

STUDY ON OPTIMIZATION OF SPECIFIC PHYSICAL TRAINING FOR 15 – 17 YEAR- OLD PLAYERS THROUGH THE COMBINATIONS OF PLYOMETRIC EXERCISES WITH TECHNICAL PROCESSES IN THE HANDBALL GAME

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***Abstract:** The experimental study took place over a period of 12 weeks, on a sample of 15 junior male handball players (15-17 years old) according to the following premise: Experimenting the plyometric method of physical training, associated with the execution of the technical procedures from the handball game. The overall conclusion of this study is that plyometric training is an effective training option when a number of conditions are met within the training process.*

***Key words:** planning, customization, evaluation.*

1. Introduction

Physical preparation - overall systematic of training procedures that aims to develop and use the natural qualities of the sportsman [3].

Plyometric exercises - means that are meant to combine the force and speed of the movement, being capable of producing a superior robustness. Are those exercises in which a muscle is prepared to achieve maximum strength in a time as short as possible.

Technical process – the actual execution of the technical element [2].

Requirements for designing training programs [4, 5, 6]:

- Progressive solicitation in a specific effort;

- The particularity and differentiated treatment in handball players training;
- Selective processing and adapting to effort;
- Building scientific training basis;
- Evaluations and periodical testing of practical training;
- Maximizing strength and minimizing time;
- Dosage and the interval between repetitions;
- Individualization of the training program
- Dividing into periods the annual training plan;
- Training planning.

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2. Purposes:

- Developing a program of physical training based on combinations of different types of muscle contractions with technical processes, adapted to each period in the calendar of competitions and to the characteristics of the subjects involved;
- The assessment of the physical training level and its evolution for the study group.

3. Hypothesis:

- The combination of the plyometric tensing scheme with basic technical processes will be essential to increase investments the driving capacity general and specific, and to improve the constant development of the handball training for players aged 15-17;

4. Content of the experiment

Table 1

Subjects of experimental study

	Name Surname	Position	Birth Year	Height [cm]	Weight [kg]	Breadth	Palm width
1	B. R.	LEFT FORWARD	2001	178	65	180	23
2	I. R.	MIDFIELDER	2001	184	80	190	23
3	B. M.	LEFT WING	2000	170	62	173	22
4	S. R.	RIGHT WING	2001	177	84	187	24
5	D. R.	PIVOT	2000	177	89	192	23
6	N. K.	GOAL KEEPER	2001	189	67	188	22
7	F. E.	RIGHT FORWARD	2001	187	78	191	25
8	I. A.	PIVOT	2000	186	82	190	24
9	S. H.	LEFT WING	2001	170	62	172	22
10	B. A.	PIVOT	2000	184	93	192	25
11	V. R.	RIGHT FORWARD	1999	184	76	193	26
12	I. A.	LEFT WING	1999	186	77	191	25,5
13	V. T.	PIVOT	1999	191	97	204	26.6
14	P.D.	LEFT FORWARD	2000	189	83	193	24
15	R.A.	GOAL KEEPER	2000	187	85	194	24

The experimental study has taken place between May 2016 (when the *initial testing* took place) and November 2016 (*final testing*).

Trials

Table 2

	MEASURED COMPONENT	TRIAL
1.	Spring	Standing long jump
2.	Spring+muscle resistance of the lower limbs	Pentajump
3.	Moving speed+resistance in speed	Speed running 5x30m
4.	Abdomen and back muscle strength	Sit-ups
5.	Upper limbs strength	Throwing the 2kg medicine ball from knee standing
6.	Upper limbs strength+execution speed	Throwing the handball ball with three step take-off

The development and implementation of physical training programmes based on plyometric exercises combined with different basic technical processes specific to the game of handball, were done in accordance with the designed planning documents:

Table 3												
<i>Planning of the training process</i>												
Training objectives	1. The constant growth in the level of general physical training; 2. Optimizing the level of specific physical training: - improving the speed of execution and reaction; - improving the ability of force-velocity (spring) of the upper and lower limbs; - improving the ability of muscle strength; - improving the capacity for coordination, balance and space orientation; 3. Maintaining health status at an optimal level for all the components of the team.											
Interval	Training				Pre-competition			Competition				
Month	July – August (25.07 – 21.08)				August - September (22.08 – 11.09)			September – October (12.09 – 16.10)				
Week	25.07 -	01.08 -	08.08 -	15.08 -	22.08 -	29.08 -	05.09 -	12.09 -	19.09 -	26.09 -	03.10 -	10.10 -
	31.07	07.08	14.08	21.08	28.08	04.09	11.09	18.09	25.09	02.10	09.10	16.10
Location	SIBIU				SIBIU			SIBIU				
Training days	2	2	2	2	2	2	2	2	2	2	2	2
Number of trainings	2	2	2	2	2	2	2	2	2	2	2	2
Training duration (min.)	150	150	150	150	150	150	90	70	70	70	70	70
Percentage of the physical training/session.	100%	100%	100%	100%	80%	80%	70%	40%	40%	35%	35%	35%
Training volume	P.1; P.2	P.3; P.4	P.1; P.2	P.3; P.4	P.1; P.2	P.3; P.4	P.5; P.6	P.7; P.8	P.5; P.6	P.7; P.8	P.5; P.6	P.7; P.8

There have been created 8 (eight) models of physical training programs based on the combination of plyometric exercises with handball technical processes and they were implemented as follows:

P. 1- TRAINING PROGRAMME MODEL I (6 exercises)

• TRAINING PERIOD: 25.07. – 29.07.2016;
 08.08- 12.08.2016;
 PRECOMPET. INTERV: 22.08 – 27.08.2016

• DAY: Tuesday -26.07.2016; 09.08.2016; 23.08.2016

TIME: 50-60 min.; 50-60 min.; 40-50 mins.

• TRAINING OBJECTIVES: improving general driving force and specific strength and coordination;

P. 2- TRAINING PROGRAMME MODEL II (6 exercises)

• TRAINING PERIOD: 25.07. – 29.07.2016; 08.08-12.08.2016;

PRECOMPET. INTERV.: 22.08 – 27.08.2016

• DAY: Thursday - 28.07.2016; 11.08.2016; 25.08.2016

TIME: 50-60 min.; 50-60 min.; 40-50 min.

• TRAINING OBJECTIVES: improving motility, the general motility, dexterity and specific coordination;

P.3 - TRAINING PROGRAMME MODEL III (6 exercises)

• TRAINING PERIOD: 01.08.–05.08.2016; 15.08.–20.08; PRECOMPET. INTERV.: 29.08–02.09.2016

• DAY: Tuesday - 02.08.2016; 16.08.2016; 30.08.2016

TIME: 50-60 min.; 50-60 min.; 40-50 min.

• TRAINING OBJECTIVES: improving general and specific motility;

P.4 - TRAINING PROGRAMME MODEL IV (6 exercises)

• TRAINING PERIOD: 01.08.–05.08.2016; 15.08.– 20.08; PRECOMPET. INTERV.: 29.08–02.09.2016

• DAY: Thursday - 04.08.2016; 18.08.2016; 01.09.2016

TIME: 50-60 min.; 50-60 min.; 40-50 min.

• TRAINING OBJECTIVES: improving general motility, dexterity and specific coordination, lower body strength;

P.5 - TRAINING PROGRAMME MODEL V (5 exercises)

• PRECOMPET. INTERVAL: 05.09.–09.09.2016; COMPET. INTERV.: 19.09. – 24.09.2016; 03.10 – 08.10

• DAY: Tuesday – 06.09.2016; 20.09.2016; 04.10.2016

TIME: 40 – 45 min.; 40–45 min.; 40 – 45 min.

• TRAINING OBJECTIVES: improving coordination and specific strength of the upper and lower body;

P.6 - TRAINING PROGRAMME MODEL VI (5 exercises)

• PRECOMPE. INTERVAL: 05.09. – 09.09.2016; COMPET. INTERV.: 19.09. – 24.09.2016; 03.10 – 08.10,2016

• DAY: Thursday - 08.09.2016; 22.09.2016; 06.10.2016

TIME: 40 – 45 min.; 20 – 25 min.; 20 – 25 min.

