Original Article

Evaluation of the training level of water polo swimming players (13-15 years old)

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Abstract
It was established that the time of overcoming the long distances of 100 m, 200 m, 400 m by freestyle is statistically significantly different among water polo players of different ages (13, 14, 15 years) with p > 0,05 and do not differ in players of various game roles. The time to overcome the 25 m and 50 m by freestyle is statistically significantly different, both by age and by game role. That means that from the age of 13 players begin to develop predispositions to one or another game role and this fact must be taken into account during training loads planning. The developed method for evaluation of the swimming training level of water pole players of 13, 14, 15 years old makes it possible to identify weaknesses in the level of swimming training of each player and compare the level of swimming training of different players among themselves. In addition, this method allows you to identify the predispositions of a water polo player to a particular game role and (in the terms of equal level of technical and tactical training between players) to decide on the inclusion of a specific player into the team.
Keywords: water polo, control, result, method.

Introduction
Water polo is the only Olympic sport contact game in the world that takes place in the water environment. The essence of the game is to move in the water and obeying certain rules to score the ball into the opponent's gates. The achievement of the result in water polo is substantially complicated by the fact that players in the competitive environment are in direct confrontation and in close contact with opponent's (Kochubei, 1989; Ostrovsky, 2010; Poproshaev, 2006).

In the process of competitive activity all water polo players have to enter repeatedly into an attack, then in defense, quickly maneuver the entire field, to use all methods of swimming (in full coordination, both in elements and in various combinations), to enter into force struggle with the opponent, stop, dive and more. At the same time sportsmen performs the following competitive actions: moves in a field of various length, jumping, acceleration, turning, deceptive moves, ball throws, etc. During this they are feeling constant obstacles, encumbrances, resistance from opponents, the water polo player must struggle all the time to win a better position or the ball. During the game the performance of all of these components of competitive activity is carried out at high speed, with high intensity and multiple repetitions which results in high requirements for the level of development, in particular, the special endurance (Platonov, 2012; Taktak, 1995; Yurchenko, 1972; Romanchyshyn, 2015).

In addition, according to experts the effectiveness of the game by 50% depends on the level of swimming training of sportsmen (Ostrovsky, 2010; Ryzhak, 1984). Swimming training consists of distance training and special training. Distance swimming training is a way of players overcoming segments from 50 to 2000 m. Special swimming training is designed to simulate the swimming regimes that are used in competitive activity of water polo players such as overcoming short segments at different speed in combination with special water polo techniques (leap, turns, jumps, etc.)

The analysis of scientific and methodological literature has shown that for the evaluation of swimming training level are recommended control time limits of overcoming distances for players of all ages. At the same time, methods for results evaluation in swimming at distances of 25 m, 50 m, 100 m, 200 m, 400 m (distances that are most often used in construction of training loads of water pole players) have not been developed till nowadays.

Aim of the study is to develop a method for evaluation of swimming training level of young water polo players (13, 14, 15 years).

Objectives of the study:
1. To reveal differences in the level of swimming training of water polo players of different age (13-15 years) and game roles.
2. To develop a method for evaluation of swimming training level.

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Materials and methods

In pedagogical experiment took part 54 water polo players of children's and youth sports school №3 and sports water polo club "Eurosport" of Lviv: 18 persons – 13 years, 18 persons – 14 years, 18 persons – 15 years. The research was carried out in the 25-meter indoor swimming pool "Dynamo" in Lviv. Athletes were divided by playing roles (mid-line players, attackers, defenders). Was studied level of swimming and special training of players during the preparation for the water polo championship of Ukraine.

The level of swimming training was determined by the timing of overcoming distances of 25 m, 50 m, 100 m, 200 m and 400 m by freestyle. The statistical analysis of the data was carried out using the computer program STATISTICA 6.0.

Results

For proper planning and control of training loads of water polo players it is necessary to know at which combinations of the basic parameters of loads there are certain functional changes in organism which allows classifying the exercises on the development of endurance in zones of energy orientation (Bulgakov, 1996; Zatsiorsky, 1970; Platonov, 2012; Willmore, 1997; Briskin, 2015). Depending on this we have determined the time of passing the distances that are traditionally used to construct training sessions for the development of special endurance of water polo players. Also, time of overcoming distances was considered taking into account the various game roles of players (Table 1).

