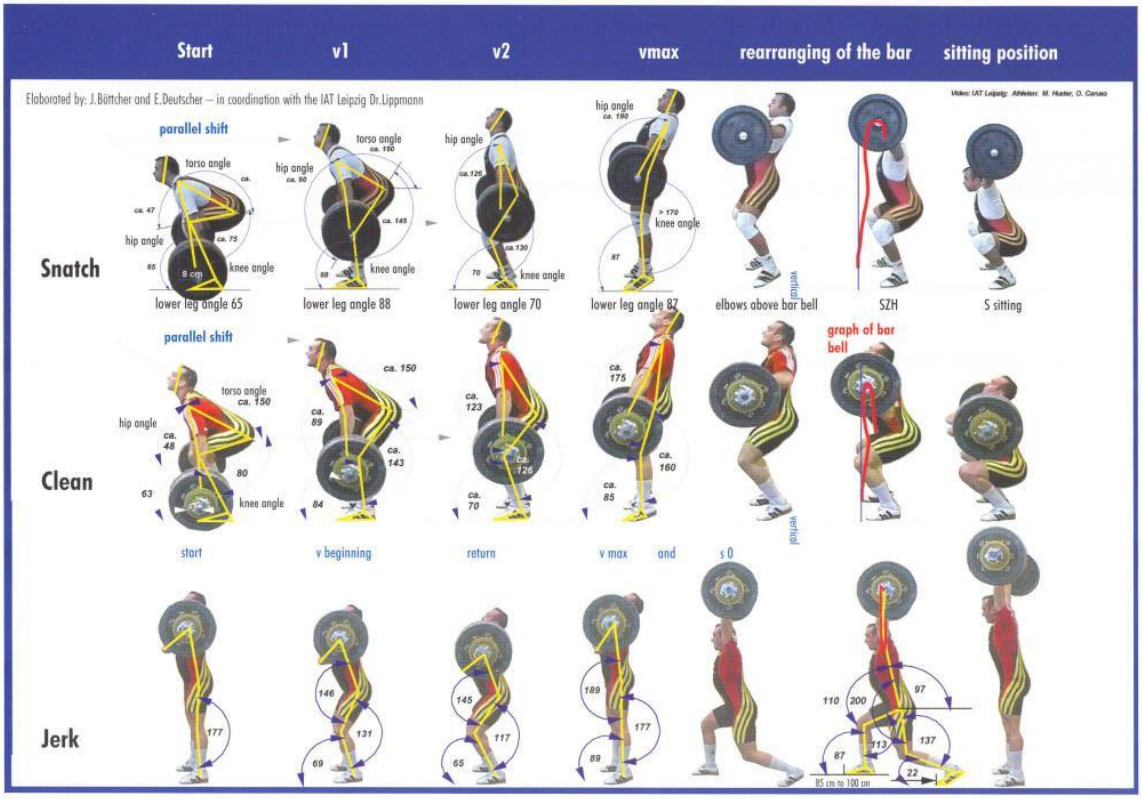


Figure 8: Snatch, clean and jerk

Grip: Both the snatch and the clean and jerk require the hook grip (figure 9). Incorrect grips are often the reason for incorrect lifts.

Figure 9: Hook grip

Various starting positions

Depending on the height of the starting position:

1. High starting position, barbell above the knees
2. Low starting position, barbell below the knees
3. From the floor
4. Depending on the barbell position:

1. The barbell is held in the hands above the floor
2. The barbell is laid on the floor or on a rack at various heights

Depending on the squat depth at the end of execution

1. Classic technique, full squat
2. Power version, in the catch phase, the knee angle is greater than 90°

Snatch:

Grip width: The grip must be wide enough, so that the barbell axis is 12-20 cm above the head when held up. The width can be measured by measuring the distance from the shoulder on the side to the knuckles of the hand on the other side of the body when the arm is extended away from the body (figure 10)

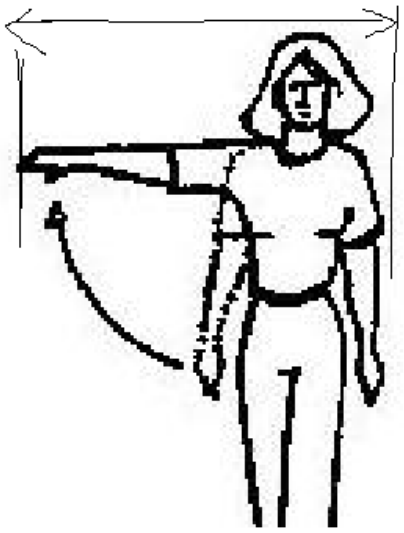


Image 10: Snatch grip width

Starting position:

Lifting off the floor is usually not used in handball, because it involves the greatest risk of back injury due to incorrect technique or bad flexibility. The correct position should be the following (figure 11):

- Feet shoulder width apart, insteps under the barbell axis, body weight distributed across the entire foot surface
- Shoulder axis a bit in front of the barbell axis
- Knees bent at 90°, the femur at least horizontal
- Lumbar region arched, abdominal and back muscles tight
- Chest forward, shoulders tight
- Head facing forward, chin slightly up

Figure 11: Snatch - starting position Source: Bratina (2012)

Sweep

From the starting position, we proceed to the sweep phase - alternatively, this can be the starting position with the barbell under the knees. This starting position can be used by players with good flexibility and good lifting technique. Things to pay attention during the pull phase:

- The axis is very close to the calves
- The hip angle must not change, only the knees are extended

Figure 12: Pull phase Source: Bratina (2012)

High pull

This is the height where most handball players start. The barbell is above the knees. If we are continuing the movement from a lower position, we continue to extend the knees.

- When the axis is in the middle of the thighs, we suddenly extend the hips as fast as possible and jump in the air
- When the bar-bell reaches waist level, we start bending the elbows

Image 13: high pull

Catch

We continue to bend the elbows and start raising the shoulders towards the ears. The barbell must be as close to the body as possible. After reaching the maximum amplitude, we must dip under the barbell as fast as possible. Handball players use a very shallow squat. To reach this point, we must take advantage of the moment when the barbell is effectively in zero-gravity. We must then catch the barbell and extend the elbows.

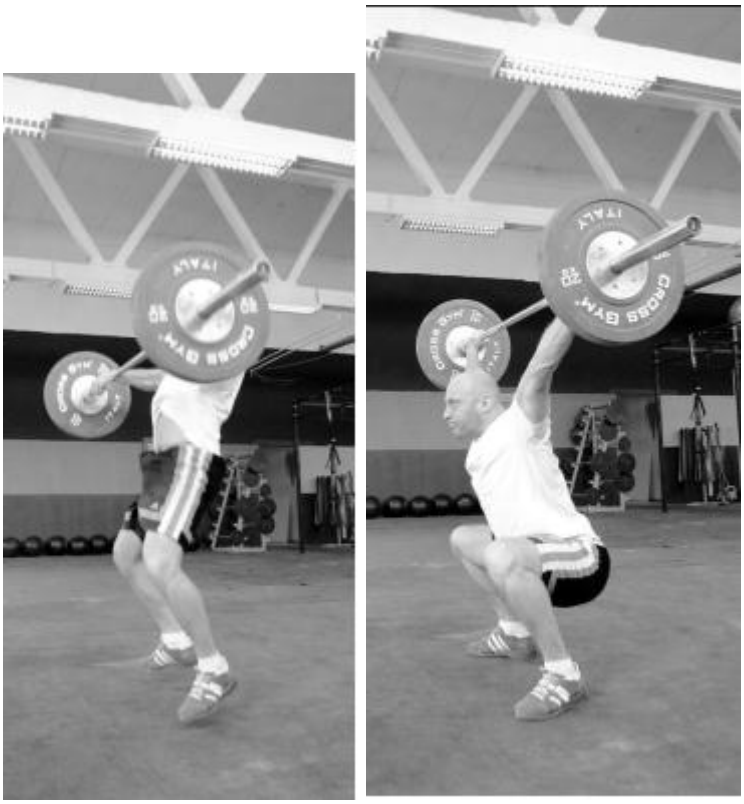


Image 14: Catch during snatch Source: Bratina (2013)

recovery

After the catch phase, we stand up from the squat position (figure 15):

- The weight rests on the heels as we try to stand up from the squat position
- We stand up straight
- The arms are extended
- The head is lowered a bit

Image 15: Recovery during snatch; Source (Bratina 2012)

Clean and jerk

In handball, we often execute just the clean, without the jerk, because the clean is simpler and heavier loads can be lifted. The reason is often also the incorrect technique in the final phase of the clean that prevents the lifter from executing the jerk. The other reason is safety. If the jerk is unsuccessful, the barbell often has to be thrown away which requires a lot of space and an appropriate surface - something that a handball court is clearly not.

Starting positions and the sweep

The starting positions are the same as with the snatch, except that the grip is narrower. The arms are a bit wider than shoulder width. The same goes for the pull phase.

Figure 16: Clean and jerk - starting position Source: Bratina (2012)

Catch

The various joints are used in a similar sequence as with the snatch, but the fall starts a bit earlier.

