

INFORMATIVE PEDAGOGIC CONTROL INDICATORS OF 14-15 YEARS AGE GIRLS' MOTOR FITNESSIvashchenko O.V.¹, Kapkan O.O.²¹H.S. Skovoroda Kharkiv National Pedagogical University²Donbass State Machine-building Academy

Abstract. *Purpose:* to determine informative indicators for in-group and intra-group control of 14-15 years age girls' motor fitness. *Material:* in the research 99 girls participated: 14 years old (n=38), 15 years old (n=61). *Results:* for control of 15 years age girls' motor fitness the most informative are indicators of speed power, dynamic power endurance and physical condition. It was found that 14 years age girls have better power fitness than 15 years girls. It points at the fact that in 15 years' age the reasons of lagging behind 14 years girls are increase of body mass and reduction of motor activity. *Conclusions:* the received data show that factorial analysis as well as discriminant one is methodological base for determination of tests' in-group and intra-group informational potential. The most informative tests for determination of age dynamic are static and dynamic power endurance of abdomen muscles and connected with them result of long jumps from the spot.

Key words: motor fitness, tests, factorial, discriminant, analysis, girls.

Introduction

The problem of school physical education quality's rising appears in connection with weakening of children's and adolescents' motor functioning [6, 12, 31, 36]. The reason of motor activity reduction is complexity of individual approach realization at school physical culture lessons [4] and non consideration of adolescents' sensitive periods. It can result in negative after effects: worsening of health [1, 12], weakening of motivation for physical culture practicing in school [11, 16, 15].

One of this problem's solutions is working out pedagogic control methodology and, on its base, control over physical education of children's and adolescents [14, 17, 24, and 25].

In the process of physical education pedagogic control is directed at motor abilities increase [8, 10, and 22], training process [2, 4, and 20], control of physical exercises' and rest intervals' regimes in adolescents' and children's physical education [9, 21, and 35].

Effectiveness of pedagogic control depends on determination of informative indicators and on assessment methods for children's and adolescents' motor fitness [7, 26, and 30]. One of effective methods of determination indicators' informational potential and motor fitness assessment is modeling [3, 13, 5, and 32].

Thus, determination of pedagogic control informative indicators on the base of modeling of schoolchildren's motor fitness structure is important and relevant.

The purpose of the research is to determine informative indicators for in-group and intra-group control of 14-15 years age girls' motor fitness.

Material and methods

Participants: in the research 99 girls participated: 14 years old (n=38), 15 years old (n=61) (school No.22, Kramatorsk). Their parents gave consent for children's participation in experiment.

Organization of the research: testing program consisted of commonly known tests [18, 19].

Statistical analysis: the materials of the research were processed with IBM SPSS 20 program. Factorial and discriminant analysis were fulfilled. In factorial analysis we used the method of principle components with invocation method: Varimax with Kaiser's normalization. For every variable we calculated the following: mean values, standard deviations, t- test for independent samples. In discriminant analysis we formed prognostic model of belonging to group. This model builds functions in the form of linear combination of predictor variables that ensure the best distribution into groups. Further, these functions can be used in new observations with known predictor variables and unknown belonging to group. For every canonic discriminant function we calculated the following: Wilks' *Lambda*, Chi-square. For every step we calculated: prior probabilities, Fisher function's coefficients, non-standardized coefficients of function, Wilks' *Lambda for every canonic function*.

Results of the research

In table 1 we gave results of motor fitness testing of 14-15 years' age girls. Analysis of testing results shows that 14 years girls demonstrate statistically confidently better results in tests №3 "Keeping angle on parallel bars, sec.", №6 "Pressing ups in lying position, quantity of times" ($p < 0.05$). 15 years girls have statistically confident difference from 14 years girls by body mass and are statistically confidently better in tests №4 "Right hand strength, kg", №5 "Left hand strength, kg", №8 "Long jump from the spot, cm", №10 "Forward torso bending from sitting position, cm", №11 "Shuttle run 4x9 m, sec.", №12 "Taking sitting position from lying position during 60 sec., quantity of times" ($p < 0.05$).

Difference in results of tests №7 "Chin ups, quantity of times", №9 "Legs' raising up to straight angle from hanging on Swedish wall position, quantity of times" between 14 and 15 years age girls statistically was not confident ($p > 0.05$).

Table 1. Comparative analysis of 14 and 15 years age girls' motor fitness Таблица 1.

