EFFECTS OF DIFFERENT TRAINING OPTIONS ON THE BASIC MOVEMENTS PHYSICAL FITNESS 4-YEAR-OLD GIRLS WITH DIFFERENT MOTOR ASYMMETRY

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Abstract. *Purpose*: to determine the effectiveness of different training options basic movements in terms of physical fitness girls with different orientation manual motor asymmetry (MMA). *Material*: the study involved 53 girls with ambidexterity: 68 - on the right, 62 - left oriented MMA. Age - 4 years. *Results*: there is a significant improvement in absolute muscle strength, speed-strength, coordination and cyclic locomotion tossing on the leading and non-leading range of hands regardless of the approach to teaching basic movements in girls. At the same time the increase of these qualities and the coordination of the throws on the accuracy of each hand is significantly higher when using one of the options "symmetric" approach. If you are using one of the options "symmetric" approach to teaching basic movements focus MMA defines the features of the development of physical qualities. *Conclusions*: regardless of the direction of MMA both versions of "symmetric" approach to improve the effectiveness of traditional indicators of physical fitness; the effectiveness of the first among themselves no different.

Key words: motor, asymmetry, girls, pre-school, physical, qualities.

Introduction

Many scientists [2; 4; 9; 11–13; 15] point that in learning and education process of children (even in pre school period) it is necessary to consider specific features, conditioned by functional asymmetry of brain and, in particular, manual motor ability (MMA). In this aspect knowledge about similar trends and specificities of such children's functional potentials and physical characteristics in pre school period is very important. At the same time actually such data are practically absent [1; 10] that condition demand in researches in this direction.

The data of special literature devoted to functional asymmetry of brain point at existence of the following: distribution and duplicating of functions in cerebral hemispheres; specificity of processing of information in them; disorder of behavioral responses and their specific character in case, if functional state of hemispheres change; dependence of functional state on emotions, memory, type of adaptation [12; 15]. Motor asymmetry, one of manifestation of which is manual asymmetry, is also regarded as functional asymmetry. It considers domination of one arm over other with selection of correct fulfillment of certain motor task (or arms' equivalence – ambidexterity). Recent data [2; 6; 14; 16–19] say that there are differences in psycho physiological indicators of children with left (LMA) and right (RMA) of MMA. These differences include: level of cerebral hemispheres' autonomy, interaction of cortex structures, choice of actions' strategy, development of optical-space and visual functions, ability to concentrate attention at certain object, quickness of distribution and re-switching of attention; volumes of memory (short-term, long-term, arbitrary, shape memory).

Besides, development of emotional-will qualities, which is more intensive in LMA children, of psycho-motor and space perception (more intensive in RMA children) have also characterized by asynchronous character [7; 19]. The research, conducted by us, showed statistically confident difference of perceptive and verbal functions' indicators of 4-6 year boys with different MMA. Our research [1] revealed existence of heterochronia in development of manual skillfulness as well as connected with fulfillment of motor tasks in walking, run, balance exercises, creeping, jumps of girls (as well as boys) with different MMA in first 3-5 years of life.

Concerning works, devoted to development of such children's physical qualities, they are rather few and fragmentary [1; 10]. Also there are no data, received with the help of longitudinal method. Comparative effectiveness of offered [1; 8] and traditional (which consider only child's preferences) variants of training of 3-6 year old children to motor actions have not studied yet. The above mentioned conditioned our work in this direction.

Purpose, tasks of the work, material and methods

The purpose of the research is to determine effectiveness of different variants of main movements' training for improvement of physical fitness's indicators of 4 years' girls with different MMA. The tasks of the research included the following: determination of MMA and initial physical fitness of the tested; fulfillment of formative experiment during one year; determination of final indicators of physical fitness; comparative analysis of changes in groups.

We used the following *methods of the research:* general (analysis, generalization of information from literature sources); pedagogic (testing, experiment); oral questioning; dynamometry and methodic of M.M. Bezrukikh [3] for determination of MMA orientation; mathematical statistic methods.

