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Original RESEARCH

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Coordination of movements: identification of age-related dynamics of its development in karate boys 7-11 years old

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Abstract

The purpose of the study is to identify the age-related dynamics of the manifestation of coordination among junior and pre-pubescent karate boys (7-11 years old) training in the karate section at the initial stage of preparation.

Materials and methods. The study involved 65 children of younger and prepubertal age. They underwent testing of coordination abilities in order to determine the level of development and identify the features of their manifestation in accordance with age and skill level. The selected sample was divided into five ages 7, 8, 9, 10 11 years old, with 13 children in each group. The children and their parents were aware of all the features of the study and gave their consent to participate in the experiment. The technical level of the children corresponded to the students of the 10th, 9th, 8th grades of Kyu (orange, orange with a blue stripe and blue belt color). To solve the tasks, the following research methods were used: study and analysis of scientific and methodological literature, pedagogical observation, timing of educational tasks, testing of coordination abilities, pedagogical ascertaining experiment, methods of mathematical statistics.

Results. One-way analysis of variance (ANOVA) showed a significant effect of the age factor on the level of indicators of coordination abilities for: differentiation of spatial-dynamic parameters of movements ($F = 95.712$; $p = 0.000$); reorganization of motor actions ($F = 111.410$; $p = 0.000$); differentiation of spatial-temporal parameters ($F = 50.863$; $p = 0.000$); coordination of hand movements ($F = 96.764$; $p = 0.000$); maintaining postural stability ($F = 38.274$; $p = 0.000$); maintaining vestibular stability ($F = 61.291$; $p = 0.000$).

Conclusions. Based on the results of studies indicators of various manifestations of coordination, statistically significant age differences are observed between groups of boys aged 7 to 10 years ($p < 0.05$). At 10-11 years old, there are no significant statistically significant differences in all indicators ($p > 0.05$), except for dynamic balance ($p < 0.05$).

Keywords: boys aged 7-11, coordination abilities, age differences, martial arts.

Анотація

Координація рухів: виявлення вікової динаміки її розвитку в хлопців каратистів 7-11 років
Світлана Марченко, Ольга Іващенко, Олег Худолій, Вадим Веригін

Мета дослідження – виявити вікову динаміку прояву координації у хлопців каратистів молодшого та передпубертатного віку (7-11 років), які займаються в секції карате на початковому етапі підготовки.

Матеріали і методи. У дослідженні взяли участь 65 хлопців молодшого та передпубертатного віку. Вони пройшли тестування координаційних здібностей з метою визначення рівня розвитку та виявлення особливостей їх прояву відповідно віку та рівня майстерності. Обрана вибірка була розподілена на п'ять вікових групи 7, 8, 9, 10 11 років по 13 дітей у кожній групі. Діти та їхні батьки були інформовані про всі особливості дослідження і дали згоду на участь в експерименті. Технічний рівень дітей відповідав учнівським ступеням 10, 9, 8 Кю (помаранчевий, помаранчевий з синьою смужкою та синій колір поясу). Для вирішення поставлених завдань були використані методи дослідження: вивчення та аналіз науково-методичної літератури, педагогічне спостереження, хронометраж навчальних завдань, тестування координаційних здібностей,

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Vollum 28 No. 3, 2024

педагогічний констатуючий експеримент, методи математичної статистики.

Результати. Однофакторний дисперсійний аналіз (ANOVA) виявив значний вплив фактору віку на рівень показників координаційних здібностей до: диференціювання просторово-динамічних параметрів рухів (F = 95,712; p = 0,000); перебудови рухових дій (F = 111,410; p = 0,000); диференціювання просторово-часових параметрів (F = 50,863; p = 0,000); координованості рухів руками (F = 96,764; p = 0,000); збереження стійкості пози (F = 38,274; p = 0,000); збереження вестибулярної стійкості (F = 61,291; p = 0,000).

Висновки. За отриманими результатами досліджень показників різних проявів координації спостерігаються статистично достовірні вікові розбіжності між групами хлопців у вікових рамках від 7 до 10 років (p < 0,05). У 10-11 років не спостерігаються значні статистично достовірні відмінності за всіма показниками (p > 0,05), крім динамічної рівноваги (p < 0,05).

Ключові слова: хлопці 7-11 років, координаційні здібності, вікові відмінності, єдиноборства.

