Special aspects of motor fitness influence on level of 11-13 years' age girls' physical exercises' mastering

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Abstract

Purpose: to find special aspects of motor fitness influence on level of 11-13 years' age girls' physical exercises' mastering.

Material: in the research 11 years' age girls (n=51), 12 years' age (n=54) and 13 years (n=63) participated.

Results: By physical condition indicators all girls statistically confidently differ ($p<0.001$). We registered increase of body height indicators (by 12%), body mass (13%), vital capacity of lungs (by 12.8%), right hand strength (by 15%) and left hand strength (by 13.8%). In girls of 11-13 years' age we registered positive dynamic of physical condition, motor abilities and level of gymnastic exercises' mastering indicators. It was found that in total dispersion results' variation by 81.259%, 79.353%, 71,019% are determined by such factors: physical condition, motor abilities, level of physical exercises' mastering. In factorial structure level of physical exercises' mastering has weight 16.435% (11years), 27.963% (12 years) and 17.010% (13 years).

Conclusions: Analysis showed that in 11-13 years age girls motor abilities' training level is effective if it becomes a component of mastered motor skills.

Keywords: motor abilities, levek of mastering, factorial analysis, girls.

Introduction

The problem of schoolchildren's physical education optimization was studied in works by I. Bondar [1], Iu.V. Vas'kov [2], T. Krucevich et al. [9]. The authors stress on demand in new approaches to integrative physical education of different health groups schoolchildren [1], to physical ducation's organization of comprehensive educational establishments' pupils [2], to planning physical culture trainings process in comprehensive educational establishments [9].

In schoolchildren's physical education directions of researches, which are connected with special aspects of motor abilities [5, 6, 7] and motor actions' training [17, 20, 28] are underlined. Specific features of children's and adolescents' functional, coordination and power fitness are determined [4, 11]. Dependence of power loads' training effects on regime of exercises' practicing and rest is found [18, 23]. The process of motor actions' training was studied from positions of interdisciplinary connections [12, 13], specificities of motor competence formation [14, 15], meta-cognitive behavior formation [16], verbal perception in the process of sport movements' mastering [19] and optimization of regimes of exercises' repetitions and rest intervals [20, 26, 28].

However, in available literature there are few data bout wholeness of motor abilities training of children and adolescents [27, 29]. Thus, study of special aspects on level of physical exercises' mastering is rather relevant.

The purpose of the research is to find special aspects of motor fitness influence on level of 11-13 years' age girls' physical exercises' mastering.

Material and methods

Participants: in the research 11 years' age girls (n=51), 12 years' age (n=54) and 13 years (n=63) participated. Their parents gave written consent for the children's participation in experiment.

Organization of the research: in the process of the research we registered: body height, body mass, vital capacity of lungs (VCL), hand dynamometry of right and left hands. We also registered results in the following tests: "Pressing ups in lying position, times", "Chin ups in lying position, times", "Legs' rising, hanging on wall bars, times"; "Angle on parallel bars, sec."; "Torso rising in sitting position from lying on back position during 1 minute";"Forward torso bending from sitting position with legs apart, cm"; "Hanging on bent arms, sec."; "Torso rising from lying on abdomen position during 30 sec., times"; "Long jump from the spot, cm"; "Throw of filled ball (1 kg) from sitting position, cm"; "Shuttle run, 4x9 m, sec." [11].

Level of gymnastic exercises' mastering was registered with the following tests: "Forward roll", "Backward roll", "Horse vaults", "Climbing the rope, three times", "Bridge", "Stance on shoulder blades" [11].

Statistical analysis: was fulfilled with the help of standard program of statistical analysis IBM SPSS 20. We used factorial analysis (principle components analysis). Besides, we used access organization: varimax with Kaiser's normalization. For every variable we calculated the following: mean values, standard deviations, Student's t-test for independent samples. Level of mastering was determined as relation of successful attempts (m) to their total quantity (5): $p = (m/5) \times 100$.

Results

Results of the research are given in tables 1, 2. By physical condition indicators, 11-13 years age girls statistically confidently differ one from another ($p<0.001$). We registered increase of body height indicators (by 12%), body mass (13%), vital capacity of lungs (by 12.8%), right hand strength (by 15%) and left hand strength (by 13.8%).