- When the barbell axis as at thigh level, we jump in the air with maximum power
- The hips are pushed forward as far as possible
- The shoulders are pushed as high as possible
- When the barbell axis is at waist level, we start bending the elbows
- When the barbell axis is at the navel level in the zero-gravity position, we dip under the barbell as fast as possible
- The upper arms are turned around their axis to a horizontal position, elbows are facing forward
- The weight of the barbell rests on the shoulders (upper part of the deltoids)
- With the weight resting on the heels, we recover from the squat and get ready for the jerk

Figure 17: Catch during clean Source (Bratina 2012)

Jerk

To continue from the catch to the jerk:

- We quickly bend the knees and straighten them to propel the barbell up and lift it above the head. We can use the split jerk or the push jerk.
- After the push jerk, the barbell is held completely vertically above the head and the knees are extended (the weight resting on the heels).
- After the split jerk, we move the forward leg back in position by lifting the front leg and moving it back. This can be done in two phases for heavier loads.

Figure 18: Clean and jerk Source (Bratina 2012)

Weight training plan creation

Prevention

Weight training has multiple positive effects, provided that it is introduced gradually and that we follow certain safety rules. Athletes using weight training have three times less chance of injuries than athletes who do not. (Bompa, 2000)

Safe training principles

Bompa (1999) defined 5 important principles for strength training planning:

1.) Developing sufficient flexibility in joints under load
2.) Developing tendons first and only later focussing on muscles
3.) First focussing on the proximal body parts and only later on limbs
4.) Strengthening the stabilizer muscles of the main muscle groups
5.) Practicing the whole movement, not individual muscles

An appropriate muscle group length allows the joints to move without problems. Limited flexibility means that certain movements cannot be executed. A typical example is a squat. If the length of the hip flexors and extensors and the Achilles tendon is inappropriate, we can have significant balance problems when squatting or we can experience the pelvic tilt. Inappropriate hip flexor and extensor length can obstruct even the most basic natural movements, such as running. If such tightness lasts too long, growth irregularities can occur. The most frequent occurrences are accentuated kyphosis and lordosis. Problems can occur especially in individuals who have undergone a significant growth spurt. Strengthening an already too short muscle would lead to additional shortening and even larger problems. Strengthening the antagonist would consequently lead to increased pressure on the joint. For this reason, flexibility training is essential before the start of strength training in such cases.

Tendon hypertrophy is normally less pronounced than muscle hypertrophy, so comparatively more time is needed. A strong muscle requires a strong tendon that binds it to the bone. High-intensity training sessions without proper preparation can damage the tendons or their attachment points. Less intensive weight training makes sure that tendons and their attachment points are loaded gradually and are prepared for higher loads. Increasing the intensity and quantity too fast without accounting for the tendon adaptation can lead to acute and even chronic injuries. Essential in this regard are the relaxation cycles when strength is not developed and tendons have the time to properly develop.

Body strengthening must follow a certain order. The body core must be strengthened at the beginning. Before starting weight training, we must increase the strength of the core muscles, especially abdominal and back muscles. Body-weight exercises for abdominal muscles are an integral part of youth training and their intensity must increase throughout an athlete's career. Strong core muscles are a basic requirement for free weight workout, because they stabilize

the spine and lumbal area. Strength program must begin with body muscle strengthening first, only later can we focus on the limbs.

Main muscle group stabilizers are very important for prevention as well as for strength development. These muscles usually statically support the body in the optimal posture for a certain movement. Shot power depends on the shoulder blade stabilizers, and a two-footed jump depends also on the strength of the abdominal and back muscles. These muscles must maintain stability and act as support to transfer the force over the limbs. Otherwise, any eccentric-concentric muscle contraction is not possible.

The strength training objective is to improve handball movements. The function of the exercises is movement and not achieving maximum force with one isolated muscle. Inter-muscular coordination is crucial for handball. This means that we should strive to execute multi-joint exercises and exercises with high power transfer for handball.

We must also take into account:

1.) the age of the player and his/her sporting history
2.) individual needs
3.) physiological and morphological individual characteristics

Age of the player and his/her sporting history

The chronologic and biological age of the player is the first parameter to take into account when planning the program (table 2). Depending on the development phase of the player, we assign a strength training method and training parameters. We must distinguish between pre-adolescent, adolescent, post-adolescent, mature and senior periods.

