

## Physiological characteristics and physical fitness of girls at the beginning of classes at the volleyball sports school

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### Abstract

We studied the state of physical fitness and the physiological characteristics display of girls at age 9 and 10 who just started to attend a volleyball sports school. *Material:* The study involved girls at age 9 (n = 73) and 10 (n = 76), all from one town, who at that age began classes at the volleyball sports school in 2015, 2016, and 2017. We studied physical fitness by the development of motor abilities, using the Eurofit tests. Physiological characteristics were related to the activity of the cardiovascular, respiratory, neuromuscular systems, the required data were obtained using well-known functional tests. *Results:* at the beginning of classes at the volleyball sports school, the development of motor abilities and physiological characteristics of girls at age 9 correspond to the low level, girls at age 10 - to the average level. Girls at age 9 have significantly lower (at the level of  $p < 0.05$  to  $p < 0.001$ ) values of the indicators than girls at age 10. They only have heart rate, blood pressure unchanged; by value of indicators all girls are within the age norm. The above is confirmed by other similar studies that took place one and two years earlier in the same town. *Conclusions:* It is advisable for girls to engage in volleyball at SSOR starting from 10 years old. In the case of the beginning of classes at age 9 it is necessary to pay increased attention to the development of their motor abilities and physiological characteristics during the school year. Along with that, it is important in this period to increase the girls motivation to regular volleyball classes at SSOR.

**Keywords:** volleyball, selection, girls, physical fitness, physiological characteristics.

### Introduction

There is no uniform view on the optimal age for beginning volleyball at a sports school in the special literature. For example, some researchers indicate the age of 12-15 years (Volkov, 2005), others - 10-11 years (Belyaev, 2009). Some coaches recommend to study volleyball techniques starting from 8-9 years (Zhelezniak, 1988). According to other data, children can perform gaming activities in a simplified form already at the age of seven, which involves the use of volleyball techniques (Viera, Bonnie, 1996).

Analyzing the information about the beginning of volleyball classes in the countries that occupy the first positions in the world ranking, we note that in the US the such age is the age of 9 (Bob, 2005; Cecile, 2015; Clemens, McDowell, 2012). In Brazil, the age of 8-9 is considered favorable for the beginning of classes (Jeff, 2005). In Italy, volleyball classes start at the age of 9-10 (Paolin, 2014). In Ukraine, the training program for sports schools of the Olympic Reserve (SSOR) states that the groups of basic, specialized training and preparation for the highest sporting skills are formed from children at age 9-12 (Prozar, Kozak, 2010).

Taking into account the optimal age for beginning volleyball training, the problem connected with the state of development of physiological characteristics, physical qualities of girls and boys who start volleyball at SSOR is actualized. (Resende, Sarmiento, Falcão, Mesquita, Fernández, 2014). At the beginning of preparation, one of the key tasks is to master the technique of performing motor actions, which are techniques of volleyball (Cecile, 2015; Clemens, McDowell, 2012; Robert, 2005; Sally, 2004). Successful mastering of such techniques is impossible without a high level of physical fitness in general and specific in particular (Di Tore, Schiavo, D'isanto, 2016; Wuest, Bucher, 2005). The classes also solve other important tasks, the success of which is largely conditioned upon the high level of physiological characteristics development (Dick, 2007; Wilmore, Costill, Kenney, 2012). However, there is little (Prozar, Iedynek, 2011) data on the state of development of these characteristics for girls at age 9 and 10, who started volleyball at SSOR. This does not contribute to the development of recommendations for coaches on the optimal content of classes at the initial stage of training. In this regard, there is a need to conduct a study of indicated direction.