Test №	Test description	14 years age girls (n=38)		15 years age girls (n=61)		t	p
		X	m	X	m		
1.	Body mass, kg	49.684	1.496	57.180	2.261	2.417	<0.05
2.	Body length in standing position, cm	162.95	.97	165.08	1.95	.825	>0.05
3.	Keeping of angle on parallel bars, sec.	3.2	.49	1.1	.16	4.630	<0.05
4.	Right hand strength, kg	16.553	.677	20.229	.694	3.571	<0.05
5.	Left hand strength, kg	15.842	.642	18.967	.645	3.248	<0.05
6.	Pressing ups in lying position, quantity of times	11.52	1.37	8.98	.64	1.874	<0.05
7.	Chin ups, quantity of times	5.55	.46	5.26	.44	.433	>0.05
8.	Long jump from the spot, cm	141.55	4.36	166.00	2.39	5.331	<0.05
9.	Legs' raising up to straight angle from hanging on Swedish wall position, quantity of times	6.52	.88	6.24	.56	.282	>0.05
10.	Forward torso bending from sitting position, cm	16.47	1.22	21.06	.79	3.313	<0.05
11.	Shuttle run 4x9 m, sec	11.78	.14	10.73	.09	6.730	<0.05
12.	Taking sitting position from lying position during 60 sec., quantity of times	25.47	1.14	38.11	.78	9.464	<0.05
13.	From lying on abdomen position torso raising upward during 60 sec, quantity of times	25.95	1.96	37.25	31.34	2.416	<0.05

For determination of the tests' in-group informational potential for 14 years girls we conducted factorial analysis by results of 13 tests (see table 2). In the process of analysis we marked out four factors, which explain 66.992% of indicators' total dispersion.

Factor 1 is the most informative (24.094%). It correlates with static and dynamic strength of abdomen muscles and speed power fitness. The factor was named "power fitness".

Factor 2 (information potential 15.770%) correlates to the largest extent with hand static strength. It was named "static power fitness".

Factor 3 (information potential 14.566%) correlates to the largest extent with test № 13 “From lying on abdomen position torso raising upward during 60 sec., quantity of times”. The factor was named “dynamic endurance of back muscles”.

Factor 4 (information potential 12.563%) correlates to the largest extent with relative strength indicator. It was named “relative strength”.

Analysis of populations shows that for motor fitness control the most informative are tests №4 “Right hand strength, kg”, №5 “Left hand strength, kg”, №8 “Long jump from the spot, cm”, №13 “From lying on abdomen position torso raising upward during 60 sec., quantity of times”.

Table 2. Matrix of 14 years girls’ motor fitness factorial analysis. Invocation method: Varimax with Kaiser’s normalization

Test №	Test description	Components				Populations
		1	2	3	4	
1.	Body mass, kg		.475		-.593	.669
2.	Body length in standing position, cm				-.775	.701
3.	Keeping of angle on parallel bars, sec.	.629				.476
4.	Right hand strength, kg		.915			.841
5.	Left hand strength, kg		.893			.847
6.	Pressing ups in lying position, quantity of times	.375		.624		.537
7.	Chin ups, quantity of times	.423			.661	.662
8.	Long jump from the spot, cm	.655		.407		.745
9.	Legs’ raising up to straight angle from hanging on Swedish wall position, quantity of times	.781				.641
10.	Forward torso bending from sitting position, cm	.767		-.396		.771
11.	Shuttle run 4x9 m, sec	-.564		-.405		.508
12.	Taking sitting position from lying position during 60 sec., quantity of times	.667				.583
13.	From lying on abdomen position torso raising upward during 60 sec, quantity of times			.849		.726
14.	Completely explained dispersion, %	24.094	15.770	14.566	12.563	66.992

For determination of the tests’ in-group informational potential for 15 years girls we conducted factorial analysis by results of 13 tests (see table 3). In the process of analysis we marked out five factors, which explain 70.630% of indicators’ total dispersion.

Factor 1 is the most informative (17.237%). It correlates with hand static strength and was named “static strength”.

Factor 2 (information potential 15.614%) correlates to the largest extent with relative strength. It was named “power fitness”.

Factor 3 (information potential 14.257%) correlates to the largest extent with physical condition indicators. The factor was named “Physical condition”.

Factor 4 (information potential 10.288%) correlates to the largest extent with speed power (test No.8 “Long jump from the spot, cm” and dynamic endurance of abdomen muscles (test No.12 “Taking sitting position from lying position during 60 sec.”). It was named “Power fitness”.

Factor 5 (information potential 10.288%) correlates to the largest extent with flexibility indicators (test No.10 “Forward torso bending from sitting position, cm” (test No.8 “Long jump from the spot, cm” and dynamic endurance of abdomen muscles (test No.12 “Forward torso bending from sitting position, cm”. It was named “Flexibility”.

Analysis of populations shows that for motor fitness control the most informative are indicators of speed-power (test №8 “Long jump from the spot, cm”, dynamic power endurance (test No.12 “Taking sitting position from lying position during 60 sec.” and physical condition.