Introduction

Coordination abilities (CA) have a significant influence on the assimilation and improvement of specific elements and their stability. They provide the ability to perform motor acts in different conditions with high efficiency and determine the execution of movements in optimal conditions [1, 2, 3].

In many studies, martial arts are considered as aerobic exercises [4, 5, 6], which require multi-cognitive participation [7] and a diverse structure of movements [3], affecting the development of children's motor skills [8, 9, 10]. According to Pinto-Escalona, Valenzuela, Martin-Loeches et al. [11], karate lessons in schools can be a promising alternative for improving relevant learning functions and behavior in children with severe psychosocial difficulties and low academic performance.

Different types of martial arts have different athletic characteristics and performance styles. For example, taekwondo [7, 12] focuses more on foot techniques, while Japanese and Chinese martial arts focus on the integrated use of the whole body. They practice body, arm, and leg techniques [8, 13]. Studies involving the use of Kyokushin karate have shown that it is important for the development of coordination in children [14, 15].

In the scientific studies Oktarifaldi, Marta, Nugroho et al. [16], Oktarifaldi, Nopembri, Yudanto et al. [17] found a positive and significant relationship between measures of motor coordination and fundamental motor skills (FMS). Children with high levels of coordination demonstrated better performance in FMS. The authors [18, 17] believe that improving motor coordination skills is one of the most important factors in achieving educational goals and recommend that as many coordination-related exercises as possible be included in the educational process.

Coordination and basic motor skills are important components that future talented athletes must master during training. These abilities and skills need to be taught and developed in accordance with developmental stages [19, 20, 16].

Coordination skills are an important factor for success in various sports disciplines, such as gymnastics [1], football [18], hockey [21], volleyball [22], tennis [23] and many others. The analysis of the structure of CA of athletes of different specializations produced by Bakhtiar, Syahputra, Putri et al. [20], Yubing [23] allowed to express the opinion that a high level of their development affects the successful performance of motor actions and sports results.

To date, the age dynamics of the development of coordination of movements in karate boys aged 7-11 years has not been sufficiently studied and requires research. Evaluation of the possibilities of manifestation of different types of CA by young karate athletes will allow planning and optimizing technical and tactical training and competent organization of the strategy for developing the potential of children.

The purpose of the study is to identify the age-related dynamics of the manifestation of coordination in junior and pre-pubescent karate boys (7-11 years old) who are engaged in the karate section at the initial stage of training.

Materials and methods

Study participants

The study involved 65 boys of younger and prepubertal age. They underwent CA testing to determine the level of development and identify the features of their manifestation in accordance with age and skill level. The selected sample was divided into five ages 7, 8, 9, 10 11 years old with 13 children in each group. The technical level of the children corresponded to students of the 10th, 9th, 8th Kyu grades (orange, orange with a blue stripe, and blue belt color). The children and their parents were informed about all the features of the study and gave their consent to participate in the experiment. All procedures were carried out in accordance with the Declaration of Helsinki [24].

Organization of the research

To solve the set tasks, the following research methods were used: study and analysis of scientific and methodological literature, pedagogical observation, timing of educational tasks, CA testing, pedagogical ascertaining experiment, methods of mathematical statistics.

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Vollum 28 No. 3, 2024

In accordance with the topic and purpose of the study, coordination training was tested using a battery of fitness tests. Simple, reliable and informative tests were selected that comprehensively characterize various manifestations of CA: jumping on two legs with hands behind the head; jump forward, backward, right, left; shuttle run 4x9m; Kopylov test "Ten eights"; one leg stand with eyes closed; walking in a straight line after 5 rotations [14].

Statistical analysis

The data analysis was collected and systematized using the EXCEL spreadsheet. The program used in the study was IBM SPSS 26. Levene's test was used to determine the homogeneity of variance in different age groups. One-way analysis of variance (ANOVA) was used for simple contrast analyses, and the Bonferroni post hoc test was used to compare differences between different age groups. Statistical significance was set at $p < 0.05$.

Results

Data on the age-related dynamics of the development of coordination of movements of karate boys aged 7-11 years are presented in Tables 1-9. Table 1 contains statistical indicators describing the distribution of data by different age groups. The obtained average values of the ability to demonstrate different types of coordination correspond to age norms at average, above average and high levels.