12 years' girls demonstrate confidently better results than 11 yrs girls in tests: "Pressing ups in lying position",

doi:10.15561/18189172.2017.0102

"Chin ups in lying position", "Rising legs, hanging on wall bars", "Angle on parallel bars", "Forward torso bending from sitting position with legs apart", "Hanging on bent arms", "Torso rising from lying on abdomen position during 30 seconds", "Long jump from the spot" and "Throw of filled ball (1 kg) from sitting position".

13 yrs girls showed confidently better results than 12 yrs girls in the following tests: "Pressing ups in lying position", "Chin ups in lying position", "Rising legs, hanging on wall bars", "Angle on parallel bars", "Torso rising in sitting position from lying on back position", "Throw of filled ball (1 kg) from sitting position" and "Shuttle run 4x9 m".

Level of mastering of gymnastic exercises "Forward roll", "Bakward roll", "Horse vault", "Rope climbing, three times", "Bridge" and "Stance on shoulder blades" with age confidently becomes better ($p<0.001$) (see table 1).

Thus, in girls of 11-13 years' age we registered positive dynamic of physical condition, motor abilities and level of gymnastic exercises' mastering indicators.

For specifying motor fitness influence on physical exercises' mastering by 11-13 yrs girls we fulfilled factorial analysis.

In the process of analysis we marked out in 11 yrs girls seven factors, which explain 81.259% of total dispersion (see table 2).

Factor 1 is the most influential (21.735%). The factor correlated with results of the following tests:

Angle on parallel bars– ,858.

Legs' rising, hanging on wall bars– ,780.

Pressing ups in lying position– ,766.

This fractor as called "relative strength".

Factor 2 has weight 16.435% and correlated with the following tests' results:

- Long jump from the spot– ,885.
- Forward roll, level of mastering– ,729.
- Backward roll, level of mastering– ,701.
- Horse vault, level of mastering – ,784.

The factor was called "Level of physical exercises' mastering".

Factor 3 contributes 11. 303% and correlates with the following:

- Body height – ,912.
- Body mass– ,878.

The factor was called "Physical condition".

Factor 4 contributes 8.978% and correlated with the following:

- Bridge, level of mastering – ,869.
- Torso rising from lying on abdoment position during 30 sec. – ,685.

Factor 5 has weight 8.958% and correlated with the following tests' results:

- Chin ups in lying position– ,818.
- VCL– ,795.
- Stance on shoulder blades, level of mastering– ,585.

Factor 6 contributes 7.604% and correlates with the following:

- Torso forward bending from sitting position with legs apart– -,911.

Factor 7 contributes 6.246% and correlates with the following:

- Torso rising in sitting position from lying on back position during 1 minute– ,616.

Factors 4-7 specify the names of factors 1-3 and point at interconnection of level of exercises' mastering with physical condition and motor fitness indicators of 11 yrs. girls.

Analysis of communalities showed that in motor fitness structure of 11 yrs girls the most influential were: "Body height– ,920; "Right hand dynamometry"– ,867; "Forward roll, level of mastering"– ,835; "Horse vault, level of mastering" – ,824.

In 12 yrs girls analysis showed six factors, which explain 79.353% of total indicators' dispersion (see table 2). Factor 1 contributes the most (27.963%) and correlated with the following tests' results:

- Forward roll, level of mastering– ,905.
- Horse vault, level of mastering – ,854.
- Rope climbing three times, level of mastering – ,853.
- Backward roll, level of mastering – ,838.
- Right hand dynamometry,– ,754.
- The factor was called "Level of physical exercises' mastering".

Factor 2 contributes 16.777% and correlates with physical condition indicators:

- VCL – ,891.
- Body mass – ,781.
- Body height – ,763.

This factor was called "Physical condition".

Factor 3 contributes 10. 249% and correlates with the following results:

- Legs' rising, hanging on wall bars – ,793.
- Shuttle run 4x9 m – -,657.
- Long jump from the spot – ,526.

This factor was called "relative strength of abdomen muscles".

Factor 4 contributes 9.373% and correlates with the following results:

- Throw of filled ball (1 kg) from sitting position– -,860.
- Angle on parallel bars– ,723.
- Long jump from the spot– -,524.

This factor was called "Speed power".

Factor 5 contributes 8.449% and correlates with the following results:

- Forward torso bending from sitting position with legs apart – -,750.
- Torso rising to sitting position from lying on back position during 1 minute – ,684.
- Torso rising from lying on abdomen position during 30 seconds – ,409.

