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METHODICAL CONTRIBUTIONS REGARDING THE IMPROVEMENT OF PHYSICAL TRAINING IN U16 FEMALE VOLLEYBALL PLAYERS

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Abstract: *Physical training in volleyball, with a focus on juniors, raises the development of new training methods as a very important issue, meant to expand the body's functional possibilities.*
The game of volleyball has a team character, a trait that entails the need for collective effort, aimed at achieving the goal - victory. The victory of the team can only be achieved if the ratios between the motor qualities, the height of the players and the overall effectiveness of the team are optimized in the two fundamental phases: attack and defense. A selection of the means applied in physical training must be made in accordance with the technical needs imposed by the sports branch, in order that the muscle groups involved in the achievement of specific movements to be well prepared, and the technical-tactical actions can be performed at their maximum potential.

Key words: *volleyball, physical training, strength, sports training.*

1. Introduction

Sports performance has progressed impressively in recent years. Levels of performance unimaginable a short time ago have become commonplace events, and the number of athletes capable of outstanding performance has increased.

Also, training has become more sophisticated, partly thanks to the help of sports specialists and scientists.

Within sports preparation, physical training includes a relatively unitary system of means and requirements regarding the athlete's performance in training and competition (improvement of motor skills, mastery of basic motor skills and abilities, development of morphological and functional indices) [15].

For a team to achieve good performance, its players must develop the ability to solve specific problems that arise during competition by creating similar situations in training lessons [2].

Along with the increase in the set of technical-tactical knowledge, as well as the increase in the possibilities of their application in the game, the ratio between the power of expression in the game and the quick reaction of using general and

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specific physical training indices is also manifested. [3], [18]

Planned performance of general physical training during all training sessions ensures the formation of a wide baggage of motor skills that facilitate the strict specialization work [14], [17].

Effective performance of the game actions throughout the match requires a high level of general and special motor skills [11], [12].

In the training of players, it is necessary to develop all the muscle groups in a homogeneous form, without any imbalances that would disrupt further training and sports performance. [9] Attention should be focused especially on the development of large muscle groups, and strength training should be gradually introduced into the training, using bodyweight exercises first, then light exercises with medicine balls, exercises with weights, and finally, exercises specific to the practiced sports branch, which ensure preparation at a high level for competitions [8], [1], [13].

By combining the means for strength development of in the forms of manifestation characteristic for the game of volleyball and the contraction regimes, we can achieve the muscular training we need in order to reach the proposed objectives. In achieving this, it is necessary to determine which muscle groups must be developed and to take into account the competitive requirements of the volleyball game [9], especially the characteristics of players, the specific functional and energy needs, therefore it is necessary to carry out a motor and energy analysis of the competitions in which they participate [5], [6].

In the case of force periodization, during training we can distinguish the following phases: physiological adaptation, maximum force, transformation, maintenance, terminal and compensation. [4], [16], [7]

1.1. Research premises

As a result of the new methodological orientation, a consequence of scientific results, as well as of advanced practice, methodological principles for modern didactic technology were established in the training's programming and planning, namely the objectification and modernization of training content.

Starting from the in-depth knowledge of the volleyball game, of the players in training and the game's concept we can say that today's trainings have greatly increased their intensity, in accordance to the age and level of training, the request parameters are configured differently, for the seniors even ending up pushing the limit of the power by such request.

In sports games, an individualization of training is necessary due to the following factors: the fundamental requirements of the game, the demands of the game model, and the particularities of the player, the level of training and competition, and some special game tasks, conditions imposed by the scientific management, injuries and illnesses, selections in national teams.

The rich content of the volleyball game, the permanent dynamism of the actions in indirect dispute with the opponent and particularly varied request, impose a full correspondence between the game requirements and the complex of skills for the one who prepares in order to achieve great performance.

1.2. Research hypothesis and tasks

By adapting the muscle training, through alternate contraction regimes, to the playing position and to the morphological-functional particularities of players, we believe that we succeed to increase the performance capacity of female volleyball players.

