Optimizing preparation of women handball players by applying the long term training of maximal strength and power

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Summary. The aim of this research is to describe an approach of maximal strength and power training during an entire competitional season, as well as the importance of its application for those muscular groups essentials in playing handball. The results obtained confirm the efficiency of planning and applying the maximal strength and power training.
Keywords: handball; preparation; maximal strength; power.

Introduction:
"The most important feature in women's handball performance is the alert dynamic in which the game is played" [1]. It can also be observed a significant increase of the numbers of body contacts between players, their hardness approaching easily to male handball. The technique seen during a women handball game has reached a high level of spectaculosity and it is used with raised parameters of speed and precision.
These particularities have come to the fore due to a very high level of speed and strength of women handball players, the development of these qualities and the correlation between those and the playing performance is one of the main focuses of domain researchers and trainers [2]. Additional weights exercises used to develop strength are among the main means used today, which contributes to the improvement of the physical potential.
Attempts to improve performance in sport, in terms of additional weights training involve massive investments of time and especially knowledge of coaches, physical trainers. The training methods used depend on the competence of those who are conducting the instruction process and must be applied in accordance with the individual particularities of each player and their level of experience.
It has been shown that for beginners, additional weights training aims to improve the execution technique, the control of the movement and muscular strength. For the experienced players, where the execution technique is known and there is an optimal standard of the control of the movement, the only objective remains the obtaining of performances [4].
The issues appeared in training with additional weights refers to knowing which muscular groups are essential in playing handball, and how different forms of speed and strength are developed, according to each preparation period, individual particularities of each player and characteristics and tasks of each position of the handball field.
The aim of this research is to describe an approach of maximal strength and power training during an entire competitional season, as well as the importance of its application for the muscular groups essentials in playing handball. The results obtained confirm the efficiency of planning and applying the maximal strength and power training.

Methods
Subjects
The subjects included in our research are the female handball players from the club CSM Bucharest, Romania, who in the competitional season 2014-2015, also the period of our research, became the champions of the Romanian handball League. The team counts a total of 19 players (age: 29.6 ± 4.3; height: 176.3 ± 5.9; weight: 69.7 ± 7.7).
Research methods
The indirect method of calculating one maximal repetition (1RM)
"Within this method, it can be determined the maximal value of an additional load that can be pushed only one time, starting from a submaximal test"[3] test was applied for bench press (muscular groups involved: pectorals, anterior deltoid and triceps) and half squat (muscular groups involved: quadriceps, gluteus).
Statistical-mathematical methods

For the interpretation of the obtained results, standard statistical methods were used, as mean, standard deviation, coefficient of variance. To establish the significance of the differences between initial and final testing, we used T student test.

Training methods

The official program of the games proposed by the Romanian Handball Federation divided the season 2014-2015 into two macrocycles. Each macrocycle included the basic preparatory phase, the precompetitional phase, the competitional phase and the transition phase.

Regardless the period, for each microcycle there were programed two training sessions with additional weights. According to the results obtained at the initial testing, each player from CSM Bucharest team received two different individual programs, each including 13 exercises. The working method used was the circuit method. The two exercises presented in Figure 1 were included in one of the 2 individual programs of each player. Our intervention through the present research was applied once a week (microcycle), during the whole season.

Figure 1.Graphical representation of bench press and half squat exercises

Dosage, loads, number of series and pause duration varied depending of the characteristics of each preparation phase. Table 1 presents in detail all these aspects.

Table 1.Strength periodization

Period	Objective	Series	Reps	Load	Break
Basic preparatory phase	Muscular hypertrophy	3	10	70%	120 sec
Precompetitional phase	Maximal strength	3	1-6	85-100%	180 sec
Competitional phase	Power	3	4	80% 1RM	120 sec
Transition phase	Strength endurance	3	12-15	50%	90 sec

Results interpretation

Table 2. Results obtained during the first macrocycle

MACROCYCLE 1	Testing	X	S	Cv	T value	P value
Bench press – 1RM	Initial	54.2	5.8	10.8%	-8.752	0.000
	Final	59.5	5.9	10.1%		
Half squat – 1RM	Initial	73.4	8.3	11.4%	-10.500	0.001
	Final	78.9	9.9	11.3%		