Table 1

**Time of overcoming the distances by water polo players of
different age and game roles, s**

Distance, meters	Age	Game role					
		Attackers		Defenders		Mid-line players	
		x±σ	C	x±σ	C	x±σ	C
25m freestyle	13	15.6±0.55	3.5	15.23±0.90	5.9	15.13±0.63	4.1
	14	14.45±0.18	1.2	14.15±0.10	0.7	14.15±0.30	2.1
	15	13.88±0.11	0.79	13.61±0.17	1.2	13.31±0.27	2.02
50m freestyle	13	34.68±2.21	6.37	33.55±5.62	16.75	32.45±1.6	4.9
	14	28.28±1.09	3.8	31.51±0.89	2.8	30.88±0.88	2.8
	15	30.92±1.67	5.4	29.87±1.68	5.6	28.07±0.74	2.6
100m freestyle	13	76.63±5.54	7.23	74.29±11.99	16.14	73.63±4.15	5.64
	14	75.09±4.54	6.05	70.54±5.43	7.7	70.31±5.27	7.5
	15	70.32±2.53	3.6	66.65±2.39	3.59	65.50±3.77	5.76
200m freestyle	13	166.33±16.52	9.93	161.81±25.49	15.75	162.00±11.63	7.18
	14	163.75±11.39	6.96	157.91±15.49	9.81	155.80±20.35	13.06
	15	154.51±5.51	3.57	144.61±5.68	3.93	143.09±6.86	4.79
400m freestyle	13	352.24±33.10	9.4	352.75±46.62	13.22	343.86±23.07	6.71
	14	341.86±9.20	2.69	340.79±27.17	7.97	335.61±38.05	11.34
	15	336.95±12.45	3.69	311.33±12.40	3.98	311.75±16.62	5.33

Notice: x- average value; σ – standard deviation; C – coefficient of variation

This allowed us to define and divide swimming distances by the energy-oriented zones. Distance of 25m that is overcoming by water polo players belongs to the zone of maximum power in the anaerobic mode due to the phosphogens suppliers of energy. The average overcoming time for this distance was 14,39 ± 1,61s. With 50-100m distances water polo players perform work in the submaximal power zone in anaerobic-glycolytic mode due to glycolytic energy supply. The average time of the distance of 50 m was 31,13 ± 4,67 s, and 100 m – 71,4 ± 7.87 s. Distances 200 and 400 m fall into the zone of high power. This work is performed in a mixed aerobic-anaerobic mode due to mixed oxidation. The average time of the distance of 200m was 156,64 ± 16,43s, 400m – 336,34 ± 28,63s. These comparisons correspond to the existing views of scientists (Zatsiorsky, 1970; Platonov, 2012; Jansen, 2006).

For a more detailed analysis of the results we calculated the coefficient of variation of the overcoming time of different lengths distances which makes it possible to compare the stability of the results demonstrated by water polo players at different distances.

According to table 1, it can be seen that with the increase of the distance length also increases the variation of the time of its overcoming. This means that the most stable is the time of water polo players overcoming of short distances (25 m, 50 m). Overcoming time of long distances by water polo players varies considerably. This suggests that precisely on short distances is determined the class of water polo players. At the same time, there is a certain difference in the variability of time overcoming the segments depending on the game role. Older players (15 years) show more stable results in overcoming the various segments. For further analysis of the results a two-factor dispersion analysis was used, where the factor A was considered the age of sportsmen (13-14-15 years), and the factor B – the role of players (attacker, defender, mid-line player).

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According to the results of the analysis of 100 m distance overcoming by freestyle (Table 2) was found that the level of factor B significance reached the value of $P_B = 0.07$. Consequently, we accept the hypothesis of the absence of the influence of the factor B (game role of players) on the overcoming of 100 m distance. For the time of 100 m distance overcoming players of different game roles do not differ.