The research tasks:

- Analysis and generalization of specialized literature regarding sports training and muscular training of junior volleyball players.
- Statistic study of the specialists' conception regarding the level of muscular training of junior volleyball players U16.
- Elaboration, theoretical and experimental argumentation of the muscle training methodology, through regimes of alternate contractions, adapted to the playing position of junior volleyball players U16.

The purpose of the research: is to optimize the muscular preparation in the training of junior female volleyball players U16, adapting it to the game tasks, by developing, capitalizing and confirming the alternate programs of the contraction regimes, having the possibility of achieving an optimal and rationalized training, in order to fulfill the proposed performance objectives.

2. Material and methods

In order to achieve the goal and the tasks we aimed at, we will use the following research methods:

- analysis and generalization of specialized literature data;
- measurement and testing method;
- the pedagogical experiment;
- the statistical-mathematical method of data processing;
- comparative analysis;
- the graphic method.

Research organization

The experiment took place in the gym of Alexandru Dima National College, the test subjects that participated in the experiment were the U16 female volleyball team, LPS Pitesti (experimental group), also part in the U16 National Volleyball Championship. The team consists of 12 players and is registered in the LPS Pitesti Sports Club, coached by Iatan Nicoleta.

The pedagogical experiment that was carried out during a competitive year (June 2022 - May 2023) and consisted in the application of muscle training programs through alternating contraction regimes (isometric - plyometric), on the experimental group (LPS Pitesti).

The control group was represented by the National College “Nicolae Titulescu” Craiova team, made up of 12 U16 volleyball players, also participating in the U16 National Volleyball Championship.

Strength training was planned in correlation with other activities: technical-tactical exercises, speed and resistance training. During the preparatory period, it was observed that in the physical training programs, the means used reach the level of maximum strength and power, which was also observed during the competitive period.

During the transition period, after a very intense physical and mental effort, accumulated in the previous periods (preparatory, pre-competitive and competitive), means were applied to help

the athletes, ensuring rest and recovery of the body.

The application of the exercises was carefully monitored to ensure the development of the musculature of the upper limbs (development of explosive force and arm strength for attacking procedures in the volleyball game), for the lower limbs (explosive force), for the muscles of the back and abdomen.

The most important aspect of muscle training was the selection of exercises and the preparation of the training programs, because each player has different indices that must be improved in order to be effective in a game.

3. Results

The evaluation of the performances for the U16 volleyball players implied the testing method, through the Bosco Protocol applied on the Kistler 9290AD Quattro Jump force measuring platform and 5 of the 6 tests of the protocol.

The Bosco protocol can evaluate through its components: explosiveness, detent, non-plyometric (SJ) and plyometric (CMJ) tests; thigh strength tests (CJbref), (CJB); reactivity tests (CJS).

High jump (h) is one of the indicators calculated by applying tests on the Kistler 9290AD Quattro Jump force measuring platform.

Squat jump (SJ) was the first one tested using this platform, which is a test of explosive strength (maximal), the height indicator registered a significant increase in the experimental group of 3.86 cm, while the control group only obtained an increase of 2.42 cm.

The coefficient of variability shows us a very good homogeneity of performances (8.01%, 7.03%) for the experimental group and (3.74%, 6.53%) for the control group. The value of "t" was 3.064 (significant $p<0.01$) for the experimental group and 2.929 (significant $p<0.01$) for the control group.