Age	Objective	Tools	Category
12	All-round development	Natural movement, games, body-weight exercises	U12
13	All-round development	Natural movement, games, body-weight exercises	U13
14	Anatomical adaptation	Focus on flexibility and consistent growth, body-weight exercises	U12
15	Anatomical adaptation	Focus on flexibility and consistent growth, body-weight exercises	U12
16	Anatomical adaptation, hypertrophy Hypertrophy, strength, endurance, force	Body-weight exercises, parallel bars, climbing, horizontal bar	U17
17	Anatomical adaptation, hypertrophy Hypertrophy, strength, endurance, force	Body-weight exercises, weight machines, light weights	
18	Anatomical adaptation, hypertrophy	Weight machines	U21

	Hypertrophy, strength, endurance, force	Free weights, learning Olympic-style weightlifting
19	Anatomical adaptation, hypertrophy	Free weights, Olympic-style weightlifting
	Hypertrophy, strength, endurance, force	Free weights, Olympic-style weightlifting
20	Anatomical adaptation, hypertrophy	Free weights, Olympic-style weightlifting
	Hypertrophy, strength, endurance, force	Free weights, Olympic-style weightlifting
21	Anatomical adaptation, hypertrophy	Free weights, Olympic-style weightlifting
	Hypertrophy, strength, endurance, force	Free weights, Olympic-style weightlifting

Table 2: Objectives in various development stages in handball, source: original

Special attention must be paid to those players whose biological and chronologic ages do not correspond (early and late developing athletes). In this case, the work plan must be adapted specifically for them.

The player's sporting history is also important. In most cases, players have undergone a systematic training process in the past and have adequate physique at the start of weight training. However, we must pay attention to exceptions coming from other clubs or without the appropriate sporting history - they must have special treatment. Before starting weight training, at least three years should be dedicated to other strength training methods (Kraemer and Zatsiorsky, 2006).

Players with chronic injuries are a special chapter. Close cooperation with the medical department is needed, because they must recommend to the coach which exercises these players can or cannot do.

Individual needs

Individuals can have different needs in various periods. We must always strive to improve weaknesses first and then develop the strength component with the greatest advantages. For example, a wing has less need for muscle hypertrophy than a line player or a defensive specialist. Young players with bit part roles may perform more strength training than older players at the end of their careers whose primary goal is to maintain fitness levels or even just slow down the negative effects of age on their bodies.

Long-term strength training plan

A long-term plan is a strength development strategy for young players for multiple years in advance. Table 2 shows an example of a 10-year-long strategy. The first 6 years consist of the preparation for weight training further down the line.

It makes sense to gradually increase the weight training intensity. Training parameters and methods must be adapted. You can find an example of progression from easier methods to more difficult ones below:

1.) Body-weight exercises
2.) Body-weight-exercises, on unstable surfaces, hanging off a horizontal bar or parallel bars etc.
3.) Weight machine exercises
4.) Free weights (simple exercises)
5.) Free weights (multi-joint exercises), Olympic-style weightlifting, weightlifting on unstable surfaces or reduced surfaces

Creating a competitive season plan

When the weight training pre-conditions are fulfilled, plan creation can start in earnest. At the beginning, the periods are defined depending on the match schedule. The durations of the pre-season, pre-competition, competition periods are defined and the mesocycles are assigned. The mesocycle objective and content are defined. This represents the training strategy for one competitive season. A table (e.g. table 3) can be referred to for help.

strategy: first league player											
Avgust	September	October	November	December	January	February	March	April	May	June	July
tekmovalna sezona											
Spring					Fall					Off season	
prep.p.	compet.p.	compet.p.	compet.p.	compet.p.	prep.p.	compet.p.	compet.p.	compet.p.	compet.p.	Off season	
	precomp.p					precomp.p					
1	2	3	4	5	6	7	8	9	10	11	12
mesocycle	mesocycle	mesocycle	mesocycle	mesocycle	mesocycle	mesocycle	mesocycle	mesocycle	mesocycle	mesocycle	mesocycle
anatomic adaptation, hypertrophy, max. Strenght	maksimalna moč, contraction speed, power	power	power	power	anatomic adaptation, hypertrophy, max. Strenght	maksimalna moč, contraction speed, power	power	power	power	anatomic adaptation, hypertrophy,recovery	

Table 3: An example of a handball season training periods table Source: original

Microcycles are then defined and methods and tools are selected for every mesocycle. If the team consists of individuals with different needs and competitive loads, the programs must be individually adapted. Table 4 shows two different approaches for strength training method selection. The upper part is appropriate for players whose primary objective is strength increase and play around 30 official matches per season. The lower part is appropriate for players whose primary objective so to maintain a certain fitness level throughout the season and play national league, cup, European cup and national team matches. These players play more than 50 matches per season and the strategy aims to maintain strength levels by muscle activation. In this case, the most effective method is Olympic-style weightlifting.

strenght training develeopment												
over 21 year - only national legue matches												
	Jun	Jul	Avg	Sep	Oct	nov	Dec	Jan	Feb	Mar	Apr	Maj
Anatomic adaptation	x	x	x				x	x				
Hypertrophy	x	x	x				x	x				
Submaximal strenght			x	x	x	x	x	x	x	x	x	x
Maximal strenght			x	x	x	x	x	x	x	x	x	x
Power (ol.weightlifting)			x	x	x	x	x	x	x	x	x	x
Plyomertics				x	x	x	x		x	x	x	x

strenght training develeopment												
over 21 year- legue matches international matches and European Cups												
	Jun	Jul	Avg	Sep	Oct	nov	Dec	Jan	Feb	Mar	Apr	Maj
Anatomic adaptation	x	x	x									
Hypertrophy	x	x	x									
Submaximal strenght			x									
Maximal strenght			x									
Power (ol.weightlifting)			x	x	x	x	x	x	x	x	x	x
Plyomertics												

Table 4: An overview of various methods depending on the number of matches played
Source: original

Before defining the actual training quantities, the mesocycle duration (microcycle count) and the training quantity distribution method must be defined. The most frequently used models have 4 or 5 microcycles per mesocycle.