In experiment 53 girls with ambidexterity participated – 14 in first and 14 in second experimental groups (EG1 and EG2), 25 – in control group (CG); also 68 girls with RMA participated (accordingly 21, 22 and 26) and 62 girls with LMA (19, 18 and 25). During 4th year of life girls with different MMA (groups EG1 and EG2) used "symmetric approach" to training of main movements with different variants of sequence (first by subordinate, then by dominating arm (leg) and on the contrary). Girls from three CG used only traditional approach during all year, considering their preferences in choice of arm or leg for fulfillment of the trained movement. With it, in all groups targeted development of the studied physical qualities was not practiced. Organization of trainings and used methodic also were similar.

Pedagogic testing was conducted in September and May. We used well known, commonly used tests, which met metrological requirements.

Results of the research

Analysis of data, received at the beginning of experiment, proved uniformity of formed groups (coefficients of variation within 20 %), normal character of values' distribution in every group (λ-criterion of Kolmogorov-Smirnov was within from p>0.10 to p>0.20) and absence of significant differences of these values (Student's t-criterion) [20] in girls groups with certain MMA orientation.

After experiment result was quite different. For example in group of girls with AMA (EG1) (at p<0.05÷0.001) all tested physical qualities improved. The same picture was in group EG2, except mobility in lumbar spine and coordination in throws by right hand for accuracy. In CG these qualities as well as coordination in throws by left hand for accuracy, quickness practically did not change after one year (see table 1).
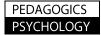
Table 1

Changes of physical qualities' indicators in groups of 4 years' girls with AMA in the course of formative experiment

Indicators	Group	At the beginning		At the end		Change		Confidence of difference, t			
		$\bar{x}_1$	m	$\bar{x}_2$	m	Absolute values	%	t	EG1–CG	EG1–CG	EG1–EG2
Dynamometry of dominating hand, kg	EG1	3.0	0.2	6.9	0.3	3.9	130.0	10.8***	3.0 **	2.68 *	0.83
	EG2	2.9	0.2	6.6	0.2	3.7	127.6	13.1***			
	CG	3.1	0.3	5.4	0.4	2.3	74.2	4.6***			
Forward bending in sitting position, cm	EG1	10.3	0.5	12.2	0.5	1.9	18.4	2.69*	0.49	0.17	0.32
	EG2	10.0	0.9	11.9	0.8	1.9	19.0	1.58			
	CG	10.2	1.02	11.7	0.9	1.5	14.7	1.1			
20 meters run, from walking, sec.	EG1	8.3	0.06	7.5	0.1	–0.8	9.6	6.86***	0.32	0.32	1.41
	EG2	8.3	0.15	7.7	0.1	–0.6	7.2	3.33**			
	CG	8.2	0.2	7.6	0.3	–0.6	7.3	1.66			
Long jump from the spot, cm	EG1	72.0	0.9	83.7	1.6	11.7	16.3	6.37***	2.4 *	1.98	1.26
	EG2	71.5	1.1	81.5	0.7	10.0	14.0	7.67***			
	CG	71.7	0.9	79.4	0.8	7.7	10.7	6.4***			
Shuttle run 3x5 m, sec.	EG1	9.0	0.12	8.0	0.05	–1.0	11.1	7.69***	2.68 *	2.57 *	0
	EG2	8.9	0.11	8.0	0.06	–0.9	10.1	7.18***			
	CG	8.8	0.16	8.3	0.1	–0.5	5.7	2.65*			
Throw at for distance by right arm, meters	EG1	2.8	0.14	4.1	0.1	1.3	46.4	7.56***	4.48 ***	3.69 **	0.67
	EG2	2.5	0.12	4.0	0.11	1.5	60.0	9.21***			
	CG	2.7	0.14	3.4	0.12	0.7	25.9	3.8**			
Throw at for distance by left arm, meters	EG1	3.0	0.15	4.5	0.12	1.5	50.0	7.81***	3.5 **	3.61 **	0
	EG2	2.9	0.14	4.5	0.11	1.6	55.2	8.99***			
	CG	3.0	0.18	3.8	0.16	0.8	26.7	3.32**			
Error in throw fro accuracy by right arm, cm	EG1	40.1	2.2	32.2	1.9	–7.9	19.7	2.72*	3.61 **	2.68 *	1.02
	EG2	40.4	2.4	35.1	2.1	–5.3	13.1	1.66			
	CG	39.5	2.7	44.7	2.9	5.2	–13.2	1.31			
Error in throw fro accuracy by left arm, cm	EG1	41.1	2.4	29.8	1.8	–11.3	27.5	3.69**	2.07 *	2.07 *	0.04
	EG2	40.4	2.8	29.9	1.7	–10.5	26.0	3.21**			
	CG	408	2.9	37,4	3,2	–3.4	8.3	0.79			