Table 3. Matrix of 15 years girls’ motor fitness factorial analysis. Invocation method: Varimax with Kaiser’s normalization

Test №	Test description	Components					Populations
		1	2	3	4	5	
1.	Body mass, kg			.857			.786
2.	Body length in standing position, cm			-.885			.809
3.	Keeping of angle on parallel bars, sec.			.326		.633	.518
4.	Right hand strength, kg	.774					.681
5.	Left hand strength, kg	.875					.774
6.	Pressing ups in lying position, quantity of times		.855				.774
7.	Chin ups, quantity of times		.867				.794
8.	Long jump from the spot, cm	.374			.784		.819
9.	Legs’ raising up to straight angle from hanging on Swedish wall position, quantity of times		.626		-.458	.354	.780
10.	Forward torso bending from sitting position, cm					.718	.630
11.	Shuttle run 4x9 m, sec	-.665					.480
12.	Taking sitting position from lying position during 60 sec., quantity of times				.798		.727
13.	From lying on abdomen position torso raising upward during 60 sec, quantity of times	-.315			.398	.468	.610
	Completely explained dispersion, %	17.237	15.614	14.257	13.234	10.288	70.630

For determination of tests’ intra-group informational potential we conducted discriminant analysis of 14-15 years age girls’ motor fitness. The analysis showed that tests №10 “Forward torso bending from sitting position, cm” and № 3 “Keeping of angle on parallel bars, sec.” make the biggest contribution in change of function (see table 4, standardized coefficients). The highest correlations with function have tests №12 “Taking sitting position from lying position during 60 sec., quantity of times”, №8 “Long jump from the spot, cm”, №3 “Keeping of angle on parallel bars, sec.” (see table 4, structural coefficients). So, the most informative coefficients for age dynamic determination are static and dynamic power endurance of abdomen muscles and connected with it result of long jumps from the spot.

Table 4. Results of discriminant analysis of 14-15 years girls' motor fitness

Test №	Test description	Coefficients of canonic discriminant function			
		Standardized	Structural	For classification	
				14 years 1	15 years 2
1.	Body mass, kg	.145	.160	1.368	1.398
2.	Body length in standing position, cm	.075	.055	2.389	2.408
3.	Keeping of angle on parallel bars, sec.	-.634	-306	1.021	.099
4.	Right hand strength, kg	.221	.236	1.051	1.189
5.	Left hand strength, kg	-.353	.227		
6.	Pressing ups in lying position, quantity of times	.119	-.124	-.195	-.363
7.	Chin ups, quantity of times	.144	-.056		
8.	Long jump from the spot, cm	.116	.353	1.088	1.105
9.	Legs' raising up to straight angle from hanging on Swedish wall position, quantity of times	-.318	-.019	1.088	1.181
10.	Forward torso bending from sitting position, cm	.729	.219	-.367	-.313
11.	Shuttle run 4x9 m, sec	.122	-.445	40.168	38.856
12.	Taking sitting position from lying position during 60 sec., quantity of times	.145	.626	-.034	.319
13.	From lying on abdomen position torso raising upward during 60 sec, quantity of times	.075	.160	.130	.166
	Constant			-554.228	-558.883

Discussion

For practical application of discriminant analysis results canonic discriminant function coefficients for classification shall be used (see table 4).

Analysis of the received results shows that 14 years age girls have better power fitness (test № 3 “ Keeping of angle on parallel bars, sec.”, test №6 “ Pressing ups in lying position, quantity of times”) than 15 years age girls. It points that in 15 years age the reasons of lagging behind 14 years girls are increase of body mass and reduction of motor activity. It supplements the data of other authors [4, 15, 16] illustrating that the reason of adolescents' low motor fitness is significant reduction of motor functioning. All these take place together with loss of interest to school physical culture lessons and negative attitude to physical culture in general

The received results expand information about special aspects of motor abilities' development in children and adolescents and permit to obtain new information with the help of modeling method [5, 23, and 32].

The received data supplement also the data of other authors [27, 29, 33] about demand in structural and functional analysis of children's and adolescents' motor fitness as well as they prove the opinion that discriminant model can be used for pedagogic control of 14-15 years age schoolchildren's fitness level. The received functions can further be used in new observations with known predictor variables and unknown belonging to group.

The propsect of further researches are determination of discriminant function effectiveness in managing children's and adolescents' physical education.

Conclusions

For control over 14 years girls' motor fitness the most informative are tests №4 “Right hand strength, kg”, №5 “Left hand strength, kg”, №8 “Long jump from the spot, cm”, №13 “ From lying on abdomen position torso raising upward during 60 sec, quantity of times”.

For control over 15 years girls' motor fitness the most informative are speed power indicators (test №8 " Long jump from the spot, cm"), dynamic power endurance (test №12 " Taking sitting position from lying position during 60 sec., quantity of times") and indicators of physical condition.

The obtained data witness that factorial and discriminant analysis are methodological base for determination of tests' in-group and intra-group informational potential. For determination of age dynamic the most informative tests are static and dynamic endurance of abdomen muscles and connected with them result of long jump from the spot.

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Conflict of interests

The authors declare that there is no conflict of interests.

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