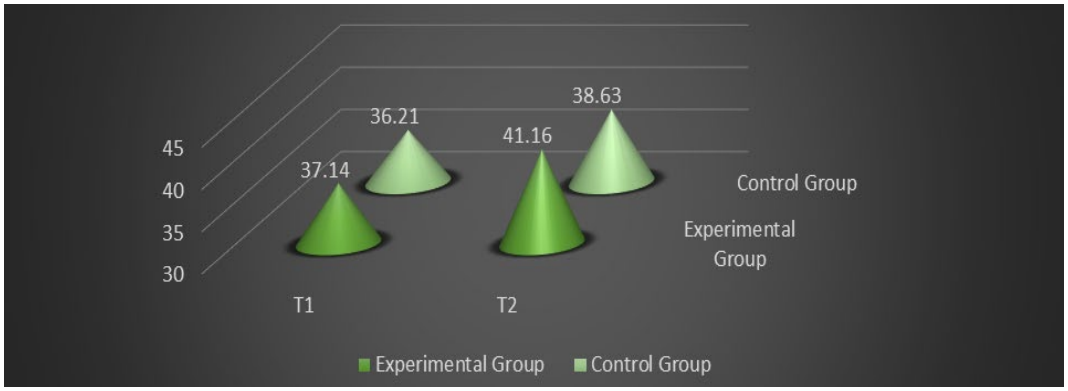

Fig. 1. "*Squat jump (SJ)" – chart of arithmetic average*

Another test applied in our research was the counter movement jump (CMJ), which involves the evaluation of the FV (maximum) explosive force of the legs and the quality of the reuse of muscle elasticity, the neuro-motor recruitment capacity, the capacity to use the viscous-elastic force in the muscular tissue.

As it can be seen from table 1, in the initial testing of this sample, the team

subjected to the experiment obtained an average of 37.76 cm, and in the final testing 41.36 cm. The control team scored 36.62 cm at initial testing and 38.46 cm at final testing. The calculation of the coefficient of variability shows us two groups with a high degree of homogeneity (4.98%; 5.06% - the experimental group and 3.96%; 3.79% - the control group). The "t" values were 4.433 (significant $p<0.001$) for the experimental group and 3.755 (significant $p<0.005$) for the control group.

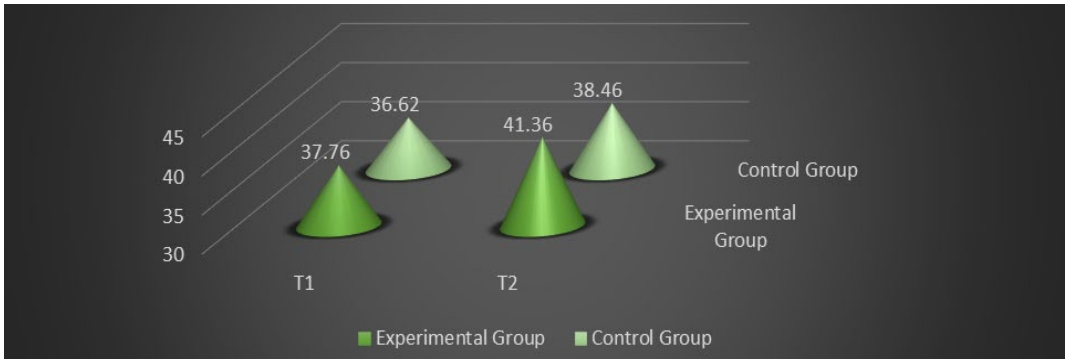

Fig. 2. *"Counter Movement Jump (CMJ)" – chart of arithmetic average*

The third test within the Bosco protocol is the continuous jump with bent legs reference (CJbref), which describes the mechanical strength of the lower body.

At the initial testing, the groups were equal in terms of values (35.24 cm experimental group and 35.2 cm control group). At the final test, the experimental group obtained an average of 38.66 cm, and the control group recorded an average of 37.09 (table 1).

The value of "t" for the experimental group is 3.739 (significant $p<0.005$) and 1.190 (not significant) for the control group. The coefficient of variability shows us two groups with a high degree of homogeneity (6.51%; 5.64% - for the experimental group and 5.97%; 5.74% - for the control group).