Factor 6 contributes 6.541% and correlates with the following results:

- Bridge, level of mastering– ,821.
- Shuttle run 4x9 m– -,515.

Table 1. Testing results fo 11-13 yrs girls' motor fitness

№	Description of measurement	Age	N	X	m	t	P
1	Body height, cm	11	51	142,274	,932	-6,628*	<0,001
		12	54	150,629	,851	-6,796**	<0,001
		13	63	159,365	,939	-12,758***	<0,001
2	Body mass, kg	11	51	37,313	1,260	-3,883	<0,01
		12	54	43,018	,789	-4,354	<0,001
		13	63	48,920	1,056	-7,110	<0,001
3	VCL, cm^3	11	51	1733,333	44,692	-3,559	<0,01
		12	54	1933,333	34,669	-4,513	<0,001
		13	63	2223,809	51,635	-6,998	<0,001
4	Right hand dynamometry, kg	11	51	15,803	,679	-3,608	<0,01
		12	54	18,981	,566	-5,950	<0,001
		13	63	23,984	,608	-8,977	<0,001
5	Left hand dynamometry, kg	11	51	16,294	,589	-2,200	<0,05
		12	54	18,000	,507	-5,868	<0,001
		13	63	22,492	,559	-7,584	<0,001
6	Pressing ups in lying position, times	11	51	14,549	,764	-2,084	<0,05
		12	54	16,870	,806	-4,422	<0,001
		13	63	22,031	,830	-6,499	<0,001
7	Chin ups in lying position, q-ty of times	11	51	4,921	,355	-6,827	<0,001
		12	54	8,925	,460	-6,855	<0,001
		13	63	14,507	,641	-12,255	<0,001
8	Legs rising, hanging on wall bars, times	11	51	4,549	,405	-4,378	<0,001
		12	54	7,574	,551	-2,234	<0,05
		13	63	9,412	,597	-6,420	<0,001
9	Angle on parallel bars, sec.	11	51	,921	,197	3,859	<0,01
		12	54	,148	,055	-2,368	<0,05
		13	63	,492	,125	1,899	<0,06
10	Torso rising in sitting position from lying on back position during 1 minute, times	11	51	37,313	,611	-1,101	>0,05
		12	54	38,166	,482	-7,929	<0,001
		13	63	44,158	,563	-8,204	<0,001
11	Torso forward bending from sitting position with legs apart, cm	11	51	4,961	,395	-4,621	<0,001
		12	54	7,370	,342	5,789	<0,001
		13	63	4,857	,274	,221	>0,05
12	Hanging on bent arms, sec.	11	51	1,902	,314	-7,631	<0,001
		12	54	7,333	,624	-4,417	<0,001
		13	63	11,365	,653	-12,124	<0,001
13	Torso rising from lying on abdoment position during 30 sec., times	11	51	20,843	,369	-2,701	<0,05
		12	54	22,129	,303	-9,323	<0,001
		13	63	27,873	,507	-10,735	<0,001
14	Long jump from the spot, cm	11	51	131,471	1,900	-11,546	<0,001
		12	54	156,666	1,129	-,575	>0,05
		13	63	157,936	1,801	-10,049	<0,001
15	Throw of filled ball (1 kg) from sitting position, cm	11	51	208,137	3,539	-11,644	<0,001
		12	54	297,407	6,657	-3,734	<0,001
		13	63	329,365	5,499	-17,582	<0,001
16	Shuttle run 4x9 m, sec	11	51	11,316	,065	-,185	>0,05
		12	54	11,331	,048	6,896	<0,001
		13	63	10,703	,073	6,095	<0,001
17	Forward roll, level of mastering	11	51	83,137	1,970	-1,940	>0,05
		12	54	88,518	1,949	-3,898	<0,001
		13	63	97,142	1,185	-6,344	<0,001
18	Backward roll, level of mastering	11	51	71,764	2,577	-1,391	>0,05
		12	54	76,666	2,408	-6,509	<0,001
		13	63	95,555	1,720	-7,918	<0,001
19	Horse vault, level of mastering	11	51	72,156	2,446	-3,481	<0,001
		12	54	83,703	2,247	-4,982	<0,001
		13	63	96,507	1,397	-9,042	<0,001
20	Rope climbing three times, level of mastering	11	51	65,882	3,082	-2,013	<0,05
		12	54	74,074	2,676	-4,779	<0,001
		13	63	89,841	2,017	-6,719	<0,001
21	Bridge, level of mastering	11	51	99,607	,392	1,893	<0,06
		12	54	97,778	,863	-1,150	>0,05
		13	63	99,047	,705	,651	>0,05
22	Stance on shoulder blades, level of mastering	11	51	83,921	1,483	,509	>0,05
		12	54	82,592	2,117	-7,827	<0,001
		13	63	99,047	,705	-9,775	<0,001