In this particular example, the strategy has 4 microcycles (diagram 1). The training quantity is increased in the second microcycle, with the intensity being increased in the third. The quantity is then reduced in the fourth, while the intensity remains the same. The first microcycle of the next macrocycle starts with increased intensity and the previous microcycle model is repeated. This ensures that the training intensity constantly increases over longer periods. The quantity fluctuates within the same limits. It can be increased a bit, if the match schedule allows for it. The example in diagram 1 show an increase of quantity in the third mesocycle.

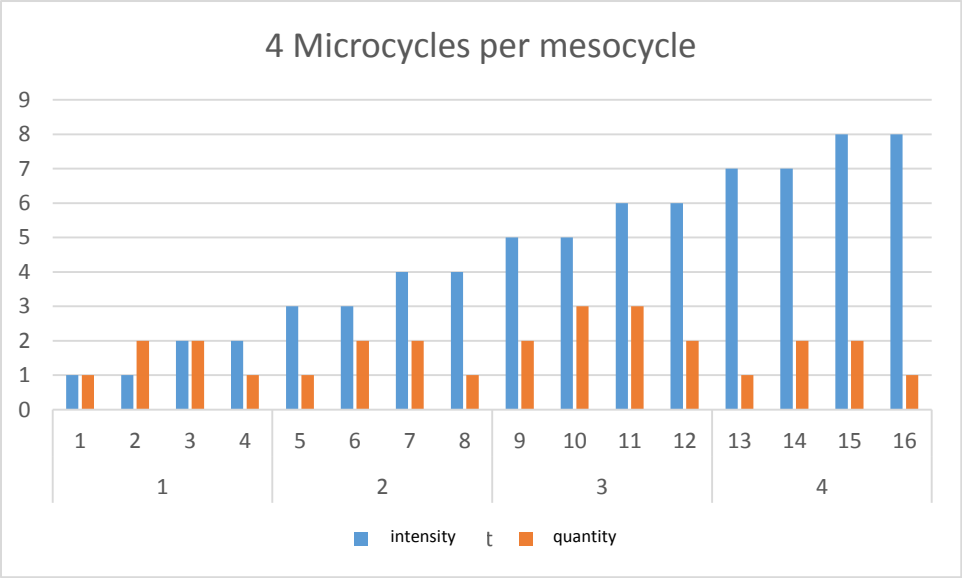


Diagram 1 Increasing the quantity and intensity, 4 mesocycles with 4 microcycles each
Source: original

When we have a clear strategy, we can start making the actual plan. We have selected the objectives, tools, methods and quantities. All we need now are actual exercises to achieve the stated objectives. Below is an example of a plan for young players during off-season. The objectives are:

- Increasing muscle mass and anatomic adaptation
- Increasing power
- Learning Olympic-style weightlifting technique

In addition to weight training, the training plan must include core body exercises, speed development exercises, speed endurance exercises, aerobic capacity exercises and ball exercises. This part is outside the scope of this seminar paper and will not be described. Instead, I will focus on weight training. Players have three weight training units per week. Each day is one segment. The segments are arranged in columns depending on the objective, tools and methods.

Segment 1:

- Objectives: Hypertrophy and anatomic adaptation
- Tools: Weight machines and free weights
- Methods: Pyramid and inverted pyramid method

Segment 2:

- Objectives: Power development
- Tools: Free weights
- Methods: Maximum force training adapted to young players (less-than-maximum loads); contraction speed training

Segment 3:

- Objective: Learning Olympic-style weightlifting technique

- Tools: Olympic-style barbells
- Methods: Olympic-style weightlifting learning methods