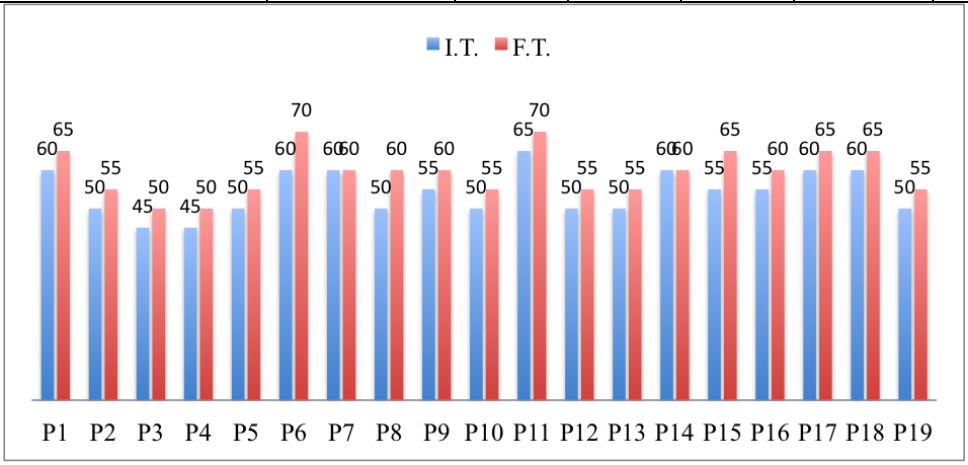

Figure 2. Bench press- results obtained by each player at both testing during the first macrocycle

According to Table 2 and Figure 2, for bench press can be observed an increase of mean with 5.3 Kg, the homogeneity inside of the team being high. The significance level ($p = 0.000 < 0.05$) shows that the difference is statistically significant, which demonstrates the efficiency of planning and application of the additional weights training program having as main focus development of the maximal strength on upper body.

For half squat, the homogeneity is also high inside of the team. The mean difference between initial and final testing has a value of 5.5 Kg. This difference is statistically significant ($p= 0.001 < 0.05$). This demonstrates efficiency of planning and application of the additional weights training program having as main focus development of the maximal strength on lower body.

Table 3. Results obtained during the second macrocycle

MACROCYCLE 1	Testing	X	S	Cv	T	p
Bench press – 1RM	Initial	58.2	5.3	9.2%	-7.550	0.004
	Final	63.2	6.9	10.9%		
Half squat – 1RM	Initial	78.2	11.3	14.5%	-5.719	0.000
	Final	84.7	14.4	16.9%		

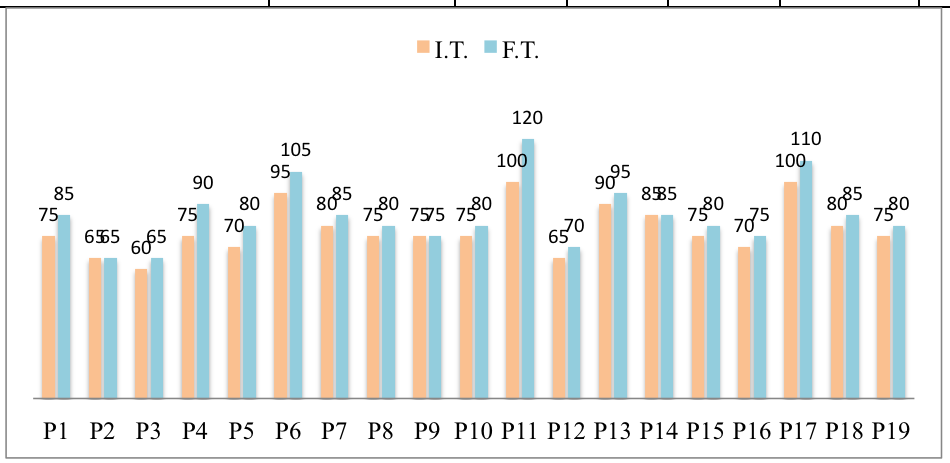

Figure 3. Half squat – results obtained by each player for both testing during the second macrocycle

For the second macrocycle, the test 1 RM for bench press shows, according to Table 3 and Figure 3, an increase of the mean with 5 kg from initial testing to final testing. The difference is statistically significant ($p = 0.004 < 0.05$), which demonstrates the efficiency of planning and application of the additional weights training program having as main focus development of the maximal strength on upper body.

Regarding the test 1 RM for half squat, mean difference between initial and final testing has a value of 6.5 Kg. This difference is statistically significant ($p = 0.000 < 0.05$). This demonstrates efficiency of planning and application of the additional weights training program having as main focus development of the maximal strength on lower body.

Conclusions

Exercises with additional weights used to develop all forms of strength are among the main ways, which help the improvement of the physical potential. Physical trainers and coaches from all handball world are more and more interested in this matter and its positive effects on achievement of performances.

Using additional weights training require prior preparation without which the intervention would be risky and could lead to severe injuries.

Discovering those exercises with additional weights that conforms to the specifics of the handball game does not guarantee the fulfilment of the proposed objectives, if the effort's parameters are not properly established, in accordance with individual particularities of each player and with the characteristics of each preparation period.

The results obtained through the present research by the women handball players of CSM Bucharest team demonstrates the effectiveness of planning and applying of the additional weights trainings.

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