At the beginning of the experiment, a null hypothesis was formed (H0: μ1 = μ2 = μ3 = μ4 = μ5) that the difference between the compared values is zero, and the difference from zero found in the sample data is random. An alternative hypothesis (H1: μ1≠μ2…≠μ5) was the assumption that the level of motor condition depends on age and the average values in these groups

Table 1. Statistical description of coordination indicators of boys 7-11 years old

Tests	Age	N	$\overline{X}$	S	m	95% confidence interval for the difference		Minimum	Maximum
						Lower	Upper		
Jumping on two legs with hands behind head	7	13	13.935	0.731	0.203	13.493	14.376	12.10	14.80
	8	13	16.285	0.735	0.204	15.841	16.729	15.20	17.50
	9	13	17.831	0.659	0.183	17.433	18.229	16.80	19.20
	10	13	19.592	1.183	0.328	18.878	20.307	17.00	21.20
	11	13	19.977	1.142	0.317	19.287	20.667	18.20	21.60
	Total	65	17.524	2.414	0.299	16.926	18.122	12.10	21.60
Jump forward, backward, right, left	7	13	4.249	0.122	0.034	4.175	4.322	4.10	4.50
	8	13	4.744	0.180	0.050	4.635	4.853	4.40	5.10
	9	13	5.058	0.133	0.037	4.977	5.138	4.80	5.26
	10	13	5.189	0.157	0.044	5.094	5.283	4.88	5.35
	11	13	5.279	0.112	0.031	5.211	5.346	5.09	5.45
	Total	65	4.903	0.402	0.050	4.804	5.003	4.10	5.45
Shuttle run 4x9m	7	13	14.023	0.608	0.169	13.655	14.391	13.20	15.20
	8	13	13.231	0.617	0.171	12.858	13.604	12.0	14.0
	9	13	12.715	0.348	0.097	12.505	12.926	12.10	13.20
	10	13	11.777	0.453	0.126	11.503	12.051	11.10	12.30
	11	13	11.385	0.623	0.173	11.008	11.761	10.30	12.20
	Total	65	12.626	1.098	0.136	12.354	12.898	10.30	15.20
Kopylov test "Ten eights"	7	13	21.739	1.809	0.502	20.645	22.832	19.10	24.20
	8	13	19.585	1.370	0.380	18.757	20.412	17.60	22.40
	9	13	17.069	1.354	0.375	16.251	17.887	15.0	19.60
	10	13	14.288	0.983	0.273	13.693	14.882	12.82	15.80
	11	13	12.762	1.090	0.302	12.104	13.421	11.20	15.10
	Total	65	17.089	3.573	0.443	16.203	17.974	11.20	24.20
One leg stand with eyes closed	7	13	3.462	0.967	0.268	2.877	4.046	2.0	5.0
	8	13	5.385	1.261	0.350	4.623	6.147	3.0	8.0
	9	13	7.846	1.676	0.465	6.834	8.859	5.0	10.0
	10	13	8.846	1.625	0.451	7.864	9.828	6.0	12.0
	11	13	9.539	1.713	0.475	8.503	10.574	7.0	13.0
	Total	65	7.015	2.695	0.334	6.348	7.683	2.0	13.0
Walking in a straight line after 5 rotations	7	13	135.462	11.851	3.287	128.300	142.623	115.0	150.0
	8	13	103.231	11.337	3.144	96.380	110.082	85.0	120.0
	9	13	94.308	11.842	3.284	87.152	101.464	65.0	110.0
	10	13	82.077	13.847	3.841	73.709	90.445	50.0	100.0
	11	13	68.692	8.654	2.400	63.463	73.922	51.0	83.0
	Total	65	96.754	25.387	3.149	90.463	103.044	50.0	150.0

are unequal. At the preliminary stage, the practical significance of the formed groups was checked. All groups have practical significance for the study, since the number of research objects in each group is sufficiently.

To justify the use of variance analysis, a test of variance homogeneity was performed (Table 2). Levine's homogeneity of variance criterion showed that variances in all tests of 5 ages do not differ statistically significantly ($p > 0.05$). Consequently, the conditions for testing the homogeneity of variances are met, so we can objectively interpret the results of the one-factor variance analysis.