	Max. Strenght and hiperthrophy		sub.maximal sternght		weightlifting
1	abdominals	60% x 12	bench press	80% x 6-8	squatting exercises
	back muscles	70% x 10	smith squat	80% x 6-8	
	bench press	80% x 6	heel rise	80% x 6-8	
	smith squat		incline bench pull		
	leg extension		chin row		
	leg curl				
	pully				
2	abdominals	60% x 15	bench press	80% x 6-8	front squat
	back muscles	75% x 12	smith squat	80% x 6-8	half squat
	bench press	80% x 6	heel rise	80% x 6-8	lounge
	smith squat		incline bench pull	80% x 6-8	high hand snatch
	leg extension		chin row		high hand clean
	leg curl				
	pully				
3	abdominals	60% x 12	bench press	86% x 6-8	front squat
	back muscles	70% x 10	smith squat	86% x 6-8	lounge
	bench press	80% x 6	heel rise	86% x 6-8	high hand snatch
	smith squat	70% x 10	incline bench pull		high hand clean
	leg extension	60% x 6	chin row		deadlift
	leg curl				
	pully				
4	abdominals	60% x 15	bench press	86% x 6-8	front squat
	back muscles	70% x 12	smith squat	86% x 6-8	lounge
	bench press	80% x 6	heel rise	86% x 6-8	high hand snatch
	smith squat	70% x 12	incline bench pull	86% x 6-8	high hand clean
	leg extension	60% x 15	chin row		deadlift
	leg curl				
	pully				

Table 5: A model of the first weight training microcycle for players aged 17 to 19 during off-season

5	abdominals	65% x 12	bench press	30% x 5	front squat
	back muscles	75% x 10	smith squat	30% x 5	overhead squat
	bench press	85% x 6	heel rise	30% x 5	deadlift
	smith squat		incline bench pull	30% x 5	low hand snatch
	leg extension		chin row	čim hitreje!!!	low hand clean
	leg curl				
	pully				
6	abdominals	65% x 15	incline bench press	80% x 6-8	front squat
	back muscles	75% x 12	step up	80% x 6-8	overhead squat
	bench press	85% x 8	SLDL	80% x 6-8	deadlift
	smith squat		heel rise		low hand snatch
	Lat machine		military press		low hand clean
	Biceps curl		incline bench pull		
	frech press				
7	abdominals	65% x 12	incline bench press	80% x 6-8	front squat
	back muscles	75% x 10	step up	80% x 6-8	overhead squat
	bench press	85% x 6	SLDL	80% x 6-8	deadlift
	smith squat	75% x 10	heel rise		low hand snatch
	Lat machine	65% x 12	military press		low hand clean
	Biceps curl		incline bench pull		
	frech press				
8	abdominals	65% x 15	incline bench press	86% x 6-8	front squat
	back muscles	75% x 12	step up	86% x 6-8	overhead squat
	bench press	80% x 6	SLDL	86% x 6-8	deadlift
	smith squat	75% x 12	heel rise		low hand snatch
	Lat machine	65% x 15	military press		low hand clean
	Biceps curl		incline bench pull		
	frech press				

Table 6: A model of the second weight training microcycle for players aged 17 to 19 during off-season

Tables 5 and 6 show that the strategy has been taken into account. The intensity increases and the quantities fluctuate within the defined limits. Learning Olympic-style weight lifting starts with the easiest and simplest elements and continues to the more difficult and complex ones.

In youth categories, where the results are not of primary importance, the whole training process can be planned in a similar way. However, with teams that have to achieve results, the planning strategy must be adapted. In best case scenario, the training is individualized so that the different characteristics of players are taken into account. It is very important to listen and give advice to older and more experienced players. Training during the best years of a career differs significantly from training at the start of a career. Training effects are smaller and regeneration time is much longer. It makes sense reducing the quantity to a minimum and increase intensity for these players. The best way to achieve this is the Olympic-style weightlifting. The 4x4 method is used. Such a training session must immediately follow a technical/tactical session, so that players can regenerate in the morning (rest or a regenerative training session).

An example of an Olympic-style weightlifting session immediately after a handball session:

- Abdominal and back muscle exercises (if they haven't been included in the handball part of the session) for 5 minutes
- Warming up with a barbell 3-5 minutes
- 4x4 Olympic-style weightlifting training - 12-20 minutes
- The snatch and the clean and jerk are alternated between the training units
- 2-3 training units per week