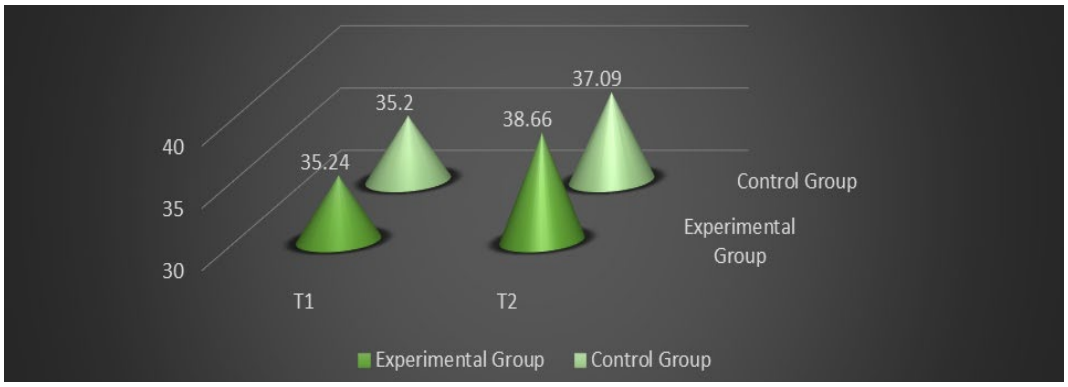

Fig. 3. "*Continuous Jump with Bent legs Reference (CJbref)" – chart of arithmetic average*

In the jump with bent legs (CJB) test, which involves the mechanical strength of the lower body, the greatest progress was recorded by the experimental group (see table 1).

In the initial testing, the values were close (experimental group – 29.59 cm, control group – 29.83 cm). In the final test, the experimental group achieved a progress of 7.24 cm, and the control group registered a progress of 2.5 cm.

It is the test in which the experimental group achieved the greatest progress, and the value of "t" confirms this (t = 4.43) significant for p<0.001, while in the control group "t" was equal to 1.763 thus insignificant p.

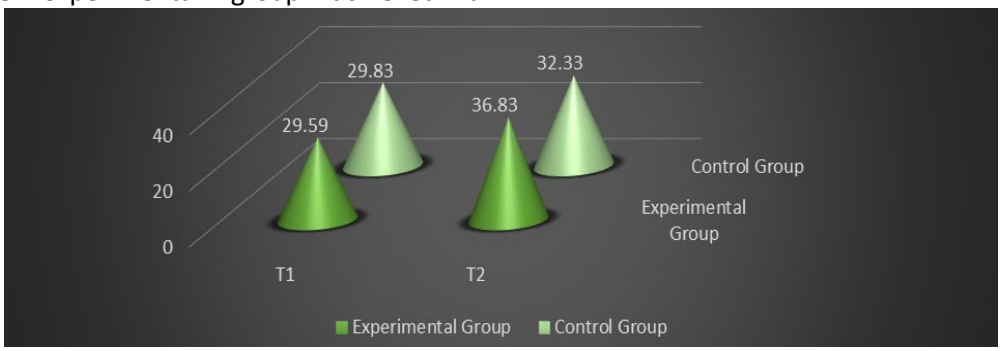

Fig. 4. "*Jump with Bent Legs (CJB)" – chart of arithmetic average*

Regarding the coefficient of variability, it recorded high homogeneity in the experimental group (11.37%, 10.84%) and average homogeneity in the control group (11.27%, 11.08%).

The continuous jump with straight legs (CJS) test (reactivity test) involves evaluation of the muscle elasticity of the leg extensors, the jumping technique and the tolerance to the extended impact, as well as the amount of fast fibers.

In this test, the experimental team obtained a progress of 3.67 cm while the control group obtained a regression of 1.98 cm. The coefficient of variability shows a high homogeneity of the two groups (experimental group – 9.72%, 7.28%; control group – 5.34%, 5.20%). After calculating the "t" value, the following result was obtained: t=2.378 (p<0.05 significant) for the experimental group and t=1.560 (not significant) for the control subjects.