Table 2

Dependence of the overcoming time of 100 m distance from the age and the game role of water polo players

Source of variation	The sum of the quadratic deviation	Degrees of freedom number	Dispersion	Ratio of dispersions, F	Critical significance, F, p=0.05	Factors influence part, %
Factor A (age)	495.6	2	247.8	7,523	0,0015	33.43
Factor B (game role)	183.2	2	91.6	2,781	0.07	12.35
Interaction of factors A and B	10.1	4	2.5	0.077	0.988	0.68
Final	275634,1	1	275634,1	8367.622	-	-
Total	1482.3	45	32.9	-	-	-

At the same time, for the factor A (age of sportsmen) was achieved level of significance $R_A = 0,0015$. With the level of significance P<0,01 it should be assumed that the influence of factor A is present. Therefore, the age of water polo players affects the time of overcoming this distance.

A similar situation was observed during analyzing the time of overcoming the distances of 200 m and 400 m by freestyle (Table 3, 4).

Table 3

Dependence of the overcoming time of 200 m distance from the age and the game role of water polo players

Source of variation	The sum of the quadratic deviation	Degrees of freedom number	Dispersion	Ratio of dispersions, F	Critical significance, F, p=0.05	Factors influence part, %
Factor A (age)	2467	2	1234	5.688	0,0062	25.27
Factor B (game role)	656	2	328	1.512	0,23	6,72
Interaction of factors A and B	88	4	22	0.101	0,98	0.90
Final	1325105	1	1325105	6109.195	-	-
Total	9761	45	217	-	-	-

It was found that the game role does not affect the time of overcoming the distance (P≥0,01). In turn, with the increase of the age results of sportsmen at these distances are significantly improved (P<0,01).

Table 4

Dependence of the overcoming time of 400 m distance from the age and the game role of water polo players

Source of variation	The sum of the quadratic deviation	Degrees of freedom number	Dispersion	Ratio of dispersions, F	Critical significance, F, p=0.05	Factors influence part, %
Factor A (age)	8144	2	4072	5.504	0,0072	24.45
Factor B (game role)	1639	2	819	1.107	0,33	4.92
Interaction of factors A and B	1377	4	344	0.465	0.76	4.13
Final	6109199	1	6109199	8256.455	-	-
Total	33297	45	740	-	-	-

A completely different situation was observed during analyzing the time of overcoming distances 25 and 50 m (Table 5, 6).

Table 5

Dependence of the overcoming time of 50 m distance from the age and the game role of water polo players

Source of variation	The sum of the quadratic deviation	Degrees of freedom number	Dispersion	Ratio of dispersions, F	Critical significance, F, p=0.05	Factors influence part, %
Factor A (age)	139.90	2	69.95	12909	0.00003	57.37
Factor B (game role)	19.26	2	24.63	4.545	0.01	20.20
Interaction of factors A and B	2.35	4	0.59	0.109	0.97	0.96
Final	54063.90	1	54063.90	9977.628	-	-
Total	243.83	45	5.42	-	-	-

From Table 5 it is seen that the achieved level of significance during overcoming the distance of 50 m by freestyle by the factor of the game role of players (factor B) was $P_B = 0.01$. Consequently, the game role of players affects at the result of overcoming the distance. At the same time, the age of athletes (factor A) also significantly influences the time of overcoming this distance ($P_A = 0.00003$).

Table 6

Dependence of the overcoming time of 25 m distance from the age and the game role of water polo players

Source of variation	The sum of the quadratic deviation	Degrees of freedom number	Dispersion	Ratio of dispersions, F	Critical significance, F, p=0.05	Factors influence part, %
Factor A (age)	26.98	2	13.49	13.96	0.000019	62.02
Factor B (game role)	5.74	2	2.87	2.97	0.06	13.195
Interaction of factors A and B	0.11	4	0.03	0.03	0.99	0.25
Final	11370.62	1	11370.62	11762.92	-	-
Total	43.50	45	0.97	-	-	-

Analysis of overcoming the distance of 25 m by freestyle showed that both the game role and the age affect the time of overcoming. The indicators of the level of significance were, respectively $P_B = 0.06$, $P_A = 0.000019$ (Table 6).

Thus, a two-factor dispersion analysis of players overcoming results of different lengths by freestyle that are traditionally used for the development of a special endurance of water polo players has shown that only at distances of 25 m and 50 m the time of their overcoming is statistically different both by age and by game role of players. At the same time, as the age of sportsmen increases, the time for overcoming all distances is reduced what is quite natural.