## Material and methods

*Participants.* The study involved girls who turned 9 and 10 years old by the time of starting their volleyball at SSOR. In September 2017, the number of these girls at age 9 was  $n = 24$ , girls at age 10 -  $n = 27$ , in September 2016 - respectively  $n = 27$  and  $n = 23$ , in September 2015 -  $n = 22$  and  $n = 26$ . The age of 9-year-old girls at the beginning of the study was in the range from 8 years 10 months to 9 years 3 months, the age of 10-year-old girls - in the range from 9 years 9 months to 10 years 2 months. The study was conducted in compliance with the World Medicine Association declaration of Helsinki: Ethical principles for medical research involving human subjects, 2013. The study protocol was approved by the Ethical committee of the Kamianets-Podilsky Ivan Ohienko national university.

*Procedures.* We studied physical fitness and physiological characteristics of girls 9 and 10 years old during their first SSOR classes this year (September 2017) and the two previous years (September 2015 and 2016). We studied physical fitness according to the data of the standing long jump, sit and reach, dynamometry of the wrist; we kept up with all the demands set forth in the recommendations (Eurofit, 1993). Physiological characteristics were related to the activity of the girls' cardiovascular, respiratory, neuromuscular systems. We used well-known functional tests recommended by the American College of Sports Medicine (2017) and researchers such as Bar-Or, Rowland (2004), Di Tore, Schiavo, D'isanto (2016), Wilmore, Costill, Kenney (2012) and others. We were determining the following: blood pressure (systolic - SBP and diastolic - DBP); heart rate (HR); vital capacity (VC); Ruffier index (Ruffier test index - RTI); Robinson Index (RI =  $SBP \times HR / 100$ ); Vital capacity index (VCI =  $VC / \text{body mass}$ ), index of maximum isometric strength (IMIS =  $\text{maximum isometric strength} / \text{body mass}$ ). During the tests, we fulfilled all the required demands. We used certified equipment: to determine the blood pressure - Santamedical Adult Deluxe Aneroid Sphygmomanometer, to determine the IMIS - handgrip Camry dynamometer, to determine the VCI - NDD EasyOne Plus System 2000-2 spirometer. Initially we got permission to participate in the study from each girl and her parents. Data for study were the quantitative values of tests and functional tests. We established the differences in the values in each characteristic under study of the girls 9 and 10 years old who started SSOR classes from September 2017. Afterwards, we compared the value of each characteristic in all groups of girls 9 and all groups of girls 10 years old, that is, who started volleyball training in September 2015, 2016 and 2017.

*Data analysis.* All statistical analyses were performed using SPSS Version 21. For each characteristic, we determined the mean value, the standard deviation; also we determined Student's t-criterion for unpaired samples. The 0.05, 0.01, 0.001 levels of probability were used to indicate statistical significance.

## Results

Girls who started volleyball at the age of 9, at the beginning had only SBP, DBP and HR at quiescent within the age norm (see Table 1). Other physiological characteristics under study, as well as results in a standing long jump, display of flexibility and muscular strength, indicated the "poor functional condition" (see Table 2).

Girls who started volleyball training at age 10 had the value of most physiological characteristics and results in physical fitness tests at the level of "average functional condition". The exceptions were SBP, DBP and HR: their values, as well as for 9-year-old girls, corresponded to the age norm. A similar result was found when comparing the results in all samples: only HR and SBP practically did not differ and were within the age norms;

Table 1. Peculiarities of discovering of physiological characteristics of girls at age 9 ( $n = 24$ ) and 10 years ( $n = 27$ ) at the beginning of classes at a volleyball sports school (September 2017).

The name of the characteristic	Age	M	$\sigma_m$	t
VC, ml	9	1645,0	39,12	3,92***
	10	1865,7	40,55	
HR at quiescent, bpm	9	95,9	1,91	1,91
	10	91,5	1,28	
HR after 30 squats, bpm	9	141,8	2,11	3,61***
	10	131,1	2,08	
HR at 45 second of rest after squats, bpm	9	106,0	1,35	2,5*
	10	101,6	1,13	
SBP, mmHg	9	104,7	1,43	0,55
	10	103,7	1,11	
DBP, mmHg	9	69,6	1,12	2,05*
	10	66,9	0,69	
VCI, ml/kg	9	45,3	1,18	2,32*
	10	49,1	1,14	
IMIS, %	9	42,0	1,25	3,0**
	10	47,9	1,52	
RI, conditional units	9	101,1	2,24	4,29***

	10	90,0	1,29	
RTI, conditional units	9	15,1	0,71	3,35**
	10	11,9	0,64	

Note: \*p <0.05, \*\*p <0.01, \*\*\*p <0.001

Table 2. Peculiarities of the results in physical fitness tests of girls at age 9 (n = 24) and 10 (n = 27) at the beginning of classes at the volleyball sports school (September 2017).