The received data witnessed about to some extent better dynamic of physical qualities in both EG groups in comparison with CG. It means that variant of "symmetric" approach is more effective than traditional one in training of girls to main movements.

We proved the received at the end of experiment result: all indicators of EG1 (except flexibility and quickness) were much better than in CG and in EG2 (except the mentioned qualities and speed-power ones). At the same time it was registered that in both EG development of the researched physical qualities reached equal level.

Thus, application of different variants of main movements' training during one year results in significant improvement of most of physical qualities of AMA girls. However two variants of "symmetric" approach (EG1 and EG2) facilitate also improvement of quickness and coordination in throwing for accuracy by left arm. At the same time both variants of "symmetric" approach ensure higher indicators in comparison with traditional approach.

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Analyzing data of RMA girls' groups we found that in EG1 and EG2 most of the tested physical qualities significantly improved. Only quickness and coordination in throws by left arm for accuracy were exceptions. During all year they remained at previously achieved level (see table 2). In CG result was to some extent different: quickness remained practically unchanged. However coordination in throws by left arm for accuracy worsened by 26.4 % and the same by right arm – by 21 % (p<0.05). In EG1 there was increment 1.8 % (p>0.05) and improvement by 20.5 % (p<0.05). In Eg2 there was no changes (4.8 %; p>0.05) and was improvement by 17.7 % (p<0.05). At the same time we registered higher values of all indicators in EG1 (except flexibility and quickness) and in EG2 (also except quickness) in comparison with CG.

Table 2

Changes of physical qualities' indicators in groups of 4 years' girls with RMA in the course of formative experiment