A comparative analysis of the influence parts of the research factors has shown that with the reduction of the length of the distance the proportion of the influence of factor B (game role of players) increases. We can assume that from the age of 13 propensities of one or another game role begin to emerge. This is confirmed by the data of specialists about the development of sportsmen high-speed qualities in this age period (Ostrovsky, 2003; Poproshaev, 2006; Taktak, 1995).

It is noteworthy, that with relatively similar influence parts of factor A (age of sportsmen) in different distances, the proportion of the influence of this factor on the distance of 50 m freestyle is the highest (57,37%).

It can be argued that this distance is the most informative for evaluation of water polo players swimming training level. This is confirmed by a number of studies (Kochubei, 1989; Yurchenko, 1972).

At the distances of 200 and 400 m were seen the smallest indicators of the influence part of the age of players on the time of overcoming the distances. This confirms the opinion that these swimming distances are not specific to the competitive activity of water polo players.

According to the results of two-factor dispersion analysis was determined that from the age of 13 years is observed a statistically significant difference in the time of water polo players overcoming distances of 25 m and 50 m by age and game role. At our opinion, this fact must be taken into account during planning of training loads.

When planning the training process for individual training sessions, micro cycles, meso cycles and macrocycles coach must know in what relationships are main components of the training loads (length of the training distance, the speed of their overcoming, the intensity of exercises, etc.).

In table 7 are presented results of the correlation analysis of overcoming time of separate distances. It can be seen, that with the increase of distance length the correlation with the result at the distance of 25 m decreases. Mostly the result of overcoming 50 m distance depends on the time of overcoming the 25 m distance (p=0,74). A similar situation is observed depending on the time of overcoming distances 100, 200, 400 m from the result at 50 m distance, as well as 200, 400 m from the result by 100 m. Attention is drawn to the fact that the largest correlation coefficient was determined according to the result of overcoming of a distance of 400 m from the time of overcoming the 200 m distance (p=0,93).

This fact allows to assert that despite the specificity of short swimming distances (25 m, 50 m) and expediency of their use for the development of special endurance of water polo players it is still inappropriate to refuse from distances of 100, 200, 400 m during the construction of the training process.

Table 7

**Correlation dependence of the overcoming time of different distances
by water polo players 13-15 years old**

Swimming distance, metres	25 m	50 m	100 m	200 m	400 m
25 m		0.74	0.61	0.56	0.55
50 m			0.82	0.73	0.71
100 m				0.93	0.87
200 m					0.93
400 m					

In addition to the study of interdependence of overcoming time of separate distances we calculated the determination coefficient which determines the part of the overall variation of indicators that were studied. Another part of the percentage of variation is explained by the influence of uncontrolled factors.

It was found that the greatest percentage of time dependence of overcoming separate distances (highest value of the determination coefficient) is observed at distances of 400, 200, 100 m. At 86,49%, overcoming time of 400 m depends on the time of overcoming the distance of 200 m, as well as the time of overcoming 200 m from 100 m.

During training loads planning and when completing the composition of the team for the competition coach needs to solve a number of significant problems, in particular:
- determinate weaknesses in swimming training of water polo player;
- for completing the composition of the team evaluate training level and readiness for competitions and take the best ones;
- decide players game roles.

For solving these problems for evaluation of swimming training level of water polo players 13-15 years old we calculated 7 point standard scales (Table 8) (Bulgakov, 1996; Zatsiorsky, 1970). The scale ranged from +3 σ to -3 σ, the range of values in one σ was equal to the 1st score.

In our case, the less time sportsmen spent on a certain distance, the higher point he received, and the more time he spent on overcoming the distances the less point was received. In this way, we proceed from the parametric scoring scale to a qualitative one. This gives us the opportunity to compare the results of one sportsman at different distances with each other and to determine the strengths or weaknesses in his swimming training level, as well as to compare the level of training of various water polo players among themselves.