Name of the test	Age	M	$\sigma_m$	t
Standing long jump, m	9	1,21	0,02	2,22*
	10	1,29	0,03	
Sit and reach, sm	9	7,9	1,01	2,14*
	10	10,7	0,83	
Dynamometry of a wrist, kg	9	12,8	0,43	6,75***
	10	17,2	0,49	

Note: \*p <0.05, \*\*p <0.01, \*\*\*p <0.001

other results were significantly (at the level  $p < 0,05$  to  $p < 0,001$ ) better for girls at age 10 than for girls at age 9. Resulting from the discovered differences we compared the values of physical fitness and physiological characteristics of girls at age 9 and 10 who started volleyball at SSOR from September 2016. We found that these samples had only HR at quiescent and SBP which did not differ. Other indicators under study had the values of girls at age 10 significantly ( $p < 0.05 \div 0.001$ ) better than of girls at age 9 (see Table 3 and 4). A similar

Table 3. Peculiarities of discovering of physiological characteristics of girls at age 9 (September 2015 - n = 22, September 2016 - n = 27), 10 years (n = 26 and n = 23) at the beginning of classes at a volleyball sports school

Indicator	Ag	2015		t	2016		t
		M	$\sigma_m$		M	$\sigma_m$	
VC, ml	9	1650,0	33,31	4,34***	1600,0	28,12	4,23***
	10	1858,7	34,72		1780,4	32,03	
HR at quiescent, bpm	9	94,9	2,12	1,68	91,8	2,39	0,81
	10	90,1	1,91		89,4	1,73	
HR after 30 squats, bpm	9	143,1	2,01	4,43***	140,8	2,68	2,61*
	10	130,2	2,11		131,5	2,34	
HR at 45 second of rest after squats, bpm	9	108,1	1,64	2,32*	109,2	1,82	2,28*
	10	102,2	1,95		101,6	2,79	
SBP, mmHg	9	104,4	1,03	0,16	103,9	1,25	0,46
	10	104,1	1,53		103,1	1,19	
DBP, mmHg	9	68,4	1,43	2,54*	67,2	1,68	1,13
	10	63,8	1,11		64,1	2,18	
VCI, ml/kg	9	44,8	1,41	2,56*	45,1	1,32	3,27**
	10	50,1	1,52		51,8	1,57	
IMIS, %	9	41,7	1,27	2,7*	41,1	1,72	2,73*
	10	46,8	1,4		48,0	1,85	
RI, conditional units	9	102,1	1,34	3,68**	101,8	1,37	3,9***
	10	92,2	2,33		91,1	2,38	
RTI, conditional units	9	14,8	0,81	2,99**	15,1	0,86	2,95**
	10	11,2	0,89		11,7	0,77	

Note: \*p <0.05, \*\*p <0.01, \*\*\*p <0.001

Table 4 The peculiarities of the results in the tests of physical fitness of girls at age 9 (September 2015 - n = 22, September 2016 - n = 27), 10 years (n = 26 and n = 23) at the beginning of classes at a volleyball sports school

Indicator	Ag	2015		t	2016		t
		M	$\sigma_m$		M	$\sigma_m$	
Standing long jump, m	9	1,20	0,05	2,03*	1,23	0,03	2,12*
	10	1,33	0,04		1,32	0,03	
Sit and reach, sm	9	7,1	0,96	2,22*	8,1	0,98	2,2*
	10	9,9	0,81		11,4	1,13	
Dynamometry of a wrist, kg	9	12,9	0,37	7,23***	13,1	0,38	6,38***
	10	17,4	0,5		17,9	0,65	

Note: \*p <0.05, \*\*p <0.01, \*\*\*p <0.001

result was obtained after analyzing the data of girls 9 and 10 years old which started volleyball at SSOR since September 2015. That is to say, during the last three years, girls at age 9 who started volleyball training at SSOR had significantly lower physical fitness and physiological characteristics than girls who started volleyball classes at age 10.