* comparison of 11-12 years; ** comparison of 12-13 years; *** comparison of 11-13 years

Table 2. Matrix of factorial analysis results of 11-13 yrs girls' testing. Access organization: varimax with Kaizer's normalization

			Components							
№	Description of measurement	Age	1	2	3	4	5	6	7	h^2
1	Body height, cm	11			,912					,920
		12		,763	,335				x	,750
		13	,483			,670		x	x	,696
2	Body mass, kg	11			,878					,835
		12		,781			,326		x	,775
		13	,348			,728		x	x	,751
3	VCL, cm^3	11					,795			,800
		12		,891					x	,839
		13			,387	,527	,329	x	x	,539
4	Right hand dynamometry, kg	11	,512		,459			,424	,339	,867
		12	,754	,379					x	,816
		13	,517				,637	x	x	,846
5	Left hand dynamometry, kg	11	,551		,524	,306			,310	,788
		12	,591	,398			,410		x	,800
		13	,484				,693	x	x	,803
6	Pressing ups in lying position, times	11	,766							,763
		12	,588	,499	,474				x	,892
		13	,590		,485			x	x	,646
7	Chin ups in lying position, q-ty of times	11					,818			,847
		12	,667	,490	,390				x	,887
		13	,606		,492			x	x	,665
8	Legs' rising, hanging on wall bars, times	11	,780							,775
		12	,337		,793				x	,865
		13	,882					x	x	,809
9	Angle on parallel bars, sec.	11	,858							,856
		12				,723			x	,628
		13	,810					x	x	,716
10	Torso rising in sitting position from lying on back position during 1 minute, times	11	,344	,463					,616	,800
		12	,436				,684		x	,823
		13	,782	,309				x	x	,711
11	Torso forward bending from sitting position with legs apart, cm	11						-,911		,845
		12					-,750		x	,793
		13				-,505		x	x	,405
12	Hanging on bent arms, sec.	11	,829							,810
		12	,592	,629					x	,795
		13	,700					x	x	,623
13	Torso rising from lying on abdoment position during 30 sec., times	11	,525			,685				,795
		12				,314	,409	,460	x	,601
		13	,415	,370		-,396		x	x	,588
14	Long jump from the spot, cm	11		,885						,832
		12			,526	-,524	,306		x	,731
		13	,521			,311		x	x	,458
15	Throw of filled ball (1 kg) from sitting position, cm	11	,582							,630
		12				-,860			x	,839
		13				,598		x	x	,495
16	Shuttle run 4x9 m, sec	11		-,375		-,485			,445	,780
		12			-,657			-,515	x	,742
		13		-,348	-,459		,560	x	x	,731
17	Forward roll, level of mastering	11	,368	,729				,328		,835
		12	,905						x	,890
		13		,750	,535			x	x	,878
18	Backward roll, level of mastering	11	,440	,701						,822
		12	,838						x	,869
		13		,607	,671			x	x	,848
19	Horse vault, level of mastering	11		,784						,824
		12	,854						x	,884
		13		,607	,645			x	x	,825
20	Rope climbing three times, level of mastering	11	,549	,323				,416	-,423	,791
		12	,853						x	,841
		13			,857			x	x	,771
21	Bridge, level of mastering	11				,869				,832
		12						,821	x	,749
		13		,940				x	x	,910
22	Stance on shoulder blades, level of mastering	11		,546			,585		-,369	,831
		12	,709	,320					x	,649
		13		,940				x	x	,910
		11	21,735	16,435	11,303	8,978	8,958	7,604	6,246	
		12	27,963	16,777	10,249	9,373	8,449	6,541	x	
		13	21,792	17,010	13,865	10,812	7,540	x	x	

- Torso rising from lying on abdomen position during 30 second – ,460.