Indicator	Group	At the beginning		At the end		Change		Confidence of diference, t			
		$\bar{x}_1$	m	$\bar{x}_2$	m	*Absolute values*	%	t	*EG1– CG*	*EG1– CG*	*EG1– EG2*
Dynamometry of dominating hand, kg	EG1	4.2	0.3	7.5	0.18	3.3	78.6	9.43***	2.86*	2.77*	0
	EG2	4.3	0.4	7.5	0.2	3.2	74.4	7.16***			
	CG	4.6	0.4	6.5	0.3	1.9	41.3	3.8**			
Forward bending in sitting position, cm	EG1	9.1	0.5	11.2	0.5	2.1	23.1	2.97**	0.42	0.17	0.69
	EG2	9.4	0.6	10.8	0.3	1.4	14.9	2.09*			
	CG	9.3	0.6	10.9	0.5	1.6	17.2	2.05*			
20 meters run, from walking, sec.	EG1	7.5	0.13	7.0	0.21	–0.5	6.7	2.02	0	0	0
	EG2	7.3	0.12	7.0	0.14	–0.3	4.1	1.63			
	CG	7.4	0.15	7.0	0.3	–0.4	5.4	1.19			
Long jump from the spot, cm	EG1	67.5	0.9	84.3	1.4	16.8	24.9	10.1***	2.36*	0.79	1.68
	EG2	67.9	1.2	81.2	1.2	13.3	19.6	7.84***			
	CG	68.2	1.1	79.8	1.3	11.6	17.0	6.8***			
Shuttle run 3x5 m, sec.	EG1	8.4	0.15	7.3	0.09	–1.1	13.1	6.29***	3.43**	2.77*	0.74
	EG2	8.5	0.12	7.4	0.1	–1.1	12.9	7.04***			
	CG	8.5	0.14	7.9	0.15	–0.6	7.1	2.92*			
Throw at for distance by right arm, meters	EG1	3.4	0.11	5.2	0.12	1.8	52.9	11.1***	4.34***	3.37**	1.23
	EG2	3.4	0.14	5.0	0.11	1.6	47.1	8.99***			
	CG	3.3	0.12	4.4	0.14	1.1	33.3	6.0***			
Throw at for distance by left arm, meters	EG1	2.4	0.12	4.1	0.12	1.7	70.8	10.1***	4.71***	3.69**	1.23
	EG2	2.3	0.12	3.9	0.11	1.6	69.6	9.83***			
	CG	2.4	0.11	3.3	0.12	0.9	37.5	5.5***			
Error in throw fro accuracy by right arm, cm	EG1	38,5	2	30.6	1.6	–7.9	20.5	3.08**	5.92***	5.25***	0.64
	EG2	39.0	1.8	32.1	1.7	–6.9	17.7	2.79*			
	CG	38.6	1.9	46.7	2.2	8.1	–21.0	2.79*			
Error in throw fro accuracy by left arm, cm	EG1	39.8	2.5	39.1	1.6	–0.7	1.8	0.24	3.61**	3.05**	0.37
	EG2	42.1	2.4	40.1	2.2	–2.0	4.8	0.61			
	CG	40.9	2.7	51.7	3.1	10.8	–26.4	2,.3*			

The received data showed that "symmetric" approach was more effective in training of main movements than traditional one. Also they point at significant improvement of most of physical qualities. Besides, they ensure higher values of physical qualities' indicators than traditional approach.

Data of LMA groups witnessed that in EG1 all physical qualities significantly improved. In EG2 – the picture, was the same, except quickness and coordination in throws by right arm for accuracy (their level remained unchanged during all year) (see table 3). In CG we registered change in coordination in throws by left arm for accuracy and worsening of coordination in throws by right arm for accuracy by 4.6 % (p<0.05).

Besides, we found that at the end of experiment in EG1 and EG2 all indicators (except quickness, flexibility and speed-power qualities) were much better than in CG. All these proved higher effectiveness of "symmetric" approach's variants that traditional one in training to main movements.

Table 3

Changes of physical qualities' indicators in groups of 4 years' girls with LMA in the course of formative experiment