Table 3 presents the results of testing the null hypothesis based on the results of a one-way ANOVA. According to its results, the null hypothesis (H0) about the equality of the average values of the indicators of motor coordination in the age groups of 7-11 years is refuted and the alternative hypothesis is accepted that there is at least one sample whose average results are significantly different from the average indicators of other samples. The ANOVA test showed significant statistical differences in age characteristics ($0.000 < 0.05$). The age factor has a significant impact on the level of CA indicators before: differentiation of spatial-dynamic parameters of movements ($F = 95.712$; $p = 0.000$); restructuring of motor actions ($F = 111.410$; $p = 0.000$); differentiation of spatial-temporal parameters ($F = 50.863$; $p = 0.000$); coordination of hand movements ($F = 96.764$; $p = 0.000$); maintaining postural stability ($F = 38.274$; $p = 0.000$); maintaining vestibular stability ($F = 61.291$; $p = 0.000$).

To determine more accurate results of the study, we identified the groups with the most significant differences (Tables 4-9). Since the variances in all tests are homogeneous, multiple comparisons were performed using the Bonferroni correction. Pairs characterized by a significant difference in means are marked with an asterisk (*).

Multiple comparisons of the ability to differentiate spatial-dynamic parameters of movements revealed the greatest difference in means ($p < 0.05$) between samples of children aged 7, 8, 9 and 10 years (Table 4). In the age pair of 10-11 years, no difference was found in the manifestation of this coordination ability ($p = 1.000$).

Quite high dynamics of age-related changes are observed in the ability to restructure motor actions (Table 5). The highest speed of this process occurs at 7-9 years ($0.000 < 0.05$). In the test "Jump forward, backward, right, left" no significant differences were found in the groups of 9-10 ($p = 0.230$), 10-11 ($p = 1.000$)

Table 2. Homogeneity of variances test (based on mean)

No.	Tests	Levene statistic	p
1	Jumping on two legs with hands behind head	2.289	.070
2	Jump forward, backward, right, left	.915	.461
3	Shuttle run 4x9m	1.109	.361
4	Kopylov test "Ten eights"	2.109	.091
5	One leg stand with eyes closed	1.233	.306
6	Walking in a straight line after 5 rotations	.579	.679

Table 3. Results of one-way analysis of variance (ANOVA)

		Sum of Squares	Mean Square	F	p
Jumping on two legs with hands behind head	Between groups	322.512	80.628	95.712	.000
	Within groups	50.544	.842		
	Total	373.056			
Jump forward, backward, right, left	Between groups	9.102	2.275	111.410	.000
	Within groups	1.225	.020		
	Total	10.327			
Shuttle run 4x9m	Between groups	59.638	14.909	50.863	.000
	Within groups	17.588	.293		
	Total	77.226			
Kopylov test "Ten eights"	Between groups	707.376	176.844	96.764	.000
	Within groups	109.654	1.828		
	Total	817.031			
One leg stand with eyes closed	Between groups	334.062	83.515	38.274	.000
	Within groups	130.923	2.182		
	Total	464.985			
Walking in a straight line after 5 rotations	Between groups	33138.062	8284.515	61.291	.000
	Within groups	8110.0	135.167		
	Total	41248.062			

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Vollum 28 No. 3, 2024

years.

In the "Shuttle Run 4x9m" test, where students demonstrated the ability to differentiate spatio-temporal parameters of movements, significant differences were found in all age pairs with the exception of 8-9 (p = 0.182) and 10-11 (p = 0.696) years (Table 6).

Table 7 contains data on the level of coordination of hand movements in the Kopylov "Ten Eights" test. Multiple comparisons using the Bonferroni post hoc test showed that the mean values of almost all ages differ significantly (0.000 < 0.05). No significant differences were found between samples of 10-11 year old boys (p = 0.056). Therefore, the age factor is important and affects the level of quality of movement coordination in boys aged 7 to 10 years.

Boys aged 9, 10 and 11 statistically significantly differ from children of the age categories aged 7 and 8 (0.000 < 0.05) according to the test " One leg stand with eyes closed " (Table 8). Also, a fairly high influence of the age factor is observed between the samples

Table 4. Multiple comparisons of the dependent variable "Jumping on two legs with hands behind head"

Age (I)	Age (J)	Average difference (I-J)	Standard error	Value	95% confidence interval	
					Lower	Upper
7	8	-2.350*	0.36	.000	-3.399	-1.301
	9	-3.896*	0.36	.000	-4.945	-2.847
	10	-5.658*	0.36	.000	-6.707	-4.609
	11	-6.042*	0.36	.000	-7.092	-4.993
8	9	-1.546*	0.36	.001	-2.595	-0.497
	10	-3.308*	0.36	.000	-4.357	-2.259
	11	-3.692*	0.36	.000	-4.742	-2.643
9	10	-1.761*	0.36	.000	-2.811	-0.712
	11	-2.146*	0.36	.000	-3.195	-1.097
10	11	-.384	0.36	1.000	-1.434	0.665