For example, a water polo player Alekseev K. at a distance of 25 m showed a result of 13 s, according to the scale he receives 6 points. When overtaking the 50 m distance with the result of 27,2s he receives the same 6 points. When overtaking 100 m with the result of 66,1s – 4 points. Upon reaching 200m with a result of 144s – 5 points and when overtaking 400 m with a result of 316,74 s he receives 4 points.

Another water polo player Vaulin P., at a distance of 25 m with a result of 13,9 s has 4 points, at a distance of 50 m with a result of 28,16 s has 5 points, at a distance of 100 m with a result of 67,0 s has 5 points, at a distance of 200 m with a result of 147,2 s has 4 points, and at a distance of 400m with the result of 324,0 s – 4 points.

Taking into account that according to the results of the dispersion analysis a reliable statistical discrepancy was established between age groups (13, 14, 15 years) by the time of overcoming all studied distances, for each age group we have developed separate scales for evaluation of overcoming distances time. For example, such scale for 15 year old water polo players is given in table 8.

Table 8

Evaluation scale of distance overcoming time results
15 years old of water polo players

Points		Distance and overcoming time, s				
		25 m	50 m	100 m	200 m	400 m
7	-3σ	12.70-12.99	24.10-25.93	56.99-60.48	124.27-131.97	266-283
6	-2σ	13.00-13.29	25.94-27.77	60.49-63.98	131.98-139.68	284-301
5	-1σ	13.30-13.44	27.78-28.69	63.99-65.73	139.69-143.54	302-310
4	-0.5σ	13.45-13.74	28.70-30.53	65.74-69.23	143.55-151.24	311-328
4	+ 0.5σ	13.75-13.89	30.54-31.45	69.24-70.98	151.25-155.10	329-337
3	+1σ	13.90-14.19	31.46-33.29	70.99-74.48	155.11-162.81	338-355
2	+2σ	14.2-14.49	33.30-35.13	74.49-77.98	162.82-170.52	356-373
1	+3σ	14.50 >	35.14 >	77.99 >	170.53 >	374 >

Discussion

By analyzing the points obtained by the water polo players it can be seen that some sportsmen received the same marks, some players scored higher or lower marks by the results of all distances. Some water polo players received relatively higher marks at short distances and got better marks at long distances, some received mixed estimates.

In our opinion, this gives grounds for making certain final statements:

• Sportsmen who have received identical marks at all distances in terms of swimming training are "universal players" capable of solving any tasks, whether in attack, in defense or in the middle line, depending on the level of their technical and tactical training.

• Water polo players that received higher results at short distances is better to use in attack.

• Players that have higher marks at long distances better be used in mid-line.

• Water polo players that receive bigger amount of points have better level of swimming training, and those who receive lower points are weaker in swimming training.

• About players that have mixed marks and received relatively less amount of points they usually have less experience in water polo and of course still didn't determine their game role.

Thus, the developed method makes it possible to compare the level and quality of training of different sportsmen and depending on the situation and the equality of other indicators to decide on the inclusion of particular sportsmen into the team. It is clear that in the composition of the team it is expedient to choose those water polo players who gain a greater amount of points.

In addition, during the research we drew attention to the fact that water polo players who scored a larger amount of points recovered quicker after overcoming training distances. This indicates on a higher level of endurance and adaptive capabilities of such sportsmen organism.

Conclusions

According to the results of two-factor dispersion analysis was established that the time of overcoming long distances of 100 m, 200 m, 400 m by freestyle is statistically significantly different among water polo players of all ages (13, 14, 15 years) with p≥0,05 and do not differ from the players of various game role. The time for overcoming the 25 and 50 m by freestyle is statistically significantly different both by age and by game role. It shows that from the age of 13 years players begin to develop predispositions to one or another game role and this fact must be taken into account during planning of training loads

Developed method for evaluation of swimming training level of water polo players 13, 14, 15 years old that makes it possible to identify weaknesses in the level of swimming training of each player and to compare the level of swimming readiness of different players among themselves. In addition, this technique allows to identify the predispositions of a water polo player to a particular game role and (with condition that players are equal in technical and tactical training) to decide on the inclusion of a specific sportsmen into the team.

Prospects for further research in this direction will allow us to explore ways to optimize the planning and conduction of the training process of young water polo players.

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