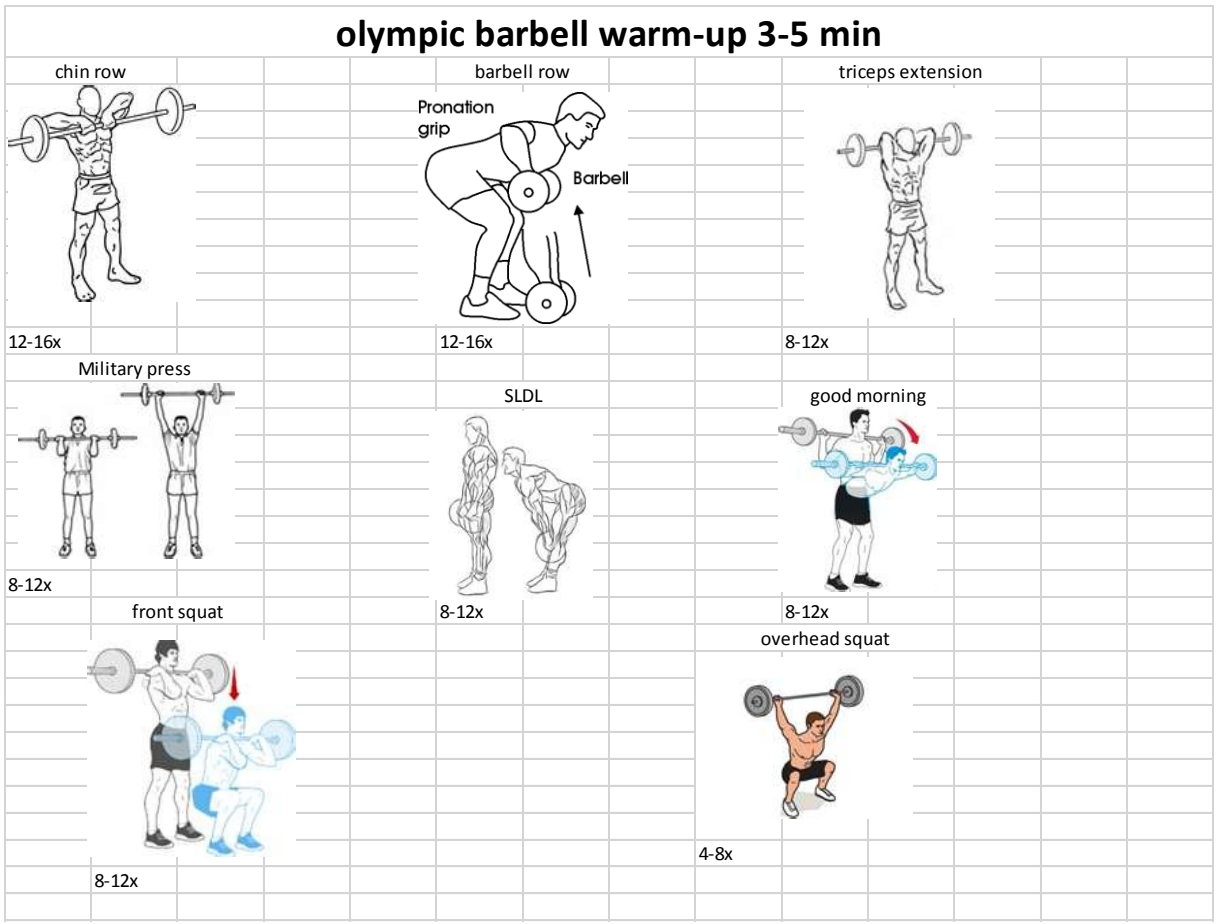


Figure 19: Warm-up exercises Source: original

Strength training organization

Off-season:

Players usually train individually during the off-season. Coaches must prepare an individual program for every player. We can use spread sheet software (e.g. Microsoft Excel), because they make creating individual plans very easy without much typing and writing. All that is needed is some basic knowledge and the ability to define the maximum weight for individual exercises - to automate individual training plan creation (Figure 20).

week:	1	Monday						
John Doe	10-15x	12x	10x	6x				
exercise:	wa.up	1	2	3	4	5	6	7
core stability	exercise complex 1 - 1							
bench press	28	42	49	56				
squat (smith)	48	72	84	96				
leg extension	24	36	42	48				
Leg curl	16	24	28	32				
pully	25,2	37,8	44,1	50,4				
week:	1	Tuesday						
	10-12x	6-8x	6-8x	6-8x				
vaja:	wa.up	1	2	3	4	5	6	7
bench press	28	56	56	56				
squat (smith)	60	96	96	96				
heel rise	60	96	96	96				
incline bench pull	21,6	50	50	50				
chin row	17,5	28	28	28				
week:	1	Thursday						
	8x	5x	5x	5x	5x			
vaja:	wa.up	1	2	3	4	5	6	7
wall squat	15							
"frankestine" squat	20							
Front squat	20	20	20					
overhead squat	20	20	30	20				
shrug jump clean grip		20	20					
shrug jump shrug grip		20	20					
clean barbell stand	20	30	35	40	30			

Figure 20: A training sheet created according to the plan in Table 4 Source: original

Pre-season

There are usually a lot of training units per week during pre-season. This means that weight training is performed by the whole team at once. Usually, careful organization is needed due to the limited number of available pieces of equipment. One possible way is to publish a list of exercises on a visible spot (figure 21) and include a training parameter sheet with the data for every player with every exercise.