* The average difference is significant at the 0.05 level

Table 5. Multiple comparisons of the dependent variable "Jump forward, backward, right, left"

Age (I)	Age (J)	Average difference (I-J)	Standard error	Value	95% confidence interval	
					Lower	Upper
7	8	-.495*	0.056	.000	-0.659	-0.332
	9	-.809*	0.056	.000	-0.973	-0.646
	10	-.940*	0.056	.000	-1.103	-0.777
	11	-1.030*	0.056	.000	-1.193	-0.867
8	9	-.314*	0.056	.000	-0.477	-0.151
	10	-.445*	0.056	.000	-0.608	-0.281
	11	-.535*	0.056	.000	-0.698	-0.371
9	10	-.131	0.056	.230	-0.294	0.033
	11	-.221*	0.056	.002	-0.384	-0.057
10	11	-.090	0.056	1.000	-0.253	0.073

* The average difference is significant at the 0.05 level

Table 6. Multiple comparisons of the dependent variable "Shuttle run 4x9m"

Age (I)	Age (J)	Average difference (I-J)	Standard error	Value	95% confidence interval	
					Lower	Upper
7	8	.792*	0.212	.004	0.173	1.411
	9	1.308*	0.212	.000	0.689	1.927
	10	2.246*	0.212	.000	1.627	2.865
	11	2.638*	0.212	.000	2.020	3.257
8	9	.515	0.212	.182	-0.104	1.134
	10	1.453*	0.212	.000	0.835	2.073
	11	1.846*	0.212	.000	1.227	2.465
9	10	.938*	0.212	.000	0.320	1.557
	11	1.331*	0.212	.000	0.712	1.950
10	11	.392	0.212	.696	-0.227	1.011

* The average difference is significant at the 0.05 level

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Vollum 28 No. 3, 2024

of 7-8 years (p = 0.015). The average results in the groups of 9-11 years tend to equality at the indicating level of significance calculated between them (p = 0.049). No statistically significant differences were found in the performance of the test for maintaining posture stability when comparing boys aged 9-10 (p = 0.895), 10-11 (p = 1.000).

The analysis of multiple comparisons of the dependent variable " Walking in a straight line after 5 rotations ", presented in Table 9, revealed significant statistically significant differences (0.000 < 0.05) of 7 and 11 year old karate boys compared to all the last age categories (8, 9 and 10 years). Boys aged 10-11 years are statistically different (p = 0.047), but in terms of average values, 10-year-olds are close to the values of 11-year-olds in the results of the test demonstrating

Table 7. Multiple comparisons of the dependent variable Kopylov test "Ten eights"

Age (I)	Age (J)	Average difference (I-J)	Standard error	Value	95% confidence interval	
					Lower	Upper
7	8	2.154*	0.53	.001	0.608	3.699
	9	4.669*	0.53	.000	3.124	6.215
	10	7.451*	0.53	.000	5.905	8.996
	11	8.976*	0.53	.000	7.431	10.522
8	9	2.515*	0.53	.000	0.970	4.061
	10	5.297*	0.53	.000	3.752	6.842
	11	6.822*	0.53	.000	5.277	8.368
9	10	2.781*	0.53	.000	1.236	4.327
	11	4.307*	0.53	.000	2.762	5.852
10	11	1.525	0.53	.056	-0.020	3.071

* The average difference is significant at the 0.05 level

Table 8. Multiple comparisons of the dependent variable "One leg stand with eyes closed"

Age (I)	Age (J)	Average difference (I-J)	Standard error	Value	95% confidence interval	
					Lower	Upper
7	8	-1.923*	0.58	.015	-3.612	-0.234
	9	-4.385*	0.58	.000	-6.073	-2.696
	10	-5.385*	0.58	.000	-7.073	-3.696
	11	-6.077*	0.58	.000	-7.766	-4.388
8	9	-2.461*	0.58	.001	-4.150	-0.773
	10	-3.461*	0.58	.000	-5.150	-1.773
	11	-4.154*	0.58	.000	-5.843	-2.465
9	10	-1.00	0.58	.895	-2.689	0.689
	11	-1.692*	0.58	.049	-3.381	-0.004
10	11	-.692	0.58	1.000	-2.381	0.996