### Discussion

The obtained data are due to a complex of reasons. One of the main reasons for the differences in girls' values of 9 and 10 years in favor of the latter is related to the morphosis (Malina, Bouchard, Bar-Or, 2004). During this period the physiological characteristics and physical fitness of the child are improved with each new year of his/her life (Astha, 2011; Bar-Or, Rowland, 2004; Carlos, Daniel, Marques, 2012; Delas, Lafrenière, Fenouillet, Paquet, Martin-Krumm, 2017). The high level of development of the body's systems, in turn, contributes to a better solution of various tasks that the coach puts in the initial stage of young athletes' training (Dick, 2007; Raiola, 2014; Sally, 2004). Young sportsmen with a high level of development of physiological characteristics are better adapted to increased physical activity; learning new motor activities, which are often complicated in terms of coordination, requires in addition to such characteristics also a high level of physical fitness (Wilmore, Costill, Kenney, 2012). This together creates very favorable conditions for achieving a high result in solving the key tasks of the initial stage of young volleyball players training (Viera, Bonnie, 1996; Ghorbanzadeh, Bayar, Koruç, 2017). In the case of lack of physical fitness and poor functional condition, a coach should significantly increase the amount of appropriate training. (Wuest, Bucher, 2005). This is caused by a reduction in the time required for technical training and other learning tasks. Achievement of the targets becomes problematic (Cecile, 2015; Clemens, McDowell, 2012; Jeff, 2005). It is also noted that the level of young athletes physical fitness to some extent depends on the effectiveness of mastering the main motor activity (Volkov, 2005). This is proved true by the following results: the effectiveness of mastering the game techniques increases in the case of the average functional condition of young volleyball players during the initial stage (Boichuk, Iermakov, Nosko, 2017). The key reason for one more result, namely poor functional condition and the development of motor abilities of girls at age 9 was associated with low physical activity in their spare time (Prozar, Iedynak, 2011). Another reason may lie in the lack of efficacy of physical education at school (Butenko, Goncharova, Saienko, Tolchieva, Vako, 2017). Awareness of the parents of the child and, to a certain extent, the teacher of physical education of the need to add physical activity for such child contributes to the realization of their joint, adequate actions. The result of such actions is display of the child's desire to engage in a particular sport (Adamčák, Nemeč, Bartík, 2017; D'isanto, Di Tore, 2016). But the parents do not take into account the poor functional condition and the development of motor abilities of their child. As a result, the likelihood of a positive result in selecting a sports section may decrease (Ivashchenko, Khudolii, Iermakov, Lochbaum, & Yermakova, 2017).

The lack of significant differences between the results obtained in one region over the past three years during the selection of girls to the SSOR volleyball section who reached the age of 9 years and who were 10 years old were associated with a complex of reasons. One of the main reasons was the implementation of the requirements of sports metrology regarding the formation of samples for the study (Vincent, 2005). Another reason was associated with the lack of radical changes in approaches to the realization of physical education in this period, the formation of motivation of elementary school graders to engage in sports or other types of physical activity in their spare time. This is one of the main conditions for improving the results of physical education at school (Di Tore, Schiavo, D'isanto, 2016).

### Conclusions

It is preferable for girls to start volleyball at SSOR starting from 10 years. In case of such classes starting at 9 years it is essential during the school year to pay increased attention to the development of their motor abilities and physiological characteristics. In the meantime, it is important to increase the motivation of such girls to systematic volleyball classes at SSOR.

### Conflicts of interest

No conflicts of interest exist.

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