Таблица 3

Indicators	Group	At the beginning		At the end		Change		Confidence of difference, t			
		$\bar{x}_1$	m	$\bar{x}_2$	m	Absolute values	%	t	EG1–CG	EG1–CG	EG1–EG2
Dynamometry of dominating hand, kg	EG1	3.5	0.4	7.1	0.2	3.6	102.9	8.05***	3.13**	2.68*	0.71
	EG2	3.5	0.5	6.9	0.2	3.4	97.1	6.31***			
	CG	3.7	0.3	5.7	0.4	2.0	54.1	4.0***			
Forward bending in sitting position, cm	EG1	6.8	0.5	9.1	0.4	2.3	33.8	3.59**	0	0.38	0.47
	EG2	6.9	0.4	9.4	0.5	2.5	36.2	3.9**			
	CG	7.1	0.7	9.1	0.6	2.0	28.2	2.17*			
20 meters run, from walking, sec.	EG1	8.1	0.2	7.4	0.1	−0.7	8.6	3.13**	0.71	0	0.45
	EG2	8.1	0.3	7.5	0.2	−0.6	7.4	1.66			
	CG	8.0	0.2	7.5	0.1	−0.5	6.3	2.24*			
Long jump from the spot, cm	EG1	65.5	1.1	81.1	1	15.6	23.8	10.5***	1.16	0.41	0.81
	EG2	65	1.2	79.9	1.1	14.9	22.9	9.15***			
	CG	65.8	1.4	79.2	1.3	13.4	20.4	7.0***			
Shuttle run 3x5 m, sec.	EG1	8.9	0.11	7.8	0.07	−1.1	12.4	8.44***	2.88*	2.98**	0
	EG2	8.8	0.13	7.8	0.06	−1.0	11.4	6.98***			
	CG	8.8	0.18	8.2	0.12	−0.6	6.8	2.77*			
Throw at for distance by right arm, meters	EG1	2.7	0.12	4.4	0.1	1.7	63.0	10.9***	4.04***	2.69*	1.41
	EG2	2.6	0.15	4.2	0.1	1.6	61.5	8.88***			
	CG	2.7	0.14	3.8	0,11	1.1	40.7	6.2***			
Throw at for distance by left arm, meters	EG1	3.4	0.13	4.8	0.11	1.4	41.2	8.22***	4.49***	4.07***	0.67
	EG2	3.3	0.11	4.7	0.1	1.4	42.4	9.42***			
	CG	3.3	0.12	4,.0	0.14	0.7	21.2	3.8**			
Error in throw fro accuracy by right arm, cm	EG1	48.6	1.9	41.2	2.1	−7.4	15.2	2.61*	8.14***	6.94***	0.91
	EG2	49.4	1.6	44.1	2.4	−5.3	10.7	1.84			
	CG	48.2	2.1	69.7	2.8	21.5	−44.6	6.1***			
Error in throw fro accuracy by left arm, cm	EG1	31.8	1.7	21.9	1.5	−9.9	31.1	4.37***	3.08**	2.88*	0.09
	EG2	32.5	1.85	22.1	1,7	−10.4	32.0	4.14**			
	CG	321	1.95	30,1	2.2	−2.0	6.2	0.68			

Discussion

Results of experiments in all EG are based on loading of both cerebral hemispheres in training process. With traditional approach only one hemisphere was mainly activated. It depended on personal preferences of a trainee in choosing of one or other arm (or leg) for fulfillment of certain movement. This assumption is proved by conclusions of other scientists [6; 9; 11; 12]. In particular it was noted [11]: with any asymmetry of hemispheres the necessary condition of high child's activity and his (her) successful training is development of inter hemi sphere interaction; coordinated movements of left and right arms intensify interaction of hemi spheres. That is why exercises for fine motor skills, fulfilled in sequence by every arm and some exercises – by two arms simultaneously.
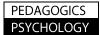
At the same time the received data do not agree with information of some scientists [4; 8] concerning advantages of "symmetric" approach, used in EG2 in comparison with approach, used in EG1. One of reasons of this we consider different age of the tested and the fact that the author [8] analyzed dynamic of only coordination.

Independently on orientation of MMA both variants of "symmetric" approach are more effective than traditional one for improvement of physical fitness's indicators; effectiveness of both variants does not differ.

Conclusions

1. Independently on approach to training of 4 years' girls with MMA of different orientation to main movements, they demonstrate significant improvement of absolute muscular strength, speed-power qualities, coordination in cyclic motions and throws for distance by dominating and subordinate arms. At the same time increment of these qualities and coordination in throws for accuracy by both arms are confidently higher, when one of variants of "symmetric" approach was used. Their effectiveness is practically the same.

2. When using of one of "symmetric" approach's variants for training of main movements, orientation of MMA determines specificities of development of physical qualities. For AMA girls, variant of fulfillment of every movement "first by subordinate and then by dominating arm" facilitates improvement of all tested qualities. Variant "first by dominating and then by subordinate arm" also facilitates improvement of all tested qualities,(except flexibility

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and coordination in throws by right arm for accuracy). For girls with RMA both cases facilitated improvement of all tested qualities (except quickness and coordination in throws by left arm for accuracy).

We think it would be purposeful to direct further researches to determination of general trends and peculiarities of development of cognitive functions of children with different MMA in pre school period. Considering it, it would be desirable to determine effectiveness of different approaches to formation of children's knowledge.

Conflict of interest

Author declares that there are no conflict of interests.

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