Factors 5-6 supplement each other and characterize flexibility.

Analysis of communalities showed that motor fitness of 12 yrs. girls is influenced most of all by: "Pressing ups in lying position"– ,892; "Chin ups in lying position"– ,887; " Horse vault, level of mastering" – ,884.

Analyzing 13 yrs. girls we marked out five factors, which explain 71.019% of total indicators' dispersion (see table 2).

Factor 1 contributes 21.792%) and correlates with the following tests' results:

- Legs' rising, hanging on wall bars– ,882.
- Angle on parallel bars– ,810.
- Torso rising to sitting position from lying on back position during 1 minute – ,782.

The factor was called "strength of abdomen muscles".

Factor2 contributes 17.010% and correlates with the following tests' results:

- Stance on shoulder blades, level of mastering– ,940.
- Bridge, level of mastering– ,940.
- Forward roll, level of mastering– ,750.

The factor was called "level of acrobatic exercises' mastering".

Factor 3 contributes 13.865% and correlates with the following tests' results:

- Climbing rope, three times, level of mastering– ,857.
- Backward roll, level of mastering – ,671.
- Horse vault, level of mastering – ,645.

The factor was called "level of gymnastic exercises' mastering".

Factor 4 contributes 13.865% and correlates with the following tests' results:

- Body mass – ,728.
- Body height – ,670.
- Throw of filled ball (1 kg) from sitting position – ,598.

The fator was called "Physical condition".

Factor 5 contributes 7.540% and correlates with the following tests' results:

- Left hand dynamometry – ,693.
- Right hand dynamometry– ,637.
- Shuttle run 4x9 m– ,560.

This factor characterizes strength and general motor coordination.

Analysis of communalities showed that motor fitness of 13 yrs. girls is influenced most of all by: " Bridge, level of mastering" – ,910; "Stance on shoulder blades, level of mastering"– ,910 and "Forward roll, level of mastering"– ,878.

Discussion

In our study we researched the assumption about wholeness of motor abilities' development and training , basing on systemic approach [3, 8]. It was found that results' variation in total dispersion in 11-13 yrs. girls by 81.259%, 79.353%, 71.019% depends on the regarded factors. Level of physical exercises' mastering in factorial structure has weight 16.435% (11 years), 27.963% (12 years) and 17.010% (13 years). Analysis of communalities showed that in 11-13 yrs girls motor abilities' training is effective if it becomes a component of the mastered motor skills. The presented data supplement researches of Xu X., Ke F. [30], E. Repko et al. [10], O.M. Khudolii et al. [28].

The fufilled factorial analysis permitted to regard motor training processes and training as holistic process. It supplements the data of Ivashchenko O. et al. [21, 22] about effectiveness of factorial analysis in physical education. Analysis of communalities in factorial analysis permits to find the role of separate indicator in factorial structure of the studied process. It points at need in application of mathematical statistic's multi-dimensional methods for study the laws of children's and adolescents' physical education [24, 25].

Conclusions

In 11-13 yrs girls we registered positive dynamic of physical condition, motor abilities indicators as well as level of gymnastic exercises' mastering.

It was found that results' variation in total dispersion in 11-13 yrs. girls by 81.259%, 79.353%, 71.019% depends on the regarded factors: physical condition, motor abilities' level and level of physical exercises' mastering. In factorial structure level of physical exercises' mastering contributes 16.435% (11 years), 27.963% (12 years) and 17.010% (13 years). Analysis of communalities showed that in 11-13 yrs girls motor abilities' training is effective if it becomes a component of the mastered motor skills.

Acknowledgements

The resaerch was fulfilled in compliance with plan of scientific-research works of Ministry of education and science, youth and sports of Ukraine by topic 13.04. "Modeling of training process and motor abilities' development in children and adolescents" (2013–2014) (state registration number 0113U002102).

Conflict of interests

The author declares that there is no conflict of interests.

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Cite this article as: Ivashchenko O.V. Special aspects of motor fitness influence on level of 11-13 years' age girls' physical exercises' mastering. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2017;1:11–17. doi:10.15561/18189172.2017.0102

The electronic version of this article is the complete one and can be found online at: http://www.sportpedagogy.org.ua/index.php/PPS/issue/archive

Received: 11.01.2016
Accepted: 18.01.2017; Published: 24.01.2017