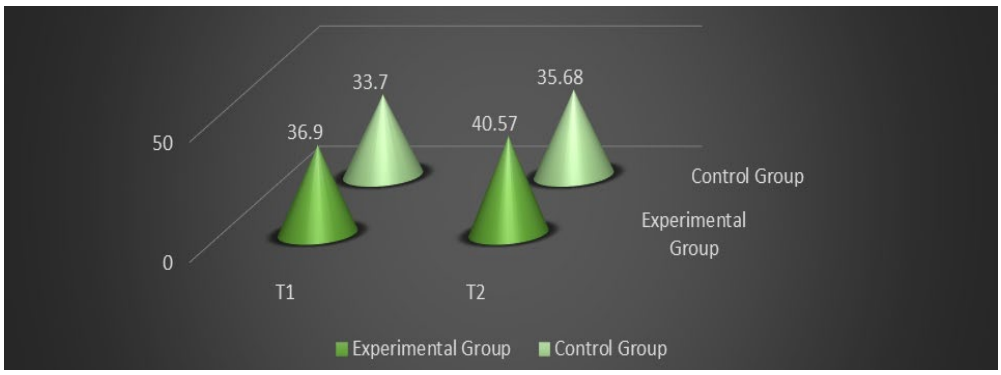

Fig.5. *"Continuous jump with straight legs (CJS)" – chart of arithmetic average*

Table 1

Results of the initial- final testing and dynamics of the high jump indicator in all 5 tests, both for the experimental and control groups

No.	Gr		hSJ		hCMJ		hCJbref		hCJB		hCJS	
			IT	**FT**	**IT**	**FT**	**IT**	**FT**	**IT**	**FT**	**IT**	**FT**
1.	E	X	37,14	41,16	37,76	41,36	35,24	38,66	29,59	36.,83	36,90	**40,57**
		S	2,977	2,894	1,883	2,094	2,297	2,182	3,366	3,923	3,894	**2,956**
		Cv	8,01%	7,03%	4,98%	5,06%	6,51%	5,64%	11,37%	10,84%	9,72%	**7,28%**
		t	**3,064**		**4,433**		**3,739**		**4,43**		2,378	
		p	**significant <0,01**		**significant <0,001**		**significant <0,005**		**significant <0,005**		**significant** <0,05	
2.	C	X	36,21	38,63	36,62	38,46	35,2	37,09	29,83	32,33	33,70	**35,68**
		S	1,348	2,526	1,450	1,458	2,101	2,130	3,364	3,582	1,907	**1,961**
		Cv	3,74%	6,53%	3,96%	3,79%	5,97%	5,74%	11,27%	11,08%	5,34%	**5,20%**
		t	**2,929**		**3,755**		**1,190**		**1,763**		1,560	
		p	**significant <0,01**		**significant <0,005**		**insignificant**		**insignificant**		**insignificant**	

4. Conclusions

The application of muscle training programs in the training of U16 volleyball players also contributed to an increase in the level of other components of sports training, this could also be seen in the results obtained at various competitions in which they participated.

Increasing the technical mastery of each player to a higher level, depending on the specialization in team positions, with the help of muscle training through alternating contraction regimes (isometric - plyometric), represented the most important objective, because during a game, one must use the most efficient specific motor actions, depending on the bio motor characteristics of the players;

The objectives of muscle building at this age (U16) have been established for each session, so as to determine its achievement at higher quality standards in order to favor its manifestation in optimal conditions during the competitive period;

Of the time allocated to physical training, between 40-45% was dedicated to general and specific muscle training, through alternating contraction regimes (isometric - plyometric), with a content adapted to the characteristics of the playing position and to the individual needs of players, throughout duration of the whole macro cycle;

This adaptation of the muscular training was done with the help of the individual sheets, in which all the test results to which they were subjected, as well as the assessments of their level of training, were filled;

The development of the strength of the muscles of the lower limbs was achieved through training programs, applied according to the training level of the athletes.

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