• TRAINING OBJECTIVES: improving general motility, coordination, space orientation, arms and legs strength;

P.7 - TRAINING PROGRAMME MODEL VII (5 exercises)

• COMPET. INTERVAL: 12.09. – 16.09.2016; 26.09 – 01.10.2016; 10.10 – 15.10.2016

• DAY: Tuesday - 13.09.2016; 27.09.2016; 11.10.2016

TIME: 35 - 40 min.; 35 – 40 min.; 35 – 40 min.

• TRAINING OBJECTIVES: improving coordination, balance, and specific strength of the lower limbs;

P.8 - TRAINING PROGRAMME MODEL VIII (4 exercises; table no. 4)

• COMPET. INTERVAL: 12.09.–16.09.2016; 26.09–01.10.2016; 10.10 – 15.10.2016

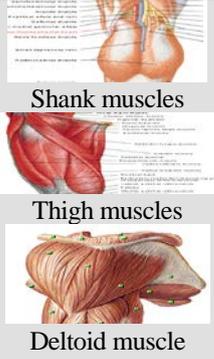
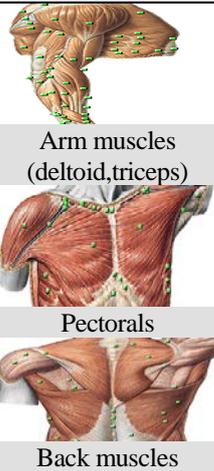
• DAY: Thursday – 15.09.2016; 29.09.2016; 12.10.2016

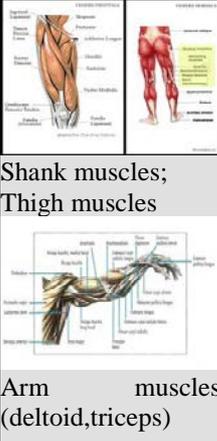
TIME: 20 - 25 min.; 20 – 25 min.; 20 – 25 min.

• TRAINING OBJECTIVES: improving specific strength and general dexterity;

Table 4

Structure and content of a training programme (Pr. no. VIII)

Technical description	Photo representation	Muscle action	Muscle graphics	Dosage	Method indications
1. Standing leg-spreaded, semi-flexion followed by a vertical jump at the same time throwing a ball upwards with two hands from the knees and catching it along with landing in the position of departure (semi-flexion);		Eccentric Plyometric Concentric	 <p>Shank muscles</p> <p>Thigh muscles</p> <p>Deltoid muscle</p>	3x15 rep. (handball ball); 30sec. Time-out (stretching)	Individual training; Catching the ball above the head; The exercise starts at an audible signal.
2. From standing on the knees the player passes the ball with both hands from above the head – plunging forwards in a push-up position – returning to the original position.		Plyometric (upper limbs)	 <p>Arm muscles (deltoid, triceps)</p> <p>Pectorals</p> <p>Back muscles</p>	3x10 rep. (handball ball); 30sec. time-out (stretching);	Execution in pairs; The distance between the players is of 3-4 m;
3. From standing on top of the jumping box (the segment above it), depth jumping-returning to the box-depth jumping-catching and passing on the ball to the partner while jumping;		Plyometric (lower limbs);	 <p>Shank muscles (gastrocnemian m.)</p> <p>Thigh muscles</p> <p>Abdominal muscles</p>	3 x 6-8 rep; Active time-out for 10-15 sec. (stretching)	The exercise shall take place in pairs; After each series the executing player shifts; passing on the ball from standing is an option;

Technical description	Photo representation	Muscle action	Muscle graphics	Dosage	Method indications
<p>4. Standing face down (on the tip of the toes and palms) starting on signal in sprint-stop-side jumping on both legs (over a plastic cone)-recovering the ball off the ground-shooting towards the gate;</p>		<p>Isometric • Plyometric</p>	 <p>Shank muscles; Thigh muscles Arm muscles (deltoid, triceps)</p>	<p>3-4 executions / position; Active time-out for 10-15 sec. (stretching);</p>	<p>After each series of exercises the players change their position in the field; The throwing procedures are being set and alternated according to the position of each player; The players execute 6 jumps over the plastic cone;</p>

5. Results

From the analysis of the results obtained from the two tests I have concluded that we can consider as confirmed the working hypothesis and perceive as effective the designed training programs because the physical training level of those involved in the experimental study has grown from one

evaluation to another in the sense that, if the initial testing tended more towards a **POOR raing** (four of the trials being classified as such), at the final testing the level was ascending to the **WELL** rating (four out of six trials were rated at this level), as we can observe in the representation below:

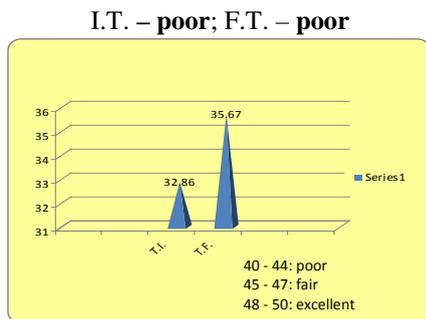


Fig.1. *Throwing the handball ball*

I.T. – poor; F.T. – poor

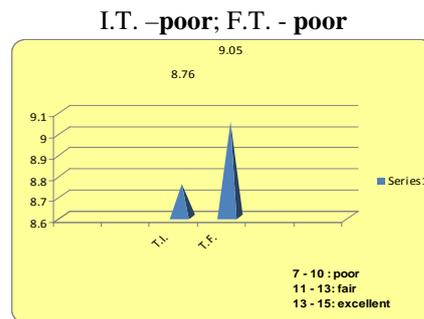


Fig.2. *Throwing the medicine ball*

I.T. –poor; F.T. - poor

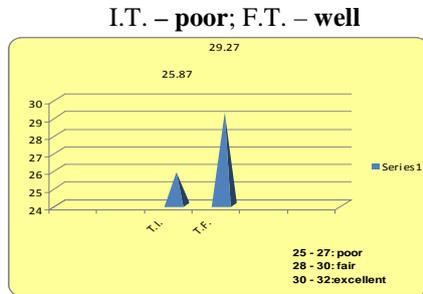


Fig.3. Sit-ups

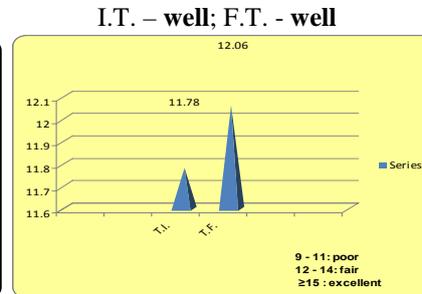


Fig.4. Pentajump

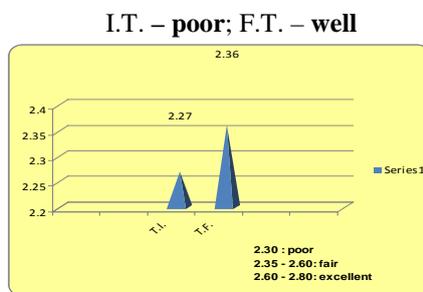


Fig.5. Long jump

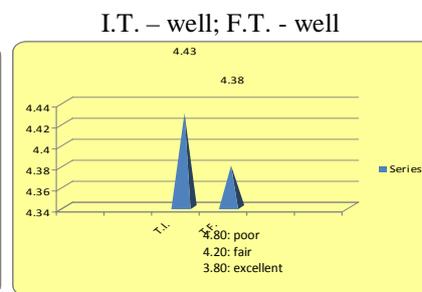


Fig.6. Speed run 5 x 30m

6. Conclusions and Proposals

- Plyometric exercises in their individual shape but especially in combination with the carrying out of technical processes may represent an interesting and effective means of physical training because of their unique character devoid of the monotonous and boring character of other "traditional" types (the famous endless jumping on the stairs of gyms or sports grounds).

- Using the plyometric training, combined with the execution of basic technical processes within the training process, one must take into consideration a number of positive aspects but also some negative ones:

- Positive:
 - they can be used at almost any age;
 - the level of difficulty of the exercises may vary from easy (simple) to intense (complex);

- Negative:
 - without properly preparing the body for the effort (warm-up) injuries may occur;
 - a proper preparing of the joints must be made before using plyometric exercises.
 - when using plyometric exercises we must turn our attention to the level of solicitation of one's body segments moving during execution (focus on the moment of take-off and landing after jumping), the athletes' skills by the time they start taking such exercises, the facilities (a hard surface is not recommended).
 - for the recovery after effort not to take a very long time it is recommended that, at this age, the athletes should apply a moderate plyometric training.

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