* The average difference is significant at the 0.05 level

Table 9. Multiple comparisons of the dependent variable "Walking in a straight line after 5 rotations"

Age (I)	Age (J)	Average difference (I-J)	Standard error	Value	95% confidence interval	
					Lower	Upper
7	8	32.231*	4.56	.000	18.940	45.522
	9	41.154*	4.56	.000	27.863	54.445
	10	53.384*	4.56	.000	40.094	66.675
	11	66.769*	4.56	.000	53.479	80.060
8	9	8.923	4.56	.550	-4.368	22.214
	10	21.154*	4.56	.000	7.863	34.445
	11	34.538*	4.56	.000	21.248	47.829
9	10	12.231	4.56	.094	-1.060	25.522
	11	25.615*	4.56	.000	12.325	38.906
10	11	13.385*	4.56	.047	0.094	26.675

* The average difference is significant at the 0.05 level

the ability to maintain vestibular stability. The groups of 8-9 ($p = 0.550$) and 9-10 ($p = 0.094$) years old do not statistically significantly differ from each other.

Thus, boys at different stages of their age development have statistically significantly different levels of coordination competence in its various manifestations. Age influences the quality level of different CA in boys aged 7–11 years. The discrepancies observed between age groups bring relevant knowledge for use in planning and individualizing the training process.

Discussion

The study was aimed at assessing the influence of the age factor on the level of manifestation of various CA by boys aged 7-11 years old who practice Kyokushin karate. It was assumed that the identification of age dynamics would make it possible to create favorable conditions for improving the training process, select adequate means, develop detailed programs for the development of coordination, and use the acquired knowledge when teaching motor abilities.

An analysis of scientific works allows us to assert that comparison of athletes of different ages is widely used in pedagogical and sports science [7, 25, 12] and many others. The authors identified many significant differences between different age groups.

The results we obtained showed that motor dexterity develops with age. We support the findings of Podrihalo, Romanenko, Podrigalo et al. [12], Koliada & Romanenko [26], Oktarifaldi, Marta, Nugroho et al. [16] that the increase in test scores is directly proportional to age and experience in advanced sports activities. According to the majority of experts [3, 27], the age range from 7 to 11-12 years is defined as a period of strong growth in the development of all types of CA. Our studies have revealed patterns of rapid development of CA in children aged 7 to 10 years. At 10-11 years, no significant statistically reliable differences are observed in all indicators except dynamic balance. Data that this development slows down until about 11 years was noted in the studies of Ceylan, Saygin & Irez [28]. The authors consider this age critical for the development of coordination.

We supplement the results of recent studies [29, 30], showing that the greatest adaptability to motor coordination abilities is manifested at the age of 7 to 12 years. In martial arts, agility is of great importance, since coordinated children are more likely to master the technique in accordance with the type of sport activity [10, 26, 13]. Children of this age are flexible, so they are easier to train, and the training itself is most effective [29, 7].

The results obtained during the experiment allow us to conclude that regular Kyokushinkai karate classes help improve the level of coordination by increasing children's motor activity both within the school and in extracurricular activities during training in sports sections. This coincides with the opinions Pinto-Escalona, Gobbi, Valenzuela et al. [31], Oktarifaldi, Nopembri, Yudanto et al. [17]; Marchenko, Ivashchenko, Jagiello et al. [13] about the importance of attracting as many children as possible, starting from primary school age, to play sports.

Conclusions

1. A review of the current state of education and upbringing of children and adolescents led to the conclusion that students who are in sufficient physical shape are always more active. The available materials contain many recommendations for targeted coordination training to improve the level of development of other motor skills and the formation of complex sports skills in the future.

2. Kyokushinkai karate classes help improve the level of coordination by increasing children's motor activity both within the school and in extracurricular activities during training in sports sections.

3. According to the obtained results of the studies of the indicators of various manifestations of coordination, statistically significant age differences are observed between the groups of boys aged 7 to 10 years ($p < 0.05$). At 10-11 years, no significant statistically significant differences are observed for all indicators ($p > 0.05$), except for dynamic balance ($p < 0.05$). The differences observed between the age groups provide relevant knowledge for use in planning and individualizing the training process.

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