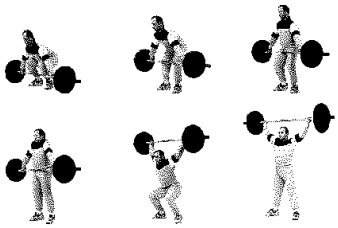
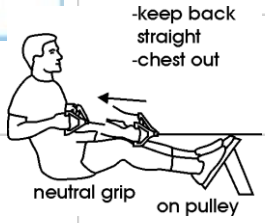
1	Incline bench press	
2	snatch	
3	french press	
4	militari press	
5	clean	
6	pully	
7	squat (smith)	6 do 8x 

Figure 21: Group training exercises order Source: original

French press			
	Kg	rep	series
Player 1	36	6-8x	x3
Player 2	40	6-8x	x3
Player 3	44	6-8x	x3
Player 4	39,2	6-8x	x3
Player 5	52	6-8x	x3
Player 6	0	6-8x	x3
Player 7	40	6-8x	x3
Player 8	36	6-8x	x3
Player 9	48	6-8x	x3
Player 10	0	6-8x	x3
Player 11	40	6-8x	x3
Player 12	44	6-8x	x3
Player 13	36	6-8x	x3
Player 14	42,4	6-8x	x3
Player 15	48	6-8x	x3
Player 16	40	6-8x	x3
Player 17	52	6-8x	x3
Player 18	42,4	6-8x	x3
Player 19	40	6-8x	x3
Player 20	42,4	6-8x	x3
Player 21	40	6-8x	x3
Player 22	40	6-8x	x3

Image 22: A training sheet with training parameters for a single exercise Source: original

Pre-competition period

This is the period when athletes in individual sports reduce quantities and increase intensity. In handball, this means increasing the quantity of technical/tactical training and decreasing the quantity of exercises without the ball. Strength training must be executed as close to the handball court as possible. We should select exercises with high power transfer for handball. An example of a training session:

Elbow extension while lying on a bench $\frac{80-85\%}{4}$ 5; immediately followed by 4 powerful ground shots on goal.

Squat $\frac{80-85\%}{4}$ 5; immediatelly followed by jumping over three high hurdles and a jump shot

3-5 series of similar combined exercises

Competition period

Various training loads can be used in the competition period. If the matches are scheduled on every 7th day, we can constantly increase the load at the beginning of the week and still have enough time to regenerate until the match. The situation is drastically different if matches are played every 3-4 days. The is little time for regeneration and usually the regeneration process is not completed. Strength training in such situations adds an additional strain on the body and can quickly lead to overtraining and injuries. Athletes should only maintain activation levels and muscle tone. The best time to use Olympic-style weightlifting is after a training session.

Conclusion

Power is one of the key performance factors in handball. Despite being heavily depended on our genetic material, significant improvements can be achieved through training. The highest gains can be seen in players with above-average genetic material. Even the best training plan and optimal execution are no substitute for good player selection.

Bad training strategy can lead to huge injury problems. This is particularly important in youth categories. Impatience and a desire for fast progress are often the reason for chronic injuries. Weight training planning should start at least three years before a barbell or dumbbell is actually held in hands. In the example described here, which can be used by most clubs in Slovenia, strength training starts at the age of 11 or 12. A clear vision of strength development and a general 8-year outline is needed to be able to compete against the best teams in the world. The most critical period in an athlete's development is the growth spurt during adolescence. The body develops quickly and disproportionately. Unprofessional methods and a disregard of the prevention principles can cause considerable damage for young players.

When the weight training requirements are fulfilled, a good plan is essential to safely fulfil the potential of every individual. Too many competitions can hinder the motor skill development of individuals. Sadly, this is most often seen with members of the U17 and U21 national teams who have practically no off-season for several years in a row. They sometimes do not have enough time between seasons to completely regenerate. The period between age of 17 and 21 is the best for increasing muscle mass and the best time to do it is the off-season. These players have national team obligations during the off-season and it is impossible to plan two muscle hypertrophy mesocycles.

Even senior players do not have enough time for strength training as they often play more than 50 matches per years with many of them scheduled every 3rd or 4th day. They accumulate fatigue and it is difficult to assess the fitness levels of individual players to give them good training advice. Even the slightest exaggeration in training can lead to injuries. Often we must depend on players' experience and feelings and let them decide on the exercises they think are best for them. With younger and less experienced players, we can use the Olympic-style weightlifting.

The Olympic-style weightlifting has been slightly forgotten in Slovenia in recent years and many clubs have ceased to use it. This is an issue of the national teams and clubs who take players from other clubs. If an individual does not master the technique, it slows down the work of the coach who has to teach this player individually, so that they can latter participate in group exercises. Every handball player should be familiar with the basics of the Olympic-style weightlifting technique.

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